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Samahan ng Nagkakaisang Mangingisda at Magsasaka ng Mabobon (SANAMMMAY)

MANUAL OF SEAWEED PRODUCTION AND FIELD GUIDE OF DISCOVERY-BASED EXERCISES FOR FARMER FIELD SCHOOLS

Compiled and edited by
DAMASO P. CALLO, JR. AND ALFREDO N. DARAG, JR.

Final Draft, September 2015

Manual of Seaweed Production and Field Guide of Discovery-based Exercises for Farmer Field Schools. This manual-field guide is based from best practices and learning experiences shared by participants during a *Workshop on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach* held in Maydalaga, Calutcot, Burdeos, Quezon, Philippines on 15-16 August 2013; by participants in *Farmer Field School and Participatory Research and Learning on Seaweed Production* undertaken in Calutcot-Kalongkoan Islands, Burdeos, Quezon, Philippines on August 2013 to May 2014; and by various stakeholders in their Research, Development and Extension (RD&E) activities from 2000-2013 in Quezon, Philippines, and elsewhere.

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FOREWORD

The ***Manual of Seaweed Production and Discovery-based Exercises for Farmer Field Schools*** is part of a series of handy training kits co-published by the Peace and Equity Foundation (PEF) and the Social Action Center-Northern Quezon (SAC-NQ) Prelature of Infanta, Quezon, in collaboration with the Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, and the Samahan ng Nagkakaisang Mangingisda at Magsasaka ng Maybobon (SANAMMMAY).

The book has been enriched by extensive pioneering contributions from our SANAMMMAY seaweed farmers and technical experts at the University of the Philippines Marine Science Institute (UP-MSI), Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, as well as from our volunteer community organizers, facilitators, and other stakeholders.

We are incredibly pleased to note that PEF, SAC-NQ, BFAR, and SANAMMMAY are making enormous and valuable contributions in the promotion of sustainable agriculture, in general, and seaweed production, in particular, in Quezon, the Philippines, and elsewhere.

REV. FR. MARIO O. ESTABLECIDA
Administrator
Prelature of Infnta

PREFACE

The Peace and Equity Foundation (PEF) envisions self-sustaining households providing for their basic needs, food, water, shelter, education, and contributing to the socio-cultural growth, economic development, and efficient governance of their sustainable communities.

Among its most notable tasks includes the packaging and reuse of best practices and learning experiences to continuously build on new knowledge capital. A concrete output along this line is the *Manual of Seaweed Production and Field Guide of Discovery-based Exercises for Farmer Field Schools*, which is co-published by PEF and SAC-NQ, in collaboration with BFAR Region IV-A and SANAMMMAY.

This manual-field guide integrates the best practices and learning experiences on integrated cultural management (ICM) in seaweed production in the Polillo Group of Islands, Quezon and in other parts of the Philippines, as well as the lessons learned from other seaweed production practitioners elsewhere. This manual-field guide provides useful technical reference materials which could enhance experiential, discovery-based, and participatory learning approaches among fisher-folks (in general) and seaweed production training participants (in particular).

We are very confident that this handy training kit will be exploited, adapted, or modified by farmer field school (FFS) facilitators in conducting season-long FFSs on seaweed production not only in the Philippines but in other Asia-Pacific countries as well, when and where they judge them to be valuable.

ROBERTO R. CALINGO
Executive Director
Peace and Equity Foundation

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We are extremely pleased to acknowledge all seaweed growers, farmer field school (FFS) facilitators, academicians, researchers, private practitioners, and other stakeholders in seaweed production for their laudable efforts in moving forward to achieve the ultimate goals of their local integrated seaweed production programs as enabling tools of people empowerment in the Polillo Group of Islands, Quezon, the Philippines, and elsewhere. The experiences they shared in various endeavors formed the basis of many best practices and learned lessons compiled in this manual-field guide.

Our sincere gratitude goes to our volunteer community organizers [Mr. Renato Salazar and Mr. Jose T. Deles, Jr.], as well as the technical experts, sponsors, and other project-partners from the University of the Philippines Marine Science Institute (UP-MSI), headed by Dr. Gavino C. Trono, Jr. [Emeritus Professor], the Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, headed by Ms. Rosella C. Lucero [Regional Seaweed Coordinator], the Social Action Center-Northern Quezon (SAC-NQ) Prelature of Quezon, headed by Rev. Fr. Miguel Floro D. Avenilla [Coordinator] and Mr. Juanito A. Gucilatar [Project Manager], and the Samahan ng Nagkakaisang Mangingisda at Magsasaka ng Maybobon (SANAMMMAY), headed by Mr. Benito Tena [President], for their generous support afforded, without which this manual-field guide may not have been completed.

Incomparable appreciations are given as well to agricultural technologists from BFAR Region IV-A, Municipal Local Government Unit (MLGU) of Burdeos, Quezon, and other stakeholders for their wide-ranging innovative contributions. Moreover, this manual-field guide may not have been published without the consensus and financial assistance extended by the Peace and Equity Foundation (PEF) and the Social Action Center-Northern Quezon (SAC-NQ) Prelature of Infanta.

ABOUT THE PUBLISHERS

Peace and Equity Foundation (PEF), also known as Peace Equity Access for Community Empowerment Foundation, aims at transforming poor communities through sustainable social enterprise. Its missions are to: (a) manage and preserve the value of the endowment fund to promote opportunities for the poor to liberate themselves from poverty; (b) enable civil society organization and other partner-intermediaries to develop and innovate on best practices and models using a social enterprise approach; and (c) engage other stakeholders, government, business, and academe in leveraging resources and technologies to replicate and scale-up models that work for sustainable communities and enterprises. Enshrined in PEF mission are its values of: (a) service orientation and commitment [mission of service to the poor]; (b) innovation [seeking better ways and solutions]; (c) inclusiveness [openness to diverse cultures and sectors]; (d) participation [constructive participation of primary stakeholders]; (e) accountability [prudent stewardship of resources]; and (f) transparency [openness to evaluation and knowledge sharing].

Social Action Center-Northern Quezon (SAC-NQ) Prelature of Infanta is a Church-based, non-stock, non-profit organization operating at the Prelature of Infanta, Provinces of Aurora, and Quezon. Established in 1972 as an offshoot of the second Vatican Council's call for the Church greater involvement in social issues and concerns, SAC is the social action arm of the Prelature and an institution for social services. It coordinates, supervises, and implements social action programs aimed at improving the conditions of the poor. It also addresses the social, cultural, economic, and political needs of the people of the Prelature and Diocese. Its main thrust is to serve the poor, catering principally on the rights of the deprived, the oppressed, and the marginalized sectors (rural poor, fishing communities, farmers, menial laborers, indigenous people, especially women and children) in the Prelature of Infanta.

ACRONYMS AND ABBREVIATIONS

AESA	Agro-ecosystem Analysis
ASEAN	Association of Southeast Asian Nations
ASEAN IPM	ASEAN Integrated Pest Management Knowledge Network
DA	Department of Agriculture
FAO	Food and Agriculture Organization
FAO-IPM	Food and Agriculture Organization IPM Programme for Asia
FFS	Farmer Field School
ICM	Integrated Cultural Management
IPM	Integrated Pest Management
IPPM	Integrated Production and Pest Management
KASAKALIKASAN	Kasaganaan ng Sakahan at Kalikasan (Philippines National IPM Program)
LGU	Local Government Unit
MAO	Municipal Agricultural Office (or Officer)
NFE	Non-formal Education
NGO	Non-government Organization
PEF	Peace and Equity Foundation
PI	Prelature of Infanta
PTD	Participatory Technology Development
R&D	Research and Development
RD&E	Research, Development, and Extension
R&E	Research and Extension
ROI	Return on Investment
SAC-NQ	Social Action Center-Northern Quezon
SANAMMMAY	Samahan ng Nagkakaisang Mangingisda at Magsasaka ng Maybobon
SEARICE	Southeast Asia Regional Initiative for Community Empowerment
TOS	Training of Specialists
TOT	Training of Trainers

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INTRODUCTION

SECTION 1

INTRODUCTION

ABOUT THE MANUAL-FIELD GUIDE

This ***Manual of Seaweed Production and Field Guide of Discovery-based Exercises for Farmer Field School*** is designed for use as reference material by technical resource persons, extension workers, and facilitators of farmer field schools (FFSs), training of trainers (TOTs), and training of specialists (TOSs) courses for integrated cultural management (ICM) on seaweed production. It is based from best practices and learning experiences shared by the workshop participants (**Annex A**) and the technical resource persons (**Annex B**) during a *Workshop on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach* held in Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon, Philippines on 15-16 August 2013; by the participants (**Annex C**) from their actual experiences in the *Farmer Field School and Participatory Research and Learning on Seaweed Production* undertaken in the seawaters of Calotcut-Kalongkoan Islands, Burdeos, Quezon on August 2013 to May 2014; and by various stakeholders in their *Research, Development, and Extension (RD&E)* activities from 2000-2014 in the Polillo Group of Islands, Quezon, Philippines, and elsewhere.

This manual-field guide is a compilation of recent developments, current practices, and success accounts in implementing integrated cultural management on seaweed production. We involved as many stakeholders as was possible in collating and compiling these notable achievements for use by seaweed farmers and other seaweed production practitioners. Thus, this manual-field guide belongs to us and it will be useless unless the new ideas in it are put into action. With ownership comes accountability. It is our responsibility to adapt, update, redesign, and modify the manual-field guide as new experiences and ideas emerge from our own seaweed production activities. Hence, refinements, additions, and adaptations could be made on various concepts, principles, practices, and procedures assembled in this manual-field guide based on our new experiences and feedbacks.

For ease in searching topics, this manual-field guide is divided into seven (7) wide-ranging sections, namely: (i) introduction; (ii) preliminary farmer field school exercises; (iii) overview of the seaweed industry; (iv) epiphytes, other competitors, grazers, and diseases management in seaweed production; (v) integrated cultural management in seaweed production; (vi) group dynamics exercises; and (vii) technical and livelihood components.

RATIONALE FOR UNDERTAKING FARMER FIELD SCHOOL (FFS) ON SEAWEED PRODUCTION

In Quezon province, seaweeds are grown mainly on coastal waters surrounding several islands within the Polillo Group of Islands. The coastal waters in Calutcot-Kalongkoan Islands of Burdeos are excellent representation of seaweed farming in the area (**Figure 1**). Because of their location, fishing, as a source of livelihood for fisher-folks in Sitios Maydalaga, Maybobon, and Calutcot Proper, Barangay Calutcot, Burdeos, Quezon (island villages of Burdeos in Calutcot-Kalongkoan Islands), is stable only about half a year, from April to September, during the southwest monsoon season (*habagat*). Sea conditions become unfavorable to fishing, especially with small sea-crafts, during the other half of the year, from October to March, the northeast monsoon season (*amihan*). Hence, high rates of poverty characterize the population in the area. Moreover, pressure for survival encourages destructive fishing practices damaging to dangerous levels the coral resources of the area[1].

Figure 1. Map of Quezon Province Showing the Municipality of Burdeos

Figure 2. Map of Polillo Group of Islands Showing the Project Sites

There is, therefore, a need for complementary sources of livelihood for fisher-folks in these villages to improve their productivity and thus, alleviate poverty. Taking into consideration their previous experiences, seaweed farming can be a remarkably practical option. In early 2000, seaweed farming was introduced in the area. Large areas of channels between islands were found suited for year-round seaweed farming. The idea of seaweed farming caught on very quickly. With bumper crops and easy access to market, fishermen took to seaweed farming as important complement to fishing. But after a few successful

[1]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

production cycles, seaweed farms in the area were wiped out by pests and diseases, identified later by scientists as a bacterial disease (*Pseudomonas*, Flavobacteria), locally known as 'ice-ice' and an epiphytic red alga (Polysiphonia/Neosiphonia), popularly known as 'buhok-buhok'[2]. In the absence of technical assistance, the seaweed farmers have not been able to revive what they experienced as a lucrative enterprise, a good way out from poverty[3].

During the last decades, Local Government Units (LGUs) in Quezon Province worked together with the Philippine National Integrated Pest Management (IPM) Program (KASAKALIKASAN) in the conduct of farmer field schools (FFSs) in rice, corn, and vegetables. Experiences from KASAKALIKASAN and Food and Agriculture Organization (FAO) Programme for Community IPM in Asia have demonstrated that the FFS approach can greatly enhance farmers' skills and confidence and help in the lateral spread of what they learned. Faced with a varied range of technology options, the FFS approach can ably equip farmers with necessary skills and know-how to assess and choose technologies that suit their local situations through individual or group experimentation[4].

Building on substantial successes in quality education undertaken by LGUs through KASAKALIKASAN, Association of Southeast Asian Nation (ASEAN) IPM Knowledge Network, and FAO Inter-country IPM Programmes in Asia for terrestrial crops (rice, corn, vegetables, and other crops), a recent concept, the Integrated Production and Pest Management (IPPM) or Integrated Cultural Management (ICM), is seen as the most appropriate approach to ensure cleaner, safer, and sustained seaweed production in the project areas. There is also an urgent need for seaweed growers to sustain their production in order to safeguard the lucrative seaweed industry in North Lamon Bay. Currently, however, not much is known about a workable ICM approach for seaweed production in the Philippines. Conversely, there is a need to decentralize extension management to introduce community-based approaches and research-extension-farmer linkages to solve current production problems or constraints and develop a more effective and

[2]Trono, Jr. G.C. 2013. Seaweed Farming: PowerPoint Presentation for the Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach held on 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos, Quezon. 15 slides.

[3]Salazar, R. 2013. Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Concept Note, 14 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 8p.

[4]Callo, Jr., D.P. 2011. Process Monitoring Report: Increasing Rice Yield and Productivity Through the Promotion of Small-Scale Irrigation and Integrated Crop Management Systems in Rain-Fed Areas in the Philippines. GCP/PHI/059/EC European Union Food Facility (EEFF) Program through the U.N. Food and Agriculture Organization (FAO), Project Management Office, Philippine Rice Research Institute, Muñoz, Nueva Ecija, Philippines. 50p.

profitable integrated approach for growing seaweeds and other sea species around the coastal waters of the Polillo Group of Islands.

To methodically address the above concerns, the Peace and Equity Foundation (PEF) and Social Action Center-Northern Quezon (SAC-NQ) Prelature of Infanta, are jointly implementing the *Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach* at Calutcot-Kalongkoan islands, Burdeos Quezon (**Figure 2**), in collaboration with the Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A and the Samahan ng Nagkakaisang Mangingisda at Magsasaka ng Maybobon (SANAMMMAY)**.** Through this partnership and collaborative endeavor, a Farmer Field School (FFS) curriculum (**Annex D**) for seaweed production evolved.

OBJECTIVES OF PARTICIPATORY RESEARCH AND LEARNING ON SEAWEED PRODUCTION

The project employs a participatory research-training approach, where selected farmer-beneficiaries actively participate to learn effective seaweed farming under concrete local conditions using the FFS approach. The overall objective of the project is to revive the seaweed industry in the area (Calutcot-Kalongkoan islands) by providing timely and appropriate technical assistance to seaweed farmers in managing epiphytes, grazers, weeds, diseases, and other seaweed production and post-production constraints. Among others, the project shall specifically aim to:

- Develop, by working in partnership with local seaweed farmers, appropriate location-specific production and post-production technology options for seaweed growers to choose from;

- Design a season-long farmer field school (FFS) curriculum for seaweed production that can be used for sustained training and scaling-up of more innovative seaweed production and post-production technology options;

- Put in place a cadre of technically empowered fisher-folks who will sustain a socio-economically viable seaweed industry in the area;

- Get underway a composite team of facilitators (BFAR, LGU, NGO, and fisher-folk organization) who can continuously organize, conduct, and implement farmer field schools (FFS) on seaweed production at community, provincial, and regional levels;

- Strengthen seaweed farmers' organizations and link them to prospective partners for livelihood opportunities to further maintain the viability of seaweed industry in the area; and

- Flesh out an action plan of activities to address other concerns related to location-specific seaweed production and post-production technology development, up-scaling, and livelihood opportunities.

FORMAT FOR THE TOPICS

Each topic in this manual-field guide is grouped into sections, depending on relevant subject matters, and presented in a standard format as shown below:

- *Question Formatted Sub-heading*. For better appreciation by users of this manual-field guide, sub-headings of topics are presented in question format. Depending upon the subject matter, contents may consist of technical background, rationale, and objectives, implementation strategies, results, accomplishments, or important lessons learned from an activity, study, or undertaking.

- *Use of Tables, Figures, and Pictures*. In many cases, tables, figures, and pictures are used to further expound results, accomplishments, or important lessons learned from an activity, study, or undertaking.

- *References Citation*. References are provided for each topic to allow readers or users of this manual-field guide to validate information contained in a particular activity, study, or undertaking.

PRELIMINARY FARMER FIELD SCHOOL EXERCISES

SECTION 2

PRELIMINARY FARMER FIELD SCHOOL EXERCISES

This section includes *Preliminary Farmer Field School Exercises* that are undertaken before starting the regular farmer field school sessions. These exercises define the issues, concerns, approaches, and 'learning field' activities agreed upon by the farmer-participants and facilitators in addressing farmers' problems in seaweed production. These include the following activities:

- What is a Discovery-based Exercise?
- Gap Analysis for Farmer Field School and Participatory Research and Learning on Seaweeds Production
- Development of Curriculum for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach
- Designing and Establishing the Learning Fields for Farmer Field School and Participatory Research and Learning on Seaweeds Production
- Designing the Agro-ecosystem Analysis (AESA) Monitoring Formats and Procedures for Seaweed Production Trial and Variety Adaptation Trial Plots
- 'Ballot Box' Exercise for Participants of Farmer Field School on Seaweed Production

WHAT IS A DISCOVERY-BASED EXERCISE[5]*?*

Introduction

In our previous workshops we repeatedly asked these questions, 'What do we really mean by a discovery-based exercise?' and 'How can we make this exercise more discovery-based?' There were no *ultimate* answers to these questions, but a number of patterns and ideas did emerge from our design sessions. These are described below. We hope that they give you some ideas of what we were aiming for:

Why is there a need to go to the seaweed farm?

The seaweed farm provides main learning material for FFS and other seaweed farms in coastal *barangay* (village) provide us with an extra resource when needed. Any exercise that we design should have its roots in seaweed farms. This means that we need to go out to the seaweed farms (**Figure 3**) and observe *before* we start any discussions or activities.

Figure 3. Participants of the FFS on seaweed production observe their seaweed crops in small group at the coastal waters of Calutcot-Kalongkoan Islands

What is happening in the seaweed farm today?

If activities are rooted in the seaweed farm, they are also based on what is happening in the seaweed farm at *this time*. We cannot generally discover something *now* if it either happened in the past, or will happen in the future. Therefore, activities described in this field guide are designed to be used in response to what is happening in the seaweed farm NOW!

Why do we share our experiences?

We must never forget that seaweed farmers may already have plenty of experiences on a particular topic. We need to listen to and learn about seaweed farmers'

[5]Adapted from Callo, Jr., D.P., Esteban, I.D., and Hiyama, C. 2009. Field Guide of Discovery-based Exercises on FFS for Agro-forestry. DENR-JICA Project for Enhancement of Community-Based Forest Management Program, Department of Environment and Natural Resources-Region 3, Department of Agriculture's Philippine National IPM Program, and ASEAN IPM Knowledge Network, National Agribusiness Corporation, PSE Building, Exchange Road, Ortigas Center, Pasig City, Philippines. p4-7.

experiences. We will gain new ideas and insights from local practices, as well as having a better idea of areas where seaweed farmers are lacking in technical information or understanding.

What do seaweed farmers want and need?

The people who are discovering in FFS are primarily SEAWEED FARMERS!

People remember[6]*:* *20% of what they HEAR*
40% of what they SEE
80% of what they DISCOVER FOR THEMSELVES.

Some of the things that FFS group discovers are also new to us. Nevertheless, 'discovery-based' exercises aim to help participants remember more of what they are learning. Therefore, we must choose exercises based on what SEAWEED FARMERS want and need to discover for themselves!

Why do we need to discover, evaluate, and understand?

We do not want to start any exercise with the assumption that there will be a *correct* answer or outcome. If we do this, then we cannot expect participants to learn from what they have observed. Instead, they will just tell us what they think we want to hear, based on what we told them to say!

An example: If we want to run a session on 'Record Keeping,' we cannot start the session by saying, '*Record keeping is important*, so what records do you think we should keep?' Even if this seems participatory, it is not discovery-based, because we have started by instructing farmers that record keeping is important! Instead, we need to guide farmers to *discover* that record keeping may be useful for them.

By discovering information ourselves and then evaluating *if* and *how* it could be useful, we can start to look more critically at what we observe or hear.

By thinking *critically, we* are not being *NEGATIVE*, we are actually being *POSITIVE*. We do not just think what people *tell* us to think anymore. We are starting to build skills in *analyzing* what we observe. We can then base our decisions on our *own experiences* and *understanding*. These skills of critical *questioning*, *discovery*, *analysis,* and *evaluation* are what seaweed farmers take away from FFS to use in tackling new problems on their own seaweed farms.

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[6]Hope, A. and Timmel, S. 1994. Training for Transformation 1: A Handbook for Community Workers. Mambo Press, Gweru, Zimbabwe. pp99-120.

Thus, building seaweed farmers' DISCOVERY-BASED skills
WITH seaweed farmers' DECISION-MAKING skills is what makes
farmer field school on seaweed production SUSTAINABLE!

What are the general guidelines for discovery-based exercises!

In consideration of the above, participants in recently concluded curriculum development workshops[7-8], as in our previous curriculum development workshop[9], agreed on some general guidelines in conducting discovery-based exercises for FFS on seaweed production namely:

1. Exercise should be preceded by a field activity (e.g., field walk, field observation, field visit, etc.);

2. Procedure should enhance participatory, discovery-based, and experiential learning;

3. Exercise should be designed to facilitate regular FFS activities, such as agro-ecosystem analysis (AESA), field studies, cultural management practices, and special topics;

4. Exercise should encourage use of environment-friendly and other non-destructive indigenous practices; and

5. Exercise should use appropriate non-formal education techniques (NFE) as learning tools like the use of actual specimens or farmer-made visual aids as learning tools.

[7]Callo, Jr., D.P. 2008. Highlights of Outputs. Workshop on Designing Farmer Field School Curriculum on Integrated Pest Management for Organic Vegetable Production held on 28-30 April 2008 at the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development Council (PCARRD), Los Baños, Laguna, Philippines.
[8]Callo, Jr., D.P. 2008. Highlights of Outputs. Write-shop to Develop A Field Guide of Discovery-based Exercises for FFS of IPM on Organic Vegetable Farming conducted in the Philippines on 17-19 June 2008 at the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development Council (PCARRD), Los Baños, Laguna, Philippines.
[9]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

Exercise No. 2.1:

GAP ANALYSIS FOR FARMER FIELD SCHOOL AND PARTICIPATORY RESEARCH AND LEARNING ON SEAWEEDS PRODUCTION

Background and rationale

Before embarking on a curriculum development endeavor, a gap analysis will have to be taken on at the outset. Data or information needed for gap analysis may well come from many sources, such as ground-working, barangay (village) immersion, baseline data gathering (**Figure 4A**), and focus group discussions[10], among others.

The local training team (community organizers, facilitators, local extension workers, and technical experts), as a pre-farmer field school (FFS) activity, carries out the task of ground-working. Ground-working determines actual needs in an area, which will ultimately be used as basis in developing local seaweed production programs. Largely, the success of a local seaweed production program is directly related to the quality of ground-working activities conducted.

Figure 4. (A) Ground-working, barangay immersion, and baseline data gathering activities by FFS training team, (B) small group workshop and (C) presentation of focus group discussion results by the FFS on seaweed production participants at Sitio Maydalaga, Barangay Calutcot, Kalongkoan Island, Burdeos, Quezon

Another useful activity prior to initiating a gap analysis exercise is the gathering of baseline data from FFS farmers-participants. Baseline data are important for comparison with current data when stakeholders review and assess impact of local seaweed production programs to farmer-participants and their communities. The formulation of appropriate recommendations, which will form courses of actions or

[10]Callo, Jr., D.P., Teofilo, L.B., and Tauli, H.A. (eds). 2002. Field Guide of Discovery-based Exercises for Vegetable IPM, Volume II. SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, Laguna, Philippines. pp17-25.

interventions, will depend on accurateness of baseline data gathered. Hence, the usefulness of baseline data is contingent on accurate data gathering.

For the FFS on seaweed production project in Calutcot-Kalongkoan islands, Burdeos, Quezon, gap analysis was conducted through workshops and focus group discussions (**Figure 4B**) with the farmer-participants of the FFS on seaweed production. Primarily, the exercise validated the information gathered by the training team from ground-working and barangay (village) immersion activities. A gap analysis exercise provides more detailed information on crop production problems, current cultural management practices, and socio-economic constraints, among others. This exercise was designed as a run through of curriculum development for farmer field school (FFS) on seaweed production.

When is this exercise most appropriate?

- Before starting a regular farmer field school (FFS) session; and
- After undertaking ground-working and barangay (village) immersion activities.

How long will this exercise take?

- One hour for small group workshop and focus group discussions; and
- Thirty minutes to one hour for presentation of results (**Figure 4C**), big group brainstorming session, and consolidation of outputs.

What are the learning objectives?

- To make participants aware and understand the importance of a gap analysis exercise in identifying the course content, field studies, and design of an FFS curriculum on seaweed production; and
- To learn innovative approaches and do hands-on of gap analysis as a pre-curriculum development exercise of a local FFS program on seaweed production.

What are the materials needed?

- Barangay (village) spot or soil map indicating farm sites of prospective farmer-participants of FFS on seaweed production;
- Farmer-validated ground-working, barangay (village) immersion, and baseline survey results on seaweed production; and
- Office supplies (e.g., Manila papers, notebooks, ball pens, and marking pens).

What will be the methodology?

• Small group workshop, focus group discussions, and brainstorming in big group.

What are the steps in a gap analysis exercise?

1. Conduct participatory (focus group) discussions in big group (plenary) to validate initial information gathered by the FFS training team members from their ground-working, barangay (village) immersion, and baseline survey activities with the farmer-participants of the FFS on seaweed production;

2. Divide the FFS participants into 4-5 smaller groups, request each group to assign their individual group leaders, and conduct a workshop on gap analysis by answering pre-determined guide questions based on validated results from the focus group discussions, namely:

   - ✓ What problems did you encounter in growing seaweeds in the coastal waters of Calutcot-Kalongkoan islands?
   - ✓ What solutions did you carry out to address those problems?

3. Present workshop outputs of the small groups to the big group, conduct brainstorming session in big group (plenary), and agree on FFS course content based on gap analysis results.

What are some suggested questions for the processing discussion?

- What is a gap analysis? Why do we need to conduct a gap analysis exercise before starting an FFS session? Who are the participants in a gap analysis exercise?
- What data do we need to initially gather for a gap analysis exercise?
- What method or approach is most appropriate in undertaking a gap analysis exercise for farmer field schools on seaweed production?
- Can we use gap analysis data to plan present and future FFS activities on seaweed production? How?
- When do we conduct a gap analysis exercise for farmer field schools?

What were the results of a gap analysis exercise conducted for FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands[11]?

Through small group workshops, focus group discussions, and brainstorming sessions, a gap analysis exercise was jointly conducted by the facilitators and participants of the FFS on seaweed production. The exercise focused on addressing the guide questions with regard to growing of seaweeds in the coastal waters of

[11]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

Calutcot-Kalongkoan islands, Burdeos, Quezon as mentioned above. The results of the gap analysis exercise are summarized below:

Major problems encountered by seaweed farmers in growing seaweeds at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon

- Problems of diseases, epiphytes, and grazers
- Inadequate locally adapted seaweed varieties
- Lack of available location-specific cultural management options
- Lack of good harvest and post-harvest technologies
- No or inadequate production capital
- Problem of market outlets and prices

Solutions to the problems encountered by seaweed farmers in growing seaweeds at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon

1. *Problems of diseases, epiphytes, and grazers*: Selecting healthy seedling materials, pruning of affected parts, transferring to unaffected farm sites, adjusting planting depth, modifying method of planting, avoiding adverse seasons

2. *Inadequate locally adapted seaweed varieties*: planting currently available varieties using indigenous cultural practices

3. *Lack of available location-specific cultural management practices*: modifying current practices based on their individual experiences as often as necessary

4. *Lack of good harvest and post-harvest technologies*: using traditional knowhow on harvest and post-harvest operations

5. *No or inadequate production capital*: farming an area depending on available cash or informally acquired capital

6. *Problems of market outlets and prices*: selling to local traders who oftentimes dictate the farm gate prices

Exercise No. 2.2:

DEVELOPMENT OF A CURRICULUM FOR PARTICIPATORY RESEARCH AND LEARNING OF SEAWEED FARMERS THROUGH THE FARMER FIELD SCHOOL APPROACH

Background and rationale

As discussed earlier, ground-working, barangay (village) immersion, focused group discussions, and gap analysis are among the essential activities to be taken on before a curriculum development for farmer field school (FFS) is initiated. In the case of FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon, a *Workshop on the Development of Curriculum for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach*[12] was undertaken as an inception activity.

Figure 5. Seaweed experts, training team members, and seaweed farmers conduct (A) site visits and assessments and (b) site selection and field activity identification for FFS on seaweed production at the coastal waters of Calutcot-Kalongkoan Islands

The workshop consisted of 'learning field' and 'training session' activities. The 'training session' activities involved the sharing of experiences and learned lessons on: (a) expert views on current technological innovations, (b) farmers best practices and experiences in seaweed growing, and (c) current issues and concerns in seaweed production. On the other hand, the 'learning field' activities included: (a) site visit and assessment of seaweed growing areas (**Figure 5A**), and (b) site selection and field activity identification (**Figure 5B**) for FFS on seaweed production.

[12]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

Taking into consideration the outputs of the 'training session' and 'learning field' activities, as well as those of the gap analysis exercise, the workshop proceeded on to: (a) technical topics identification, (b) 'learning field' and 'training session' activity identification, and (c) training process adaptation, more particularly for the participants of the FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon.

When is this exercise most appropriate?

- Before starting a regular farmer field school (FFS) session; and
- After undertaking the gap analyses exercise.

How long will this exercise take?

- One day for 'training session' activities, which allow the sharing of experiences and learned lessons through participatory discussions and brainstorming sessions;
- Half-day for 'learning field' activities, which include site visit and assessment, site selection, and field activity identification; and
- Another half-day for designing a curriculum for local FFS program on seaweed production.

What are the learning objectives?

- To make participants aware and understand the importance of a curriculum development workshop for the design of an FFS curriculum on seaweed production; and
- To learn innovative approaches and do hands-on on curriculum development for a local FFS program on seaweed production.

What are the materials needed?

- Seaweed farms and prospective 'learning fields' for farmer-participants of FFS on seaweed production;
- Farmer-validated gap analysis results on seaweed production; and
- Office supplies (e.g., Manila papers, notebooks, ball pens, and marking pens).

What will be the methodology?

- Workshop through seaweed farm visits, sharing of experiences, brainstorming, and participatory discussions in big group (plenary) and small group sessions.

What are the steps in a curriculum development workshop for FFS on seaweed production?

1. Undertake sharing of experiences and learned lessons among seaweed experts, facilitators, and participants of FFS on seaweed production through participatory discussions and brainstorming in small (4-5) groups and big group (plenary) sessions on:

   - ✓ Expert views on current technological innovations;
   - ✓ Farmers best practices and experiences in seaweed growing; and
   - ✓ Current issues and concerns in seaweed production

2. Conduct site visit and assessment, site selection, and field activity identification with the farmer-participants of the FFS on seaweed production;

3. Conduct workshop to design a curriculum, more particularly for FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon in small (4-5) groups and big group (plenary) through participatory discussions and brainstorming sessions among seaweed experts, facilitators, and participants on:

   - ✓ Technical topics identification;
   - ✓ 'Learning field' and 'training session' activity identification; and
   - ✓ Training process adaptation.

4. Summarize and present workshop outputs in the big group (plenary), conduct additional brainstorming session (if necessary), and agree on a curriculum design for FFS on seaweed production, specifically for the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon.

What are some suggested questions for the processing discussion?

- What is an FFS curriculum? Why do we need to conduct a curriculum development workshop before designing an FFS curriculum? Who are the participants in an FFS curriculum development workshop?
- What data do we need to initially gather for designing a curriculum for FFS on seaweed production?
- What method or approach is most appropriate in undertaking a curriculum development workshop for farmer field schools on seaweed production?
- Can we use gap analysis data to design a curriculum for FFS on seaweed production? How?
- When do we conduct a curriculum development workshop for farmer field schools?

What were the outputs of the curriculum development workshop conducted for FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands[13]?

The 'Workshop on the Development of Curriculum for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach' was carried out by undertaking 'learning field' and 'training session' activities. The workshop outputs were generated through participatory discussions and brainstorming in small (4-5) groups and big group (plenary) sessions. Thus, the outputs of the curriculum development workshop for FFS on seaweed production, specifically for the coastal waters of Calutcot-Kalongkoan islands are summarized below:

- ✓ Clear understanding of the current technological innovations, farmers best practices, and experiences in seaweed growing;
- ✓ Thorough appreciation of current issues and concerns in seaweed production;
- ✓ Identification of technical topics, 'learning field' and 'training session' activities, and training methodologies; and
- ✓ Curriculum design for FFS on seaweed production for the southwest monsoon ('habagat') season, which can be adapted or fine-tuned for northeast monsoon ('amihan') season, and the calm, hot, and dry ('lantapin') season. The curriculum design for FFS on seaweed production consists of two sections (**Annex D**), namely:

  a. *Characteristics of an FFS on seaweed production*; and

  This sub-section (see **Annex D_A**) defines the principles, approaches, methodologies, and component activities of typical season-long farmer field school (FFS) sessions. It highlights the andragogic, experiential, and discovery-based approach of an FFS as a direct contrast to the traditional, pedagogic, diffusionist, and top-down extension paradigm.

  b. *Season-long activity guide for an FFS on seaweed production*

  This sub-section (see **Annex D_B**) details the weekly activities of an FFS on seaweed production. It highlights the two important phases in the design of an FFS curriculum, namely: (a) workshop on curriculum development; and (b) season-long FFS weekly activities. The curriculum design is an adaptation of a typical FFS on terrestrial crops. While the participants meet for half day every

[13]Callo, Jr. D.P. 2013. Scaling Up on FFS for Seaweed Production and Expansion to FFS for Sea Cucumber Production: Concept Note. Maydalaga, Kalongkoan Island, Burdeos, Quezon. p5-21.

week, they conduct an agro-ecosystem analysis (AESA) only on one study in their 'learning fields' every other week. Thus, on weeks 1, 3, 5, 7, 9, 11, 13, 15, and 17, the AESA are carried out only in the Seaweed Production Trial plots while on weeks 2, 4, 6, 8, 10, 12, 14, 16, and 18, the AESA are taken on only in the Seaweed Variety Adaptation Trial plots. This approach was decided and agreed upon by the FFS participants and facilitators, not only to use the half day weekly sessions efficiently, but also to ensure a more focused and exhaustive participatory discussions and analysis of the individual bi-weekly 'learning field' studies and weekly 'training session' activities.

<u>Exercise No. 2.3</u>:

DESIGNING, LAY-OUTING, AND ESTABLISHING THE LEARNING FIELDS FOR FARMER FIELD SCHOOL AND PARTICIPATORY RESEARCH AND LEARNING ON SEAWEEDS PRODUCTION

Background and rationale

In order to address the most important seaweed production issues ensuing from a gap analysis exercise, 'learning field' studies, to be agreed upon by the FFS participants and facilitators, are set-up in a seaweed 'learning field'. On the whole, such 'learning field' studies are arranged based on prioritized seaweed production problems that are most common in seaweed farms of farmers within a project area. In consonance with the learning objectives of enhancing the seaweed farmer-participants' decision-making skills through the Agro-Ecosystem Analysis [AESA] and Participatory Technology Development [PTD], the 'learning field' studies carried out by the seaweed farmers at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon consisted of two key components, namely: (a) seaweed production trial plots for the participants to unravel the process of solving location-specific production problems; and (b) seaweed variety adaptation trial plots for the participants to develop the skills in isolating seaweed varieties that are most adapted to their local growing conditions.

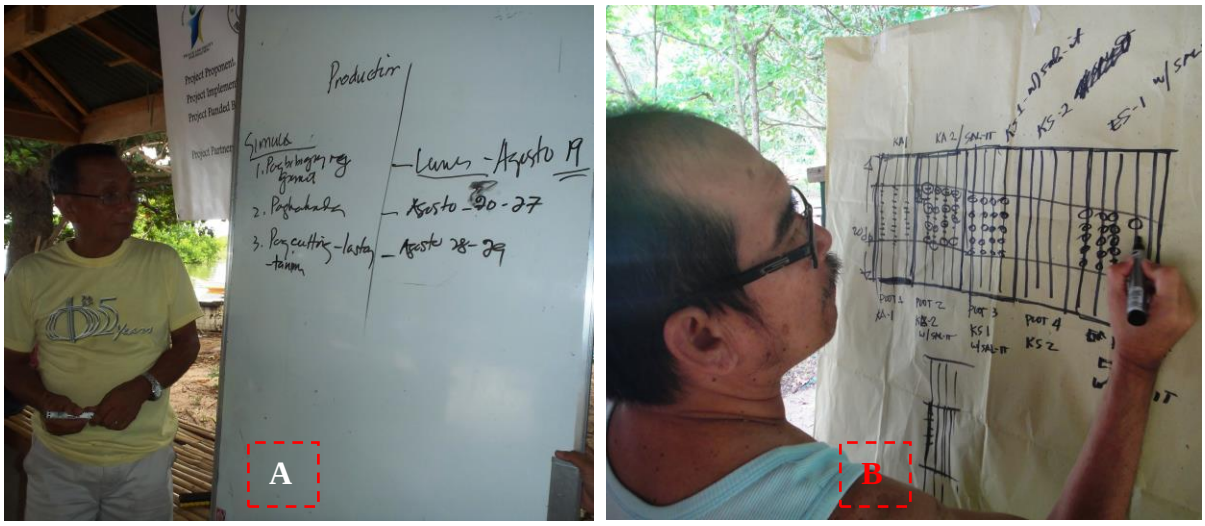

Figure 6. Facilitators lead participatory discussions in designing the 'learning field' lay-outs, for (A) production trial plots and (B) variety adaptation trial plots, with the farmer-participants of the FFS on seaweed production at the coastal waters of Calutcot-Kalongkoan Islands

In previous farmers' field schools (FFSs) for terrestrial crops, the 'learning field' lay-out considered only one study (e.g., crop protection or cultural management) consisting of two treatments (e.g., integrated pest management versus farmers' crop

protection practice [IPM vs. FCP] or integrated crop management versus farmers' management practice [ICM vs. FMP])[14]. Such lay-out had been modified in current FFS on seaweed production, which now involve two 'learning field' studies (e.g., production trial plots and variety adaptation trial plots). Unlike an FFS for terrestrial crops, where there is only one 'learning field', the FFS for seaweeds make use of several 'learning fields' depending on the number of small groups. This exercise will focus on addressing this particular concern.

When is this exercise most appropriate?

- After designing the FFS on seaweed curriculum; and
- Before seedling establishment in the 'learning fields' for (FFS) on seaweed production.

How long will this exercise take?

- Half-day for 'training session' activities, which allow the sharing of experiences and learned lessons through participatory discussions and brainstorming sessions before designing the 'learning fields' for FFS on seaweed production;
- Another half-day for preparation of seaweed seedlings and planting materials
- One day for 'learning field' activities, which include lay-outing and establishing the 'learning fields' for FFS on seaweed production.

What are the learning objectives?

- To make participants aware and understand the importance of designing appropriate 'learning fields' lay-out before the establishment of 'learning field' studies for an FFS on seaweed production; and
- To learn innovative approaches and do hands-on on designing 'learning field' lay-outs and establishing 'learning fields' for an FFS on seaweed production.

What are the materials needed?

- Selected 'learning field' sites with the farmer-participants of FFS on seaweed production;
- Individual group lay-outs of 'learning fields' agreed upon by the participants and facilitators for FFS on seaweed production; and
- Office supplies (e.g., Manila papers, notebooks, ball pens, and marking pens).
- Field supplies (e.g., floaters, mainlines, mono-lines, plastic straws, seedling materials, mangrove posts, among others)

[14]Callo, Jr., D.P., L.B. Teofilo, and H.A. Tauli (eds). 2002. Field Guide of Discovery-based Exercises for Vegetable IPM, Volume II. SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, Laguna, Philippines. pp45-48.

What will be the methodology?

- Workshop through seaweed 'learning field' activities, sharing of experiences, brainstorming, and participatory discussions in big group (plenary) and small group sessions.

What are the steps in design of 'learning field' lay-outs and establishment of 'learning fields' for FFS on seaweed production?

1. Undertake sharing of experiences and learned lessons among facilitators and participants of FFS on seaweed production through participatory discussions and brainstorming in small (4-5) groups and big group (plenary) sessions on:

   ✓ Current seaweed production constraints (based on gap analysis) that farmers want to address in FFS on seaweed production; and
   ✓ Current farmers best practices and experiences in seaweed establishment and seaweed growing.

2. Design the 'learning field' lay-outs, more particularly for FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon in small (4-5) groups and big group (plenary) through participatory discussions and brainstorming sessions among facilitators and participants on:

   ✓ Seaweed production trial plots; and
   ✓ Seaweed variety adaptation trial plots.

3. Summarize and present outputs in the big group (plenary), conduct additional brainstorming session (if necessary), and agree on the design of 'learning field' lay-outs for FFS on seaweed production, specifically for the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon.

4. Conduct actual layouting and establishment of 'learning field' studies in small groups at their selected 'learning field' locations in the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon.

5. Share and consolidate in big group (plenary) the experiences and learned lessons from actual lay-outing and establishment of 'learning field' studies in the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon.

What are some suggested questions for the processing discussion?

- What is a 'learning field' lay-out? Why do we need to design 'learning field' lay-outs?
- What information do we need in designing 'learning field' lay-outs for FFS on seaweed production?
- Can we use gap analysis data to design 'learning field' lay-outs for FFS on seaweed production? How?
- When do we conduct the actual lay-outing and establishment of 'learning field' studies for farmer field schools?

What were the outputs of the activities on designing and establishing 'learning field' studies for FFS on seaweed production in the coastal waters of Calutcot-Kalongkoan islands?

The activities on designing, lay-outing, and establishing the 'learning field' studies for FFS on seaweeds production, specifically for the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon, were carried out by undertaking participatory discussions, sharing of experiences, brainstorming, and hands-on in small (4-5) groups and big group (plenary) sessions. The outputs[15] of these activities are summarized below:

Figure 6. Layout of production trial plots showing (A) location of group members per plot and (B) row orientation of *Kappaphycus alvarezii* mono-lines per group member

a. *Seaweed production trial plots*

The big group chose *Kappaphycus alvarezii*, a popularly-grown seaweed variety in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon, as the test crop in their seaweed production trial plots. It was decided upon that:

[15]Darag, Jr., A.N. 2013. Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 10-13 September 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 12p.

- ✓ Each small group member will lay-out their seaweed production trial plots individually but side by side with the other small group members in their selected 'learning field' location;
- ✓ Each small group will establish the 'learning fields' for their seaweed production trial plots in selected criteria-based locations with varying substratum depth at high tide of 4.6 m, 4.9 m, 5.9 m, and 4.2 m for Groups 1, 2, 3, and 4, respectively as shown in **Figure 6A**.
- ✓ Each small group member will maintain 20 rows (in 20 m long mono-lines with 30-33 seedling ties per mono-line) of *Kappaphycus alvarezii* variety in their individual seaweed production trial plot as shown in **Figure 6B**.

b. *Seaweed variety adaptation trial plots*

The big group selected five (5) out of eight (8) introduced varieties from Calatagan, Batangas and *Kappaphycus alvarezii* Strain 1 (KA_1), a popularly-grown seaweed strain in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon, as the test crops in their seaweed variety adaptation trial plots. The other seaweed varieties tested were *Kappaphycus alvarezii* Strain 2 (KA_2), *Kappaphycus striatum* Strain 1 (KS_1), *Kappaphycus striatum* Strain 2 (KS_2), *Kappaphycus striatum* Strain 4 (KS_4), and *Eucheuma spinosum* (*denticulatum*) Strain 1 (ES_1). It was agreed upon that:

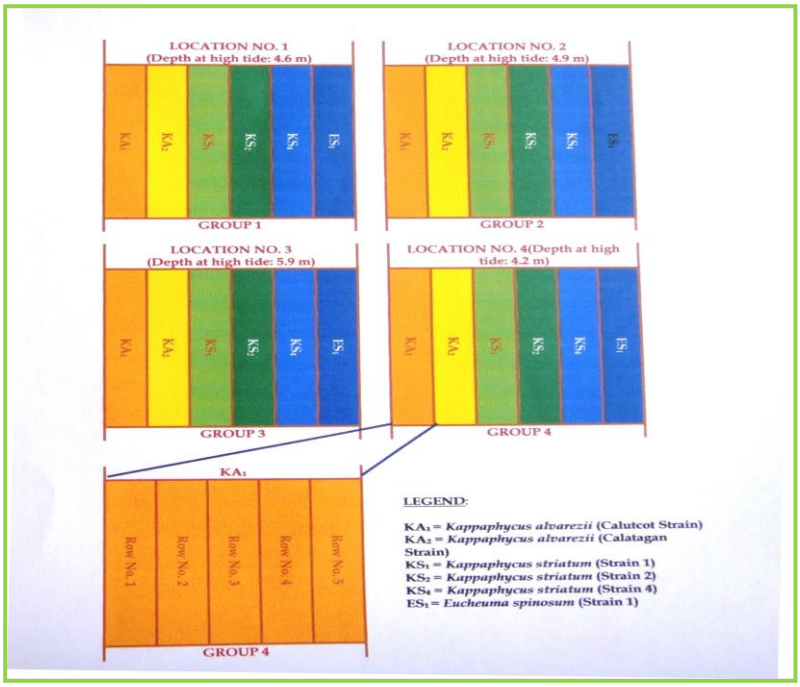

Figure 7. Layout of the variety adaptation trial plots showing (A) location of seaweed varieties per plot and (B) row orientation of seaweed mono-lines per seaweed variety

- ✓ Each small group will lay-out their seaweed variety adaptation trial plot side by side with their seaweed production trial plot in their selected 'learning field' location;
- ✓ Similarly, each small group will establish the 'learning fields' for their seaweed variety adaptation trial plots in selected criteria-based locations with varying

substratum depth at high tide of 4.6 m, 4.9 m, 5.9 m, and 4.2 m for Groups 1, 2, 3, and 4, respectively as shown in **Figure 7A**.

- ✓ Each small group will maintain 5 rows (in 20 m long mono-lines with 30-33 seedling ties per mono-line) of each variety in their seaweed adaptation trial plot as shown in **Figure 7B**.

Exercise No. 2.4:

DESIGNING THE AGRO-ECOSYSTEM ANALYSIS (AESA) MONITORING FORMATS AND PROCEDURES FOR SEAWEED PRODUCTION TRIAL AND VARIETY ADAPTATION TRIAL PLOTS

Background and rationale

Seaweed agro-ecosystem analysis (AESA) is a way of assembling what participants are studying and placing into a process useful for decision-making based on many a-biotic and biotic factors[16]. An AESA, therefore, must look into various elements of

Figure 8. Agro-ecosystem analysis (AESA) for FFS on seaweed production at the coastal waters of Calutcot-Kalongkoan Islands: (A) 'learning field' observation and (B) data processing in small group; AESA presentation for (C) production trial plot and (D) variety adaptation trial plot to the big group

[16]Callo, Jr., D.P., Baniqued, C.A., Maagad, A.G., Villa, N.C., Tobia, O.T., and Seballos, K.A. (eds). 2009. Field Guide of Discovery-based Exercises for Organic Vegetable Production. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Department of Science and Technology, Los Baños, Laguna. p31-34.

a seaweed crop ecosystem, how these elements, in one way or another, affect a crop and what are those elements that work interdependently or separately for a particular seaweed variety or crop. This exercise, therefore, provides a holistic approach in monitoring seaweed varieties or crops in question.

In previous field guides[17-18], the minimum data necessary for decision-making had been established for FFS on terrestrial crops. For this manual-field guide, minimum data necessary for decision-making in FFS on seaweed production will have to be established as well. In this regard, an agro-ecosystem analysis (AESA) format, detailing these minimum data, must be jointly developed by the participants and facilitators to ascertain a more organized AESA procedure and an enhanced decision-making skills development among the participants. Thus, this activity will be undertaken to address this particular concern.

When is this exercise most appropriate?

- Before starting the weekly agro-ecosystem analysis (AESA) for an FFS on seaweed production; and
- After the 'learning fields' establishment for an FFS on seaweed production.

How long will this exercise take?

- One to two hours for 'training session' activities for sharing of experiences, participatory discussions, and brainstorming in big group (plenary) to establish the minimum data required for decision-making and to agree on AESA formats for FFS on seaweed production;
- Another one to two hours for 'learning field' pre-testing activities, which will include seaweed farm observations, data gathering, and filling-up of AESA formats; and
- Another one hour for 'training session' activities for reporting in small groups and finalizing the AESA formats in big group (plenary) on:

  - ✓ Seaweed production trial, and
  - ✓ Seaweed variety adaptation trial.

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[17]Callo, Jr., D.P., Teofilo, L.B. and Tauli, H.A. 2002. Field Guide of Discovery-based Exercises for Vegetable IPM, Volume II. SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, Laguna, Philippines. pp13-16.

[18]Callo, Jr., D.P., Esteban, I.D., and Hiyama, C. 2009. Field Guide of Discovery-based Exercises on FFS for Agro-forestry. DENR-JICA Project for Enhancement of Community-Based Forest Management Program (ECBFMP), Department of Environment and Natural Resources, Region III, San Fernando City, Pampanga, Philippines and ASEAN IPM Knowledge Network (ASEAN IPM), National Agribusiness Corporation, PSE Building, Exchange Road, Ortigas Center, Pasig City, Philippines p37-49.

What are the learning objectives?

- To make participants aware and understand the importance of establishing the minimum data for decision-making and for designing the agro-ecosystem analysis (AESA) formats for FFS on seaweed production; and
- To learn innovative approaches and do hands-on on agro-ecosystem analysis (AESA) for FFS on seaweed production.

What are the materials needed?

- Seaweed 'learning fields' for farmer-participants of FFS on seaweed production;
- Farmer-validated agro-ecosystem analysis (AESA) formats;
- Office supplies (e.g., Manila papers, notebooks, ball pens, and marking pens); and
- Field supplies (e.g., weighing scale, thermometer, refractometer, plastic bags, AESA monitoring forms, among others).

What will be the methodology?

- Workshop through seaweed farm observation, sharing of experiences, brainstorming, and participatory discussions in small groups (4-5) and big group (plenary) sessions.

What are the steps in designing the agro-ecosystem analysis (AESA) monitoring formats and procedures for FFS on seaweed production?

4. Undertake sharing of experiences, participatory discussions, and brainstorming in small (4-5) groups and big group (plenary) sessions among seaweed experts, facilitators, and participants of FFS on seaweed production in order to establish and agree on the following:

    - ✓ Minimum data required for decision making on seaweed production trial plots;
    - ✓ Minimum data required for decision making on seaweed variety adaptation trial plots;
    - ✓ Agro-ecosystem analysis (AESA) monitoring format for seaweed production trial plots; and
    - ✓ Agro-ecosystem analysis (AESA) monitoring format for seaweed variety adaptation trial plots

5. Conduct observation and data gathering (**Figure 8A**) in small groups on the seaweed production and variety adaptation trial plots at the 'learning fields' for

FFS on seaweed production to validate the minimum data agreed upon and to pre-test the AESA monitoring formats;

6. Conduct workshop to finalize the minimum data to be gathered and the AESA monitoring formats in small groups (**Figure 8B**) and big group (plenary) through participatory discussions and brainstorming sessions among seaweed experts, facilitators, and participants; and

7. Summarize and present workshop outputs in the big group (plenary), conduct additional brainstorming session (if necessary), and agree specifically for FFS on seaweed production in the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon on the following:

   - ✓ Minimum data required for decision making on seaweed production trial plots;
   - ✓ Minimum data required for decision making on seaweed variety adaptation trial plots;
   - ✓ Agro-ecosystem analysis (AESA) monitoring format for seaweed production trial plots (**Figure 8C**); and
   - ✓ Agro-ecosystem analysis (AESA) monitoring format for seaweed variety adaptation trial plots (**Figure 8D**).

What are some suggested questions for the processing discussion?

- What are the minimum data required for decision-making in seaweed production? Why do we need to develop agro-ecosystem analysis (AESA) monitoring formats for FFS on seaweed production? Who will gather the minimum data required for decision-making in seaweed production?
- How do we gather agro-ecosystem analysis (AESA) data for FFS on seaweed production?
- How often do we conduct agro-ecosystem analysis (AESA) for FFS on seaweed production? Why?

What were the outputs of the workshop on designing AESA monitoring formats and procedures for FFS on seaweed production, specifically in the coastal waters of Calutcot-Kalongkoan islands[19]?

As discussed earlier in **Exercise No. 2.3**, the FFS on seaweed production participants meet for half day every week, but conduct an agro-ecosystem analysis (AESA) only on one study in their 'learning fields' every other week. Thus, the AESA in the

[19]Darag, Jr., A.N. 2013. Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 10-13 September 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 12p.

Seaweed Production Trial (SPT) plots and in the Seaweed Variety Adaptation Trial (VAT) plots are carried out alternately every other week. In this regard, two separate AESA monitoring formats and procedures were developed for SPT and VAT, respectively, as discussed below:

Seaweed Production Trial Plots

a. *AESA monitoring format*

Taking a cue from workshop results and the participatory discussions that later ensued, it was decided that the training team drafts an SPT-AESA monitoring format for presentation and critiquing in big group. As a result, a validated final SPT-AESA monitoring format was agreed upon in a plenary session. In this regard, an agro-ecosystem analysis (AESA) monitoring form indicating the required minimum data for decision-making in the Seaweed Production Trial (SPT) is detailed in **Monitoring Format No. 1**. The required minimum data to be gathered consist of: (a) general information and (b) selected parameters. A unique feature of the monitoring format is the drawing by the participants of the seaweed crop showing its details (e.g., thalli progress, disease infection, grazer infestation, and others), as truthfully as they can remember, at the time of observation. This feature allows the participants to share their individual experiences from their observations and in the process enhance their group's learning process.

b. *AESA monitoring procedure*

During that same workshop and participatory discussions, the big group agreed that each small group shall gather all the minimum data required for making decision in the SPT plots as indicated in **Monitoring Format No. 1**. It was also agreed upon that the aforesaid data will be collected every two weeks. Furthermore, the procedures in gathering the minimum data required for decision-making were established through sharing of experiences in a plenary session, as fallow:

1. General Information data are either fix or pre-determined data that must be indicated regularly in the monitoring form to relate their effects to the Selected Parameters data on a bi-weekly basis or every observation period;
2. Selected Parameters data are variable data that must be gathered regularly to understand their effects to the growth of the seaweed crop on a bi-weekly basis or every observation period;
3. Every small group member shall select at random five inner rows from the plot that he/she is assigned to manage, select again at random a tie and collect the seaweed tied to it in each selected row;
4. Gather together all the seaweeds collected by all members per group, weigh all the seaweeds collected per group to get the total weight of seaweeds per group;

5. Divide the total weight of seaweeds obtained per group with the total number of selected rows per group to calculate the weight per tie of seaweeds and tally the weight obtained in the Selected Parameters section of **Monitoring Format No. 1**;
6. Observe the general crop conditions of the seaweeds collected by each small group in terms of thalli color, disease infection, epiphyte infestation, grazer damage, among others, and tally all observations in the Selected Parameters section of **Monitoring Format No. 1**;
7. Return all the seaweed samples collected and retie each seaweed sample at random to the mono-lines of rows that were randomly selected earlier in the 'learning fields' after all pertinent data are gathered and properly recorded;
8. Collect also one sample data each on water quality, weather condition, and wind direction at the 'learning field' of each small group and record the same in the Selected Parameters section of **Monitoring Format No. 1**;
9. Return to the training session hall; enter all the minimum data required for decision-making and draw a seaweed depicting all the observations of the small group on a space provided for in **Monitoring Format No. 1**;
10. Tally all your general observations and offer your recommendations or actions to be taken to further improve crop growth in the Seaweed Production Trial (SPT) plots for the current week;
11. Present the output of each small group to the big group for critiquing and consolidation of outputs and come up with an integrated list of recommendations or actions to undertake for the current week.

Seaweed Variety Adaptation Trial Plots

a. *AESA monitoring format*

The agro-ecosystem analysis (AESA) monitoring form specifying the required minimum data for decision-making in the Seaweed Variety Adaptation Trial (VAT) is shown in **Monitoring Format No. 2**. Similarly, the required minimum data to be gathered include: (a) general information and (b) selected parameters. A unique feature of the monitoring format is the inclusion by the participants of fresh sample for each variety showing their actual distinctiveness (e.g., plant vigor, growth rate, morphological structure, and reaction to a-biotic and biotic factors, among others) as exhibited by the test varieties at the time of observation. This attribute allows the participants to evaluate their individual appreciation of their real-life observations and in the process enhance the group learning process.

b. *AESA monitoring procedure*

Similarly, the big group agreed that each small group shall gather all the minimum data required for making decision in the VAT plots as indicated in **Monitoring Format No. 2**. Likewise, it was also agreed upon that the aforesaid data will be

collected, alternately with the data gathering in the SPT plots, every two weeks. In the same vein, the procedures in gathering the minimum data required for decision-making in the VAT plots were resolved through sharing of experiences in a plenary session, as fallow:

1. General Information data are either fix or pre-determined data that must be indicated regularly in the monitoring form to relate their effects to the Selected Parameters data on a bi-weekly basis or every observation period;
2. Selected Parameters data are variable data that must be gathered regularly to understand their effects to the growth of the seaweed crop on a bi-weekly basis or every observation period;
3. Every small group shall select at random a tie and collect the seaweed tied to it in all the rows of each test variety;
4. Gather together all the seaweeds collected per test variety per group, weigh all the seaweeds collected per test variety per group to get the total weight of seaweeds per test variety per group;
5. Divide the total weight of seaweeds obtained per test variety per group with the total number of selected rows per variety per group to calculate the weight per tie of seaweeds per test variety and tally the weight obtained per test variety in the Selected Parameters section of **Monitoring Format No. 2**;
6. Observe the general crop conditions of the seaweeds collected per test variety by each small group in terms of thalli color, disease infection, epiphyte infestation, grazer damage, among others, and tally all observations in the Selected Parameters section of **Monitoring Format No. 2**;
7. Return all the seaweed samples collected per test variety and retie each seaweed sample at random to the mono-lines of rows per variety in the 'learning fields' after all pertinent data are gathered and properly recorded;
8. Collect also one sample data each on water quality, weather condition, and wind direction at the 'learning field' of each small group and record the same in the Selected Parameters section of **Monitoring Format No. 2**;
9. Return to the training session hall; enter all the minimum data required for decision-making and attach a sample seaweed representing each test variety per small group on a space provided for in **Monitoring Format No. 2**;
10. Tally all your general observations and offer your recommendations or actions to be taken to further improve crop growth in the Seaweed Variety Adaptation Trial (VAT) plots for the current week;
11. Present the output of each small group to the big group for critiquing and consolidation of outputs and come up with an integrated list of recommendations or actions to undertake for the current week.

MONITORING FORMAT NO. 1: AGRO-ECOSYSTEM ANALYSIS (AESA)
MONITORING FORM FOR SEAWEED PRODUCTION TRIAL (SPT)

<table>
<tr><td colspan="4">I. GENERAL INFORMATION</td></tr>
<tr><td colspan="2">▪ GROUP NO.:</td><td colspan="2">▪ MEMBERS:</td></tr>
<tr><td colspan="2">▪ 'LEARNING FIELD' LOCATION[1]:</td><td colspan="2">▪ DATE OF LAST OBSERVATION:</td></tr>
<tr><td colspan="2">▪ DATE PLANTED:</td><td colspan="2">▪ DATE OF CURRENT OBSERVATION:</td></tr>
<tr><td colspan="2">▪ DISTANCE BETWEEN TIES (CM):</td><td colspan="2">▪ NO. OF MONO-LINES:</td></tr>
<tr><td colspan="2">▪ DISTANCE BETWEEN MONO-LINES (M):</td><td colspan="2">▪ LENGTH OF MONO-LINE (M):</td></tr>
<tr><td colspan="2">II. SELECTED PARAMETERS</td><td colspan="2" rowspan="9">DRAW SEAWEED SAMPLE SHOWING ACTUAL DETAILS (E.G., THALI COLOR, DISEASE SYMPTOMS, GRAZER DAMAGE, AND OTHERS) AT TIME OF OBSERVATION</td></tr>
<tr><td rowspan="2">A. WEIGHT (Grams)</td><td>1. Before</td></tr>
<tr><td>2. Now</td></tr>
<tr><td rowspan="3">B. CROP CONDITION</td><td>1. Color[2]</td></tr>
<tr><td>2. Diseases/ Epiphytes[3]</td></tr>
<tr><td>3. Grazer Damage</td></tr>
<tr><td rowspan="6">C. WATER QUALITY</td><td>1. Color</td></tr>
<tr><td>2. Current (m/sec)</td></tr>
<tr><td>3. Temperature (°C)</td></tr>
<tr><td>4. Turbidity (ft)</td></tr>
<tr><td>5. Salinity (ppt)</td></tr>
<tr><td>6. Depth (metro)</td></tr>
<tr><td colspan="2">D. WEATHER CONDITION[4]</td><td colspan="2"></td></tr>
<tr><td colspan="2">E. WIND DIRECTION[5]</td><td colspan="2"></td></tr>
<tr><td colspan="3">GENERAL OBSERVATIONS</td><td>RECOMMENDATIONS/ACTIONS TO BE TAKEN</td></tr>
<tr><td colspan="3">1.</td><td>▪</td></tr>
<tr><td colspan="3">2.</td><td>▪</td></tr>
<tr><td colspan="3">3.</td><td>▪</td></tr>
<tr><td colspan="3">4.</td><td>▪</td></tr>
<tr><td colspan="3">5.</td><td>▪</td></tr>
<tr><td colspan="3">6.</td><td>▪</td></tr>
</table>

[1]**'Learning field' location:** (a) silted; (b) sandy; (c) muddy; (d) grassy; (e) rocky. [2]**Crop condition (color):** (a) pale; (b) bright; (c) shiny; (d) smooth. [3]**Crop condition (disease/epiphytes):** (a) 'ice-ice' or whitening; (b) epiphytes or 'buhok-buhok'; (c) blackening; (d) pitting or 'uka'; (e) goose bumps or 'kurikong'; (f) grazer damage; (g) silted; (h) entangled with sargasum weed. [4]**Weather condition:** (a) cloudy; (b) sunny; (c) rainy; (d) drizzly. [5]**Wind direction:** (a) southwest monsoon; calm; northeast monsoon

MONITORING FORMAT NO. 2: AGRO-ECOSYSTEM ANALYSIS (AESA)
MONITORING FORM FOR VARIETY ADAPTATION TRIAL (VAT)

I. GENERAL INFORMATION	
▪ GROUP NO.:	▪ MEMBERS:
▪ 'LEARNING FIELD' LOCATION[1]:	▪ DATE OF OBSERVATION:
▪ DATE PLANTED:	▪ INITIAL WEIGHT/TIE (GM):
▪ DISTANCE BETWEEN TIES (CM):	▪ NO. OF MONO-LINES:
▪ DISTANCE BETWEEN MONO-LINES (M):	▪ LENGTH OF MONO-LINE (M):

FRESH SAMPLE OF EACH VARIETY ⇨						

II. PARAMETERS		**SEAWEED VARIETIES**					
		1	**2**	**3**	**4**	**5**	**6**
A. WIEGHT (Grams)	1. Before						
	2. Now						
B. CROP CONDITION	1. Color[2]						
	2. Diseases/ Epiphytes[3]						
	3. Damage by Grazers						
C. WATER QUALITY	1. Color						
	2. Current (m/sec)						
	3. Temperature (°C)						
	4. Turbidity (ft)						
	5. Salinity (ppt)						
	6. Depth (metro)						
D. WEATHER CONDITION[4]							
E. WIND DIRECTION[5]							

GENERAL OBSERVATIONS	**RECOMMENDATIONS/ACTIONS TO BE TAKEN**
1.	▪
2.	▪
3.	▪
4.	▪
5.	▪
6.	▪

[1]**'Learning field' location:** (a) silted; (b) sandy; (c) muddy; (d) grassy; (e) rocky. [2]**Crop condition (color):** (a) pale; (b) bright; (c) shiny; (d) smooth. [3]**Crop condition (disease/epiphytes):** (a) 'ice-ice' or whitening; (b) epiphytes or 'buhok-buhok'; (c) blackening; (d) pitting or 'uka'; (e) goose bumps or 'kurikong'; (f) grazer damage; (g) silted; (h) entangled with sargasum weed. [4]**Weather condition:** (a) cloudy; (b) sunny; (c) rainy; (d) drizzly. [5]**Wind direction:** (a) southwest monsoon; calm; northeast monsoon

Exercise No. 2.5:

'BALLOT BOX' EXERCISE[20] FOR PARTICIPANTS OF FARMER FIELD SCHOOL ON SEAWEED PRODUCTION

Background and rationale

'Ballot box' test is a field-based test administered to FFS participants without using pen or pad papers. It uses specimens (e.g., materials, objects, plants, or animals) in seaweed ecosystem. Questions in a 'ballot box' evaluation dealt mainly on knowledge and skills in identification of disease symptoms, damages caused by grazers and epiphytes, s well as constraints related to water quality, substrata, and environmental stresses in seaweed production.

Figure 9. A facilitator (A) preparing functional 'ballot box' questionnaire and the participants (B) undertaking the 'ballot box' pre-test exercise using the functional questionnaire for FFS on seaweed production at the coastal waters of Calutcot-Kalongkoan Islands

For each questions, there are three 'ballot boxes' representing possible correct answers to choose from and where FFS participants put a replicate of their numbers corresponding to a correct answer. A question may refer to a plant indicated by a string attached to three specimens in seaweed ecosystem as possible answers. In another instance, a question may refer to a specimen indicated by a string attached to three plants in seaweed ecosystem as possible answers.

[20]Adapted from Callo, Jr., D.P., Esteban, I.D., and Hiyama, C. 2009. Field Guide of Discovery-based Exercises on FFS for Agro-forestry. DENR-JICA Project for Enhancement of Community-Based Forest Management Program (ECBFMP), Department of Environment and Natural Resources, Region III, San Fernando City, Pampanga, Philippines and ASEAN IPM Knowledge Network (ASEAN IPM), National Agribusiness Corporation, PSE Building, Exchange Road, Ortigas Center, Pasig City, Philippines p28-36.

Past experiences showed that for a 'ballot box' test to be effective, questionnaires should be framed to focus on functions of organisms or specimens rather than on their technical definitions. This particular exercise was designed to develop functional 'ballot box' questionnaires for and an evaluation instrument to assess pre- and post-training knowledge and skills gained by the participants of FFS on seaweed production. Thus, the exercise consisted of two aspects, namely: (a) developing the functional 'ballot box' questions, and (b) undertaking the 'ballot box' test using the functional questions. The 'ballot box' exercise is normally administered twice. The first or pre-test exercise is oftentimes performed before undertaking the first agro-ecosystem analysis (AESA) while the second or post-test exercise is usually taken on as a culminating activity of a regular FFS session.

When is this exercise most appropriate?

Pre-test:

- Before the 'learning fields' establishment for an FFS on seaweed production; and
- After conducting the gap analysis exercise for an FFS on seaweed production.

Post-test:

- After conducting the field day for the FFS on seaweed production; and
- Before the graduation exercise for the FFS on seaweed production

How long will this exercise take?

- One hour for 'training session' activities for sharing of experiences, participatory discussions, and brainstorming in big group (plenary) to gather insights on and to develop functional questionnaires of field problems in seaweed production;
- Another one hour for 'learning field' activities for administering the 'ballot box' pre-test or post-test exercise to the participants of FFS on seaweed production; and
- Thirty minutes for 'training session' activities for processing in big group (plenary) the results of the ballot box' pre-test or post test exercise.

What are the learning objectives?

- To determine the initial knowledge and skills (pre-test) and knowledge and skills gained (post-test) of FFS seaweed production participants in identifying the major field constraints in seaweed production; and
- To provide first-hand experience to FFS on seaweed production participants in undertaking the 'ballot box' pre- and post-test exercises.

What are the materials needed?

- Seaweed 'learning fields' for farmer-participants of FFS on seaweed production;
- Factional 'ballot box' questionnaires on major field constraints in seaweed production;
- Office supplies (e.g., Manila papers, notebooks, ball pens, and marking pens); and
- Field supplies (e.g., mangrove or bamboo stakes, plastic bags, actual specimens, among others).

What will be the methodology?

- 'Learning field' activities, sharing of experiences, brainstorming, and participatory discussions in big group (plenary) session.

What are the steps in administering the 'ballot box' pre-test or post-test exercise for FFS on seaweed production?

1. Undertake sharing of experiences, participatory discussions, and brainstorming in big group (plenary) sessions among facilitators, and participants of FFS on seaweed production in order to to gather insights on and to develop functional questionnaires of field problems in seaweed production on the following:

   - ✓ Commonest diseases of seaweeds;
   - ✓ Commonest biotic constraints other than diseases (e.g., epiphytes, grazers, weed competitors);
   - ✓ Commonest a-biotic constraints (e.g., silt accumulation, inappropriate substrata, problem in crop establishment); and
   - ✓ Other common field problems.

2. Collect actual or live specimens and prepare functional 'ballot box' pre-test or post-test questionnaires (**Figure 9A**) of commonest biotic and a-biotic constraints in seaweed production;

3. Administer the 'ballot box' pre-test or post-test (**Figure 9B**) using functional questionnaires in the 'learning field' or in the seashore nearest to the 'learning field' of the FFS on seaweed production;

4. Conduct participatory discussions and brainstorming sessions in big group (plenary) with the FFS on seaweed production participants to process the result of the 'ballot box' pre-test or post-test exercise; and

5. Summarize the processing outputs in the big group (plenary), conduct additional brainstorming session (if necessary), and document the learning experiences and lessons learned in undertaking the 'ballot box' pre-test or post-test exercise specifically for FFS on seaweed production in the coastal waters of the Calutcot-Kalongkoan islands, Burdeos, Quezon on the following:

   - ✓ What went well in the conduct of the 'ballot box' pre-test or post-test exercise;
   - ✓ What needs improvement in the conduct of the 'ballot box' pre-test or post-test exercise;
   - ✓ What were the most significant learning experiences and lessons learned in the conduct of the 'ballot box' pre-test or post-test exercise?

What are some suggested questions for the processing discussion?

- What are the commonest diseases in seaweed production at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon? Why do we need to develop agro-ecosystem analysis (AESA) monitoring formats for FFS on seaweed production? Who will gather the minimum data required for decision-making in seaweed production?
- What are the commonest biotic constraints other than diseases in seaweed production at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon?
- What are the commonest a-biotic constraints in seaweed production at the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon?

What were the outputs of the 'ballot box' pre-test exercise administered to the FFS on seaweed production participants in the coastal waters of Calutcot-Kalongkoan islands[21]?

The exercise generated two important outputs, namely: (a) functional 'ballot box' questions developed by the facilitators after a participatory discussion with the FFS on seaweed production participants, and (b) results of the 'ballot box' test administered to the FFS on seaweed production participants using the functional questions developed by the facilitators.

As discussed earlier, the 'ballot box' exercise is carried out to compare the initial (pre-test) with the end (post-test) of training knowledge and skills of the FFS on seaweed participants in identifying the most common a-biotic and biotic field constraints in seaweed production. In this particular exercise, the following functional questions developed were used as a midterm-test exercise to determine

[21]Darag, Jr., A.N. 2013. Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 10-13 September 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 12p.

the current knowledge and skills in identifying field constraints specifically of the FFS on seaweed production participants in the coastal waters of Calutcot-Kalongkoan islands, Burdeos, Quezon. Some of these functional 'ballot box' questions (correct answers are presented in bold fonts) are enumerated below:

1. Which of these seaweeds is infected with 'ice-ice' disease? Specimens: **(a) *Kappaphycus alvarezii* infected with 'ice-ice' disease**, (b) healthy *Kappaphycus striatum*, and (c) healthy *Eucheuma denticulatum*.
2. Which of these specimens indicate a good substrate for growing seaweeds? Specimens: (a) muddy soil sample, (b) fine sand sample, and **(c) eelgrass specimen**.
3. Which of these seaweed varieties is most resistant to epiphyte or 'buhok-buhok' infestation? Specimens: (a) *Kappaphycus alvarezii*, (b) *Kappaphycus striatum*, and **(c) *Eucheuma denticulatum***.
4. Which of these animals is a voracious seaweed grazer? Specimens: (a) hermit crab; **(b) 'balawis' fish species**, and (c) sea cucumber.
5. Which of these seaweeds is infested with 'buhok-buhok' epiphyte? Specimens: (a) healthy *Kappaphycus alvarezii*, **(b) 'buhok-buhok' infested *Kappaphycus striatum***, and (c) healthy *Eucheuma denticulatum*.
6. Which of these seaweed disorders is cuased by a fungus? Specimen: (a) seaweed infected with 'ice-ice' disease, **(b) seaweed infected by black fungus disease**, and (c) seaweed infested with 'buhok-buhok' epiphyte?
7. Which of these seaweed varieties has not been grown before in Calutcot-Kalongkoan islands? Specimens: (a) *Kappaphycus alvarezii*, **(b) *Kappaphycus striatum***, and (c) *Eucheuma denticulatum*.
8. Which of these animals is not a weed competitor of seaweeds? Specimens: (a) eelgrass or 'lusay', (b) Sargasum seaweed or 'kulapo', and **(c) *Kappaphycus alvarezii* seaweed**.
9. Which of these instruments is used to measure water salinity level? Specimens: (a) thermometer, (b) meter stick, and **(c) refractometer**.
10. Which of these seaweed varieties is infected by a bacterium? Specimens: **(a) *Kappaphycus alvarezii* variety infected with 'ice-ice' disease**, (b) *Kappaphycus alvarezii* infested with 'buhok-buhok' epiphyte, and (c) *Kappaphycus alvarezii* infected with black fungus disease.

On the other hand, the scores obtained by the FFS on seaweed production participants who took the 'ballot box' midterm-test are presented in **Table 1**. Take note that at this stage of the training, six (6) participants got scores below the big group's average score of 69 percent. With regard to the performance of the small groups, only Group I did not obtain scores higher than the small group's average score of 69 percent. Surprisingly, only five (5) participants obtain the highest score of 90 percent. These results seem to suggest that additional efforts will have to be focused by the training team on improving the knowledge and skills of the FFS on

seaweed production participants in the identification of both the a-biotic and biotic field production constraints in growing seaweeds.

Table 1. 'Ballot Box' Midterm-test Scores (%) of Participants in the Farmer Field School (FFS) on Seaweed Production held on 04 December 2013 at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon

GROUP	NAME	% SCORE*	SMALL GROUP AVERAGE % SCORE
I	Eddie B. Bracero	60	60
	Salvador C. Castillo	40	
	Alex R. Mundo	-	
	Gil A. Telejada	-	
	Manuel A. Telejada	60	
	Rafael T. Tena	80	
II	Jomar T. Acejo	80	75
	Narmel B. Deliña	90	
	Eduardo D. Macagaling	40	
	Edwin L. Resare	-	
	Marty A. Telejeda	90	
III	Felix C. Conchada	80	74
	Robert B. Laviña	90	
	Ernesto S.R. Taroma, Sr.	50	
	Benito T. Tena, Sr.	90	
	Joven J. Tena	60	
IV	Rembert R. Barba, Sr.	70	68
	Jonathan B. Laviña, Jr.	90	
	Rodel B. Pujeda	40	
	Randy D. Reazon	70	
	Erwin Taroma	-	
LARGE GROUP AVERAGE % SCORE		69	69

*Four (4) participants (absent) did not take the 'ballot box' test (two [2] from Group I and one [1] each from Groups II and IV)

OVERVIEW OF THE SEAWEED INDUSTRY

SECTION 3

OVERVIEW OF THE SEAWEED INDUSTRY

This section compiles topics that articulate the *Current Situation of Seaweed Industry in the Philippines* and elsewhere, more particularly in the Polillo Group of Islands, Quezon Province. It also draws together the best practices and learning experiences by farmers as they undertook adaptation of currently recommended production technology package for seaweed production in their own farms. This know-how is lucidly expressed in two (2) themes, namely:

- Seaweed production in the Philippines and elsewhere: Constraints, trends, and opportunities

- Seaweed production in North Lamon Bay: Polillo Group of Islands

SEAWEED PRODUCTION IN THE PHILIPPINES AND ELSEWHERE: CONSTRAINTS, TRENDS, AND OPPORTUNITIES

What is seaweed?

Seaweed is a loose colloquial term encompassing macroscopic, multi-cellular, benthic marine algae. The term includes some members of the red, brown, and green algae. Botanically, seaweed belongs to a group of plants known as algae[22]. Its mode of reproduction is either:

a) Vegetative, through the regeneration of fragmented or cut portion of a thallus;
b) Asexual, through the formation of spores which are released either as motile or non-motile spores; or
c) Sexual, involving the fusion of male and female gametes.

In a more convenient manner of classification, seaweeds can be divided in three (3) major categories, namely:

1. Green seaweeds [light or dark green in color], characterized by their presence of chlorophylls *a* and *b*;
2. Brown seaweeds [light or dark brown in color], characterized by their presence of chlorophylls *a* and *c* and fucoxanthin; and
3. Red seaweeds [red or purple in color], characterized by their presence of chlorophylls *a* and *d* and phycobilin (r-phycocyanin and phycoerythrin).

Seaweeds can also be classified by use (as food, medicine, fertilizer, filtration, and industrial, among others.)[23]. Seaweed is an important component of the marine ecosystem along with the mangrove and coral reefs and can be viewed in two perspectives, from its ecological value as well as its economic uses[24]. Seaweeds are marine resources of various economic importances. They are either used as food and non-food, or as sources of raw materials in many industries such as pharmaceuticals, cosmetics, feeds, and fertilizers, including uses for various food applications[25].

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[22]Ferrer, M.S.R. 2013. An Introduction to Seaweed Biology and Ecology. Marine Plant Section, MFRD-NFRDI. PowerPoint Presentation. 26 slides.
[23]Smith, G.M. 1944. Marine Algae of the Monterey Peninsula, California. Stanford Univ., 2nd Edition, as cited in http://en.wikipedia.org/wiki/Seaweed.
[24]BFAR. 2013. Seaweeds. Bureau of Fisheries and Aquatic Resources (BFAR), as cited in http://www.bfar.da.gov.ph/pages/Programs/prog-seaweed.html.
[25]Lucero, R.C. 2013. Seaweed Development Program: Project Outline. Bureau of Fisheries and Aquatic Resources (BFAR), Region IV-A, Los Baños, Laguna. 3p.

How is seaweed farming carried out in the Philippines and elsewhere?

Seaweed farming is the practice of cultivating and harvesting seaweed. In its simplest form, it consists of the management of naturally found batches. In its most advanced form, it consists of fully controlling the life cycle of the algae. Seaweed farming has frequently been developed as an alternative to improve economic conditions and to reduce fishing pressure and over exploited fisheries. Seaweeds have been harvested throughout the world as a food source as well as an export commodity for production of agar and carrageenan products[26]. The main food species grown by aquaculture in Japan, China, and Korea include *Gelidium*, *Pterocladia*, *Porphyra*, and *Laminaria*[27]. In Japan alone annual production value amounts to US$2 billion and is one of the world's most valuable crops produced by aquaculture. The high demand in seaweed production provides plentiful opportunities and work for the local community. The practice of seaweed farming has long since spread beyond Japan. Cultivation is also common in all of Southeast Asia, Canada, Great Britain, Spain, and the United States.

In 1997 it was estimated that 40,000 people in the Philippines made their living through seaweed farming[28]. In a study, it showed that plots of approximately one hectare can have a net income from *Eucheuma* farming that was 5 to 6 times that of the minimum average wage of an agriculture worker. In the same study, it also saw an increase in seaweed exports from 675 metric tons (mt) in 1967 to 13,191 mt in 1980, which doubled to 28,000 mt by 1988[29]. The earliest seaweed farming guides in the Philippines recommended cultivation of *Laminaria* seaweed and reef flats at approximately 1.0 m depth at low tide. They also recommended cutting off sea grasses and removing sea urchins prior to farm construction. Seedlings are then tied to monofilament lines (mono-lines) and strung between mangrove stakes pounded into the substrate. This off-bottom method is still one of the major methods used today[30]. There are new long line cultivation methods that can be used in deeper water approximately 7.0 m in depth. They use floating cultivation lines

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[26]Ask, E.I. 1999. Cottonii and Spinosum Cultivation Handbook. Philippines: FMC BioPolymer Corporation. p52.

[27]Borgese, E.M. 1980. Seafarm: the story of aquaculture. Harry N. Abrams, Incorporated, New York. ISBN 0-8109-1604-5. p111-116, as cited in http://en.wikipedia.org/wiki/Seaweed_farming

[28]Zertruche-Gonzalez, Jose A. 1997. Coral Reefs: Challenges and Opportunities for Sustainable Management. The World Bank. ISBN 0-8213-4235-5. p54, as cited in http://en.wikipedia.org/wiki/Seaweed_farming.

[29]Trono, G.C. 1990. Seaweed resources in the developing countries of Asia: production and socioeconomic implications. Aquaculture Department, Southeast Asia Fisheries Development Center. Tigbauan, Iloilo, Philippines. p4.

[30]Crawford, B.R. 2002. Seaweed farming: An Alternative Livelihood for Small-Scale Fishers. Proyek Pesisir Publication. University of Rhode Island, Coastal Resources Center, Narragansett, Rhode Island, USA. p2.

anchored to the bottom and are the primary methods used in the villages of North Sulawesi, Indonesia[31]-[32].

Cultivation of seaweed in Asia is a relatively low-technology business with a high labor requirement. There have been many attempts in various countries to introduce high technology to cultivate detached plants growth in tanks on land in order to reduce labor, but they have yet to attain commercial viability[33].

In the Philippines, farming of the seaweed *Kappaphycus* can be a low-cost venture and a profitable one, with the right site. The technology can use family labor in either fixed off-bottom ('parasdas') or single raft long-line culture. The more line modules, the more investment and care are needed. After tying seaweed plantlets or 'seedlings' to the ropes, and the ropes staked to the seabed by bamboo or tied to floating rafts staked to the seabed, seaweed farming needs no more inputs. Seaweed culture can last 45-60 days. However, it needs periodic visitation, two to three times a week, in order to:

a. Remove undesirable algae, barnacles, and attached sediments;
b. Re-tie loose or fallen seaweeds and tighten lines; and
c. Check for signs of bacterial disease ('ice-ice') and epiphytes ('buhok-buhok').

What is the status of the Philippine seaweed industry?

Seaweed farming is currently the largest and most productive form of livelihood among the coastal population of the Philippines. Data from the Seaweed Industry Association of the Philippines (SIAP) for 2004 indicated that more than 116,000 families consisting of more than 1 million individuals were farming more than 58,000 ha of seaweed. In 2000-2004, the average annual production of dried seaweeds in the Philippines was nearly 125,000 mt, with a value averaging about US$ 139 million[34].

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[31]Pollnac, R.B. 1997a. Rapid Assessment of Coastal Management Issues on the Coast of Minahasa. Proyek Pesisir Technical Report No: TE-97/01-E. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. p67.

[32]Pollnac,, R.B. 1997b. Baseline Assessment of Socioeconomic Aspects of Resources Use in the Coastal Zone of Bentenan and Tumbak. Proyek Pesisir Technical Report No: TE-97/01-E. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. p79.

[33]Crawford, B.R. 2002. Seaweed farming: An Alternative Livelihood for Small-Scale Fishers. Proyek Pesisir Publication. University of Rhode Island, Coastal Resources Center, Narragansett, Rhode Island, USA. p2.

[34]FAO. 2014. Cultured Aquatic Species Information Programme. *Eucheuma* spp. Cultured Aquatic Species Information Programme. Text by Trono, Jr., G.C. In: Food and Agriculture Organization (FAO) Fisheries and Aquaculture Department [online]. Rome. Updated 13 January 2005. As cited 14 January 2014 in http://www.fao.org/fishery/culturedspecies/Eucheuma_spp/en#tcNA00C5.

The Philippines seaweed is highly diversified among the flora in Asia-Pacific regions. More than 800 species of seaweeds have been recorded in the Philippines. The major commercial seaweeds in the country are *Eucheuma, Kappaphycus*, *Gracilaria* spp. and *Caulerpa lentillifera*. Other seaweeds with economic importance are *Codium*, *Gelidiela acerosa*, *Halymenia*, *Porphyra* and *Sargassum* sop[35].

Seaweed farming is an alternative livelihood since the 1980s. It is now emerging to be an important and major livelihood in the coastal areas, specifically in Southern Philippines. *Kappaphycus alvarezii* and *Eucheuma denticulatum* are the major species cultivated and where two major culture methods are used by the farmers namely: the fixed bottom mono-line and floating mono-line. Recently, seaweed contributed about 27% to the total fisheries production, with Regions IV, IX and ARMM as major producers. The steady increase in production in the past (1997-2002) can be attributed to high market demand, better price, and good weather condition that encourage farmers to expand their areas for seaweed culture. The industry employs between 100,000-120,000 manpower where 90% are seaweed farmers and the rest are seaweed processors and traders.

The Philippines is one of the top producers of seaweeds in the world, specifically the red seaweeds - next to China and Japan. Seaweeds are exported either in raw (fresh or dried seaweeds) or processed forms (semi-refined chips or carrageenan and refined carrageenan). The major importing countries of seaweeds and its natural products are France, Korea, China, USA, and Hong Kong (**Figure 10**).

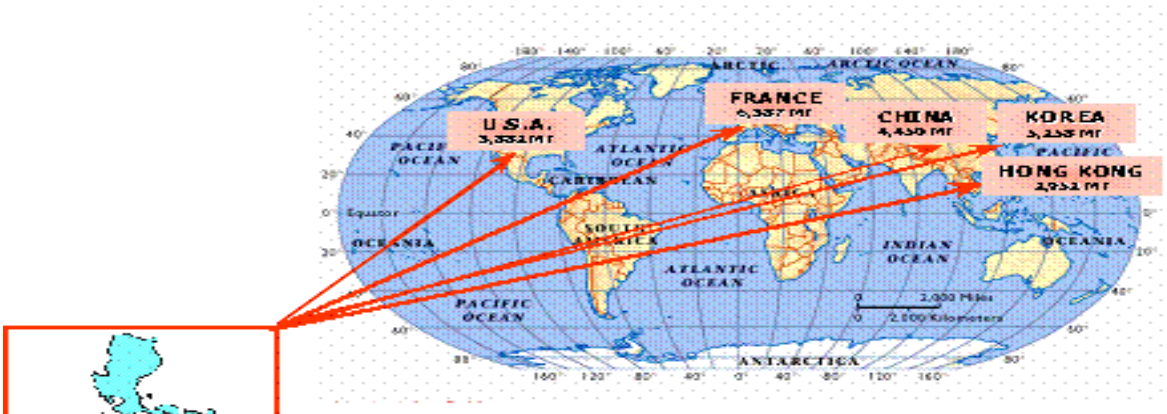

Figure 10. Seaweed Top Export Destination (CY 2001)

[35]BFAR. 2013. Seaweeds. Bureau of Fisheries and Aquatic Resources (BFAR), as cited in http://www.bfar.da.gov.ph/pages/Programs/prog-seaweed.html.

What are the constraints, trends, and opportunities in seaweed farming?

Despite the continuous increase in seaweed production and share in the world market, the industry is beseeched with existing problems and constraints. These are categorized into:

a) Local problems [e.g., pollution in production areas, inadequate supply of dried seaweeds for processing leading to processors' losses; peace and order situation in seaweed-producing areas, and diseases and epiphytes affecting seaweeds]; and
b) Global constraints [e.g., increasing competition in *Kappaphycus* and *Eucheuma* production with other and emerging seaweed producing countries such as Malaysia, Indonesia, and Africa].

To address these problems and constraints, the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) commits to provide strategies and interventions which include, among others, the:

1. Establishment of additional seaweed nurseries (e.g., further increase seaweed production nationwide),
2. Promotion of seaweed health management (e.g., further improve seaweed quality);
3. Provision of post-harvest facilities (e.g., reduce post-harvest losses); and
4. Establishment of a pilot semi-processing plant (e.g., introduce 'value added' to producers).

These interventions are aimed to provide livelihood opportunities and increase income of fisher-folks, increase production of seaweeds, and promote 'value-added' in aquaculture commodities for export.

Several environmental problems can result from seaweed farming. Sometimes seaweed farmers cut down mangroves to use as stakes for their ropes. This, however, negatively affects the farming since it reduces seawater quality and mangrove biodiversity due to depletion. Farmers may also sometimes remove eelgrass from their farming areas. This, however, is also discouraged, as it adversely affects seawater quality[36].

[36]Zertruche-Gonzalez, Jose A. 1997. Coral Reefs: Challenges and Opportunities for Sustainable Management. The World Bank. ISBN 0-8213-4235-5. p53, as cited in http://en.wikipedia.org/wiki/Seaweed_farming

On the other hand, seaweed farming helps to preserve coral reefs[37] by increasing diversity where the algae and seaweed have been introduced and it also provides added niche for local species of fish and invertebrates. Farming may be beneficial by increasing the production of herbivorous fishes and shellfish in the area[38]. An increase in Siginid population after the start of extensive farming of *Eucheuma* seaweed was also reported in villages in North Sulawesi, Indonesia[39]. Seaweed culture can also be used to capture, absorb, and eventually incorporate excessive nutrients into living tissues. 'Nutrient bio-extraction' is the preferred term for bio-remediation involving cultured plants and animals. Nutrient bio-extraction (also called bio-harvesting) is the practice of farming and harvesting shellfish and seaweed for the purpose of removing nitrogen and other nutrients from natural water bodies[40].

[37]Zertruche-Gonzalez, Jose A. 1997. Coral Reefs: Challenges and Opportunities for Sustainable Management. The World Bank. ISBN 0-8213-4235-5. p54, as cited in http://en.wikipedia.org/wiki/Seaweed_farming

[38]Ask, E.I. 1999. Cottonii and Spinosum Cultivation Handbook. Philippines: FMC BioPolymer Corporation. p52.

[39]Pollnac, R.B. 1997b. Baseline Assessment of Socioeconomic Aspects of Resources Use in the Coastal Zone of Bentenan and Tumbak. Proyek Pesisir Technical Report No: TE-97/01-E. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. p79.

[40]LISS. 2013. Nutrient Bio-extraction Overview. Long Island Sound Study (LISS). As cited in http://longislandsoundstudy.net/issues-actions/water-quality/nutrient-bioextraction-overview/

SEAWEED PRODUCTION IN NORTH LAMON BAY: POLILLO GROUP OF ISLANDS

The Philippines pioneered in *Eucheuma* and *Kappaphycus* or carrageenan-bearing seaweeds farming and was the world's leading producer of these species until 2007. In 2008, however, Indonesia overtook the Philippines, producing 2.79 million metric tons, or 60% more than the Philippine production of only 1.73 million metric tons as of 2009[41].

Figure 11. Map of Quezon Province showing the five (5) municipalities of the Polillo Group of Islands

In Quezon province, seaweeds are grown mainly on coastal seawaters surrounding several islands within the Polillo Group of Islands[42]. This group of islands is composed of 27 small islands and islets located on the eastern coast of Luzon. It is within Quezon Province and is comprised of 5 municipalities, namely: Polillo, Burdeos, Panukulan, Patnanungan, and Jomalig (**Figure 11**). The first 3 municipalities are situated on the mainland (Polillo Island) while the remaining two are offshore island municipalities[43]. It has been recognized as one of the most important areas for conservation of biodiversity since it is home to a number of important species and sub-species of animals and many other living species, including seaweeds, sea cucumbers, and abalones, among others. One town in Polillo Island worth mentioning is Burdeos, the gateway to the surrounding smaller

[41]Lucero, R.C. 2013. Seaweed Development Program: Project Outline. Bureau of Fisheries and Aquatic Resources (BFAR), Region IV-A, Los Baños, Laguna. 3p.

[42]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

[43]NewCAPP. 2013. Polillo Group of Islands: New Conservation Areas in the Philippines Project (NewCAPP). Protected Areas and Wildlife Bureau-Department of Environment and Natural Resources-Global Environment Facility of the United Nations Development Programme, as cited in http://newcapp.org/polillo-group-of-islands.php.

islands and islets and a town with a very rich history[44]. Seaweed farming started slowly in the municipality of Burdeos and in its smaller island barangays (Calutcot, Kalongkoan, Katabunan, and Pandan) in the late 1990s and its cultivation spread in early 2000s. Large areas of channels between islands were found suited for year-round seaweed farming. It is for this reason that in 2002, Quezon province became one of the top five producers of seaweeds in the Philippines[45].

The idea of seaweed farming caught on very quickly. With bumper crops and easy access to market, fishermen took to seaweed farming as important complement to fishing. But after a few successful production cycles, seaweed farms in the area were wiped out by diseases and epiphytes, identified later by scientists as a bacterial disease (*Pseudomonas*, Flavobacteria), locally known as 'ice-ice' and an epiphytic red alga (Polysiphonia/Neosiphonia), popularly known as 'buhok-buhok'[46]. In the absence of technical assistance, the seaweed farmers have not been able to revive what they experienced as a lucrative enterprise, a good way out from poverty.

In August 2013, the project entitled *Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School (FFS) Approach* was conceived. It aims to revive the seaweed industry in the area (Calutcot-Kalongkoan island groups) by providing timely and appropriate technical assistance to seaweed farmers in managing epiphytes, grazers, weeds, diseases, and other seaweed production and post-production constraints. The project used an existing residential house owned by the Gucilatar family at Sitio Maydalaga, Barangay Calutcot, Burdeos, Quezon as the 'processing venue'. However, the seaweed 'learning fields' were located along the coastal waters of Calutcot-Kalongkoan islands, which are excellent representation of seaweed farming in coastal areas of the Polillo Group of Islands. The first phase of the project is being implemented in two cycles from 15 August 2013 to 15 May 2014[47].

[44]Sunny Beach. 2013. Polillo Group of Islands, as cited in http://www.bestphilippinesislands.com/polilio-group-of-islands-in-the-philippines

[45]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

[46]Trono, Jr. G.C. 2013. Seaweed Farming: PowerPoint Presentation in the Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach held on 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos, Quezon. 15 slides.

[47]Salazar, R. 2013. Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Concept Note, 14 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 8p.

What are the initial successes of the project?[48]

After one production cycle (August-November), the farmer-participants and the training team members are convinced that seaweed farming can be successfully revived in the Calutcot-Kalongkoan areas. Among others, the intervention resulted to more innovative, location-specific, and best farmers' practices for managing seaweed grazers, epiphytes, weeds, diseases, and other production constraints during the southwest monsoon season (*habagat*). These include the following:

1. More location-specific production technology options for the southwest monsoon season (*habagat*), by working in partnership with local seaweed farmers, for seaweed growers to choose from;

2. A number of seaweed varieties for seaweed growers to select from, whose agronomic performance are as good or better than current farmers' varieties;

3. A farmer field school (FFS) curriculum on seaweed production for sustained training and scaling-up of more innovative seaweed production technology options in succeeding production cycles;

4. An initial cadre of 21 technically empowered fisher-folks to sustain a socio-economically viable seaweed industry in the area;

5. A seaweed farmers' organization (SANAMMMAY) being continuously strengthened and linked to prospective partner (PEF) for livelihood opportunities to further maintain the viability of seaweed industry in the area; and

6. An action plan of activities for the succeeding production cycles to address other concerns related to location-specific seaweed production technology development, scaling-up, and livelihood opportunities.

What are the emerging challenges and opportunities in the project areas?[49]

Gauging from the initial success of the project, it becomes apparent that scaling-up of farmer field school (FFS) initiatives in the adjoining islands around the Calutcot-Kalongkoan islands will be a reasonable stride to undertake. In this regard, the following activities may be considered, namely:

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[48]Callo, Jr. D.P. 2013. Scaling Up on FFS for Seaweed Production and Expansion to FFS for Sea Cucumber Production: Concept Note. Maydalaga, Kalongkoan Island, Burdeos, Quezon. p2-3.
[49]Callo, Jr. D.P. 2013. Scaling Up on FFS for Seaweed Production and Expansion to FFS for Sea Cucumber Production: Concept Note. Maydalaga, Kalongkoan Island, Burdeos, Quezon. p3-4.

1. A *'Manual on Seaweed Production and Field Guide of Discovery-based Exercises for Farmer Field School'* must be completed and published to serve as technical reference manual and field guide for scaling-up of farmer field school (FFS) initiatives at the provincial, regional, and national levels;

2. The participatory research and learning process must be sustained to fine-tune location-specific technology options, farmers' best practices, and experiences for the succeeding production cycles (December-February [2nd cycle] and March-May [3rd cycle]) in project areas; and

3. A capacity-building mechanism should proceed to develop a composite team of facilitators (BFAR, LGU, NGO, and fisher-folk organizations) who can continuously organize, conduct, and implement farmer field schools (FFS) on seaweed and other species (sea cucumber, abalone, among others) production at community, provincial, and regional levels;

There are as well a number of opportunities that developed as a result of the above initial successful initiative. Among others, it may interest various stakeholders or partners on the following agenda:

1. The use of Farmer Field School (FFS) approach for participatory research and learning on seaweed production is the first in Asia-Pacific region. The initial success of project implementation in the Calutcot-Kalongkoan islands is convincing enough to indicate that scaling-up of farmer field school (FFS) on seaweed initiatives can now be successfully undertaken using the lessons learned during the southwest monsoon season (*habagat*), where major technical and socio-economic seaweed production constraints were remarkably addressed;

2. Following the well-developed farmer field school (FFS) model of Integrated Pest and Production Management (IPPM) popularized and successfully used in South and Southeast Asia as well as in Africa, Latin America, and Eastern Europe for terrestrial crops (rice, corn, vegetables, among others), the model can as well be exploited to expand the FFS initiatives to initially cover sea cucumber production and later to include other sea species following the same process undertaken in initiating the '*Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School (FFS) Approach*'; and

3. Taking on the success of the initial project in the coastal waters of Calutcot-Kalongkoan islands, the farmer field school on seaweed and sea cucumber production can be as well adapted as a regional initiative which will include other seaweed and sea cucumber producing countries within the Asia-Pacific region in order to generate more location-specific technology options, help improve productivity, and create better livelihood opportunities for fisher-folks in the region.

What are the other initiatives being undertaken to revive the seaweed industry in the Polillo Group of Islands?[50]

The *Seaweeds Development Program (SDP)* of the Bureau of Fisheries and Aquatic Resources (BFAR) is envisioned to strengthen the seaweeds industry of the Philippines in terms of maintaining good product quality through:

a. Proper aquaculture practices, capability to meet local and international demand, and
b. Providing livelihood to many coastal fisher-folks.

BFAR Region IV-A, in its commitment to the nation and to the fisher-folks, is continuously and actively implementing projects that meet the goals of SDP. The projects being implemented are all geared towards sustainability of seaweed farming in the identified areas by providing:

a. Proper knowledge on the culture technology,
b. Information on seaweed health diseases and treatment,
c. Development of skills and abilities in maintenance and monitoring, and
d. Assistance for development of innovations initiated by the farmers.

The local seaweed industry in the region is firmly supported by BFAR Region IV-A though the cooperation of local government units (LGUs), their respective technicians, and seaweed farmers. The strong network linkage among the stakeholders of the seaweed industry is also a key factor that ensures the sustainability of projects being implemented in the identified areas. The partnership with the LGU is especially important in dealing with municipal-wide problems that plague the seaweed industry. One difficult problem that is given special attention is the rampant cyanide-fishing in many seaweed farming areas in the province of Quezon. Many municipalities have succeeded in decreasing the number of cyanide fishers but those that still exists cause problems for seaweeds production and quality. The role of BFAR Region IV-A is providing alternative livelihood for these cyanide fishers so that they can leave their illegal ways for good.

In the past, many prominent fishermen from Burdeos, Quezon were engaged in ornamental cyanide fishing because of poverty. Through the LGUs and BFAR Region IV-A advocacy activities, they learned of the seaweeds input assistance program and shifted to seaweeds farming on their own initiatives. Through this initiative, many cyanide fishers in Patnanungan, Polillo, and other coastal

[50]BFAR. 2013. Seaweeds Development Program (SDP) for CALABARZON, Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, as cited in http://region4a.bfar.da.gov.ph/.

municipalities of Quezon have also converted to seaweeds farming. Today, the advocacy is continuously sustaining the expansion of seaweed farming areas and provision of alternative livelihood while the marine environment is protected and conserved.

EPIPHYTES, WEED COMPETITORS, GRAZERS, AND DISEASES MANAGEMENT IN SEAWEED PRODUCTION

SECTION 4

EPIPHYTES, WEED COMPETITORS, GRAZERS, AND DISEASES MANAGEMENT IN SEAWEED PRODUCTION

A section on *Epiphytes, Weed Competitors, Grazers, and Diseases Management in Seaweed Production* includes an assemblage of topics that enlightens FFS facilitators, researchers, extension workers, and seaweed growers on all-embracing subject matters related to epiphytes, grazers, weeds, and diseases of seaweeds, as well as their management. These topics are thoroughly proved in four (4) areas of interest, namely:

- Epiphytes, weed competitors, and their management
- Grazers and their management
- Diseases and their management

EPIPHYTES, WEED COMPETITORS, AND THEIR MANAGEMENT IN SEAWEED PRODUCTION

A. *Epiphytes and Their Management*

What is an epiphyte?

Figure 12. Epiphyte-infested seaweed, *Kappaphycus alvarezii* (brown), grown in the coastal waters of Calutcot-Kalongkoan Islands

An epiphyte is a plant that grows non-parasitically upon another plant (such as a seaweed), and derives its moisture and nutrients from the air, rain, and sometimes from debris accumulating around it instead of the structure it is fastened to[51]. The term *epiphytic* derives from the Greek *epi-* (meaning 'upon') and *phyton* (meaning 'plant'). Epiphytic plants are sometimes called 'air plants' because they do not root in soil. However, there are many aquatic species of algae, including seaweeds, which are *epiphytes* on other aquatic plants (seaweeds or aquatic angiosperms). In seaweed production, epiphytes refer to aquatic marine plants attached to the cultured seaweeds (**Figure 12**) that compete for space, sunlight, nutrient, and dissolved gasses[52].

How do epiphytes survive on seaweeds?[53]

As with any surface in the marine environment, seaweeds (sea-grasses) provide a place for planktonic organisms to settle. When they settle on seaweeds, they are called epiphytes (sessile organisms that grow on plants). Epiphytes of seaweeds

[51]Wikipedia. 2014. Epiphytes. Wikipedia: The Free Encyclopedia. As cited in http://en.wikipedia.org/wiki/Epiphyte.

[52]Hortado, A.Q. 2013. Disease and epiphytism in *Kappaphycus* Farming. PowerPoint Presentation: Integrated Services for the Development of Aquaculture and Fisheries, Jaro, Iloilo City, Philippines. 26 slides.

[53]LISC. 2014. Epiphytes. Long Island Sea-grass Conservation (LISC) Website, Cornell University Cooperative Extension of Suffolk County. As cited in http://www.seagrassli.org/ecology/fauna_flora/epiphytes.html

include algae (micro and macro), bacteria, fungi, sponges, bryozoans, ascidians, protozoa, hydroids, crustaceans, and mollusks. Of all these, algae are the most abundant and diverse group to colonize seaweeds. Algal epiphytes significantly contribute to the primary ecosystem (20-60%), and form the base of many food webs within the seaweed (sea-grass) communities. Algal epiphytes are directly consumed by grazers such as snails and sea slugs. The distribution and abundance of epiphytes is influenced by several factors including light, temperature, water motion, nutrients, seasonal or successional changes as well as grazer or predator interactions.

Since seaweeds (sea-grasses) are constantly producing new blades (leaves), they are relentlessly creating new areas for 'fouling' organisms to colonize. For most seaweeds, the oldest parts of the plant are the most fouled, which are the oldest thallus and thallus apexes (tips). These areas contain the highest biomass and diversity of organisms. Eventually the oldest thalli (blades), often heavy with epiphytes, are sloughed off by the plant. The load of epiphytes directly affects the amount of light that can reach the blades (leaves) of seaweeds. In healthy seaweed ecosystem, epiphyte, grazers, and predator interactions help keep the system balanced, but algal epiphytes can become excessive due to nutrient loading and can lead to seaweed die-off if the plants are not receiving enough light.

How do epiphytes affect seaweed production?

Epiphyte outbreak has been occurring regularly in major *Kappaphycus alvarezii* farms in the Philippines, Indonesia, Malaysia and Tanzania. Infected materials from these countries were studied to establish baseline information on the epiphyte's identity, density, symptoms and secondary infection on the host seaweed. The causative organism was identified as *Neosiphonia apiculata* (Hollenberg) Masuda *et* Kogame, based on its morphological features. Recent study show that epiphyte density on host seaweed materials decreased in the following order: the Philippines, Tanzania, Indonesia, and Malaysia. Initial symptoms were the presence of tiny black spots, indicating the embedded tetrasporeling in seaweed cortex layer. Vegetative form emerged after 2 weeks measuring less than 0.5 mm in length. Upon maturation, infected seaweed takes on a 'hairy' appearance with 'goose-bumps-like' cortical swellings. The epiphyte appears as a solitary plant with multiple secondary rhizoids or as multiple epiphytes appearing from a single cortical opening. At the end of infection, the epiphytes left dark pits on the cortical swelling, and the seaweeds are infected by opportunistic bacteria ('ice-ice'). Bacterial enumeration of healthy and infected seaweed materials showed an increase of more than 300% in

total bacterial count on infected materials dominated by *Alteromonas* sp., *Flavobacterium* sp. and *Vibrio* sp.[54] The presence of epiphytes may[55]:

a. Damage the seaweed by removing tissue, and weighing down the plant thereby reducing its access to light needed for photosynthesis;
b. Increase the amount of drag on the plant canopies and increase the rate of breakage or detachment of branches[56]; and
c. Slow the growth of seaweed and may decrease its reproductive success.

The actual effect of epiphytes on carrageenan yield and quality of carrageenan from healthy and infected specimens were also examined by seaweed scientists[57]. Infected specimens showed:

a. Lower carrageenan yield [20.5 ± 2.5 % dry weight (dw)] compared with the healthy seaweed [65.5 ± 4.2 % dw];
b. Higher phenolic and fatty acid content, compared with healthy specimens.

Similarly, the carrageenan from the infected seaweed, as compared with carrageenan from healthy specimens, also showed:

a. Lower viscosity [by 74.5 ± 2.8 %];
b. Lower gel strength [by 52.6 ± 3.6 %];
c. Higher syneresis [by 22.9 ± 1.5 %]; and
d. Higher melting temperature [by 5 °C].

Chemical analysis of carrageenan from infected seaweed did not show any differences in their functionality or carbon atom chemical shift as compared with healthy and standard *k*-carrageenan. However, size exclusion chromatography showed the infected carrageenan molecular size to be 80 kDa as compared with 800 kDa for the healthy and standard *k*-carrageenan. These findings prove that infection of *Kappaphycus* by the filamentous red algae epiphyte, *N. apiculata*, reduces carrageenan molecular size and affects the physical properties of the carrageenan.

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[54]Vairappan, C.S., *et. al.* 2009. Distribution and symptoms of epiphyte infection in major carrageenophyte-producing farms. Nineteenth International Seaweed Symposium, Developments in Applied Phycology Volume 2, 2009, p27-33.

[55]John, D.M., Hawkins, S.J., and Price, J.H. 1992. Plant-Animal Interactions, Marine Benthos Clarendon Press Oxford. As cited in http://www.clarku.edu/departments/biology/biol201/2004/.

[56]Williams, G. and Seed, R. 1992. Interactions between macro-faunal epiphytes and their host algae. In John, D.M., Hawkins, S.J., and Price, J.H. 1992. Plant-Animal Interactions, Marine Benthos Clarendon Press Oxford. As cited in http://www.clarku.edu/departments/biology/biol201/2004/.

[57]Vairappan, C.S., Chung, C.S., and Matsunaga, S. 2013. Effect of epiphyte infection on physical and chemical properties of carrageenan produced by *Kappaphycus alvarezii* Doty (Soliericeae, Gigartinales, Rhodophyta). Journal of Applied Phycology, October 2013. As cited in http://link.springer.com/article/10.1007/s10811-013-0126-0

How are epiphytes classified in seaweed production?

Epiphytes in seaweed production, locally known as 'buhok-buhok', can be classified according to their size[58], namely (a) meso-epiphytes, or (b) macro-epiphytes; and to their harmful effects to seaweeds[59], namely (a) causing cortical disorganization [penetrates to the outer layer of the host cell cell], or (b) causing cortical and medullary cell destruction [invades the tissues of the host, growing inter-cellularly].

The meso-epiphytes are very small (<1.0 mm) and cannot be counted. These particular epiphytes invade the tissues of the host and grow inter-cellularly (inside the cells) damaging the cortical and medullary cells. Among the common meso-epiphytes are:

a. *Polysiphonia*, locally known as 'balahibo', 'bolo', or 'bungot-bungot'.
b. *Neosiphonia*, which are also called locally as 'bulbol amo', 'lambog', and 'serin-serin'.

Those that are easily observed and counted are the macro-epiphytes (>1.0 mm). These epiphytes show no damage on the tissue of the host. They include the:

a. Loosely attached macro-epiphytes. The macro-epiphytes that are loosely attached to the surface of the host are *Ulva*, *Chaetomorpha*, *Dictyota*, and *Hydroclathrus*.
b. Strongly attached macro-epiphytes. Whereas, *Gracillaria*, *Acanthophora*, and *Chondrophycus*, are those that are strongly attached to the surface of the host.

What are the causes of epiphyte occurrence in seaweed farming?

Epiphytic infection of the red filamentous micro-algae, locally known as 'buhok-buhok', is not a new phenomenon. It has been known to exist for the last 30 years. An epiphytic outbreak in farmed *Kappaphycus* was reported as early as 1975[60]. It has been noted that epiphyte outbreaks are seasonal in nature and may be affected by

[58]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. 59p. As cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

[59]Hortado, A.Q. 2013. Disease and Epiphytism in *Kappaphycus* Farming. PowerPoint Presentation: Integrated Services for the Development of Aquaculture and Fisheries, Jaro, Iloilo City, Philippines. 26 slides.

[60]Doty, M.S. and Alvarez, V.B. 1975. Status, problems, advances and economics of *Eucheuma* farms. Mar Technol Soc J 9:30–35. As cited in http://link.springer.com/chapter/10.1007%2F978-1-4020-9619-8_4.

changes in weather and environmental conditions[61]. However, the occurrence of epiphytes in seaweed farming has been highly associated with the following phenomena[62]:

1. Poor quality seedlings (stressed, weak, and unhealthy seedlings are more prone to epiphytic attacks)
2. Slow water movement (stationary water or no water movement limits nutrient absorption, hastening nutritional deficiency, thereby lessening seaweed resistance to epiphyte aggression)
3. Low salinity (low salinity (< 30 ppt) slows down growth, reduces plant vigor, and weakens seaweed resistance to epiphyte infestation)
4. High temperature and light intensity (these conditions also slow down growth and reduce plant resistance to epiphyte invasion)

What are the available management options against epiphyte infestation in seaweed production?

Currently, very little is understood about the cause and effect of epiphytic growth on *Kappaphycus alvarezii* farms and no management measures are in place to cope when extensive outbreak are evident. The only solution thus far practiced is to isolate the afflicted seaweed crops into smaller plots and wait until the outbreak peters. If growth of the epiphyte is too dense, affected crops are taken out, dried,

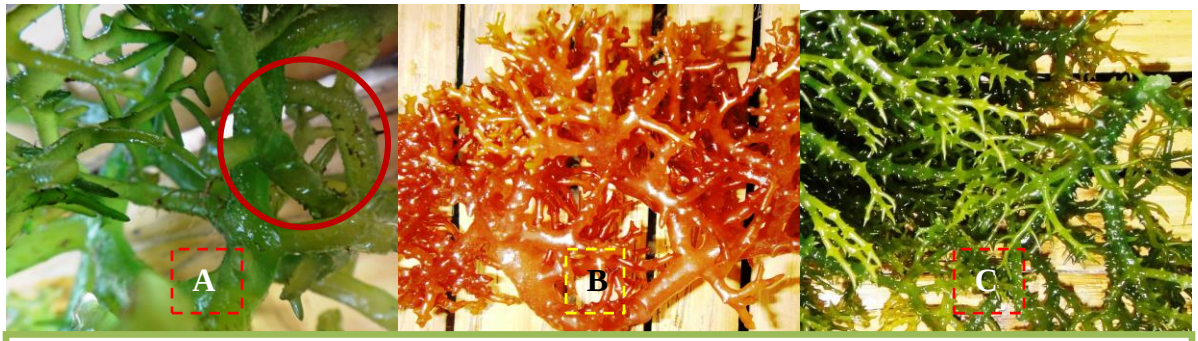

Figure 13. Epiphyte-infested seaweed (A) *Kappaphycus alvarezii* [green], relatively epiphyte-resistant seaweed (B) *Kappaphycus striatum* [brown], and highly epiphyte-resistant (C) *Eucheuma denticulatum* [green] grown in coastal waters of Calutcot-Kalongkoan Islands

and sold later along with healthy crop batches[63]. In Calutcot-Kalongkoan Islands,

[61]Chung, C.S. 2009. Seasonal Occurrences of Epiphytes and Their Effects on the Quality of Carrageenan in Commercially Cultivated Kappaphycus alvarezii. Borneo Marine Science Institute, Universiti Malaya, Sabah, Malaysia. 90p. As cited in http://eprints.ums.edu.my/6376/1/mt0000000150.pdf.

[62]Hortado, A.Q. 2013. Disease and Epiphytism in *Kappaphycus* Farming. PowerPoint Presentation: Integrated Services for the Development of Aquaculture and Fisheries, Jaro, Iloilo City, Philippines. 26 slides.

Burdeos, Quezon, farmers harvest their seaweeds as often as every time they would observe that about 10 percent of their seaweed farms are infested by epiphytes. They then select healthy thalli from the infested batch and replant them again in a new area. Epiphyte-infested seaweeds (**Figure 13A**) that were harvested are dried, stored, and sold while market prices are good.

Nevertheless, the use of resistant varieties (**Figure 13B** and **13C**) and healthy seedling stocks, growing under favorable environmental conditions, and practicing proper crop management has been demonstrated to deter severe epiphytic infestation. In this regard, appropriate remedial measures can be undertaken against specific causes of epiphyte occurrence as shown in **Table 2**[64].

Table 2. Common causes of epiphyte occurrence in seaweed farms and their associated remedial measures (Hortado, 2013)

CAUSE OF EPIPHYTE OCCURRENCE	REMEDIAL MEASURE
1. Poor seedling quality	▪ Use healthy, clean, and non–infested seedlings; grow resistant varieties
2. Slow water movement	▪ Grow in semi-exposed area with water current of 20-40 m/minute
3. Low salinity	▪ Grow in deeper area with water salinity levels of 30-40 ppt
4. High temperature and light intensity	▪ Grow during moderately warm period with temperatures of 25-31^{o}C in areas 1-2 m below the water surface (optimum at 0.50-0.75 m below the water surface)

B. *Weed Competitors and Their Management*

What are the common weed competitors of seaweeds?

1. Sea-grasses

Sea-grasses are the only group of submerged flowering plants in the marine environment. They thrive in shallow-water coastal habitats. Like the terrestrial grasses from which they originated, they possess erect leafy shoots and creeping

[63]Chung, C.S. 2009. Seasonal Occurrences of Epiphytes and Their Effects on the Quality of Carrageenan in Commercially Cultivated Kappaphycus alvarezii. Borneo Marine Science Institute, Universiti Malaya, Sabah, Malaysia. 90p. As cited in http://eprints.ums.edu.my/6376/1/mt0000000150.pdf.

[64]Hortado, A.Q. 2013. Disease and Epiphytism in *Kappaphycus* Farming. PowerPoint Presentation: Integrated Services for the Development of Aquaculture and Fisheries, Jaro, Iloilo City, Philippines. 26 slides.

stems or rhizomes which are effective for propagation. In contrast to other submerged marine plants (e.g., seaweeds and algae), sea-grasses flower develop fruits, and produce seeds. They also have true roots and an internal system for the transport of gasses and nutrients. There are only 50 species of sea-grasses in the world and 16 of these can be found in the Philippines[65].

Figure 14. (A) Eelgrasses (B) dominate substratum of a seaweed farm in coastal waters of Calutcot-Kalongkoan Islands

The most common species are tropical eelgrass (*Enhalus acoroides*), estuarine spoon-grass (*Cymodocea rotundata*), and round-tipped sea-grass (*Halophila ovalis*). Usually existing in enormous quantities and often forming large, dense meadows in tropical areas, sea-grasses perform a wide spectrum of biological and physical functions. In the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, the tropical eelgrass (**Figure 14A**) is a predominant species of sea-grass growing on substrata of many seaweed farms (**Figure 4B**). As a weed competitor, eelgrasses consume available nutrients and soluble gasses passing through the substratum of the seaweed farm. If eelgrass growth is so profuse, it may render the seaweed nutrient-deficient and may considerably weaken its resistance against diseases and epiphytes.

2. *Sargassum* weeds

Sargassum grows abundantly in the tropics where it attains very high biomass. *Sargassum* beds are known as important nursery grounds where a large number of animal organisms including species of commercial value such as fishes, shrimps, crabs, mollusks, and others live. They are important source of alginates and alginic

[65]Fortes, M.D. 1990. Sea-grasses: A Resource Unknown in the ASEAN Region. Published by the International Center for Aquatic Resources Management in behalf of the Association of Southeast Asian Nations (ASEAN) and United States Coastal Resources Management Project. ICLARM Education Series 5, Manila Philippines. 46p. As cited in http://www.google.com.ph/books?

acids used in many industrial products such as fabrics, cosmetics, foods, among others. The genus *Sargassum* has about 400 species distributed in the sub-tropical and tropical waters in the world[66].

In the Philippines, 72 *Sargassum* species have been recorded. Of these species, the most common are *Sargassum cristaefolium* C. Agardh, *Sargassum crassifolium* J. Agardh, *Sargassum polycystum* C. Agardh, and *Sargassum oligocystum* Montagne[67]. The brown *Sargassum* spp., locally known as 'kulapo', abounds in rocky substrata grown to seaweeds in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon. During typhoon seasons with strong wind and current, the *Sargassum* spp. (**Figure 15A**) are detached from their rock habitation, float, and entangle with seaweeds tied to mono-lines (**Figure 15B**). While remaining appended to seaweed on mono-lines for some time, they impede in sunlight reception and compete for nutrients and soluble gasses in the seawater available for seaweed consumption.

Figure 15. (A) Common *Sargassum* spp. (B) entangles with seaweeds tied on a mono-line in coastal waters of Calutcot-Kalongkoan Islands

How do we manage the weed competitors of seaweeds?

While the presence of sea-grasses and *Sargassum* weeds in substrata of seaweed farms would indicate favorable seaweed growth, their presence is negated by their role as seaweed competitors. Thus, it is important to employ some management techniques to abate their growth and allow optimum seaweed growing conditions.

[66]Largo, D.B. and Ohno, M. 1992. Phenology of Two Species of Brown Seaweeds, *Sargassum myriocyslum* J. Agardh and *Sargassum siliqousum* J. Agardh (Sargassaceae , Fucales) in Lioloan, Cebu, in Central Philippines. Bull. Mar. Sci. Fish., Kochi Univ. No. 12, p17-27.

[67]Ortiz, A.T. and Trono, Jr., G.C. 1997. Growth and Reproductive Pattern of Intertidal and Sub-tidal Sargassum (Sargassaceae, Phaeophyta) Populations in Bolinao, Pangasinan. Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines. 50p. As cited in http://journals.upd.edu.ph/index.php/sciencediliman/article/viewFile/216/200.

As often said, after tying seaweed 'seedlings' to the ropes, and the ropes staked to the seabed, seaweed farming practically needs no more inputs. However, there is a need for periodic visitation, two to three times a week, to remove undesirable sea-grasses, barnacles, attached *Sargassum* and sediments; to re-tie loose or fallen seaweed; to tighten lines; and to check for signs of 'ice-ice' disease and epiphyte infestation.

In Calutcot-Kalongkoan Islands, Burdeos, Quezon, seaweed farmers do not by and large remove sea-grasses in the substrata of their seaweed farms unless their populations become exceedingly dense. In the case of *Sargassum*, they gorge the nylon strings in bamboo tubes installed between the mono-lines and floaters. During typhoon seasons, when strong water current normally occur, this technique prevents the entangling of the mono-lines with the floater strings and entraps *Sargassum* on the bamboo tubes rather than on the seaweeds tied to the mono-lines. Thus, this method also allows easy removal of entrapped *Sargassum* weeds.

GRAZERS AND THEIR MANAGEMENT IN SEAWEED PRODUCTION

What is a seaweed grazer?

The plant-eating animals are called grazers. Thus, a seaweed grazer is a seaweed-eating animal. Like their terrestrial relatives, marine plants (seaweeds and sea-grasses) are a primary food source for a wide variety of animals, including grazers. Some examples of seaweed grazers are fishes (rabbit fish and puffer fish), sea urchins, starfishes, and sea turtles[68]. In the Philippines, particularly in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, a fish species locally known as 'balawis' or 'kuyog' is a predominant seaweed grazer. Grazer damage is characterized by scraped epidermis or eaten out portion of the seaweed thalli that eventually turn into whitish

Figure 16. Seaweed, *Kappaphycus alvarezii* (green), grown in coastal waters of Calutcot-Kalongkoan Islands, damaged by a grazer fish, locally known as 'balawis'

[68]LISC. 2014. Grazers. Long Island Sea-grass Conservation (LISC) Website, Cornell University Cooperative Extension of Suffolk County. As cited in http://www.seagrassli.org/ecology/fauna_flora/grazers.html.

colorations (**Figure 16**). Experts estimate that the damage caused by seaweed grazers can bring about 10 to 30 percent losses in seaweed biomass[69].

What are the main herbivore species grazing on seaweeds?

In the tropics, rabbit and puffer fishes are reported as the main seaweed grazers. Sea urchins and sea turtles are also described damaging the seaweed plants. However, rabbit fishes are usually cited as the most destructive. Nevertheless, after the warmer months, fish grazing becomes a minor problem. In fact, fishes move away from the seaweeds. Thus, it is always a good idea to set seaweed farms far away from coral heads, since these fishes normally live around the corals and move out to graze on seaweed[70].

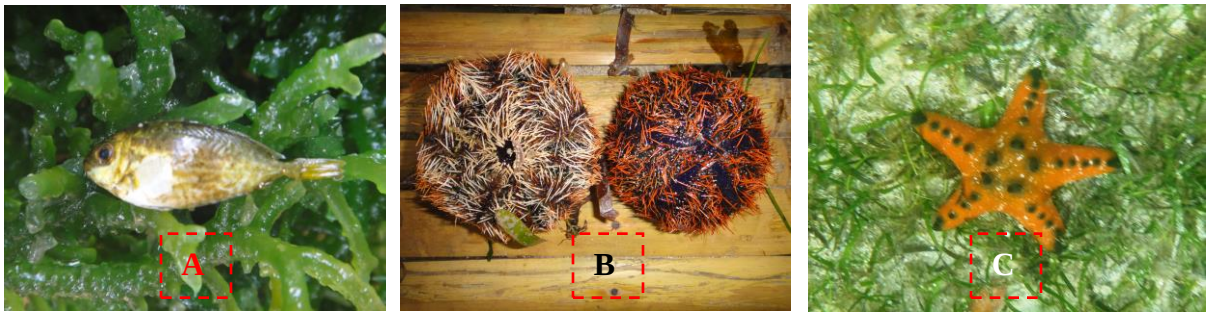

Figure 17. (A) Fish species, locally known as 'balawis', (B) sea urchins, and (C) starfish are the common grazers of seaweeds grown in coastal waters of Calutcot-Kalongkoan Islands

As frequently observed in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, a fish species locally known as 'balawis' (**Figure 17A**) is the main seaweed grazer. In addition to these, sea urchins (**Figure 17B**) and starfishes (**Figure 17C**) are also often seen grazing on seaweeds. Among all of these, 'balawis' and other fishes are generally the most damaging. During the warmer months, large schools of fishes, 1-6 cm in length, locally known as 'kuyog', can be seen living among seaweed mono-lines. On some occasions, these small fishes can graze seaweed to such an extent that they will entirely destroy seaweed farms.

[69]Trono, Jr. G.C. 2013. Seaweed Farming: PowerPoint Presentation in the Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach held on 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos, Quezon. 15 slides.

[70]Foscarini, R. and Prakash, J. Handbook of *Eucheuma* Seaweed Cultivation in Fiji. Fisheries Division, Ministry of Primary Industries, and U.N. Food and Agriculture Organization (FAO) South Pacific Aquaculture Project, Suva, Fiji. 45p. As cited in http://41.215.122.106/dspace/bitstream/0/419/1/ .

What are the types of grazer damage?[71]

Significant grazing means significant losses; severe grazing means that grazers are harvesting most of seaweed crop. Thus, depending upon the degree of gazing inflected on the seaweed plants, grazer damage can be described as:

a. *Gouging* is the sort of damage where small chunks of pigmented tissue are removed as on the thallus of seaweed. This pattern seems typical of perhaps small sea urchins.

b. *Planing* is the sort of damage where the side of a branch is flattened by removal of tissue as if by a plane. This pattern seems typical of the larger sea urchins.

c. *Stripping* occurs when gouging or planing is so severe as to cause complete removal of the plants' pigmented cortical layers.

d. *Tip-nipping* occurs when growing tips are bitten off. It is commonly seen and is often attributed to fish such as rabbit fish, juvenile surgeonfish, or parrotfish, and a fish species locally known as 'balawis'.

e. *Total damage* can occur all of the types of grazer damage except total loss.

f. *Plants just gone as if chomped off in one bite*. This has been reported with green turtles (*Chelonia midas*) in many tropical countries. These animals can be kept out of farms by sturdy fences or avoiding planting where they feed if it can be done.

How do we manage seaweed grazers?

One of the ever present factors which control marine vegetation are the associated animal life. Seaweeds are constantly being grazed upon by a host of herbivorous animals. These animals significantly control the amount of harvestable organic matter (biomass) in reef areas. Studies have shown that when grazing is controlled by the physical destruction or removal of grazers, luxuriant growth of seaweeds would follow[72]. Grazing can be stopped in a variety of ways but few methods are

[71]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

[72]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. 59p. As cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

both environmentally acceptable and economically feasible. The best 'green' ways to deal with grazers are to[73]:

a. *Avoid them*. Place farm habitats in locations where endemic grazer populations are not abundant; for example by placing floating habitats in water several meters deep over muddy or sandy bottom.

b. *Swamp them out*. Build *Kappaphycus* and *Eucheuma* seaweed populations to a 'critical mass' where any grazing pressure is trivial relative to the total biomass and production; then accept some losses. This is a widest-spread method of dealing with grazers.

c. *Block them*. Use barrier nets or enclosures on a selective basis during seed stock production or to prevent the entrance of large grazers such as turtles.

d. *Evade them*. Crop back and wait out seasonal grazing periods if they last for only a few weeks (e.g. dry, hot season).

e. *Catch them*. Many marine herbivores are good to eat. Some have aquaculture potential (e.g., abalone, local fish species known as 'balawis').

Seaweed farmers in the Philippines exploit several management options to contain seaweed grazers. Their choices are often dictated by the farm location, the kinds of dominant grazers, the cropping season, and the experiences of seaweed farmers. In the coastal waters of Western Mindanao, the floating mono-line method of seaweed farming is used so that grazing by bottom-associated animals is minimized or eliminated because the plants are raised out of reach by benthic grazers[74]. In Northeastern Sorsogon, Southern Luzon, the modified floating raft method is preferred by seaweed farmers to prevent sea urchin grazing damage, reduce plant sedimentation, and avoid thalli breakage[75]. In the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, seaweed farmers employ suitable combinations of the following approaches, namely:

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[73]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

[74]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. p23. As cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

[75]Salayao, N.D., Tagarino, R.N., Kick, C.G. 1991. Seaweed Farming in the Philippines: Its Prospects Northeast Sorsogon. Research and Training Program for Agricultural Policy(RTPAP), Department of Agriculture accelerated Agricultural Productivity Program (DA-AAPP), and the University of the Philippines Los Banos Center for Policy and Development Studies (CPDS) and College of Economics and Management (CEM). 25p. As cited in http://www.drkick.com/CGK3%20writings/Weed_Aisa.pdf.

1. Avoiding the establishment of seaweed farms on shallow coastal waters near mangroves during period of moderate water current (summer), which usually coincide with the habitation and egg-laying season for fish grazer species, locally known as 'balawis';

2. Increasing the distance between the substratum of seaweed farm and the mono-lines where the seaweeds are tied to evade the water depth mostly frequented by juvenile fish grazers, locally known as 'kuyog';

3. Gathering of sea urchins and starfishes in substratum of seaweed farm and transferring them to seaweed off-farm areas;

4. Providing enough distance (at least 1.0 m) between the mangrove posts where the mono-lines are tied to and the first seaweeds tied to the mono-lines; herbivorous fishes normally graze on least moving seaweeds that are tied too close to the mangrove posts.

DISEASES AND THEIR MANAGEMENT IN SEAWEED PRODUCTION

What is a seaweed disease?

A seaweed disease is defined as a continuing disturbance to the plant's normal structure and function such that it is altered in growth rate, appearance, or economic importance[76]. There are two kinds of diseases in plants, namely:

a. Infectious disease involves a transmissible infectious agent (bacteria, fungi, virus, others); and

b. Non-infectious disease is induced by physiogenic factors such as extremes of temperatures, salinity, light intensity, or pollution.

Other than those in economic seaweeds, most of what is known to be diseases in macro-algae are the types that are generally less threatening to the natural seaweed population[77]. Some of the commonly observed seaweed diseases in the Philippines

[76]Andrews, J.H. 1976. The Pathology of Marine Algae. Biol. Rev. 51: 211-253. As cited in Lagro, D.B. 2002. Recent Development in Seaweed Diseases. In: Hortado A.Q., Guanzon, Jr., N.G., Castro-Mallare, T.R., and Luhan, M.R.J. (ed.). Proceedings of the National Seaweed Planning Workshop held on 2-3 August 2001, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines. p35-42.
[77]Lagro, D.B. 2002. Recent Development in Seaweed Diseases. In: Hortado A.Q., Guanzon, Jr., N.G., Castro-Mallare, T.R., and Luhan, M.R.J. (ed.). Proceedings of the National Seaweed Planning Workshop held on 2-3 August 2001, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines. p35-42.

include: (a) 'ice-ice'; (b) goose bumps or 'kurikong'; (c) tip-darkening; and (d) pitting[78]. In the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, the most problematic is the 'ice-ice' disease. In fact, since 2002, seaweed farming in the Polillo Group of Islands drastically declined due to serious 'ice-ice' devastation to most *Kappaphycus alvarezii* seaweed farms in the area. In recent years, many seaweed farms ceased to exist because of the 'ice-ice' problem. This has been happening in Bohol, in Batangas, and even in Iloilo. It is interesting to note that the widespread 'ice-ice' event took place during the *El Niño* and *La Niña* seasons[79]. In countries where seaweed is harvested as a crop, 'ice-ice' can wreak havoc on yields. An outbreak of 'ice-ice' disease was reported in Zamboanga, Philippines in 2004[80], and Bali, Indonesia, experienced an outbreak in 2009[81].

What is an 'ice-ice' disease? How does an 'ice-ice' disease occur on seaweeds?

Figure 18. Severely 'ice-ice' infected *Kappaphycus alvarezii* (green) grown in coastal waters of Calutcot-Kalongkoan Islands

'Ice-ice' is a seaweed disease generally caused by unfavorable environmental conditions in the planting site leading to bleaching and whitening appearance of seaweed thalli. Affected thalli lose their pigments, become soft, and eventually disintegrate[82] (**Figure 18**).

However, experts regard 'unfavorable factors' in the cultivation site as a general statement referring to either high or

[78]Simbajon, R.S. and Lucero, R.C. 2013. Seaweed Diseases and Health Management. PowerPoint presentation, Bureau of Fisheries and Aquatic Resources, Region IV-A, Sub-Regional Office, Los Banos, Laguna, Philippines. 37 slides.

[79]Lagro, D.B. 2002. Recent Development in Seaweed Diseases. In: Hortado A.Q., Guanzon, Jr., N.G., Castro-Mallare, T.R., and Luhan, M.R.J. (ed.). Proceedings of the National Seaweed Planning Workshop held on 2-3 August 2001, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines. p35-42.

[80]Fresco, M.C.O. 2001. Water pollution, ice-ice rough up Zamboanga's seaweed industry. As cited in http://sntpost.stii.dost.gov.ph/frames/jantomar04/pg27b.htm.

[81]Nurhayati, D. 2009. Rising sea temperatures bad news for seaweed farmers. The Jakarta Post, Sanur/Headline/Wednesday, 28 October 2009, 1:30 pm. As cited in http://www.thejakartapost.com/news/2009/10/28/.

[82]Simbajon, R.S. and Lucero, R.C. 2013. Seaweed Diseases and Health Management. PowerPoint presentation, Bureau of Fisheries and Aquatic Resources, Region IV-A, Sub-Regional Office, Los Banos, Laguna, Philippines. 37 slides.

low temperature, high or low salinity, high or low light intensity, and also to insufficient nutrients, and so on. Addressing any of these factors is considered a management intervention strategy. So far, the role of temperature, salinity, and light intensity, taken singly was observed in controlled laboratory set up as possible predisposing factors that can lead to 'ice-ice' disease. The role of microbial pathogens has also been shown as having to do with 'ice-ice. It was discovered that normal (resident) bacteria could become opportunistic pathogens under certain conditions. Subliminal environmental factors (e.g., low salinity, or low light intensity), although in itself may not readily lead to the disease manifestation, could predispose the seaweed to bacterial attack, mainly by certain opportunistic pathogens[83]. These findings suggest that the whitening phenomenon in 'ice-ice' infected seaweed is caused by both a-biotic (non-infectious) and biotic (infectious) factors acting in combination. When the seaweed is under stress, it emits a moist organic substance that attracts bacteria in the water and induces the 'whitening' and hardening of the seaweed branches. Uninfected parts remain healthy while infected ones undergo de-pigmentation and eventually lead to plant breakage by any force of nature[84].

Normally, the surfaces of submerged plants are areas readily colonized by bacteria but only a few strains could be potential pathogens. In the case of *Kappaphycus*, two such bacterial pathogens belonging to the *Vibrio-Aeromonas* complex and the *Cytophaga-Flavobacterium* complex demonstrate the seaweed-bacteria interaction. Strains of these two groups of bacteria can induce the 'ice-ice' disease in *Kappaphycus* when the seaweed plant is subjected to stressful factor of either low salinity or low light intensity in sub-optimal level. While *Cytophaga* sp. showed non-motile behavior, cells of *Vibrio* sp. are active swimmers. This motile behavior of *Vibrio* makes such bacterium an efficient seaweed invader[85]. 'Ice-ice' disease triggered by bacteria could take place under the following conditions:

- ***If there is slow water movement in the cultivation ground***. Some pathogens, especially bacteria, are highly motile and can very easily invade seaweed surfaces. Strong water current, aside from enhancing nutrient exchange, also

[83]Lagro, D.B. 2002. Recent Development in Seaweed Diseases. In: Hortado A.Q., Guanzon, Jr., N.G., Castro-Mallare, T.R., and Luhan, M.R.J. (ed.). Proceedings of the National Seaweed Planning Workshop held on 2-3 August 2001, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines. p35-42.

[84]Tisera, W.L. and Naguit, M.R.A. 2009. 'Ice-ice' Disease Occurrence in Seaweed Farms in Bais Bay, Negros Oriental and Zamboanga Del Norte. The Threshold, 5: 1-16. As cited in http://www.eisrjc.com/documents/Ice-Ice_Disease_Occurence_In_Seaweed_Farms_in_Bais_Bay.

[85]Lagro, D.B., Fukami, K., Nishijima, T., and Ohno, M. 1995. Laboratory-induced Development of the 'Ice-ice' Disease of the Farmed Red Algae *Kappaphycus alvarezii* and *Eucheuma denticulatum* (Solieriaceae, Gigartinales, Rhodophyta). J. App. Phycol. 7: 545-554.

prevents potential pathogen that comes from the surrounding water from establishing on the seaweed surface[86];

- ***If the cultivation ground is close to freshwater sources, such as rivers or creeks***. This practically reduces the salinity of the seawater below normal and a stressful factor to the seaweed, These places are not the desirable sites for *Kappaphycus* farming since it has a normal water salinity requirement of between 30-35 ppt[87]; and

- ***If the water temperature is high, especially if this is accompanied by high light intensity***. This is also stressful to the seaweed. This can be remedied by moving the plants to a slightly deeper location, but not too deep to dampen growth performance. Normal Temperature requirement for *Kappaphycus* is between 25-31^{o}C[88].

Although each of the above factors could act independently from each other, they could act synergistically, intensifying the development of 'ice-ice' disease[89]. The progress of the ice-ice phenomenon is generally as follows[90]:

1. Formerly dark-colored, clean, vigorously growing plants lose pigmentation while otherwise remaining healthy in appearance and growth rate;

2. In a matter of weeks, sometimes even in a matter of days, the loss of pigmentation may become severe and growth rate becomes very low or negative. At this stage if the plants are moved to 'better water', they may exhibit full recovery;

3. New tips, if they occur at all, tend to be spindly and lacking in vigor. In this case the plant has acquired an overall appearance that is reminiscent of a centipede. There were many tips but growth was negligible; and

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[86]Largo, D.B., Fukami, K., Adachi, M., and Nishijima, T. 1997. Direct enumeration of total bacteria from macroalgae by epifluorescence microscopy as applied to the fleshy red algae *Kappaphycus alvarezii* (Doty) and *Gracilaria* spp. (Rhodophyta). J. Phycol. 33: 554-557

[87]Lagro, D.B., Fukami, K., Nishijima, T., and Ohno, M. 1995. Laboratory-induced Development of the 'Ice-ice' Disease of the Farmed Red Algae *Kappaphycus alvarezii* and *Eucheuma denticulatum* (Solieriaceae, Gigartinales, Rhodophyta). J. App. Phycol. 7: 545-554.

[88]Lagro, D.B. 2002. Recent Development in Seaweed Diseases. In: Hortado A.Q., Guanzon, Jr., N.G., Castro-Mallare, T.R., and Luhan, M.R.J. (ed.). Proceedings of the National Seaweed Planning Workshop held on 2-3 August 2001, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines. p35-42.

[89]Lagro, D.B., Fukami, K., Nishijima, T., and Ohno, M. 1995. Laboratory-induced Development of the 'Ice-ice' Disease of the Farmed Red Algae *Kappaphycus alvarezii* and *Eucheuma denticulatum* (Solieriaceae, Gigartinales, Rhodophyta). J. App. Phycol. 7: 545-554.

[90]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

4. Areas devoid of pigment appear at intervals on plant thalli; they weaken and eventually the tissue atrophies, thus causing plant breakage.

What are the possible management interventions against 'ice-ice' disease of seaweeds?

Crop management suggests that to optimize production, any crop has to be grown at the plant's optimal growth requirement, with optional external investments on energy. Any factor that tends to deviate from this simple rule will produce inferior crop that is below sustainable level. Some suggestions to properly manage the *Kappaphycus* crop are[91]:

- Avoid overcrowding plants in cultivation. This renders them susceptible to opportunistic pathogens, like some *Vibrio* and *Cytophaga* spp. Less crowding of plants also enhances light penetration and therefore to growth.

- Stay within the optimal growth requirements of *Kappaphycus*. Drastic changes in salinity and water temperature have to be avoided.

- In times of very high light intensity, as during summer period, especially during *El Niño* seasons, it may be advisable to move plants to a deeper location where light intensity does not lead to photo-inhibition. Ways to improve planting techniques in such a way that *Kappaphycus* crop can be easily moved need to be studied. *El Niño* season is destructive to seaweed cultivation; hence measures to prevent 'ice-ice' disease need to be in place.

- There is a need to identify more 'ice-ice' disease-resistant strains of *Kappaphycus* and *Eucheuma*. The 'sakol' variety of *Kappaphycus* seems to have this property. New *Eucheuma* strains from protoplast fusion out of disease-resistant variety are expected to have this desirable characteristic.

Seaweed farmers in Calutcot-Kalongkoan Islands, Burdeos, Quezon now practice several, if not all, of the above-mentioned management options. Recently, they observed in their farmer field school (FFS) 'learning fields' that the green strains of seaweeds *Kappaphycus striatum*, locally known as 'sacol' and *Eucheuma denticulatum*, locally known as 'spinosus' or 'milyon-milyon' were more resistant to 'ice-ice' disease compared to the green and brown strains of seaweed *Kappaphycus alvarezii*, locally known as 'tambalang' or 'jumbo'.

[91]Lagro, D.B., Fukami, K., Nishijima, T., and Ohno, M. 1995. Laboratory-induced Development of the 'Ice-ice' Disease of the Farmed Red Algae *Kappaphycus alvarezii* and *Eucheuma denticulatum* (Solieriaceae, Gigartinales, Rhodophyta). J. App. Phycol. 7: 545-554.

Aside from the 'ice-ice', what other diseases can infect seaweeds? How do we manage them?

Aside from 'ice-ice', other common, but less destructive, seaweed diseases in the Philippines are goose bumps or 'kurikong', tip-darkening, and pitting. Goose bumps or 'kurikong' disease is characterized by the presence of bump-like protrusions on seaweed thalli. The tip darkening disease is distinguished with the presence of dark or blackish seaweed thalli tips which progresses to the whole plant parts that eventually disintegrates. On the other hand, the pitting disease shows formation of cavities from outer part towards the inner part of the seaweed thalli, which commonly occur when the seaweed survives from an 'ice-ice' infection. A seaweed thallus breaks if pit is large[92]. A local seaweed expert had also reported black fungus disease as a minor seaweed disease[93]. Seaweed farmers in the coastal waters of Calutcot-Kalongkoan Islands also concede that black fungus (**Figure 19A**) and goose bumps or 'kurikong' (**Figure 19B**) diseases are common in their seaweed farms but observe them to be less destructive than the 'ice-ice' disease.

Figure 19. (A) Black fungus and (B) goose bumps, locally known as 'kurikong' are common, but less destructive, diseases of *Kappaphycus alvarezii* seaweeds grown in coastal waters of Calutcot-Kalongkoan Islands

[92]Simbajon, R.S. and Lucero, R.C. 2013. Seaweed Diseases and Health Management. PowerPoint presentation, Bureau of Fisheries and Aquatic Resources, Region IV-A, Sub-Regional Office, Los Banos, Laguna, Philippines. 37 slides.

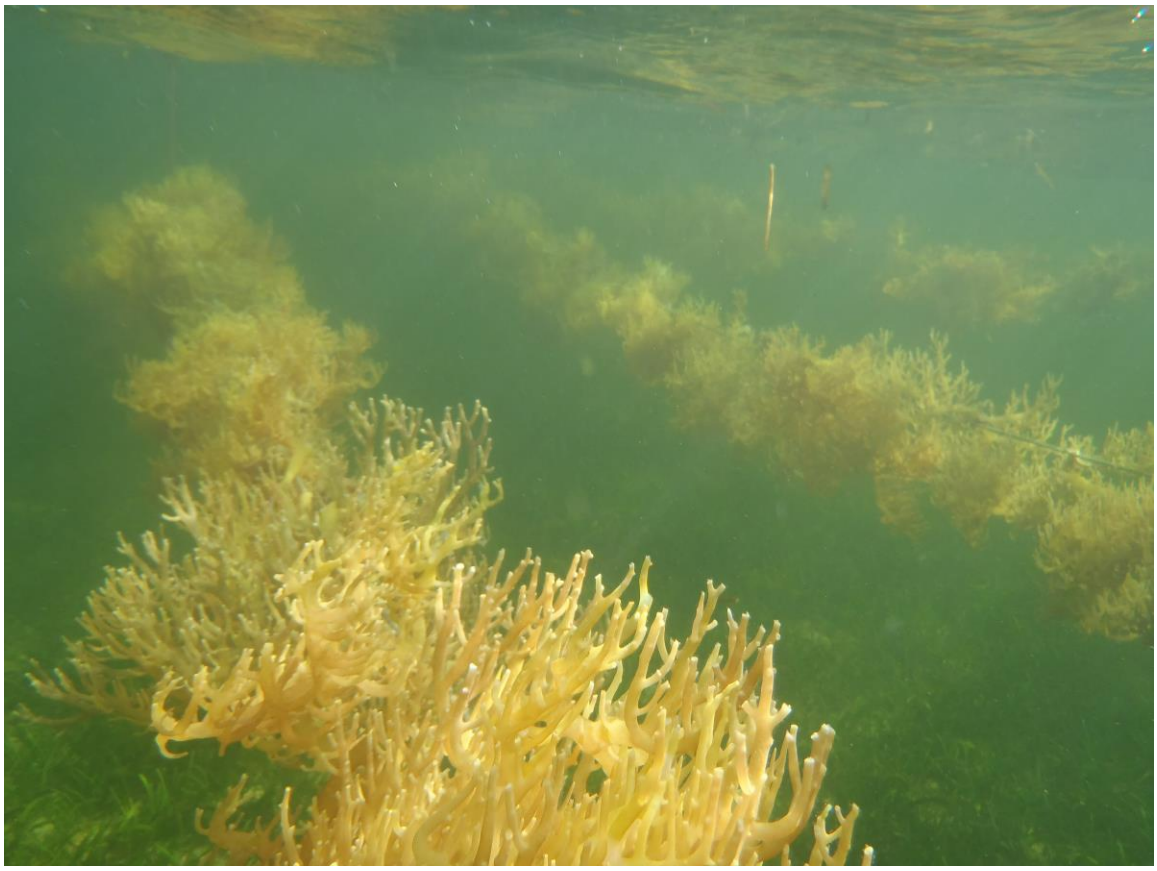
[93]Hortado, A.Q. 2013. Disease and Epiphytism in *Kappaphycus* Farming. PowerPoint Presentation: Integrated Services for the Development of Aquaculture and Fisheries, Jaro, Iloilo City, Philippines. 26 slides.

The pre-disposing factors of 'ice-ice' disease occurrence appear to be the same factors enhancing the incidence of goose bumps, tip darkening, pitting, and black fungus diseases. Likewise, these diseases seem to co-exist with the 'ice-ice' disease; hence the same management strategies are often opted for these less destructive diseases. Aside from the aforesaid management interventions mentioned earlier, seaweed farmers in the coastal waters of Calutcot-Kalongkoan Islands make the most of the following recommended alternative practices[94], namely:

- Removing infected seaweed plants and replacing them with healthy seaweed seedlings;
- Transferring the seaweed farm to another site where the problem is not observed; and
- Harvesting, drying, and marketing the affected seaweed crops if the condition is aggravated.

[94]Simbajon, R.S. and Lucero, R.C. 2013. Seaweed Diseases and Health Management. PowerPoint presentation, Bureau of Fisheries and Aquatic Resources, Region IV-A, Sub-Regional Office, Los Banos, Laguna, Philippines. 37 slides.

INTEGRATED CULTURAL MANAGEMENT PRACTICES IN SEAWEED PRODUCTION



SECTION 5

INTEGRATED CULTURAL MANAGEMENT PRACTICES IN SEAWEED PRODUCTION

Similarly, a section on *Integrated Cultural Management Practices in Seaweed Production* incorporates novel farmer-driven research findings on management of biotic and a-biotic constraints in seaweed production. These innovations can be considered for further participatory technology development (PTD) activities by FFS farmer-graduates and facilitators, researchers, extension workers, and seaweed growers to improve their current management approaches. Among others, this section takes account of six (6) pioneering management topics, namely:

- Site selection for seaweed production
- Seaweed Nursery management
- Seaweed species, varieties, and their characteristics
- Methods of seaweed establishment
- Cultural management for seaweed production
- Harvest and post-harvest operations

SITE SELECTION FOR SEAWEED PRODUCTION

Why is site selection important in seaweed farming?

Site selection is critical to success in the nursery and field culture of seaweeds. Site choice can lead to project failure or to success and competitive advantage. It is the most important aspect in developing a potentially productive seaweed farm. A seaweed farmer must assess the area to evaluate the suitability for growing seaweeds. Seaweed production depends largely on the specific environment. One needs to identify and locate the most suitable areas for seaweed farming. The search for a suitable area is the most difficult task encountered by seaweed farmers because of the very delicate nature of the plant[1].

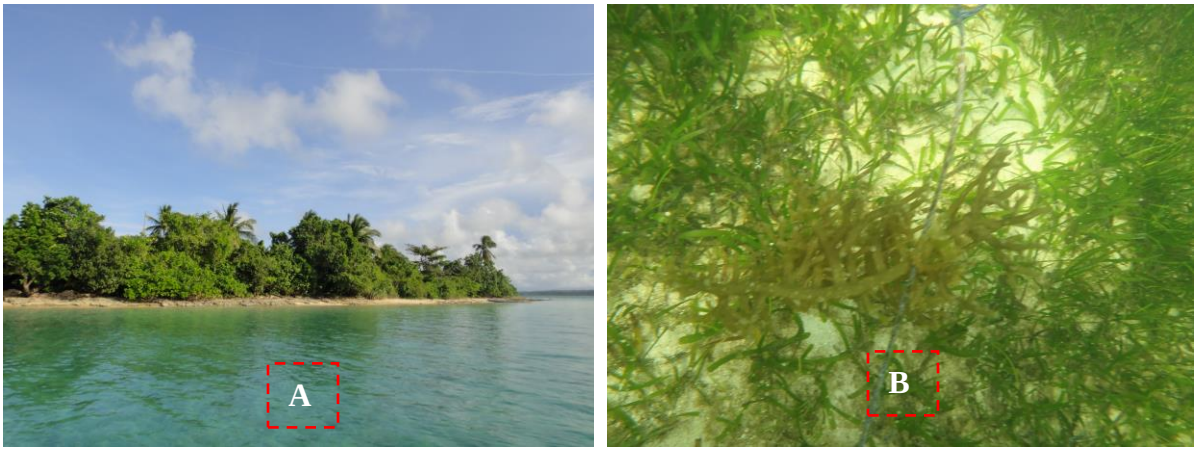


Figure 20. (A) Site protected from strong tidal or wind-generated waves and (B) substrate with coarse-sandy to slightly corally bottom that support good growth of seaweeds and sea-grasses are important factors in growing seaweeds at coastal waters of Calutcot-Kalongkoan Islands

In general, areas that support natural stocks of seaweed species to be cultured are good sites. If culture will be done in an area where no stock of the species exists, then one should select sites which have comparable ecological conditions as the site where the stocks are found. This will need the gathering of data on various parameters such as salinity ranges, nutrient levels (NO^{-1}_3, PO^{-3}_4), turbidity, and type of substrate; other ecological parameters such as degree of exposure to waves, depth of the water, and accessibility are also included in the evaluation of sites[2].

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[1]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. 59p. as cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

[2]Trono, Jr., G.C. 1990. A Review of the Production Technologies of Tropical Species of Economic Seaweeds: Technical Research Reports. Food and Agriculture Organization (FAO) Corporate Document Repository, Fisheries and Aquaculture Department. As cited in http://www.fao.org/docrep/field/003/ab728e/ab728e01.htm

What are the factors to be considered in selecting sites for growing seaweeds?

The basic elements of *Kappaphycus* and *Eucheuma* seaweed growth dictate that successful farm systems must have the following features[3]:

- Large surface area exposed to sunlight having optimum characteristics;
- Effective, even water flow to and from all plants in the system;
- Even dispersion of plants throughout farm sites;
- Amenable to frequent cropping, cleaning, and tending so weeds, epiphytes, diseases, and other fouling organisms cannot overrun seaweed cultures;
- Rugged enough to withstand the substantial hydraulic forces of moving water and wind;
- Located in places with environmental conditions as close to ideal as possible for the seaweed crops being grown;
- Protected from weather and sea conditions beyond farm habitats' structural limits;
- Minimal fixed and variable production costs; and
- Secure from human interference (e.g. pilferage, vandalism, and accidental damage from boats).

Thus, in selecting the site for growing seaweeds, the following factors are to be considered[4]:

a. The site should be free from fresh water source such as rivers, creeks, and estuaries as well as other sources of pollution. *Kappaphycus* and *Eucheuma* are marine species and will be adversely affected by fresh water dilution. Salinities lower than 30 ppt (parts per thousand) are detrimental to the normal growth and development of the plants.

b. The site should be protected from strong tidal or wind-generated waves which can destroy the seaweed farm. The presence of islands or reefs in the area can minimize the destructive effects of strong wind-driven waves especially during the monsoon seasons (**Figure 20A**).

c. The site should be subjected to good amount of water movement, such as in the form of moderate currents. Water movement is a major factor which influences

[3]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

[4]Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng *Eucheuma* (*Eucheuma* Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

the growth of the plants. It facilitates rapid absorption of nutrients from the water by the plants, thus, playing a very important role in their growth and development. It also prevents extreme fluctuations of environmental factors such as water temperature, salinity, pH, dissolved gases, among others, which can adversely affect the growth of the plants. A velocity of 20-40 meters per minute is the site is desirable. Very strong current is also destructive. One indicator of moderate current velocity in the area is shown by the bending of sea-grass leaves to about 45° angle or less. Such observations should be related to tidal changes in the area.

d. The substrate should be firm, with coarse-sandy to slightly corally bottom, especially supporting good growth of seaweeds and sea-grasses (**Figure 20B**). The state of the substrate also reflects the amount of water movement in the area. Areas with fine and soft sandy-muddy bottom should be avoided. Areas of this nature are devoid of currents and are generally poor areas for seaweed farming.

e. During low tides, the water should be about 0.5-1.0 m deep so that the planted *Kappaphycus* and *Eucheuma* should be just below the lowest tide level and not exposed to sun and air. During high tides, the water should not be more than 2.0-3.0 m deep to facilitate ease during seaweed farm planting and maintenance. If the method to be used for seaweed farming is the 'bottom mono-line method', the depth of the water, especially during low tide, is important.

f. The presence of natural beds of *Kappaphycus* and *Eucheuma* is a good indicator of the potential of the site for seaweed farming. In general, reef areas characterized by good seaweed communities which posses the above cited characteristics may be good potential sites. However, this should be subjected to test planting activities using the desired seaweed species.

How do we ascertain that the site selected is potential for seaweed farming?

Ultimately the only way to find out whether a given site supports vigorous plant growth is to plant test plots and expand where plants grow best. Only growing the desired seaweed crops over several seasons confirm which locations are best. The critical factors necessary at a good site are[5]:

- Communities of people willing and able to become effective seaweed farmers;
- Clean, nutrient-rich water at the right temperature;
- Low probability of force majeure episodes due to natural or human causes;
- Access to essential inputs, infrastructure, and resources at attractive cost; and

[5]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

- A stable, friendly climate for business, political, and socio-economic activities.

The question of whether the site will support the farming of *Kappaphycus* and *Eucheuma* seaweeds can only be resolved by test planting the area. This activity involves test planting the desired species and monitoring its growth rate. Test plots should be constructed at different strategic locations in the area. The size of the seedlings and the method of construction of the test plots should follow that of a real farm except that the sizes of the plots are smaller. As soon as the mono-lines are set-up, the following activities should be done[6]:

1. Prepare the seedlings by splitting the seed stocks into 50-100 grams (if seed stocks are limited) or into 100-150 grams (if seed stocks are sufficient);

   Note: Seaweed farmers in Calutcot-Kalongkoan islands of Burdeos, Quezon opted for splitting seed stocks into 50-150 gram per seedling (instead of 100-300 gram per seedling) to either economize or optimize on limited or sufficiently available seed stocks, as the case may be.

2. Obtain the fresh weight (initial weight) of each seedling using a desirable weighing scale (e.g., a top load or spring balance) and the formula:

   $$W_{initial} = \frac{W_{20\ randomly\ selected\ seedlings\ (gm)}}{20}$$

   Note: Seaweed farmers in Calutcot-Kalongkoan islands of Burdeos, Quezon opted for randomly selecting and taking the average of 20 sample seedlings after splitting the seed stocks to compute for initial weight ($W_{initial}$) per seedling.

3. Monitor fresh weight of the plants every other week using the formula:

   $$FW = \frac{W_{2\ randomly\ selected\ seedlings\ per\ line\ (gm)}}{\text{Total number of seedlings selected}} \times \text{Number of lines selected}$$

   Note: Seaweed farmers in Calutcot-Kalongkoan islands of Burdeos, Quezon opted for randomly selecting (instead of individually tagging) and taking the average of sample seedlings every other week (instead of weekly) to avoid subjecting the same sample seedlings to stresses as a result of regularly taking them out from their ties.

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[6]Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng *Eucheuma* (*Eucheuma* Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

4. Compute for the daily growth rate and percent growth rate using the formula:

$$\text{Growth Rate or GR (gm/day)} = \frac{W_{final} - W_{initial\ (gm)}}{\text{Time (days)}}$$

$$\%\ \text{Growth Rate} = \frac{GR}{W_{initial}} \times 100$$

5. Keep a neat and clean records of the weights and other important observations (refer to **Monitoring Form No. 3**)

Sites which support daily growth rates of 3-5 percent are potentially good. Although a 2-3 months monitoring of the growth rates may suffice as basis for starting a small family or large commercial farm, it is advisable, however, that the expansion into a commercial size farm should be held in abeyance until a whole year round monitoring of the test plants has been completed because of the danger of obtaining different growth rate results (e.g., low percentage growth rates may result after the succeeding months, due to some ecological factors affecting the seasonality of *Kappaphycus* and *Eucheuma* in the area. However, if the adjacent areas had been or are presently being farmed, then short term growth trial would suffice. For practical purposes, areas which will allow *Kappaphycus* and *Eucheuma* test plants to double in size every 30 days or less are considered productive areas[7].

Aside from test planting their current seaweed species (*Kappaphycus alvarezii*) and monitoring its growth rate, seaweed farmers in the coastal waters of Calutcot-Kalongkoan islands of Burdeos, Quezon, conduct variety adaptation trials to identify more suitable seaweed varieties that are as good as or better than the seaweed species currently grown in the area every cropping season[8]. The procedures for undertaking the variety adaptation trial are extensively discussed in **Section 2, Exercise No. 2.3**.

[7]Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng Eucheuma (Eucheuma Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

[8]Darag, Jr., A.N. 2013. Workshop on Designing the Curriculum on Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach: Activity Report, 15-17 August 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 42p.

MONITORING FORM NO. 3: BI-WEEKLY SEAWEEDS MONITORING FORM

Group _____ **Farm Location** _____

PARAMETERS	BI-WEEKLY RECORDS OF OBSERVATIONS							
	00	**02**	**04**	**06**	**08**	**10**	**12**	**14**
Date of Observation								
Seawater Salinity (ppt)								
Seawater Temperature (°C)								
Seawater Current (ft/sec)								
Seawater Turbidity (ft)								
Weight of Individual Seaweed Tie (g)								
▪ *Kappaphycus alvarezii* Calutcot Strain (KA1)								
▪ *Kappaphycus alvarezii* Calatagan Strain (KA2)								
▪ *Kappaphycus striatum* Calatagan Strain 1 (KS1)								
▪ Kappaphycus striatum Calatagan Strain 2 (KS2)								
▪ *Kappaphycus striatum* Calatagan Strain 4 (KS4)								
▪ *Kappaphycus alvarezii* Jumbo (Nursery)								

Nevertheless, the crucial role of test plots in starting successful seaweed farming can be summed up as follow[9]:

1. When developing new areas, install plenty of test plots. Inevitably the farm-ability of sites will vary among locations, between seaweed varieties, through seasons, and between different crop years. This applies to any crop. Clearly, it is better to detect problems on a small scale rather than having potentially high-profile failures at the level of multi-hectare sites. Test plots have ongoing value in the planning of farming tactics. Proper crop-logging of plants on test plots will give guidance as to what corrective actions may provide solutions as conditions shift.

2. Expand farms using small plots at many places; clearly identify these as test sites; avoid 'perceived failures'. The sight of dozens of people in the sea and on the seashore doing farming can make a powerful impression. This can be a two-edged sword. The inevitable failure of some sites has the potential to be high-profile and may lead to adverse spin-off. Starting small at many sites rather than going large at fewer sites is initially awkward from a management point of view but reaps substantial rewards in the long run. This approach quickly reveals the most cost effective sites.

3. Consider the environmental and business impacts. Remember: don't rush 'mother nature'. Expanding too far, too fast with limited site experience can lead to a world of grief.

In consideration of the above, seaweed farmers at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon pulled together data on weather and seawater conditions as shown in **Table 3** as well as on the growth performance of *Kappaphycus alvarezii* as summarized in **Table 4** at different times of observations (e.g., 11 September-19 October 2013 and 05 October-08 November 2013, respectively) in their four seaweed production sites. Except for the nominal occurrence of 'ice-ice' and 'buhok-buhok', it can be surmised from these information that, among others, the farm sites they selected are suitable for seaweed farming during the September to November growing period.

Note: A permit to farm should be secured only if test planting in the area has been successful, and that commercial scale seaweed farming will be pushed through. As may be feasible, the proposed area must be surveyed by a geodetic engineer to determine the area's bearings and the exact size intended for seaweed farming.

[9]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

After the survey, the applicant should acquire an official application form from the Bureau of Fisheries and Aquatic Resources (BFAR) and prepare all the necessary requirements as provided for by law. Guidelines promulgated by BFAR must be followed to the fullest to avoid cancellation of the application. The application should be approved first before a permit to farm is issued and before seaweed farming commences[10].

Table 3. Weather and seawater conditions at different times of observations in four seaweed production sites at the coastal waters of the Calutcot-Kalongkoan Islands, Burdeos, Quezon (11 September-19 October 2013)

PARAMETERS	GROUP I	GROUP II	GROUP III	GROUP IV
Water Depth at High Tide (meter)	4.6	4.9	5.9	4.2
11 September:				
Weather Condition	Rainy	Rainy	Rainy	Rainy
Water Current	Slow	Slow	Slow	Slow
Salinity (ppt)	28	30	28	27
Temperature (°C)	32	30	32	32
26 September:				
Weather Condition	Sunny	Sunny	Sunny	Sunny
Water Current	Moderate	Moderate	Moderate	Moderate
Salinity (ppt)	30	29	30	30
Temperature (°C)	30	29	29	30
10 October:				
Weather Condition	Cloudy	Cloudy	Cloudy	Cloudy
Water Current	Strong	Strong	Strong	Strong
Salinity (ppt)	33	32	33	33
Temperature (°C)	29	29	29	29
19 October:				
Weather Condition	Rainy	Rainy	Rainy	Rainy
Water Current	Strong	Strong	Strong	Strong
Salinity (ppt)	32	32	32	32
Temperature (°C)	28	30	28	28

*Based on a 38-day period (11 September to 19 October 2013) agro-ecosystem analysis (AESA) conducted by the participants of Farmer Field School (FFS) on Seaweed Production

[10]Business Diary. 2011. How to Start a Seaweed Production Business. Business Diary. As cited in http://businessdiary.com.ph/1083/how-to-start-a-seaweed-production-business/

Table 4. Growth performance* of *Kappaphycus alvarezii* (KA_1) in coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon (05 October-08 November 2013)

PARAMETERS	GROUP I	GROUP II	GROUP III	GROUP IV	AVERAGE
Water Depth at High Tide (meter)	4.6	4.9	5.9	4.2	4.9
Nature of Substratum	Sea-grass bed	Sea-grass bed	Sea-grass bed	Sea-grass bed	Sea-grass bed
Weather Condition	Rainy	Rainy	Rainy	Rainy	Rainy
Water Current	Strong	Strong	Strong	Strong	Strong
Salinity (ppt)	30-33	29-32	32-33	32-33	32
Temperature (^oC)	28-29	29-30	28-29	28-29	29
Doubling Rate (14 days)*	2.8	2.4	2.9	3.3	2.9
Growth Rate (grams/day)*	30.4	13.6	16.4	20.5	20.2
% Growth Rate*	17.5	9.3	13.2	16.2	14.1
Reaction to Bacterial Disease ('Ice-ice')	Slightly Affected	Slightly Affected	Slightly Affected	Slightly Affected	Slightly Affected
Reaction to Epiphytes ('Buhok-buhok')	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible

*Growth performance based three (3) bi-weekly (05 October 2013 to 08 November 3013) agro-ecosystem analysis (AESA) by FFS on Seaweed Production participants: Doubling Rate (14 days) = Final Weight (grams) ÷ Base Weight (grams); Growth Rate (grams/day) = {Final Weight (grams) − Base Weight (grams)} ÷ Time (days); % Growth Rate = {Growth Rate (grams/day) ÷ Base Weight (grams)} × 100 [Trono and Ganzon-Portes, 1989]

SEAWEED NURSERY MANAGEMENT

Why do we need seaweed nurseries?[11]

Seaweed farmers must establish their own community-based seaweed nurseries prior to farm establishment to ensure the availability of sufficient seed stocks for planting in their seaweed farms. To save time and money, test planting may very well start during nursery establishment. This ensures the expansion of seaweed farming areas which in turn, will result to increase livelihood and income for the fisher-folks. The establishment of seaweed nurseries, which aims to benefit the seaweed processors and farmers, will help increase seaweed production, improve seaweed quality, and reduce post-harvest losses.

The Department of Agriculture (DA) through the Bureau of Fisheries and Aquatic Resources (BFAR) had established seaweed nurseries in seaweed production areas nationwide to ensure the continuous supply of high quality seed stocks for propagation. The seaweed nurseries are the sources of seed stocks that are being dispersed to their seaweed farmer-beneficiaries. In 2007, the impact of the seaweed nurseries established nationwide was assessed. A ¼ hectare seaweed nursery can serve one and a half (1.5) new hectares of seaweeds grow-out every cropping. With an estimated three (3) croppings per nursery in twelve (12) months, the establishment of 863 seaweeds nurseries served 2,232 hectares of seaweed grow-out farms (**Figure 21**). The estimated additional production from this intervention alone was about

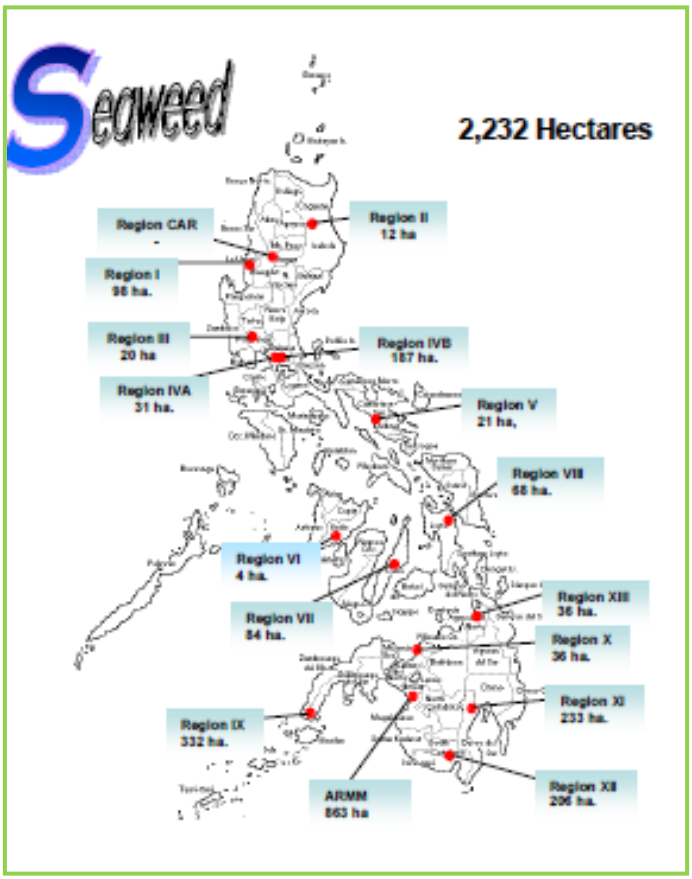

Figure 21. Map showing the 2,232 ha seaweed regional targets from 863 seaweed nurseries established nationwide (BFAR, 2007)

[11]BFAR. 2014. Seaweed Development Program (SPD) for CALABARZON. Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, Quezon City, Philippines. As cited in http://region4a.bfar.da.gov.ph/pages_all/column_right/on_going_research/seaweed/

144,984 mt (wet) or 20,712 mt (dry), valued at P1.2 billion at P60 per kilogram of dried seaweeds.

In CALABARZON, most of the seaweed nurseries established and beneficiaries identified are located in the provinces of Quezon and Batangas. Existing seaweed farming areas are located in the municipalities of Balayan and Calatagan, Batangas, and in Quezon in the municipalities of Agdangan, Burdeos, Jomalig, Mauban, Padre Burgos, Panukulan, Patnanungan, Perez, Polillo, Tagkawayan, and Unisan. BFAR has actively conducted expansion of seaweed farming areas thru these established nurseries and dispersal of seedlings to farmers and fisher-folks. Farming paraphernalia are also distributed to assist the farmers in the initial establishment of their farming area. Trainings and seminars are also conducted prior to dispersal especially to beneficiaries who are first time farmers[12].

What culture preparations are needed in seaweed nursery establishment?

Similar to what are usually done in seaweed farm establishment[13], seaweed farmers at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon adapt (e.g., with slight modification to go well with their specific situations) the following as their culture procedures for nursery establishment:

1. Prepare the necessary materials and install the needed structures prior to seaweed nursery planting.
2. Source out quality seed stocks from the vicinity to ensure easy transport to the farm site. Seed stocks must be protected from direct exposure to sun and rain. Transport container like Styrofoam box is recommended although ordinary materials, like jute sacks, will suffice.
3. Seed stocks must be immersed in seawater upon arrival, preferably in the seedling bin. Seaweeds get their food from seawater brought in by water current, so once they are off the water for more than 12 hours and without pouring seawater into them in-between, seed stocks will die. If the seed stocks are placed in a container with inadequate ventilation, packed with too much pressure, or if there is an increase in temperature in the container, seaweed seed stocks will die.
4. Seed stocks to be planted must be around 50-100 gm each (for limited seed stocks) or 100-200 gm each (for sufficient seed stocks). Choose healthy and

[12]BFAR. 2014. Seaweed Development Program (SPD) for CALABARZON. Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, Quezon City, Philippines. As cited in http://region4a.bfar.da.gov.ph/pages_all/column_right/on_going_research/seaweed/

[13]Business Diary. 2011. How to Start a Seaweed Production Business. Bureau of Micro, Small and Medium Enterprise Development (BMSMED), neda.gov.ph. As cited in http://businessdiary.com.ph/1083/how-to-start-a-seaweed-production-business/

strong branches; these are usually found at the center and near tips of a healthy plant.
5. Use a clean, sharp, stainless steel knife for cutting branches to leave a smooth surface.

How are the materials for nursery establishment prepared?

Seaweeds farmers at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon follow, more or less, the procedure below with slight modifications, particularly in the use of locally available materials (e.g., mangrove sticks instead of bamboos or mangrove posts instead of anchor bars).

1. Prepare a measuring stick made of bamboo, or any available suitable materials, about 0.5 cm thick, 8.0 cm width, and 25.0 cm long.
2. Wind the plastic straw 25 times around the stick.
3. Insert a sharp knife and cut the straw at one end. Cut similarly the straw at the other end.
4. Get one strip and tie it tightly around one end of the strips to make a bundle. Split each strip into two and make a tight knot at each tip.
5. One strip is sufficient to tie one cutting (planting material). Tie nylon lines to stakes.
6. After clearing the area (e.g., collecting and transferring sea urchins and starfishes to off-farm seaweed areas, instead of killing them), measure the exact dimensions of the intended nursery farm.
7. Commence posting by using the anchor bar. Position the stakes such that nylon lines will be parallel to the water current. Bamboo poles or mangrove posts are driven to the bottom, half a meter between rows.
8. The lines are tied at both ends of the posts parallel to each other at 20-25 cm from the bottom.

How do we maintain the seaweed nursery after establishment?

Akin to what are typically taken on when maintaining a seaweed farm[14], seaweed farmers at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon monitor the seed stocks in the seaweed nursery on a bi-weekly basis to conduct the following activities:

1. Re-tie loosened plants in the ties and mono-lines;
2. Replace fallen or washout plants;

[14]BFAR. 2014. Seaweed Development Program (SPD) for CALABARZON. Bureau of Fisheries and Aquatic Resources (BFAR) Region IV-A, Quezon City, Philippines. As cited in http://region4a.bfar.da.gov.ph/pages_all/column_right/on_going_research/seaweed/

3. Clean manually the seed stocks; Remove undesirable seaweeds and other organisms that have attached to the lines or to the seed stocks;
4. Remove and transfer sea urchins, starfishes, and other sea animals from the substratum that may feed on the seaweeds; and
5. Check occurrence of any symptoms of diseases or epiphytes to avoid their spread to other plants. Prune disease-infected or epiphyte-infested portion of the seed stock.

How are the seed stocks harvested in the seaweed nursery?

Through the years, seaweed farmers at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon have developed their own procedures for harvesting their seaweed nursery grown-outs. These take into considerations the various constraints that they have normally encountered in their previous seaweed farming ventures, namely:

1. Harvesting is usually done by pruning the branches and leaving portions of the plant to grow again or by taking all the plants and replacing them with new cuttings, which is best done before each plant reaches 0.5-1.0 kg or after 25-30 days if 'ice-ice' infection or 'buhok-buhok' infestation would occur and 30-45 days if the seed stocks are healthy.
2. For best results, maintain a 30-day culture period in the nursery to have young and healthy plants for propagation. Plants should not be overgrown for matured plants won't make good plant materials.
3. From the harvested plants, the best-looking and healthy plants are selected for use as nursery seed stocks for the next planting.
4. These are stored in the nursery seedbed if these cannot be planted immediately due to bad weather or delayed availability of nursery materials.
5. Harvested seaweeds are placed in bamboo baskets, fish nets, or any similar suitable materials, in the boat during immediate transport to the seaweed farm.

How are the seed-stocks transported from the nursery to the seaweed farm?

When there is a need to transport seaweed seed-stocks from one place to another, as in the case of taking the seed stock from the nursery to another village or even when there is a need to take seaweed at home to prepare the lines, one should consider that the seaweed is a living plant and needs particular care.

The first thing that should be done is to cover the seaweeds with tarpaulin, coconut leaves, or any available suitable materials. If it is necessary to be travelling for several hours moving the seaweeds, it is advised to put them in jute or onion bags. It is very important to keep the seaweeds moist at all times. Seawater should be poured over the bags or, when there is a chance, dipping the bags in the sea may be

done. Styrofoam boxes may also be used to transport the seaweeds. In this case, a few holes should be made on the upper edges of the box to facilitate aeration. Remember to keep the seaweeds moist always. Do not fill the box with seawater as this will make the seaweed rot rapidly unless the seawater is constantly circulated.

Even when the seaweed seed-stocks are carried on a punt to the farm site, keep the seed stocks covered to protect them from direct sunlight. Pour some seawater over them at regular intervals. Preparing the lines from the punt, might take several hours and if not covered and kept moist, the seaweed seed stocks will be spoiled. You might wonder why you should cover and keep your seaweed moist. This is to avoid the seaweeds being exposed directly to sunlight, wind, and rain. Seaweeds need to be kept moist, cool, and protected to survive out of the water.

What can harm our seaweeds in the nursery?[15]

Just like growing seaweeds in the farm site, we should keep in mind that there are several factors that can damage the seaweeds in the nursery. These might occur especially during the warmer months of the year, from March to May. During these months, seaweeds are more susceptible to diseases or epiphytes and are readily harmed by grazers. Appropriate management strategies for seaweed diseases, epiphytes, and grazers are discussed exhaustively in **Section 4**. Also during this period, the growth of *Kappaphycus* and *Eucheuma* slow down and cyclones and bad weather may cause some damage to the seaweeds while being raised in the nursery.

a. *Natural Predators or Grazers*

As frequently observed in many tropical areas, fishes (e.g., rabbit and puffer fishes) are the main seaweed grazers. In the Calutcot-Kalongkoan islands of Burdeos, Quezon, a fish species, locally known as 'balawis', is a predominant seaweed grazer. In addition to these, sea urchins and starfishes are also often seen damaging the seaweed plants. Among all of these, fishes are usually the most destructive.

b. *Diseases and Epiphytes*

Even though there are no specific diseases that might affect *Kappaphycus* and *Eucheuma*, in situations where plants are heavily grazed, it is common to observe whitened areas on their branches. Whitened areas are more exposed to bacterial and fungal infections. Especially during the warmer months, infections can spread quite rapidly and the seaweed plants show large portions of discolored branches

[15]Business Diary. 2011. How to Start a Seaweed Production Business. Bureau of Micro, Small and Medium Enterprise Development (BMSMED), neda.gov.ph. As cited in http://businessdiary.com.ph/1083/how-to-start-a-seaweed-production-business/

commonly seen as white and pink areas. 'Ice-ice' is the common term used to describe seaweed plants in this condition.

During the southwest monsoon season, from December to March, when strong waves and relatively low temperatures occur, epiphyte, locally known as 'buhok-buhok', infestation become a serious problem in growing seaweeds at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon.

c. *Weather*

Apart from occasional bad weather (rough sea and heavy rain), the effect of cyclones occurring during the monsoon months can be devastating. Cyclones cannot be avoided, but what you can do is take precautions.

During the cyclone season, you should listen to the radio weather forecast regularly and carefully. If a cyclone is expected, harvest as much seaweed from your nursery as you can and keep it on shore protected from wind and rain. Put aside sufficient seaweed seed stocks to allow you to re-start propagating new seed stocks after the cyclone has passed by. Remember you need to keep these seaweeds in bags moist with seawater at all times. Those seaweeds will be your re-planting materials.

If seaweeds are kept small during this period, and not allowed to become over-mature, little damage is expected. You might decide to harvest after 4 or 5 weeks of growth instead of waiting for 6 or 8 weeks. Experience after going through several cyclones suggests that this strategy could limit your damage. Also, be sure that your stakes are firmly erected otherwise the strong water currents and swells during cyclones might wash away your effort. Seaweed farmers at the coastal waters of Calutcot-Kalongkoan islands in Burdeos, Quezon manage the possible adverse effect of cyclones to their seaweed nurseries by either removing the floaters or adjusting the heights of mainlines and mono-lines.

After the cyclone has gone through, tangled lines should be entangled and secured again. Badly damaged seaweeds should be completely removed and replaced with new seed stocks. If you are heavily hit by a cyclone but you have not lost all your seaweeds, then it is possible to be back in full business again after 8 weeks. A lot of work has to be done and done quickly, but it will be worth it.

SEAWEED SPECIES, VARIETIES, AND THEIR CHARACTERISTICS

How carrageenan-bearing seaweed species are taxonomically classified?

The commercially useful genera of the Tribe Eucheumatoideae, colloquially known as the 'eucheuma seaweeds' are taxonomically classified as:

- **Phylum** Rhodophyta,
- **Class** Rhodophyceae,
- **Subclass** Florideophycidae,
- **Order** Gigartinales,
- **Family** Areschougiaceae, and
- **Tribe** Eucheumatoideae

The trade names, 'gelatinae', 'spinosum', and 'cottonii' generally refer to *Eucheuma gelatinae* (Esper) J. Agardh, *Eucheuma denticulatum* (Burmann) Collins and Hervey, and *Kappaphycus alvarezii* Doty, respectively. The trade name 'cottonii' was originally applied to the wild crop and to the first farmed *Kappaphycus striatum* Schmitz. It originally referred to the elk-horn variety but came to be applied to all kappa-carrageenan producing Eucheumatoideae. There is a species *Kappaphycus cottonii* but it is a thick, flattened species and has never been farmed successfully.

The trade name 'gelatinae' refers to the scientific species *Betaphycus* (ex. *Eucheuma*) *gelatinae*. It may also be applied to any species of *Betaphycus* that yields *beta* carrageenan. The trade name 'spinosum' generally refers to *Eucheuma denticulatum* but may be applied to any species of *Eucheuma* that yields *iota* carrageenan during extraction. Although the specific name 'spinosum' has been used in a taxonomic sense, it is applied in this instance as a descriptor of the spiny protuberances typical of the commercial species. The specific name 'alvarezii', as applied to the *Kappaphycus alvarezii* Doty, commemorates the late Vicente Alvarez, a pioneer in the methods of 'cottonii' agronomy.

What are the carrageenan-bearing seaweed species commercially-farmed in the Philippines?

There are three (3) carrageenan-bearing seaweed species commercially-farmed in the Philippines[16–17]. They are as follows:

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[16]Salayao, N.D., Tagarino, R.N., Kick, C.G. 1991. Seaweed Farming in the Philippines: Its Prospects Northeast Sorsogon. Research and Training Program for Agricultural Policy(RTPAP), Department of Agriculture accelerated Agricultural Productivity Program (DA-AAPP), and the University of the Philippines Los Banos Center for Policy and Development Studies (CPDS) and College of Economics and Management (CEM). 25p. As cited in http://www.drkick.com/CGK3%20writings/Weed_Aisa.pdf

1. *Kappaphycus alvarezii*, locally known as 'tambalang' (**Figure 22A**), which is propagated from vegetative cuttings using artificial support systems on open reefs. The seaweeds are dried and processed for the production of *kappa* carrageenan, which form strong rigid gels containing potassium ions. Extensive farm areas are found in southern Philippines. It is the most common species grown at the coastal areas of Calutcot-Kalongkoan islands in Burdeos, Quezon;

2. *Kappaphycus striatum*, locally known as 'sacol' (**Figure 22B**), which is also propagated from vegetative cuttings and just like *K. alvarezii* is dried and processed for the production of *kappa* carrageenan. This is the type of seaweeds commonly grown in the coastal waters Calatagan town in Batangas Province; and

3. *Eucheuma denticulatum*, locally known as 'spinosum' (**Figure 22C**), which is cultivated much the same as *K. alvarezii* and *K. striatum*, but which grows slower. Vast farm areas are located in coastal towns of Bohol Province. This species is a source of *iota* carrageenan, which forms soft gels containing calcium ions. However, more carrageenan is produced from *E. denticulatum* than from the same amount of *K. alvarezii* or *K. striatum*.

Figure 22. (A) *Kappaphycus alvarezii* var. 'tambalang' [green]; (B) *Kappaphycus striatum* var. 'sacol' [light green]; and (C) *Eucheuma denticulatum* var. 'spinosum' [green] grown at the coastal waters of Calutcot-Kalongkoan Islands

What are the common trade names and varieties of seaweeds?[18]

Since the Philippines have hosted commercial farming for the longest time, it is here that the greatest number of *Kappaphycus* variants seems to have arisen. At least two

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[17]Arevalo, N.B., Donaire, T.C., Ricohermoso, M.A., and Simbajon, R. 2013. Better Management Practices for Seaweed Farming *Eucheuma* and *Kappaphycus*. 21p. As cited in http://library.enaca.org/bmp/manuals/seaweed-culture-bmp-manual.pdf

[18]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

variants of *kappa* carrageenan are found among these, the *Kappaphycus alvarezii* type with a distinct infrared absorption peak at wave No. 805 and the *Kappaphycus cottonii* type that lacks this peak. Most cultured strains are of the former type but have recently been reported that the 'sacol' strain is of the latter type. The following descriptions represent *Kappaphycus* strains now in commerce, but this inventory is not comprehensive as the proliferation of strains continues:

1. Tambalang type: long strands; typically fewer branches than 'flower' type; small to large diameter branches; generally thriving in deep water more in northern areas of the Philippines but seldom seen in Southern Philippines as 'flower' type now predominates there; also the predominant strain in much of Indonesia, India, Sabah, Malaysia, and Tanzania;

2. Flower type: short strands; bundles of multiple branches resembling a 'flower' type; found in shallow reefs areas of the Philippines; dominant strain in the Bongao-Sitangkai areas of the Philippines since 2000; also seems to be appearing in South Sulawesi and Nusa Tenggara Timur in Indonesia;

3. Vanguard type: shorter than 'tambalang' type but bigger than 'flower' type; found in farm areas of southwest Mindanao;

4. Bisaya type: looks like a cross between 'tambalang' and 'sacol' types; predominant form in the Bohol region of the Philippines;

5. Sacol type: clumps of short multiple branches, with small diameter stems; often found over sandy or muddy substrate such as that found near its source area of Sacol Island, Zamboanga, Philippines; sold as salad vegetable in Cebu markets; this strain is recently being replaced by farmers with the 'bisaya' type;

6. Sumba type: long, thick strands; rather like a coarse, robust form of the 'tambalang' type; originated in Sumba Island, Indonesia but now grown at several sites in Indonesia; favored by some farmers in Bali, Indonesia.

Aside from the 'sacol' type all of these appear to be strains of *Kappaphycus alvarezii*. As comparisons of DNA characteristics are extended to strains, their relationships should become clearer. For example, some used such methods to compare various strains of *K. alvarezii*, *Kappaphycus* sp. 'sacol' variety and *Eucheuma denticulatum*. Different strains of *Kappaphycus alvarezii* appeared to have similar banding patterns regardless of their differences in morphology and habit but *Kappaphycus* sp. 'sacol' variety from Bohol showed a different banding pattern. The 'sacol' type may have closer affinity to *K. cottonii* than to *K. alvarezii*. Thus, these variations are described more explicitly below:

1. *Kappaphycus alvarezii* var. 'tambalang' (cottonii of the trade)

   Kappaphycus alvarezii var. 'tambalang' (**Figure 22A**) plant exhibits a cylindrical axis with branches that are commonly enlarged maximally just beyond the basal curvature towards the light as manifested through the 'candelabra effect'. The clean, un-swept tips are typical of a healthy and rapidly growing plant. The sweep of fronds towards the light results in a candelabra-like appearance.

2. *Kappaphycus striatum* var. 'sacol' ('sacol' cottonii, may be a new species)

   Kappaphycus striatum var. 'sacol' (**Figure 22B**) is one of several cultivars that appears to have been propagated vegetatively from plants obtained in wild stocks. The morphology of the plant tends to be quite variable and can result from genetic differences among strains, environmental factors, agronomy methods, and apparently from spontaneous mutations that occur within a strain and lead to sustained characteristics such as color differences. Taxonomic classification of *Kappaphycus* species based on morphology is notoriously difficult because of the extreme plasticity of this genus. Recently published data suggest that based on molecular analysis, *Kappaphycus striatum* var. 'sacol' is most likely a form of *K. cottonii*.

3. *Eucheuma denticulatum* var. 'spinosum' ('spinosum' of the trade)

   Eucheuma denticulatum var. 'spinosum' (**Figure 22C**) is less variable than *Kappaphycus* sp. among sites and types. The plant may vary in color from light brown to deep read (almost black); the branches may be more or less spindly; and the density of 'spines' may range from sparse to dense. It is thought that several indigenous varieties have been developed from local wild stocks in the Philippines, Indonesia, and Tanzania. There has been some dispersal of these stocks; notably with the dispersion of Bali 'spinosum' to the Central Philippines. Its appearance aside, one distinguishing characteristic of *E. denticulatum*, is a distinct 'chlorine' (probably bromine) odor that becomes especially noticeable during drying.

As discussed in previous sections of this manual, a seaweed variety adaptation trial was conducted by seaweed farmers to identify other seaweed varieties that will perform as good as or better than the current seaweed variety commercially grown at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon. Out of the eight varieties and strains initially tested as shown in **Figure 23**, only five survived after six weeks of growing period. The characteristics and growth performance of the five seaweed varieties that survived are summarized in **Table 5**. The data on doubling rate, growth rate, and percent growth rate indicate that three seaweed strains, namely *Kappaphycus alvarezii* (KA_1), *Kappaphycus striatum* (KS_1), and

Eucheuma denticulatum (ES_1) performed as good as or better than *Kappaphycus alvarezii* (KA_2). However, only the variety *Eucheuma denticulatum* (ES_1) is resistant to the 'ice-ice' disease and the 'buhok'buhok' epiphyte. This observation suggests that *Eucheuma denticulatum* (ES_1) can be an alternative seaweed variety for commercial farming in the area during the March to May growing period, when heavy 'ice-ice' disease infection and 'buhok'buhok' epiphyte infestation are expected to occur.

Figure 23. Seaweed varieties and strains *Kappaphycus alvarezii* [SA_1, SA_2]; *Kappaphycus striatum* [SA_1, SA_2, SA_3, SA_4, SA_5, SA_6]; and *Eucheuma denticulatum* [ES_1] tested at the coastal waters of Calutcot-Kalongkoan Islands

Table 5. Characteristics and growth performance of selected seaweed varieties and strains in coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon (25 September-08 October 2013)

VARIETY/ CHARACTER	*Kappaphycus alvarezii* [tambalang] (KA)		*Kappaphycus striatum* [sacol] (KS)			*Eucheuma denticulatum* [spinosum] (ES)
Strain (Source)	KA_1 (Calutcot)	KA_2 (Calatagan)	KS_1 (Calatagan)	KS_2 (Calatagan)	KS_4 (Calatagan)	ES_1 (Calatagan)
Natural Product	Kappa Carrageen	Kappa Carrageen	Kappa Carrageen	Kappa Carrageen	Kappa Carrageen	Iota Carrageen
Thallus Color	Dark Green	Dark Green	Light Green	Dark Green	Light Brown	Light Green
Thallus Branching	Downward	Downward	Sideward	Sideward	Sideward	Sideward
Doubling Rate (13 days)*	2.9	2.2	2.6	1.5	2.0	2.3
Growth Rate (grams/day)*	14.0	4.0	7.2	2.0	4.4	5.1
% Growth Rate*	14.0	9.3	12.2	4.4	8.0	14.1
Reaction to Bacterial Disease ('Ice-ice')	Slightly Affected	Slightly Affected	Slightly Affected	Slightly Affected	Slightly Affected	Resistant
Reaction to Epiphytes ('Buhok-buhok')	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible	Moderately Susceptible	Resistant

*Growth performance based on a 13-day period (25 September to 08 October 2013) agro-ecosystem analysis (AESA) by FFS on Seaweed Production participants: Doubling Rate (13 days) = Final Weight (grams) ÷ Base Weight (grams); Growth Rate (grams/day) = {Final Weight (grams) − Base Weight (grams)} ÷ Time (days); % Growth Rate = {Growth Rate (grams/day) ÷ Base Weight (grams)} × 100 [Trono and Ganzon-Portes, 1989]

PREPARATIONS FOR SEAWEED FARM ESTABLISHMENT

What are the important factors to be considered in seedling management?

Once cultivar strains have been selected the key elements of seedling management are[19]: (a) choice of cultivar strain[s] to be grown; (b) size of seedlings to be planted; (c) age and or size at which seedlings are to be harvested; (d) spacing of seedlings on and within habitat systems; and (e) selection and cutting of seedlings for replanting.

The choice of strain varies with local experience and several are now under cultivation. The predominant choice for most seaweed farmers seems to be *Kappaphycus alvarezii* var. 'tambalang'. The *Eucheuma denticulatum* appears to be widespread but several locally developed *Eucheuma* strains have been developed in various 'spinosum' producing areas.

There is wide variation among farm areas with respect to seedling size at planting and harvesting. Age at harvesting is most commonly set at 40-50 days. Significantly longer and shorter cycles are encountered in some regions. In some areas 'pruning' is done as seedlings are left attached to lines for many weeks and growing tips are removed. This method may cause quality problems related to an unfavorable mix of young and old tissue in the crop and it is discouraged by many buyers.

With respect to the combined effects of seedling size and cropping cycle, two distinctly different strategies have been evolved by *Kappaphycus* seaweed farmers:

- Small size: long cycle with seedlings of about 50-150 grams cropped at 45-60 day cycles, or
- Large size: medium cycle with seedlings of about 150-300 grams cropped at 30-45 day cycles.

Strategy choices are determined by a combination of local conditions and farmers' opinions. In general choppy waters tend to favor 'small-long' strategies but smooth waters with strong currents favor 'large-medium' approaches. In all cases a major determining factor in strategy choice is the point at which significant seedling breakage losses are incurred.

Seaweed farmers at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon conducted participatory discussions on the projected total number of ties and seaweed production area at different initial weights using researchers seedling stocking rate as shown in **Table 6**. Based on this projection, positive outcomes

[19]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

would result as regards final weights per tie at different seaweed growth stages using different initial weights per tie of seaweed seedling stock (**Table 7**) and total harvest (kg) at different initial and optimum final weights of seaweed seedling stock for ¼ hectare family seaweed farm (**Table 8**). They concluded that: (a) wider production area can be farmed by using smaller seedlings under limited seed-stock situation; (b) ideal final weight and carrageenan quality can be attained under normal growing period (8-10 weeks); and consequently, (c) higher yield level can be achieved under said growing duration.

Table 6. Projected total number of ties and seaweed production area at different initial weights using researchers seedling stocking rate*

RESEARCHERS' SEEDLING STOCKING RATE (KG)	INITIAL WEIGHT OF SEEDLING STOCK PER TIE (GRAM)	TOTAL NUMBER OF TIES	TOTAL PRODUCTION AREA (SQM)
400	50	8,000	2,500
400	100	4,000	1,250
400	150	2,666	833
400	200	2,000	625

*Based from participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013

Table 7. Projected final weights per tie at different seaweed growth stages using different initial weights per tie of seaweed seedling stock*

GROWTH STAGE (WEEKS)	Final Weight/Tie at Different Initial Weights/Tie of Seedling Stock (gm)			
	50	**100**	**150**	**200**
2	100	200	300	400
4	200	400	600	800
6	400	800	1,200	**1,600****
-	-	-	**1,600****	-
8	800	**1,600****	2,400	3,200
10	**1,600****	3,200	4,800	6,400
12	3,200	6,400	9,600	12,800

*Based from participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013
**Agreed optimum yield levels

Table 8. Projected total harvest (kg) at different initial and optimum final weights of seaweed seedling stock for ¼ hectare family seaweed farm*

WEIGHT PER TIE (GRAM)		GROWTH STAGE (WEEK)	NUMBER OF TIES	TOTAL HARVEST (TON)	
INITIAL	**FINAL**			**GROSS**	**LESS 10%****
50	**1,600**	10	8,000	12.8	11.5
100	**1,600**	8	4,000	6.4	5.8
150	**1,600**	7	2,666	4.3	3.9
200	**1,600**	6	2,000	3.2	2.9

*Based from participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013
**Less 10% to factor yield loss due to biotic and a-biotic factors

On the other hand, spacing of seedlings varies widely among farmers and farm regions. In general, farmers adopting 'small-long' strategies tend to space seedlings close together on lines (10-20 cm) while those adopting 'large-medium' strategies space plants more widely on lines (20-30 cm). Spacing among lines follows a similar trend with the space between lines often being similar to the spacing of plants on lines. This depends partly on space availability, habitat type, and currents. Some long line methods involve the spacing of lines several meters apart as a means of reducing line tangling. Selection of clean, vigorous growing tips for replanting is an essential function of farm management. These must be securely attached but not too tightly bound. Seaweed farmers at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon use closer spacing (20-25 cm) between ties compared to wider spacing (25-30 cm) between ties recommended by seaweed researchers.

By and large, seedlings are broken from their mother plants by transverse cuts or breaks. Seaweed experts proposed that slicing plants obliquely yields higher growth rates than transverse cutting. Others opined that apical tissue grows faster than basal and median fragments. Well branched, obliquely sliced seedlings with numerous tips appear to be best for replanting.

What are the necessary operations required for the preparation and planting of seedlings in the seaweed farm?

Prior to seaweed farm establishment, the following necessary operations will have to be undertaken, namely[20]:

1. *Preparation of the area for farm establishment*. Clear the seaweed farm of sea-grasses, seaweeds, large stones and corals, and other obstacles. Remove and transfer sea urchins and starfishes in the farm area to off-farm area because they will eat the *Kappaphycus* seaweeds.

2. *Transport of seedlings*. Available seedlings or seed-stocks of the appropriate species or variety should be acquired from the nearest nursery. If transport of the seedlings should take several hours, these should be occasionally wet with clean seawater (**Figure 24A**). This should be transported to the farm site in the shortest possible time and protected from too much exposure to heat, sun, wind, or rain (**Figure 24B**). Experience has shown that for long distance transport of seedlings, the use of Styrofoam boxes provided with quarter-size holes near the upper sides of the container to facilitate aeration was found to be the most efficient. The seedlings are allowed to drip to remove excess water before these

[20]Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng Eucheuma (Eucheuma Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

are placed inside the Styrofoam box, then covered. The seedlings should be immediately placed in seawater in the seed-bin upon arrival at the farm site. Wet the seedlings occasionally with seawater during transport. Protect these from spillage of gasoline and oil. Immediately place the seedlings, transported from a far nursery source, in a seed-bin upon arrival. For locally harvested seedlings, do the same if these cannot be processed immediately for planting.

Figure 24. Seaweed seedling stocks (A) wetted occasionally with clean seawater and (B) transported immediately to farm site by participants of FFS on seaweed production at the coastal waters of Calutcot-Kalongkoan Islands

3. *Splitting of the seedlings*. Prepare the seedlings for planting by cutting or splitting with a knife the *Kappaphycus* seed-stocks into 100-150 grams (**Figure 25A**). Tie each with a 25 cm long soft plastic straw or 'tie-tie'. Make sure that the soft plastic straw or 'tie-tie' is positioned at the center of gravity of the seedling before making a knot in order to hold it firmly.

4. *Tying of the seedlings to the mono-line.* Prepare soft plastic straws or 'tie-ties' (**Figure 25B**) and tie each seedling to the mono-line at 15-25 cm (6-10 in) intervals. Be sure that the seedlings are tied securely to the mono-line. In order to facilitate the maintenance and management of the farm, planting should be done on a unit or module basis (e.g., ¼ ha parcel per unit or module). In other words, a unit or module of the farm should be planted fully first before proceeding to plant the next unit or module.

What are the supplies, materials, and basic tools to be prepared for seaweed farm establishment?

Seaweed farming experiences at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon suggest that a family of 3-5 members can practically and profitably

manage a 2,500 sqm or ¼ ha seaweed farm. Using the bottom mono-line method of seaweed farm establishment, the supplies, materials, and basic tools required for a ¼ ha of seaweed farm[21] are detailed in **Table 9**.

Figure 25. Seaweed seedling stocks are (A) split by cutting them with sharp knives or scissors while plastic straws or 'tie-ties' are (B) secured by tying them on mono-lines in a big group hands-on exercise of FFS on seaweed production participants at the coastal waters of Calutcot-Kalongkoan Islands

Table 9. Supplies, materials, and basic tools required for a ¼ ha bottom mono-line method of seaweed farm establishment (Trono and Ganzon-Fortes, 1989)

SUPPLIES/MATERIALS/ BASIC TOOLS	DESCRIPTION	REQUIREMENT	
		Amount	Unit
1. Mangrove stakes or equivalents	2-3 ft long, 1.5 in diameter	300	pc
2. Nylon mono-filaments	200 lbs test evelon cord	6.25	kg
3. Plastic straw	White, large	4	rolls
4. *Kappaphycus alvarezii* seedlings	50-100 gram-pieces	375-400	kg
5. Bolo	'itak'	1	pc
6. Knife	'lanseta'	2	pc
7. Sledge hammer	'maso'	1	pc
8. Net bags	Large ('yaring lambat')	2	pc
9. Rattan baskets	Lage ('yari sa yantok')	2	ps
10. Banca	Wooden boat	1	pc
11. Pump boat (optional)	10 hp ('lantsa')	1	pc
12. Iron bar	1 pointed end, 3 ft long, 1.5 in diameter ('bakal na bara')	2	pc
13. Seed-bin (optional)	'kulungan ng punla'	1	pc

[21]Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng Eucheuma (Eucheuma Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

METHODS OF SEAWEED FARM ESTABLISHMENT

Why is seaweed farm establishment important?

The commercial success of *Kappaphycus* and *Eucheuma* seaweed farming is based on the fact that these plants produce vegetative thalli large enough to be economically planted as propagules (cuttings) and harvested individually. In vegetative cultivation, small pieces of seaweed are taken and placed in an environment that can sustain growth. When they have grown to a suitable size, they are harvested, either by taking off the entire plant or by detaching most of it but leaving a small piece that will be allowed to grow again. When the whole plant is harvested, small pieces are cut from it and used as seed stock for further cultivation. However, the success of a *Kappaphycus* or *Eucheuma* farming does not only depend on excellent selection of farm site but also on the method of farm establishment[22].

What features of habitat system are considered in seaweed farm establishment?[23]

The most obvious physical manifestation of seaweed farms is their habitat structures. These incur most capital and operating costs so it is normal for farm systems to be classified according to their most obvious physical characteristics such as 'off-bottom' or 'bamboo raft' or 'long-line', among others. Given below is a summarized description of several such farm systems. The fact is that the diversity of farm habitat systems has gotten so diverse that they can no longer be meaningfully described or in terms of just one or a few of their characteristics. Habitat systems comprise combinations of five features such as:

1. The type of *substrate of enclosure* that serves as a physical matrix for holding crops within farm boundaries;
2. The *position or location* of the substrate or enclosure relative to the sea floor and the sea surface;
3. Whether the substrate or enclosure is *oriented* horizontal or perpendicular to the sea surface (or has no fixed orientation);
4. The method by which the substrate or enclosure is *fixed, suspended or held in place* within the farm area; and
5. The method by which seedlings are *attached to or suspended within* the substrate or enclosure.

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[22]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. 59p. as cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

[23]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

What are the different types of seaweed farm establishment?

When 'attach-to-string' methods are used, labor comprises most of the cost of crop production. 'Attach-to-string' farming methods facilitate experimentation and cultivar screening. Individual test thalli can be labeled, removed, weighed, and replaced at intervals. The growth rates of individual thalli can then be easily calculated from successive weights. This approach greatly facilitates comparisons between farming strategies and crop varieties so farmers are able to innovate and expand farms rapidly. The attachment methods initially used for fastening cuttings to lines were the 'tie-tie' method and containment in bags.

Since 2000 a 'loop' system has been introduced in Madura, Indonesia. The 'loop' system, which originated in Bali, reduces planting labor, eases the recycling of planting materials, and eliminates most raffia or string from the crop. Bag methods protect crops but they are expensive so their use tends to be confined to propagule production. The major habitat configurations that developed for commercial use have been the 'floating' and 'off-bottom' systems. Floating methods employ rafts (usually made of bamboo) or systems of floats (most often empty plastic beverage bottles) to suspend lines near the sea surface. Off-bottom methods utilize stakes driven into the sea floor to suspend lines above the sea floor. The general advantages of floating systems include:

a. Grazing by bottom associated animals is minimized or eliminated because the plants are raised out of reach of the benthic grazers;
b. Plants near to the surface of the water column are often exposed to more adequate water movement (e.g., wave chop);
c. Floating cultures can be tended during any tide level, whereas work on off-bottom cultures is limited by tidal cycles; and
d. Floating cultures are not restricted to shallow waters.

A wide variety of line arrays can be seen in commercial farms but minimum line spacing is seldom less than 15 cm. Sizes of farms and rafts vary widely. Efficacy of habitat construction and technique is sometimes dictated by environmental factors but in other cases it seems to be a matter of farmers' experience or preference.

In summary, the most common types of seaweed farm establishment now practiced in the Philippines include[24]:

[24]Adapted from Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng Eucheuma (Eucheuma Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

1. Bottom Mono-line Method

The bottom mono-line method of cultivation is commonly used in commercial farms (**Figure 26**). Among the different methods of *Kappaphycus* and *Eucheuma* seaweed farm establishment, the bottom mono-line method is, so far, the best because it is the easiest to maintain, with less material and labor cost.

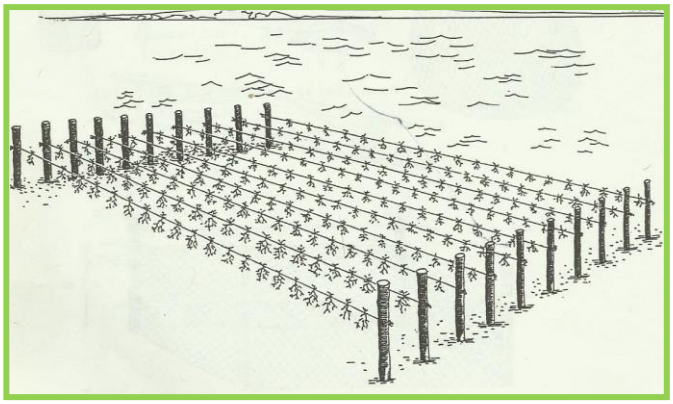


Figure 26. Bottom Mono-line Method of Seaweed Farming (Trono and Ganzon-Fortes, 1989)

Establishment is started when making a hole on the substrate by driving down the iron bar with a sledge hammer. On the hole, place the wooden stake and drive it down using the sledge hammer (**Figure 27A**). The wooden stakes should be arranged in rows at 1.0 m interval and the distance between rows is commonly 10.0 m. Tie securely one end of the mono-filament line (about 11.0 m long) to the stakes, and its other end to the stake in the opposite row. Be sure to stretch the mono-line to make it tight (**Figure 27B**). The distance of the line from the ground (0.3-0.5 m) is adjusted to the depth of the water during low tides so that the plants are not exposed to air and sun. If the current in the area is quite strong, an additional row of stakes is recommended to be placed at the middle of the original row in order to provide additional support to the line, thus reducing the distance between rows to 5.0 m. The distance between the rows of the stakes may, thus vary depending on the strength of local current; the shorter the distance between rows, the stronger the support system. The lines are generally positioned parallel to the direction of the current or waves.

Nevertheless, there are slight differences in the way researchers and seaweed farmers at the coastal waters of Calutcot-Kalongkoan Island, Burdeos, Quezon set up their bottom mono-line method of seaweed farm establishment. These differences are summarized in **Table 10**.

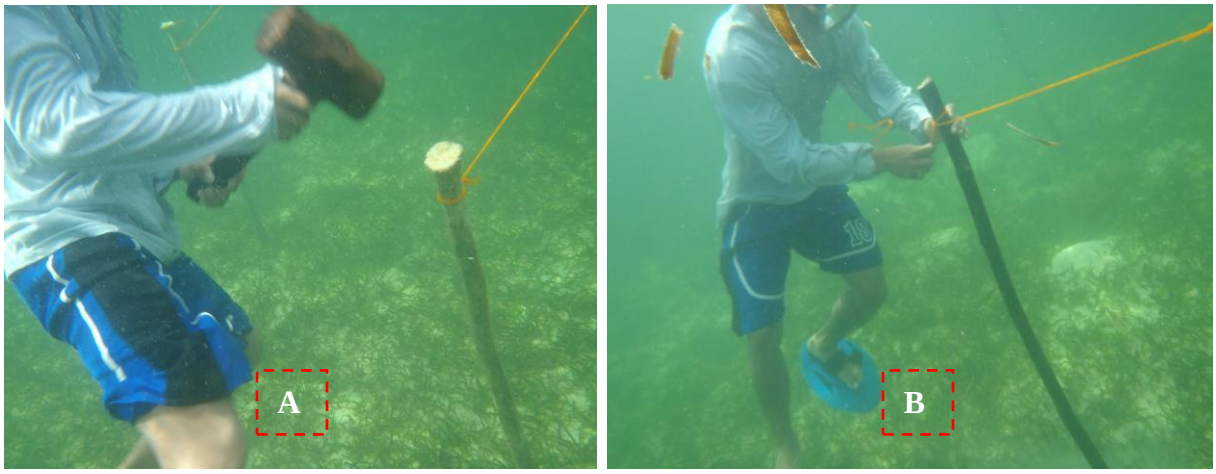


Figure 27. Bottom mono-line establishment: (A) secure wooden stake by driving it down using a sledge hammer; and (B) tie one end of a mono-filament line to a stake, and its other end to a stake in opposite row

Table 10. Comparison of researchers' and Calutcot-Kalongkoan seaweed farmers' bottom mono-line method of seaweed farm establishment (¼ ha or 2,500 sqm)

PARAMETERS	RESEARCHERS	FARMERS*
Length of mono-lines (m)	20	30 (20 'dipa')
Number of mono-lines	100	41 (100 per 0.6 ha)
Distance between mono-lines (m)	1.25	2.00
Number of ties per meter of mono-lines	3-4	3-4
Total number of ties	7,500-8,000	3,690-4,920
Initial weight of seedling per tie (gm)	50	100
Total weight of seedling stock (kg)	375-400	369-492

*Based from information provided during participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013; Data converted from 'dipa' to meters and transposed to ¼ ha equivalent

2. Floating Mono-line Method

These methods are used in deeper areas as well as in shallow areas that are characterized by weak water movement or where the bottom topography is irregular. The mono-lines are arranged in a similar manner as in the bottom mono-line method, but these are tied to a bamboo beam on each end (**Figure 28**). The whole structure floats naturally because of the bamboo, but floating can still be reinforced my attachment of floats along the sides of the structure. The whole set-up is then tied to the bottom on its four sides, to wooden tripods, on single stake, or on coral rocks, using strong plastic cord.

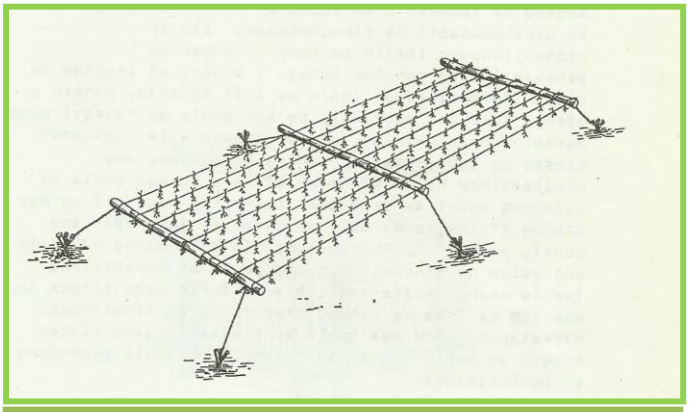


Figure 28. Floating Mono-line Method of Seaweed Farming (Trono and Ganzon-Fortes, 1989)

The level of the lines in relation to the surface of the water column is determined by adjusting the length of the line of the floatation device. Single floating lines are distanced some 5-8 m apart to avoid them from becoming entangled. The floating methods have two sub-types[25]:

a. *Floating Mono-line Method*

This method uses mono-filament lines to which cuttings are tied approximately 20-25 cm from each other. Wooden posts are driven to the bottom, 10 m apart in rows and and 1.0 m between rows. The lines are tied at both ends of the posts parallel to each other. Modifications to this method (spider web method) involve supplementary lines tied to the anchors for additional support.

As mentioned earlier, the floating mono-line method is more preferred over the fixed bottom mono-line method when benthic grazers is a common problem in the area and a more moderate water movement caused by waves is desired.

[25]Pelinggon, R.E. and Tito, O.D. 2009. Seaweeds Production: Module 7, Enhancing the Demand of AFNR Graduates Through Curricular Intervention Using Modular Approach with High S&T Contents. Western Mindanao State University, Zamboanga City, Philippines. 59p. as cited in http://www.wmsu.edu.ph/rdec/PDF/Seaweeds%20Production.pdf.

b. *Raft Method*

In the raft methods, the mono-lines are attached to a wooden or bamboo frame, the size of which varies depending on the available frame materials. The mono-lines are attached to the frame parallel to the length of the frame at 20-30 cm intervals. A 4 x 5 m raft unit may be planted with 350-400 cuttings. The units are anchored to the substrate from their corners, using nylon ropes. Floatation materials are attached to the corners of the rafts to increase their buoyancy.

However, seaweed farmers at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon had introduced necessary modifications in their seaweed farm establishment by using different types of mono-lines to suite their location-specific requirements as illustrated in **Figure 29**[26]. Most of these are adaptation of the bottom mono-line and floating mono-line methods of farm establishment. These include the following: (a) Multiple Horizontal Mono-lines, With or Without Middle Top Mainline [**Figure 29A**]; (b) Multiple Horizontal Mono-lines With Downward 2-Ties [**Figure 29B**]; (c) Multiple Horizontal Mono-lines Attached Between 2 Top Mainlines [**Figure 29C**]; and (d) Multiple Vertical Mono-lines Attached to Floats and Single Bottom Mainline [**Figure 29D**]. The advantages and disadvantages of these different types of mono-lines are compared in **Table 11**.

[26]Darag, Jr., A.N. 2013. Farmer Field School Periodic Monitoring and Workshop: Activity Report, 10-15 November 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 16p.

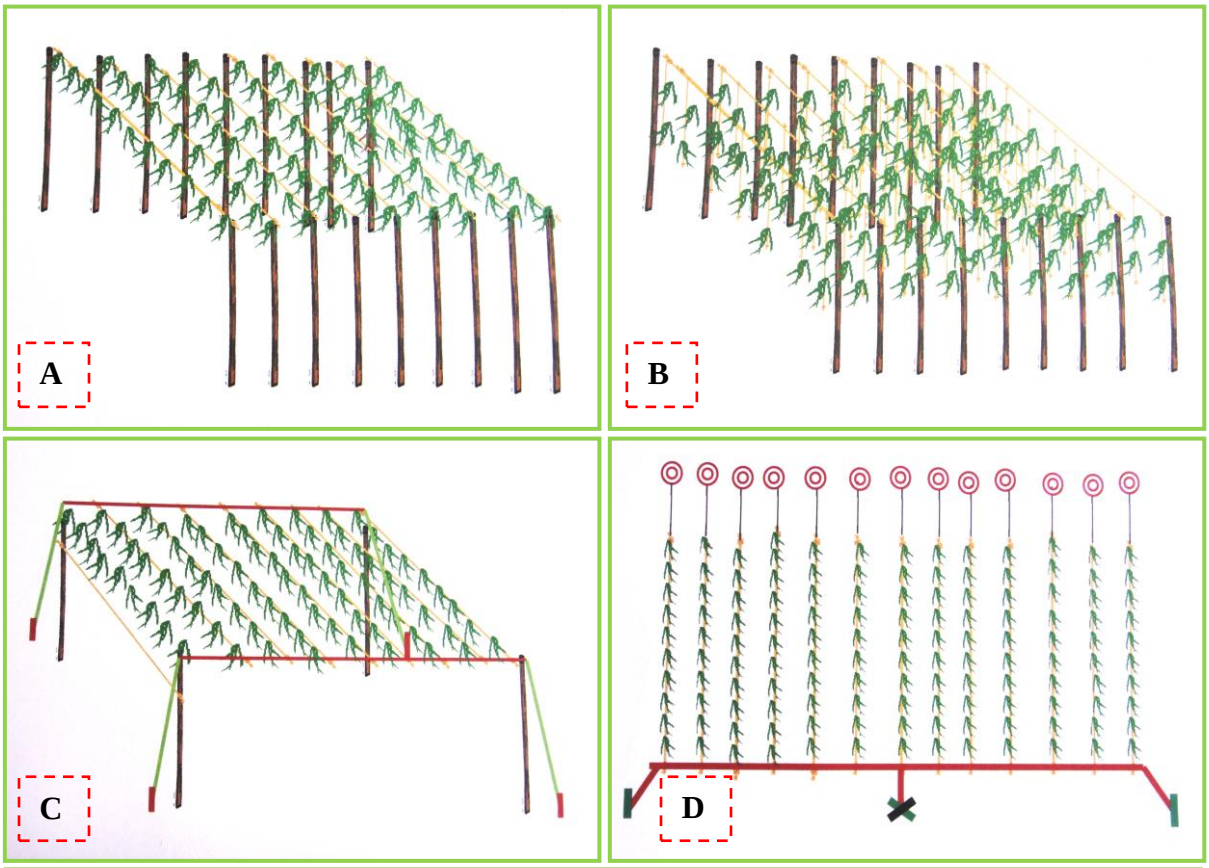


Figure 29. (A) Multiple horizontal mono-lines, with or without middle top mainline; (B) Multiple horizontal mono-lines with downward 2-ties; (C) Multiple horizontal mono-lines attached between 2 top mainlines; and (D) Multiple vertical mono-lines attached to floats and single bottom mainline

Table 11. Comparison of different types of mono-lines used by farmers for seaweed production in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon*

CHARACTERISTICS	TYPES OF MONO-LINES (SEE FIGURES 25-28)			
	Multiple Horizontal Mono-lines, With or Without Middle Top Mainline	**Multiple Horizontal Mono-lines With Downward 2-Ties**	**Multiple Horizontal Mono-lines Attached Between 2 Mainlines**	**Multiple Vertical Mono-lines Attached to Floats and Single Bottom Mainline**
Suitable Location	• Shallow production areas with soft bottom seabed	• Shallow production areas with soft bottom seabed	• Deep or shallow production areas with firm or rocky seabed	• Deep production areas with soft or firm seabed
Suitable Weather Condition	• Season with moderate water current (March-September)	• Seasons with strong or moderate water current (year-round)	• Season with moderate water current (March-September)	• Season with strong water current (October to February)
Advantages	• Requires less or no mainline, less cost of production, more stable during typhoon season	• Good for nursery establishment, not prone to weed ('kulapo') entanglement, more stable during typhoon season	• Not prone to grazers, easy to establish, lesser stakes required, easy to relocate during adverse weathers, longer usability	• Stable during strong water current season, not prone to weed ('kulapo') entanglement, easy to relocate during adverse weathers, longer usability
Disadvantages	• Seaweeds near the stakes are prone to grazer attacks, require more stakes resistant to seawater pest ('broma'), not suited in deeper production areas	• Relatively labor intensive, higher cost of production, require more stakes resistant to seawater pest ('broma')	• More expensive, danger of total loss of seaweed production set-up in case the mainlines are unavoidably cut or broken	• More expensive, not suited in shallow production areas

*Based from information provided during participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013

MAINTENANCE OF THE SEAWEED FARM

Why do we need to maintain our seaweed farms after establishment?

A superficial examination of *Kappaphycus* seaweed farming can mislead the observer into thinking that it is a low-effort occupation such that seaweed farmers simply tie cuttings to strings, go away, and return to harvest the crop after 5-6 weeks. Nothing can be further from the truth. Seaweed farming is an occupation such that the most successful are those with skill, diligence, and a 'green thumb'. These attributes must translate to 'tender loving care' (TLC)[27]. This means that the seaweed farmer must ensure daily attention to functions such as:

- Replacing loose or weak seedlings;
- Shaking silt or other loose 'scum' off the seaweed plants;
- Removing drift material such as plastic bags, debris, and weeds that get tangled in the seaweed crop;
- Re-attaching or tightening detached or loose lines; and
- Replacing or repairing loose netting, stakes, and floats, among others.

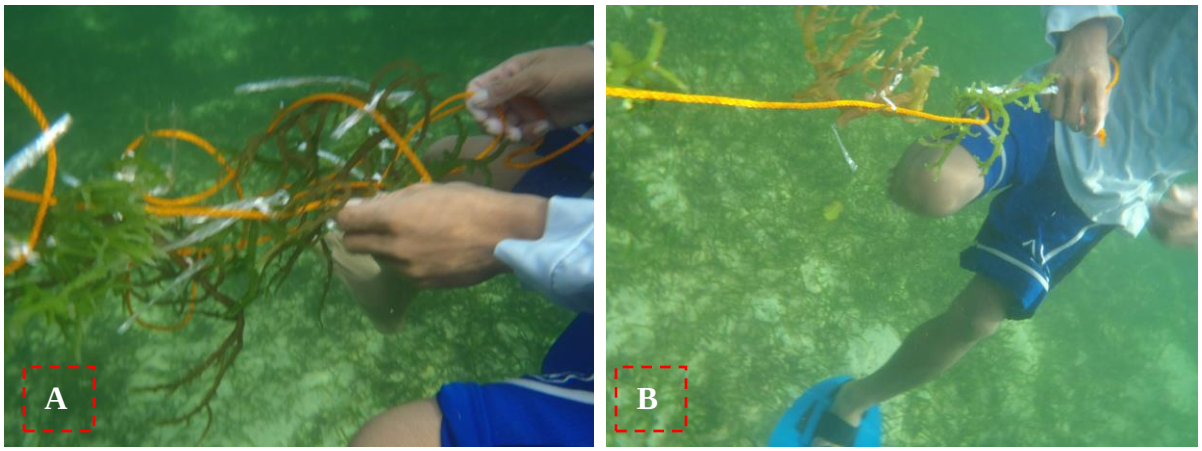


Figure 30. A seaweed farmer at the coastal waters of Calutcot-Kalongkoan Islands provides 'tender loving care' (TLC) to his seaweed farm by taking care of the (A) seaweed crops and the (B) seaweed farm structures, among others.

Care for crops (**Figure 30A**) and farm structures (**Figure 30B**) is essential for success but it is equally important to take care of the surrounding environment. Seaweed farmers must take care to avoid trampling or damaging local habitats; littering the environment with trash; polluting farm areas with human and other waste; or

[27]Neish, I.C. 2003. The ABC of Eucheuma Sea-plant Production. Monograph # 1-0703, SuriaLink, July, 2003. As cited in http://www.fishdept.sabah.gov.my/download/ABC_eucheuma_a.pdf

undertaking collateral activities such as cyanide and dynamite fishing or other destructive activities.

How do we manage seaweed epiphytes, grazers, and diseases after seaweed farm establishment?

If seaweed epiphytes, weeds, or disease become prominent you should crop out the farm and move it and or replace seedlings with healthy materials. Current protocols for managing non-epiphytic weeds include observing seasonal patterns, then immediately removing weeds manually as soon as they appear in the seaweed farm in order to prevent them from reproducing and spreading[28]. Removed pest weeds may be taken to land and used as fodder or compost material. Grazers, on the other hand can be minimized, if not prevented, by planting seaweeds at the right place (e.g., away from gazer habitat), time (e.g., avoiding grazer reproduction period), and depth (e.g., manipulating seaweed farm establishment method). However, in the case of epiphytes and diseases, there is little choice but to crop out old stock and replace it with clean seedlings. The management of seaweed epiphytes, weed competitors, grazers, and diseases are discussed at great length in **Section 4** of this manual.

In one of the sessions of a season-long FFS on seaweed production training, participatory discussions among researchers, facilitators, and seaweed farmers were undertaken to compare the researchers and farmers experiences on addressing common biotic constraints in seaweed production at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon[29]. The outputs of the activity clearly indicated that there are very close congruencies between the researchers and farmers perceptions, experiences, and approaches on how to address problems of diseases, epiphytes, and grazers of *Kappaphycus* seaweeds as shown in **Table 12**. This observable fact is indicative of the significance of farmers' actual seaweed farming exposure (e.g., 3-4 growing cycle per year) and duration (e.g., 5-10 years farming experience) in the accrual of location-specific management options against recurring biotic constraints in seaweed production.

[28]Ask, E.I., 1999. Cottonii and Spinosum Cultivation Handbook. FMC Food Ingredients Division, Philadelphia, 52p.

[29]Darag, Jr., A.N. 2013. Farmer Field School Periodic Monitoring and Workshop: Activity Report, 10-15 November 2013, Maydalaga, Kalongkoan Island, Burdeos Quezon. 16p.

Table 12. Comparison of researchers and farmers experiences on common biotic constraints in seaweed production at the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon

PROBLEMS	FARMERS EXPERIENCES*		RESEARCHERS VIEWS	
	CAUSES	MANAGEMENT	CAUSES	MANAGEMENT
'Ice-ice' Disease (*Pseudomonas*, Flavobacteria)	• High seawater temperatures (April-May) • Always turbid seawater • During typhoon season • Severe infestation of epiphytes ('buhok-buhok') • Heavy dirt deposits on seaweed branches	• Selective pruning of infected plant parts and relocation to more suitable sites at early signs of infections • Harvesting whole production area at later stages of disease infection	• Disease caused by a Flavobacteria • Unsuitable production area (freshwater intrusion, no or strong water current, too shallow or too deep production area) • Continuous planting of the same variety or strain • Dirt or weed accumulation on seaweed thallus (mud, 'kulapo', epiphytes)	• Harvest or replant at 10% infection (prune infected plant parts) • Relocate in more suitable production area (not too shallow or too deep with moderate water current) • Use new or more resistant variety or strain • Remove dirt deposits on seaweed thallus (mud, 'kulapo', epiphytes)
'Buhok-buhok' (Epiphytic red alga)	• Seawater always turbid • Muddy substratum • Too many seaweeds planted in a production area (above carrying capacity) • Same production area planted to seaweeds more than 3 times • Always changing weather conditions (cooler to warmer periods)	• Relocate production area • Maintenance of floaters (raise [moderate current], lower [slow current], or add [strong current] as necessary) • Regular monitoring, removal of weeds ('kulapo'), replaced detached seedlings, pruning of epiphyte infested plant parts	• Caused by epiphytic (parasitic) red alga • Adverse weather conditions (intense sunlight, high temperatures, still or no water current) • Too shallow production area • Unsuitable variety or strain	• Relocate to deeper production area with moderate current in the dry season • Use more adapted or resistant variety or strain

*Based from information provided during participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013

PROBLEMS	FARMERS EXPERIENCES		RESEARCHERS VIEWS	
	CAUSES	MANAGEMENT	CAUSES	MANAGEMENT
Grazing (fishes, sea urchins, and starfishes)	• Insufficient number of floaters and too low fixing of mono-lines • Growing during egg-laying season of grazer-fishes (Aril-May) • Too shallow production area	• Raising and adding number of floaters • Control height of floaters	• Shallow planting during the dry season and egg-laying season of grazer-fishes ('balawis') • Too low fixing of mono-line • Seaweed seedling ties too close to stakes of mono-lines	• Deeper production area planting and avoiding egg-laying areas of grazers during the dry season • Raising of mono-lines (1 meter from substratum) • Use wider spacing between stakes and first seedling tie (1 meter away) • Use floating method of mono-line establishment

*Based from information provided during participatory discussions with participants of Farmer Field School (FFS) on Seaweed Production held at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon on August-December 2013

Are there permanent solutions to technical problems that will occur after seaweed farm establishment?[30]

Fortunately, farmers are now able to manage 'ice-ice' and 'buhok-buhok' problems that occur during March-April seaweed growing, when water temperatures are relatively high and the sea is quite calm. Usually, May-June plantings are more favorable to seaweed growing as water temperatures start to taper down and sea current becomes moderate. However, after going through a hectic, almost year-round, and yet admittedly successful on-site experimentation to find more lasting solutions to previous problems in seaweed farming through the Farmer Field School (FFS) approach, it is unfortunate that an entirely new and more devastating glitch struck the seaweed farms of our farmers at the coastal waters of Calutcot-Kalongkoan Islands during their May-June 2014 plantings. Although they attribute the recent setback to 'ice-ice', they are also unanimous in their observation that the occurrence and behavior of the problem is different from the previous cases of 'ice-ice' that they had experienced.

The 'ice-ice' of the past developed over a 1-2 week period. More often than not, it was preceded by 'buhok-buhok', which would attack the seaweed crop first followed by progressive onset of 'ice-ice' or whitening of some parts of the thalli (branches) that will eventually detached from tie-ties (*tali*) attached to the mono-line (*lastayan*) and dissolve (*natutunaw*). In their FFS studies, farmers were able to come up with the following measures to manage this kind of situation:

a) Pruning the affected thalli and re-tying the healthy ones in the tie-ties or replacing the empty tie-ties with healthy seedlings;
b) Harvesting the whole farm and replacing the whole seed-stock with new healthy ones;
c) Relocating the farm to deeper areas with moderate water current; and
d) Adjusting the depth of the mono-lines (*lastayan*) by manipulating the distance of mainlines and/or floats from the water surface, among others.

In the recent case, the farmers observed that their seaweeds dissolved (*natunaw*) abruptly in just 1-2 days. From the reflection sessions that followed, our initial conclusion is that it was not 'ice-ice' (or biotic in nature). It looked like severe stress that caused immediate cessation of growth due to sudden and prolonged rise in water temperatures and salinity (a-biotic). These conditions may have not allowed the usual 'ice-ice' and 'buhok-buhok' to attack and survive on their seaweed host. This was the farmers' first time to experience extremely high temperatures (37-38 ^{o}C)

[30]Gucilatar, J.A. 2014. Excerpt from a Technical Report prepared by the SANAMMMAY Seaweed Project Advisory Team and submitted by the Project Manager to Peace and Equity Foundation (PEF) in support of the request for deferment of loan amortization due to the latest problems encountered by the seaweed farmer-beneficiaries.

between 12 noon and 3 pm and also water salinity of 36 ppt. The farmers' experience of high temperatures in the open sea ranged 33-35 ^{o}C (and salinity of 29-33 ppt) in the months of March-April causing the appearance of 'buhok-buhok' followed shortly by 'ice-ice'.

The limitation of the FFS is that it is based on experience. Unlike academics, the tools that FFS give the farmers do not provide them the luxury to experiment with theoretical variables. Our farmer-beneficiaries are dealing with fast changing environmental conditions. It is a dynamic situation where there are no permanent technological (and final) technical solutions. A production problem may be solved but new ones are sure to come, and solved ones may come back in more intense or virulent form. That is why, for many research institutions, with their generous budget and army of experts, the work is never done.

It is worth noting that the most important point in participatory research is to empower the poor to strengthen their capacity to experiment, gather and analyze data, and make conclusions. Thus, the SANAMMMAY Seaweed Project Advisory Team is confident that the modest seaweed project has made significant contribution to the body of ever growing knowledge on seaweed farming. More important, the Team believes it has succeeded in creating a community of seaweed farmers who in their own right create their own knowledge and can become partners of the science and academic community in seaweed culture.

HARVEST AND POST-HARVEST OPERATIONS[31]

It is the responsibility of the seaweed farmer to harvest the crop at the right maturity, dry the harvested seaweed, and keep it in a well-protected place such as a storage shed until the buyer comes to the village to collect it.

What are the proper procedures of harvesting *Kappaphycus* seaweeds?

Harvesting is breaking-off part of each thallus (pruning) or removing it from the farm area (total harvest). *Kappaphycus* seaweed is harvested after 6 to 8 weeks (not less than 45 days but not more than 90 days) of growth depending on the culture method used. Immediately clean and sort the seaweeds, place in clean sacks or platforms and should not be expose to rain or fresh water. The proper procedures in harvesting *Kappaphycus* seaweed are enumerated below:

1. Prepare all necessary materials for harvesting (e.g., 1-2 bancas or bamboo rafts, several rattan baskets or similar containers, one 100 kg capacity weighing scale, recording materials [notebook and pencil], drying platforms lined with banana leaves or fine-meshed nylon nets);
2. Harvest whole plants mono-line by mono-line. Be sure to retain or set aside enough plants in mono-lines to be used as source of planting materials for the next growing cycle. Seaweed farmers in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, harvest their seaweeds mono-line by mono-line and load them directly to their small boats.

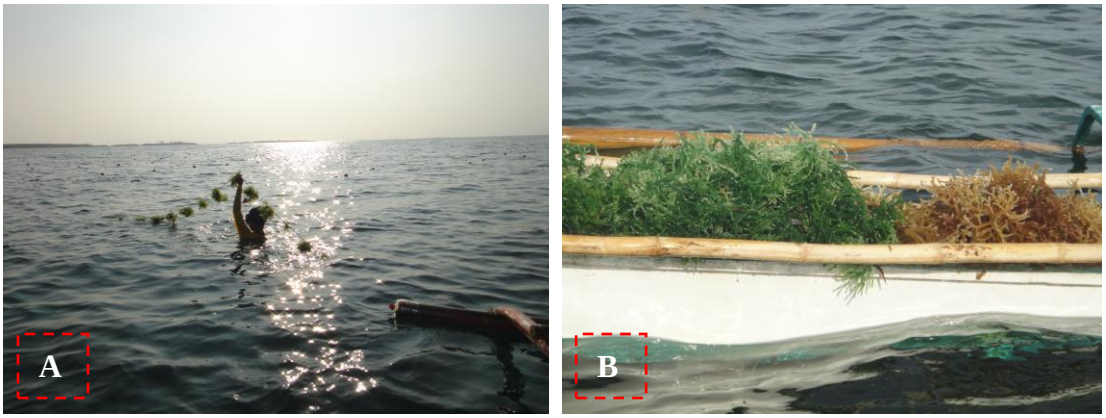


Figure 31. Seaweed farmers in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, harvest their seaweeds mono-line by mono-line (A) and load them directly to their small boats (B)

[31]Adapted from Trono, Jr., G.C. and Ganzon-Fortes, E.T. 1989. Ang Paglinang ng Eucheuma (Eucheuma Farming). Seaweed Information Center (SICEN), Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, Through a Grant from the International Development Research Centre, Ottawa, Canada. 57p.

3. Place the harvested plants in net-bags, rattan baskets, or directly in nearby bancas or bamboo rafts. Harvested plants are accumulated in the banca before transport to the drying or seeding area;
4. If banca is full, transport the harvested plants to a nearby drying area and unload; and
5. Protect the harvest from sun, wind, rain, and from spillage of gasoline and oil.

What are the necessary post-handling activities to be undertaken after harvesting *Kappaphycus* seaweeds?

Proper post-handling activities are very important because these will affect the quality of the dried *Kappaphycus* seaweed. The following stages are undertaken:

1. Cleaning and weighing. After harvest, clean the plants of other species of algae, animals, tie-tie, rocks, coral debris, and other foreign materials. Weigh the harvested plants and record the weight

2. Drying. Spread thinly the harvested plants on a drying platform built from bamboo slots or cement pavement. Be sure to line the drying area first with coarse but fine-meshed nylon net or dried banana or coconut palm leaves. Turn over the seaweeds regularly to facilitate drying. Protect these from being wet by rain, or by dew in the evenings by covering them with water proof sheets.

   The simplest way to dry seaweed is by spreading the harvested wet seaweed over a net, a tarpaulin (**Figurer 32A**) or over coconut leaves on the ground. However, in this way only the seaweed exposed directly to the sun (top portion) will dry efficiently and the remaining (lower portion) will stay wet[32].

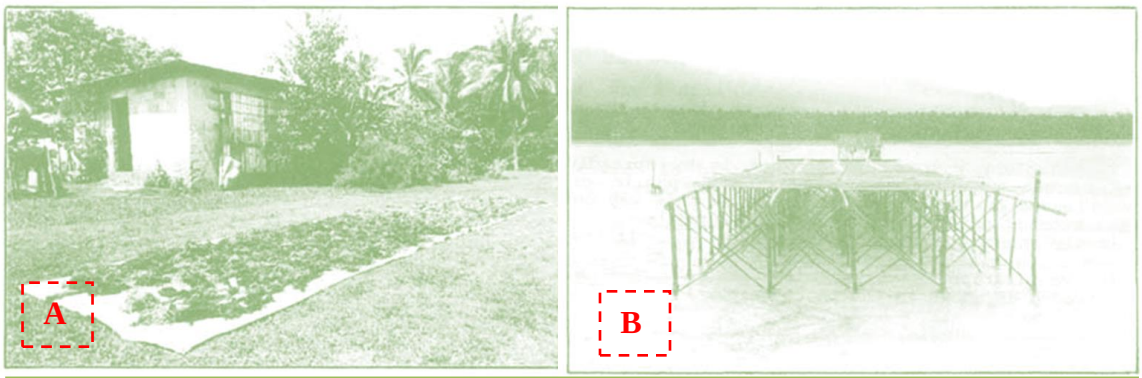


Figure 32. Newly harvested seaweeds are dried in (A) a tarpaulin spread on the ground and on (B) a drying platform in the drying area made of fine netting

[32]FAO. 2015. Handbook on *Eucheuma* seaweed cultivation in Fiji, FAO Corporate Document Repository, Fisheries and Aquaculture Department, Food and Agriculture Organization (FAO) of the United Nations (UN), http://www.fao.org/docrep/field/003/ac287e/AC287E04.htm

Fresh wet seaweed, just harvested, cannot be placed directly on tarpaulin for proper drying. Moreover, if you dry the seaweed on the ground, sand, soil and other rubbish can mix with the wet seaweed. The seaweed buyers will not buy a dirty product. The best way to dry seaweed, is to use a drying platform with the drying area made of fine netting (**Figure 32B**). Detailed drawing of a drying platform with dimensions is shown in **Figure 33A**. The drying platform can be constructed on shore or in shallow water near the seaweed farm as shown in **Figure 33B**[33].

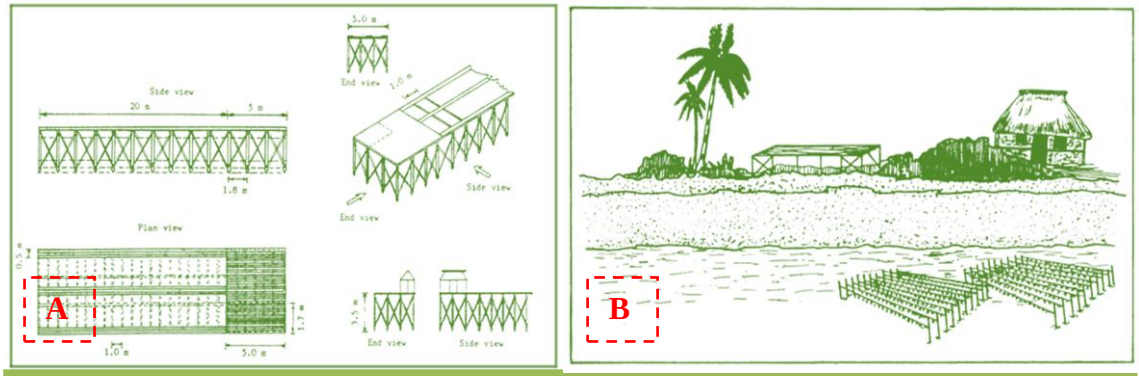


Figure 33. Detailed drawing of a drying rack (A), which can be constructed on shore or near the seaweed farm (B)

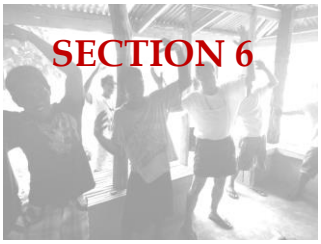
Seaweed farmers in the coastal waters of Calutcot-Kalongkoan Islands, Burdeos, Quezon, dry their harvests by spreading them directly in grassy lawn (**Figure 34A**) or in plastic canvas (**Figure 34B**), and by hanging them under the shade (**Figure 34C**).

Figure 34. Seaweed farmers at the coastal waters of Calutcot-Kalongkoan Islands dry their harvests by spreading them directly in grassy lawn (A) or in plastic canvas (B), and by hanging them under the shade (C).

[33]FAO. 2015. Handbook on *Eucheuma* seaweed cultivation in Fiji, FAO Corporate Document Repository, Fisheries and Aquaculture Department, Food and Agriculture Organization (FAO) of the United Nations (UN), http://www.fao.org/docrep/field/003/ac287e/AC287E04.htm

3. Washing and re-drying. After 2-3 days of good sunny weather, prepare the dried seaweed for washing. The dried seaweed at this time should be crisp and not moist, and salt particles are visible at the surface. Put seaweed in rattan basket. Wash it for 5 minutes in seawater by stirring it and shaking the basket. Spread the washed seaweed on the drying area. This time, drying takes only one-half to one day. Dry seaweeds are crisp and these do not have salt on the surface. The dried seaweeds should not contain more than 30% moisture.

4. Packing and storing. Pack the dried seaweeds in sacks. Weigh and write weight on the sack. Keep a separate record of these weights as these represent the total dry harvest. Keep the packed seaweeds in a dry storage area. Prepare for selling.



NON-FORMAL EDUCATION AND TEAM BUILDING EXERCISES

SECTION 6[34]

NON-FORMAL EDUCATION AND TEAM BUILDING EXERCISES

This section pull together useful non-formal education methods and approaches, team building exercises, and energizers and icebreakers that can be undertaken to enhance leadership, cultivate team building, build-up cooperation and coordination, develop resourcefulness, facilitate problems of absenteeism, and other related concerns among FFS on seaweed production participants. These undertakings are grouped as follow:

- Non-formal education methods and approaches
- Team building exercises
- Energizers and icebreakers
- Evaluation exercises

[34]This section was adapted from *Callo, Jr., D.P., Cuaterno, W.R. and Tauli, H.A. 1999. Handbook of Non-Formal Education and Team Building Exercises for Integrated Pest Management.* Published jointly by ASEAN IPM Knowledge Network, SEARCA, College, Laguna, Philippines; KASAKALIKASAN, Department of Agriculture, Diliman, Quezon City, Philippines and SEAMEO SEARCA, College, Laguna, Philippines. 106p.

NON-FORMAL EDUCATION METHODS AND APPROACHES

Non-formal education (NFE) methods and approaches, as knowledge management strategies, bring about sharing of knowledge and the creation of new knowledge, and in the process empowers the participants. Activities focus on allowing participants to observe, discuss, interact, brainstorm as well as perform analysis, make decisions, and solve problems[35].

Essentially, NFE is a participatory educational process based on the assumptions of adult learning. When adult learners decide to participate in any learning activity, they bring along a wealth of experience, knowledge, and skills. They are armed with their own beliefs, values, and convictions. They have their own perceptions, biases, and feelings. With such a background, the adult learner is the richest resource in the learning process[36].

NFE methods and approaches encourage participants to see themselves as source of information and knowledge about the real world. When they are encouraged to work with the knowledge they have from their own experience, they can develop strategies together to change their immediate situations. This learning experience takes place in several ways, as follows[37]:

- *Existing popular knowledge is recognized and valued.* The learning process starts with the assumption that participants already possess some knowledge. Participants do not start with a clean slate. In this approach, the synthesis of popular knowledge with existing scientific knowledge strengthens the learning experience of the participants.

- *New knowledge is built on the existing knowledge.* In the learning process, the starting point for creating new knowledge is the existing knowledge that people have, particularly the authentic elements of it. As people begin to appreciate what they already know, they are more open to seek new information. This desire to seek new information and knowledge enhances the learning process.

- *Participants learn to exercise control.* The learning process puts emphasis on the active participation of participants in generating their own knowledge. This encourages them to take the responsibility for their own learning. It is this active

[35]DA. 1997. Technical Proposal for the ASEAN Integrated Pest Management Knowledge Network. Department of Agriculture (DA), Diliman, Quezon City, Philippines. pp4.
[36]Ortigas, C. D. 1997. Training for Empowerment. Office of Research and Publication, Ateneo de Manila University, Loyola Heights, Quezon City, Philippines. pp13-26.
[37]Society for Participatory Research in Asia. 1987. Participatory Training for Adult Educators. Society for Participatory Research in Asia Publication, New Delhi, India. pp7-9.

posture which constitutes a powerful impetus for learning and for learners to exercise control over their learning.

- *Learning becomes a collective process.* One of the elements of NFE is the promotion of collective responsibility for seeking new knowledge. As a result, participants learn to get together, collectively seeking and analyzing information.

- *Learning creates informed options.* The very process of collectively analyzing a given situation throws up various alternatives. As part of the process of analysis, options are debated based on concrete information. As a result, participants are able to accept and reject options on an informed basis. This creates a sense of empowerment, which is based on the confidence that the information has been understood and interpreted.

- *Actions emerge out of this analysis.* The very act of involvement in the process of analyzing a given reality creates a sense of ownership of that knowledge and willingness to transform that situation. The participants are then able to take concrete actions.

Thus, where possible, facilitators should create a learning situation where adults can discover answers and solutions for themselves. People remember the things they have said themselves best, so facilitators should listen more and not speak too much. They need to give participants a chance to find solutions before adding important points the group has not mentioned[38]. The NFE methods and approaches described in the following pages consider most of the characteristics mentioned above. The facilitator is therefore given a number of options to select from, depending on the situation and the need of participants.

[38]Hope, A. and S. Timmel. 1994. Training for transformation 1: A Handbook for Community Workers. Mambo Press, Gweru, Zimbabwe. pp99-120

Exercise No. 6.01

SHARING

How is the method used?

Knowledge, ideas, and opinions on a particular subject are freely exchanged among training participants and facilitators (**Figure 35**).

When is the method most appropriate?

The method is suitable where the application of information is a matter of opinion. It is suitable when attitudes need to be induced or changed. Participants are most likely to change attitudes after discussion. The method is also suitable as means of obtaining feedback about the way in which participants may apply the knowledge learned.

Figure 35. Seaweed farmers share their experiences in small group on how to manage 'ice-ice' disease and 'buhok-buhok' epiphyte in their own farms at the coastal waters of Calutcot-Kalongkoan Islands

What are the points to watch is using the method?

The participants may be led away from the subject matter or fail to discuss it fully. The whole session may be vague. Participants may become entrenched in their attitude rather than be prepared to change them.

Exercise No. 6.02

SMALL AND BIG GROUP DISCUSSIONS

How is the method used?

Divide a big group of 25-30 participants into five smaller groups, giving each group a particular task to accomplish and discuss. Give every member of the small group the chance to share his or her ideas about the assigned task. Leaders chosen by the group will lead the discussions. After a certain given time, ask all groups to convene and process their discussions with the bigger group.

When is the method most appropriate?

This method is suitable when eliciting participation and sharing of experiences as well as ideas from individual in-groups. It is easier for an individual to share his ideas within a small group (**Figure 36A**) than within a big group (**Figure 36B**). This is true all the more when participants are not comfortable with the big group yet, as

Figure 36. Seaweed farmers conduct (A) small group and (B) big group discussions to consolidate their individual experiences on the management of 'ice-ice' disease and 'buhok-buhok' epiphyte in their own farms at the coastal waters of Calutcot-Kalongkoan Islands

in the instances when the training program has just started. Sometimes, participants may feel intimidated or threatened when asked to share their ideas with the big group. Thus, it becomes helpful to structure training activities in such a way that group discussions precede large group work or discussions. The ideal group for small group discussions is at least 5-6 and not more than 10 members. Big group discussions should not exceed 30 members.

What are the points to watch is using the method?

Some members of the group may impose on others (e.g., insist on their ideas). There is also a danger that some participants may use up considerable time in presenting their opinions. These situations may lead to others not having the chance to speak. The facilitator should always be sensitive to these behaviors and be able to handle the group so that each member is given equal chance to be heard. Accept all opinions to show respect for individual members. It might be helpful if the facilitator will remember that there are different kinds of people (e.g., some need to be encouraged to speak up or some need recognition). It is his role to clarify inputs and tasks to avoid problems that may arise as a result of differences in personalities. Facilitators must maintain good judgment and not be swayed by opinions of anyone of the group members.

Exercise No. 6.03

BRAINSTORMING

How is the method used?

Either in small group or in big group, give participants an issue or problem to be discussed and deliberated on exhaustively. Accept all ideas during the discussion. After a thorough deliberation on the issue or problem, the entire group comes up with a consensus as a final output.

When is the method appropriate?

This method is suitable when tackling issues and problems that need or call for group decision-making. It is particularly helpful when participants are expected to actively join in the deliberation and share their ideas and experiences as well as knowledge about the issue on hand. A group of not less than five and not more than 10 members should give the best results (**Figure 37**).

What are the points to watch in using the method?

If the issue or problem is not clear to the group(s), it is possible that participants will not be able to come up with what is expected of them. Discussions may move away from the topic. As in the small and big group method, some members of the group may impose on others (e.g., insist on their ideas). There is also a danger that some participants may use up considerable time in presenting their opinions. These situations may lead to others not having the chance to speak. The facilitator should always be sensitive to these behaviors and be able to handle the group so that each member is given equal chance to be heard. Accept all opinions to show respect for individual members.

Figure 37. Participants of FFS on seaweed production conduct brainstorming session in small group on the agro-ecosystem analysis (AESA) results of their seaweed varieties

It might be helpful if the facilitator will remember that there are different kinds of people (e.g., some need to be encouraged to speak up or some need recognition). It is his role to clarify inputs and tasks to avoid problems that may arise as a result of differences in personalities. Facilitators must maintain good judgment and not be swayed by opinions of anyone of the group members.

Exercise No. 6.04

OBSERVING BY FIELD WALK

How is the method used?

Divide the participants in small groups of at least five members per group. Assign an existing issue or problem that the big group needs to address in an area. Let each small group observe the area by walking around and have a first-hand experience of the issue or problem. Synthesize the observations through small and big group participatory discussions.

When is the method most appropriate?

This method is suitable when there is an issue or problem that will need or call for a group decision-making. It is particularly useful when there is an actual situation in the field or village which will allow the participants to be exposed to the issue or problem at hand and thus, be able to share their knowledge and ideas as well as experiences more comfortably.

What are the points to watch in using the method?

Sharing of knowledge, ideas, or experiences after a field walk is usually more lively and meaningful. However, as we encourage freewheeling group discussions, some members of the group may impose on others by insisting on their ideas. There is also a danger that some participants may use up considerable time in presenting their opinions, which may lead to others not having a chance to speak. The facilitators must be sensitive of these behaviors and be able to handle the group by reaching a consensus after everybody is given a chance to be heard.

Exercise No. 6.05

LEARNING FROM FIELD TRIPS

How is the method used?

To maximize results from field trips, these guidelines should be considered:

- Be certain that the objectives of the trip are well-defined and related to the central purpose of a given training activity. Literally ask yourself: Is this trip really necessary?
- Plan logistic properly: who to contact, how to reach the visitation points, when to arrive, when to depart.
- Provide written instructions to the participants concerning what to look for at the point of visitation. Provide appropriate background materials as well.
- Indicate whether the work is done individually, in pairs, in small groups, among others.
- Indicate what kind of tasks participants are responsible for upon return to the training session: a report (written or oral), a case study, a completed survey, summaries of interviews, certain documentation such as pictures, collection of specimens, to name a few.
- Schedule enough time for the processing of the learning from the field.
- Secure feedback (evaluation) from the group concerning the field trip. This will enable the strengthening of programming of future field trips.

When is the method most appropriate?

This activity is most appropriate if conducted toward the middle to the end of the training program. Field visits to points of interest away from the training room, whenever practicable, are advantageous because they:

- Are a means of enriching the learning experience;
- Are particularly essential to complement seemingly theoretical and conceptual learning activities;
- Provide a desirable change of pace in the learning process;
- Provide an opportunity for participants to get to know one another in a more in-depth way;
- May provide fun, excitement, novelty, new motivation to learn, and so on; and
- Provide a chance to develop oral and/or written communication skills, in respect to the reporting phase of the field trip.

What are the points to watch in using the method?

Obviously, field trips may be organized as a total group activity, with each member being individually responsible for observing and reporting his or her experience. However, the use of small groups or teams of at least five participants should be emphasized.

Exercise No. 6.06

CONDUCTING MINI-WORKSHOP

How is the method used?

Depending upon the need, the participants may be divided into smaller groups (break-up sessions) or regrouped (plenary sessions) to tackle a certain issue or problem in a workshop-like atmosphere. During break-up sessions, the small group participants work together to produce an output for an issue or problem predetermined in plenary sessions (**Figure 38**). The outputs in breakup sessions are then validated in plenary sessions. An action plan, agreed upon in a plenary session, is usually developed at the end of a mini-workshop.

Figure 38. Seaweed farmers conduct mini-workshops in small groups to work out on most appropriate cultural management practices for seaweed farming in the coastal waters of Calutcot-Kalongkoan Islands

When is the method most appropriate?

This method is most useful when there are topics or issues that arise during the training process and there are no concrete plans on how to address them. It is likewise helpful when the participants want to learn more about a particular topic or issue. More than just developing an action plan, mini-workshops may be used as a strategy to develop the participants' technical competence in dealing with specific topics or problems.

What are the points to watch in using the method?

As we encourage a freewheeling group discussion, some members of the group may impose on others by insisting on their ideas. This may use up considerable time, which may lead to others not having a chance to speak. The facilitators must be sensitive of these behaviors and be able to handle the group so that everybody is given equal chance to actively participate in the design of an action plan.

Exercise No. 6.07

FOLK MEDIA PRESENTATION

How is the method used?

The participants plan and prepare an appropriate folk media either as a big group or as an individual small group. Local songs, dances, poems, proverbs, stories, tales, legends, and drama are forms of folk media to select from. Folk media are prepared to convey a developmental message using the most appropriate local medium that is familiar to a group of people. Folk media are then presented as part of a field day, a fiesta, or other kinds of celebration. By doing so, the message becomes easier for the intended audience to understand.

When is the method most appropriate?

Folk media can be used in various ways. The facilitators can use it to explain complex concepts. Weakness in a culture or group may be approached in a non-threatening situation through a folk media presentation. It can create awareness and lead to analysis of problems by the people in a community.

What are the points to watch in using the method?

The differences and uniqueness of culture and values from one region to another or from one village to another suggest that the selection of the most appropriate folk media to convey a desired message to a particular group be treated with utmost importance.

Exercise No. 6.08

CONDUCTING FIELD DAY

How is the method used?

The field day is an occasion when farmers and facilitators show other people or the community what they have learned and the results of their participatory technology development (PTD) activities. The field day may include such activities as field tour, exhibit, and a program where local officials deliver speeches. In the Philippines, the participants and the community also jointly prepare foods as part of the event. A field day takes in a festival-like atmosphere. Folk media prepared by farmers complete the celebrations.

The field day is the training participants' affair. This means that they must plan for and implement the activity. For the Farmer Field School (FFS), the farmer-participants may choose to invite co-farmers from the same or neighboring villages (barangays). For the facilitators, they may choose to invite their local chief executives or direct supervisors with the end view of orienting them on the program.

When is the method most appropriate?

The best time to have a field day is when there is still standing crop that is nearing maturity in the 'learning field.' That is, unless there is an emergency situation and there is no choice but to harvest the crop before a field day. The field day is the culminating activity of a Farmer Field School (FFS), a Training of Trainers (TOT) and or a Training of Specialist (TOS) course.

What are the points to watch in using the method?

Although a field day is also designed to convey desired messages (e.g., result demonstration and other developmental messages), more importantly, the activity must also highlight the participants' experience on what can be accomplished by working together.

Exercise No. 6.09

FOLLOW-UP PROGRAM

How is the method used?

The first phase of a program usually focuses on capability and capacity building. In many FFS-initiated programs, this comes with the season-long training of specialists, trainers, and farmers in Farmer Field Schools (FFSs). However, before the end of the first season, trainers must already look toward to sustaining a program in local communities. This means that after the initial activities (e.g., in the FFS on seaweed production), farmers must already start planning for follow-up activities in their communities. In so doing, barangay-based organizations (e.g., SANAMMMAY) are strengthened. This is the goal of the follow-up program. In seaweed production, participants in an ongoing FFS may sit together to plan what they will do upon completion of the season-long seaweed production training program. Farmers are expected to discuss about getting organized into an FFS club, if they have not been formally organized yet. Some suggested activities that an FFS club can carry out are:

- Technical backstopping through home and field visit to FFS and non-FFS farmers;
- Networking of trained farmers in the different barangays in a community;
- Conduct of participatory technology development (PTD) activities to discover new management options;
- Conduct of farmer field school (farmer-to-farmer); and
- Preparation and circulation of FFS newsletter to disseminate new and localized seaweed technologies and management strategies.

When is the method most appropriate?

This activity is best done in the TOS, TOT, and FFS, with farmers and local community leaders, starting on the 12th week of the training session.

What are the points to watch in using the method?

From the start of the training, it should be made clear with the participants, particularly the farmers, that they are expected to pass on their best experiences on seaweed farming to other members of the community and to other farmers. This will put their mind into proper perspective, once the planning session for FFS on seaweed production follow-up activities is conducted.

Exercise No. 6.10

PARTICIPATORY TECHNOLOGY DEVELOPMENT

How is the method used?

- *Introductory activities*

Conduct participatory discussions regarding the topic; conduct group exercise to draft procedure to be followed in designing, planning, and implementing participatory technology development (PTD) activities; and conduct participatory discussions to determine what can be done now.

- *Identify local problems*

Before entering a village (barangay), participants should make a concrete list of things to do. Design appropriate Baseline Survey Form and use it to obtain specific data on pest, fertilizer, and other cultural management practices. Visit the barangay as often as possible in small groups until all relevant data are finally gathered.

- *Validate initial information*

Consolidate initial data gathered in small groups, validate in the big group and with farmers by conducting participatory discussions. List down all major issues for consideration in designing PTD activities. Determine when and what additional data to gather for designing and planning immediate PTD activities.

- *Prioritize problems, design, and implement activities*

Consolidate additional data gathered in small groups, validate in big group and with farmers by conducting participatory discussions. List down additional issues for consideration in designing PTD activities. Plan additional visits to the barangay if needed. Update data, revalidate in big group and with farmers through participatory discussions. Make a final list of major issues for use in designing and planning of final PTD activities. Conduct mini-workshop in small groups to design and plan individual PTD activities of small groups. Present output to farmers and the big group for additional suggestions and comments. Implement the activities with farmers.

When is the method most appropriate?

This activity is appropriate for a group of 25-30 participants in a TOS, a TOT, or an FFS. PTDs on seaweed production are being implemented to empower participants

(both facilitators and farmers) with analytical ability and skills to investigate the cause-effect relationship of problems in seaweed farming practices and thereby stimulate them to design a set of actions for solving their problems.

What are the points to watch in using the method?

This activity must enhance the participants' learning process through experiential, discovery-based, and participatory approaches. As a team, the participants learn from other farmers' response at each stage of intervention and draw lessons for future FFS program implementation strategies. In addition, the participants develop their analytical skills and attitudes in working within participatory framework in planning, organizing, and evaluating development activities.

PTD as a learning process empowers in three ways: (a) it empowers because of the specific insights, new understanding, and new possibilities that participants discover in creating better explanation about their social world; (b) participants learn how to learn; and (c) it liberates when participants learn how to create new possibilities.

TEAM BUILDING EXERCISES

Team building is an organized effort to improve team effectiveness. In a sense, team building draws upon the athletic model for its basic concepts. These concepts include assumptions that performance must be continually critiqued, that the team cannot rest on past accomplishments, that a team must constantly strive for greater teamness, that a team must be willing to engage in introspection and feedback (e.g., receiving as well as giving), and that such values as openness, trust, spontaneity, mutuality, sharing, caring, risk taking, and experimentation are paramount[39].

Team building typically begins when the team leader realizes that there are blocks to team effectiveness that the team is not hitting on all cylinders, that improvements or change is desirable, and that help along those lines is wanted. Note that this is not the same as the team leader wanting team development so that the team leaders will can be imposed more fully to the group. In the latter case, team building would be a wasted effort, for such a leader's concept of a team would be one where members are subservient rather than creative, independent, questioning, among others. An effective team has the following characteristics[40]:

- *Mutual trust.* Mutual trust takes a long time to build and can be destroyed quickly. It is established in a team when every member feels free to express his opinion, says how he feels about issues and asks questions, which may concern retaliation, ridicule, or negative consequences.

- *Mutual support.* Mutual support results from group members having genuine concern for each other's welfare, growth, and personal success. If mutual support is established in a team, a member need not waste time and energy protecting himself or his function from anyone else. All will give and receive help to and from each other in accomplishing whatever goal the team is working on.

- *Genuine communication.* Communication has two dimensions: the quality and openness and authenticity of the member who is speaking, and the quality of non-evaluative listening by other members. Open authentic communication takes place when mutual trust and support are so well established that no member feels he has to be guarded or cautious about what he says. It also means that members of a good team won't 'play games' with each other, such as by asking 'trap' questions or suggesting wrong answers to test another member's integrity. Non-evaluative listening simply means listening to what the other

[39]Eitington, J. E. 1984. The Winning Trainer: Winning Ways to Involve People in Learning. Gulf Publishing Company, Houston, Texas, U.S.A. pp169-178.
[40]Ortigas, C.D. 1994. Group Process and the Inductive Method: Theory and Practice in the Philippines. Ateneo de Manila University, Philippines. pp54-61.

person is trying to communicate, with bias-filters removed. Most persons listen through an evaluative screen and tend to hear only those aspects of a communication that do not threaten status, roles, and convictions.

- *Accepting conflicts as normal and working them through.* Individuals differ uniquely from one another and will not agree on many things. An unproductive heritage left by the old school of 'human relations' is the notion that people should strive for harmony at all costs. A good leader (where mutual trust, mutual support, and genuine communication are well established) accepts conflict as normal, natural and as an asset, since it is from conflict that most growth and innovation are derived. It is also worth noting that conflict resolution is a group process and the notion that a manager can resolve a conflict between or among subordinates is a myth.

- *Mutual respect for individual differences.* There are decisions which, in a goal-oriented team, must be team decisions because they require the commitment of most or all of the resources of the team and cannot be implemented without this commitment. However, a good team will not demand unnecessary conformity of its members. It is easy for a group to drift into the practice of making decisions or forcing decisions on an individual where clearly, for his growth and for the good of the organization, he should make the decision. The individual member should be free to ask advice from other members who, in turn, will recognize that that person is not obligated to take the advice. A good team delegates within itself. In a well-established team with high mutual trust and support, the leader or a member will be able to make a decision, which commits the team. In such a team, only important issues need not be 'worked through,' and there is much delegation from leader to members, from members to members, and even from members to leader. Team building exercises included in this section of the handbook try to demonstrate most of the above mentioned characteristics of an effective team. However, the facilitator should select the best exercise that he will use to suit a particular situation.

Team building exercises included in this section of the handbook try to demonstrate most of the above mentioned characteristics of an effective team. However, the facilitator should select the best exercise that he will use to suit a particular situation. Team building exercises may be grouped into the following categories, namely:

A. Group Games

A game can be an end in itself. As adults, the justification for participating in game activities can be purely for personal enjoyment. No validity hassles; or attempting to manipulate the cognitive, affective, psychomotor triumvirate - just flat-out fun. If an ongoing program needs a boost because of scheduling problems, personality

conflicts or activity repetition, try playing a couple of these games. Games, presented in a lighthearted manner, can provide the morale growth that facilitates group cohesion and enthusiasm for the program. De-emphasize competition and try to present the activities in such a way that everyone will want to participate. Consider the following play pointers[41]:

- Don't just explain. Involve yourself in the activity. You don't have to play every game, but be ready to personalize the game with your person; get in there and mix it up with the group.

- Keep the rules to a minimum. Wordy explanations lead to pre-game boredom.

- Bend some rules occasionally or change a few as fits the participants and the situations.

- Don't run a good game into the ground. Play a game only at least once a day or once in a while (e.g., three straight days of any game in this sub-section is boring).

- Keep the participants playing. Don't include or evolve rules that permanently eliminate participants.

- Pick teams that are fair. Don't use the disastrous socio-gram method for choosing sides (e.g., asking two participants to pick their own teams).

- Play games that allow as much as 50:50 male-female split as possible. Organized sports generally demand a sex split and there's enough of that. These games can be played as well by either sex.

- Emphasize competition against self when competition seems natural. Trying to beat a time established by your own team or attempting to smash a nebulous world record is great fun with none of the second place, next time symptoms of the loser syndrome.

[41]Rohnke, K. 1988. Silver Bullets: A Guide to Initiative Problems, Adventure Games, and Trust Activities. Wilkcraft Creative Printing, Beverly, Massachusetts, U.S.A. pp14-78.

Exercise No. 6.11

THE LONGEST LINE

What is the purpose of this exercise?

- To develop sharing and cooperation among participants.
- The exercise is also useful in instilling group resourcefulness, which is an indispensable aspect in implementing a community-based program.
- Team members will be able to come up with successful program or activity results when they cooperatively work, voluntarily share their efforts, resources, ideas, and talents and actively participate in the undertaking.

What are the materials needed?

- Any articles found on the bodies of the participants.

Figure 39. Participants of an FFS on seaweed production make use of everything they have in their bodies to form a long line

How is the exercise undertaken?

1. Divide a big group of 25-30 participants into five smaller groups. Give the following instructions:

2. Make a line out of the articles found on the body of each group member within five minutes (**Figure 39**).

3. After completing the line, group members should form a straight line and clap their hands three times to announce that they have completed their task.

4. The group with the longest line wins. After giving the instructions, start the game. When the game ends, process and analyze the activity.

5. Ask the following questions:

   - What happened during the activity?
   - How did each group come up with their lines?

- What behaviors or attitudes did the group members show?
- Who's the group that won? Why did that group win? Why did the other groups lost?
- How do you associate the exercise in putting into operation a local FFS on seaweed production program?

1. Summarize the salient points arrived at in the exercise as it correlate to local implementation of FFS on seaweed production.

When is this exercise most appropriate?

This game is appropriate with a group of 25-30 participants. Use it as a starter for a session on 'Working with others.' Use it for sessions on how to go about group activities and carry out objectives successfully.

Exercise No. 6.12

BODY ENGLISH

What is the purpose of this exercise?

- To encourage discussion, decision-making, and cooperation of the participants.

What are the materials needed?

- Warm bodies of the participants

How is the exercise undertaken?

A big group of 25-30 participants is divided into three smaller groups. A group tries to spell out the words of a well-known proverb by using their bodies as letters. Forming letters with the fingers is not allowed. Another group tries to decipher what the first group is trying to say. The groups switch roles from time to time so that everyone gets the chance to be dramatic and disfigured.

When is this exercise most appropriate?

This activity will be most useful if done before or after a learning activity that needs group discussion, decision-making, and cooperation among the participants. This exercise may be undertaken to strengthen or to measure the learned knowledge of the participants on their cohesiveness as a group. This exercise may call for a participant to perform an activity that one may not normally do to one's self or that one may not normally do to others. The facilitators are therefore cautioned to do the exercise only when there is already a well-established rapport among the participants.

Exercise No. 6.13

BODY PARTS (P AND T GAME, FILIPINO VERSION)

What is the purpose of this exercise?

- To strengthen or measure the learned knowledge of the participants on their cohesiveness as a group.

What are the materials needed?

- Masking tapes and marking pens

How is this exercise undertaken?

A big group of 25-30 participants is divided into five smaller groups. A female and a male participant are selected from each of the small groups. Masking tapes and marking pens are provided to each group for marking. The females will mark all the body parts beginning with the letter **T** of their male partners. Similarly, the males will mark all the body parts beginning with the letter P of their female partners. Their group-mates may coach their respective group participants. The small group with the most number of marked **P** and **T** parts, that were processed and validated by the big group, wins.

When is this exercise most appropriate?

This activity will be most useful if done before or after a learning activity that needs group cooperation. This exercise may be undertaken to strengthen or to measure the learned knowledge of the participants on their cohesiveness as a group. This exercise may call for a participant to perform an activity that one may not normally do to one's self or that one may not normally do to others. The facilitators are therefore cautioned to do the exercise only when there is already a well-established rapport among the participants.

Exercise No. 6.14

'I THINK I KNOW IT' GAME

What is the purpose of this exercise?

- To demonstrate to participants the danger of making decisions without ample bases.

What are the materials needed?

- Five Manila papers with a circle (representing a head) already drawn on them and five marking pens

How is the exercises undertaken?

A big group of 25-30 participants is divided into five smaller groups. Five Manila papers with a circle drawn on them and five marking pens are prepared. Two participants from each of the small groups are selected. One will act as an 'illustrator' and the other as a 'guesser.' As the 'guesser' (with eyes closed or blindfolded) faces his other group members, the 'illustrator' faces a facilitator. As the facilitator points to a part in his head, his group members silently take note of that head part. The 'guesser' then guesses how many that head part is, without really knowing what part it is. Then the 'illustrator' draws how many head parts as guessed (even though he knows it is wrong) to the circle in the Manila paper provided. The facilitator asks each group, one at a time. The group with the most number of correct guesses wins.

> *Example:* How many like this (e.g., facilitator pointing to one of his eyes) do you have? If the 'guesser' says, "there are three," then the 'illustrator' draws three eyes, as the case may be.

When is this exercise most appropriate?

This activity is most appropriate after an agro-ecosystem analysis (AESA) activity. It is a very useful exercise to demonstrate the danger of making decisions without ample bases. It is possible that outcomes of the game will be such that most of the guesses are correct and the participants may be simply overwhelmed by the results. It is therefore important that the facilitator devise an appropriate strategy to counter outcomes, which may unclearly demonstrate the objective of the exercise.

Exercise No. 6.15

LIST AS MANY AS YOU CAN

What is the purpose of this exercise?

- To demonstrate the advantage of working in groups.

What are the materials needed?

- Pieces of papers and ball pens

How is this exercise undertaken?

1. The facilitator invites the whole group to listen while he/she reads a list of 20 wholly unrelated items such as:

   - ✓ pin chair blanket medicine
   - ✓ juice door line cake
   - ✓ phone spoon car bulb
   - ✓ sea cat globe watch
   - ✓ ship carpet light flower

2. After reading the list ONCE, participants are asked to write the items they can recall. After 3 minutes, ask who among the participants was able to list 20 items, 19, 18, and so on. Then ask them to work in pairs and give three minutes more for the task.
3. After three minutes, ask again which pair has listed 20 items, 19, 18, and so on. Next, ask them to group into four to do the same task in one minute.

4. When the time is up, ask which group was able to list all 20 items.
5. Process the activity when everyone has settled. Ask the following questions:

   - ✓ Were you able to list more items when you worked alone or when you worked in pairs?
   - ✓ Did working with a bigger group result in your being able to list more items? Why was this so?

6. Parallel the exercise with working in the community. Ask the participants if they think more will be accomplished in the community, particularly with farmers, if they work in teams rather than working alone. Find out why they think so.

When is this exercise most appropriate?

The activity will be most appropriate if the participants are asked to reflect on their experiences in implementing community projects. Ask them to parallel implementation of FFS with the exercise (e.g., completing list of 20 items). If a person works alone, he or she might not complete the list. This is true of community projects. More things are achieved by working together. Members need to cooperate and contribute their share or perform their roles to get more things done.

Exercise No. 6.16

PICTURE HANGING

What is the purpose of the exercise?

- To demonstrate the need for cooperation for successful teamwork. Illustrate the value of building from parts to make a whole.

What are the materials needed?

- Old magazines from where participants may cut pictures;
- Scissors, colored papers, cardboard or chipboard; and
- Paste, pieces of string, thumb tacks, or tapes (for hanging the frame) for each group.

How is the exercise undertaken?

1. Group the participants into five. Provide each group with a complete set of materials listed above. Provide the following instructions:

   ✓ Look for a picture that reflects your perception of how groups should work.
   ✓ Mount the picture using as many materials as could be used from the set provided the group.
   ✓ Hang the picture after mounting it.

2. Ask participants to talk about their experience in the context of working together and using parts to come up with a whole.

When is this exercise most appropriate?

Use the activity as a starter for a session on evaluating a training activity or program. View the parts out of which the picture frame is made as items that contributed to the whole training program. And that, without the cooperation of all the members of the group, it would have been difficult to achieve goals or accomplish targets.

Exercise No. 6.17

NINE-DOT GAME

What is the purpose of the exercise?

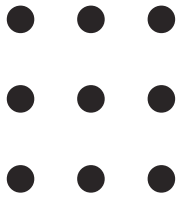
- To be aware of the concepts, objectives, and approach of the FFS on seaweed production program to the problems and issues of seaweed farmers in the local area. Compare with our past seaweed farming experiences.

What are the materials needed?

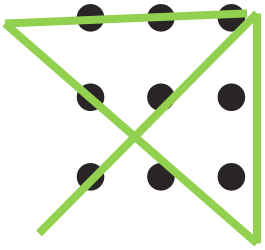
- Manila paper, tape, and pens

How is the exercise undertaken?

1. Draw nine dots up on a piece of Manila paper like this:



2. Ask the participants to try to join all of the nine dots with only four straight lines, and without lifting the pen from the page. Ask the farmers to share their results. The solution will be something like this:



3. Ask the farmers: Why was it difficult to find the way to do this at first? How did we overcome the problem?
4. Discuss how this relates to solving other problems (e.g., very often we need to look outside the things that we think are the problem, to understand the real

causes before we can go about solving them). In this game we had to look outside the square to find the solution.

5. Tell the farmers that the nine dots can represent the nine most important problems of farmers in this area. All of the problems begin with 'P.'
6. Ask them to help you list them. Adapt what is discussed to fit it into nine categories beginning with 'P' that are something like this:

   - ✓ Pests (diseases. Epiphytes, and grazers)
   - ✓ Poverty (profits are low)
   - ✓ Pesticides (poisoning due to cyanide fishing)
   - ✓ Programs (that are no good)
   - ✓ Politicians (do not help us)
   - ✓ Public health
   - ✓ Pollution
   - ✓ Provision of water
   - ✓ Protection of mangroves

7. The facilitators then use each of the nine problems to lead into an explanation of some of the central concepts and approaches of FFS on seaweed production. Here are some of the ideas that we talked about in our design session:

   - ✓ In the FFS, we explore ways to solve the problems of diseases and epiphytes, low profits, and pesticide poisoning.
   - ✓ The program is based on what seaweed farmers need and want to learn - farmers decide what we will do in the FFS on seaweed production.
   - ✓ The field school is based in farmers' seaweed farms and so looks at the real problems that are happening now.
   - ✓ We learn by exploring the problems together as a group. By working together we can discover how to start to work on problems that are too big for one person, the group can do much more than one.
   - ✓ By becoming a strong group, we will be able to get more support and attention from the local government or other organizations that we may want to influence.
   - ✓ The seaweed farms are a part of the local environment and the community, so we also look at the effects our actions has on things that are outside our fields.
   - ✓ The facilitators guide a participatory discussion on how FFS differs from our experiences and ideas of working together.

When is this exercise most appropriate?

Use the activity as a starter for a session on 'Concepts, Objectives and Approaches of the FFS on Seaweed Production Program.' Use the exercise to compare with our past experiences the FFS concepts, objectives, and approaches in addressing problems and issues of seaweed farmers in the local area.

B. Trust Activities

In any learning activity, we need to be constantly sensitive to group needs. We cannot emphasize often enough that building trust, openness, and honesty between people is the critical element for group actions. This demand great openness on our part, not only for others. As facilitators, we need to be open to feedback about the way we work and to take time to examine our own values, attitudes, and belief. Trust is never finally achieved. Even if a group has known each other well, the process of trust building is continuous[42].

Trust is a powerful and essential learning tool[43]. It is the key to personal involvement. At the end of a session in which trust activities have been used, it's satisfying to hear participants say, 'I'd like to try that', in contrast to their initial reaction of 'No way'! A part of the reason for the extent of this growth in personal confidence is the establishment of trust. Trust that: I don't have to 'do' everything; the safety equipment and procedures work; what the facilitators say is honestly presented; if I try something and fail, my peers will be supportive of my efforts; I will not be laughed at or made to appear foolish; my ideas and comments will be considered without ridicule.

A group surrounded with positive experiences and successes will experience trust growing apace with personal confidence. Trust within the framework of a participatory, discovery-based, and experiential curriculum is gained with patience, thoughtfulness, and care over a period of time, and can be damaged or lost in a second by carelessness or inconsiderate behavior. Cultivate and protect the trust that an individual offers and shares.

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[42]Hope, A. and S. Timmel. 1984. Training for Transformation 2: A Handbook for Community Workers. Mambo Press, Gweru, Zimbabwe. pp6-8.

[43]Rohnke, K. 1988. Silver Bullets: A Guide to Initiative Problems, Adventure Games and Trust Activities. Wilkcraft Creative Printing, Beverly, Massachusetts, U.S.A. pp79-94.

Exercise No. 6.18

WHERE AM I HERE?

What is the purpose of this exercise?

- As a discussion starter in developing trust among the participants and the facilitators.

What are the materials needed?

- Blackboard and chalk or newsprint and marking pens

How is the exercise undertaken?

The discussion leader goes up to the blackboard or newsprint and draws a square to represent the place where the group is currently holding its session. To help the participants picture where they are, he can draw some landmarks the group is familiar with like a nearby store or tree or house. The whole group must first be consulted as to what they want to put in the picture. Some might want to indicate where their farms are. Others might want to indicate where their homes are. When this has been decided, ask participants to come up to the blackboard or newsprint and put a circle or a cross to mark where from the community he is.

When is this exercise most appropriate?

Use this activity as the discussion entry point during the first meeting in a farmer field school. It does not require reading or writing that might be threatening to participants who do not possess the skill. It is thus a good starter in developing trusts among the participants and the facilitators.

Exercise No. 6.19

I DRAW MY SELF

What is the purpose of the exercise?

- To introduce one's self in a non-threatening and non-embarrassing manner.

What are the materials needed?

- Pieces of papers big enough to draw on (e.g., short-sized bond papers).

How is the exercise undertaken?

Provide each participant with a piece of paper and crayons. Give them 10 minutes to draw on their pieces of paper any objects that represent them. When everyone has finished, give each a chance to talk about his or her drawings. Encourage them to discuss why they chose the objects to represent themselves and the characteristics of the objects that resemble their personal qualities.

When is this exercise most appropriate?

Use this activity with a group of 25-30 participants preferably during the session on 'getting-to-know each other.' Allowing the participants to talk about objects that represent themselves provide non-threatening, non-embarrassing situation where each one learns about each other's positive and negative qualities. This will hasten the development of trust among the participants. Use this activity with extension workers, community organizers, and farmers.

Exercise No. 6.20

ESTABLISHING PARTICIPATORY NORMS

What is the purpose of the exercise?

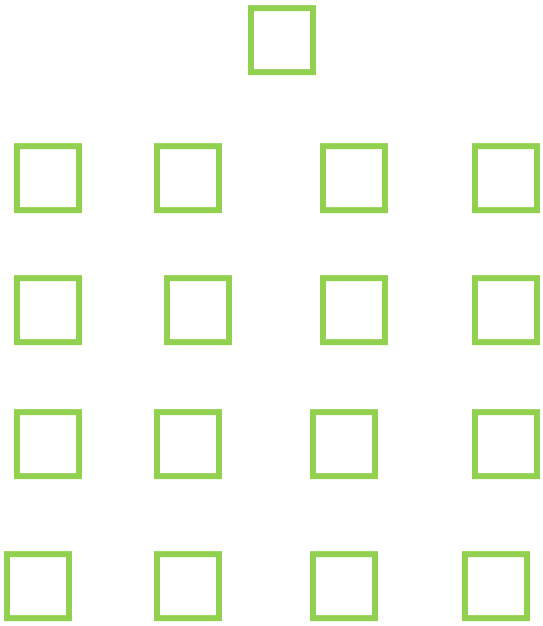
- To identify and set participatory norms for a training program or farmer field school (**Figure 36**).

What are the materials needed?

Manila papers, marking pens, and masking tapes

How is the exercise undertaken?

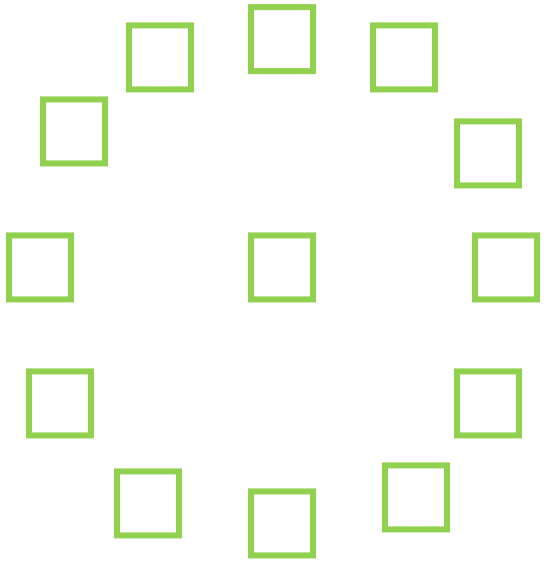
- On a Manila paper, present the following illustration:



1. Facilitate discussions by asking the following questions:

   ✓ In this kind of set-up, how would the participants feel? How will the group participate?
   ✓ What kind of group leader would there be? What kind of behavior may take place?

2. Present the second illustration (see **Figure 40A**):



3. Lead the discussion again using the same set of questions asked in the earlier discussion.

Figure 40. A facilitator stays at the (A) middle of farmer-participants who are arranged in a circle to solicit (B) group ideas, attitudes, and concerns during an exercise on participatory norm setting for FFS on seaweed production

- ✓ Expect the participants to express their ideas on the differences of facilitator's roles (**Figure 40B**).
- ✓ Expect them also to express their feelings about participants' behaviors as well as expected results based on the illustration presented.

4. Ask them what situation they would prefer.

5. Ask them what they should do to get the most benefit or results if they were placed in a non-formal, participatory situation.
6. Lead them into the discussion of setting the participatory norms (e.g., standards they would like to adopt to get the training program or farmer field school going on smoothly).

When is this exercise most appropriate?

This activity is most useful in a training program or farmer field school where the participants (including the facilitators) establish their own house rules that will eventually govern themselves. This activity will be very crucial in establishing initial trust among the participants and the facilitators.

Exercise No. 6.21

DYADS: GETTING TO KNOW EACH OTHER

What is the purpose of the exercise?

- To establish rapport among participants and develop cohesive working groups.

What are the materials needed?

- Envelopes, drawings of objects cut into halves (e.g., seaweeds-related objects like diseases and epiphytes), pencils or ball pens, sheet of papers

Figure 41. A dyad of partner-participants (A) interviews each other and then (B) each one introduces his/her new friend to the rest of the group during an exercise on 'getting to know each other' for FFS on seaweed production

How is the exercise undertaken?

1. Place one cut drawing of half an object inside each envelope.
2. Give the following instructions:

   ✓ Enclosed in this envelope are drawings of halves of objects.
   ✓ Try to locate the person who has the other half of the object you picked.

- ✓ When you find him/her, sit with her and get the following information: name; occupation; job-related information like specialized skills, previous job experience, training attended, other abilities; and personal information.

3. Give sufficient time for partners to interview each other (**Figure 41A**).
4. Ask each one to introduce her new friend to the rest of the group (**Figure 41B**).
5. Give a time limit of two to three minutes to each participant to introduce his or her new friend.

When is this exercise most appropriate?

Use this activity during the earlier sessions of a training activity. Use it during the session on 'getting-to-know-each-other.' The activity helps build immediate rapport between the interviewed and the interviewer. It should help form cohesive working teams through establishment of trust and confidence with a co-participant. Use the activity with extension workers, community organizers, and farmers.

Exercise No. 6.22

BLINDFOLD EXERCISE

What is the purpose of the exercise?

- To generate commitment from participants for the implementation of a project.

What are the materials needed?

- Handkerchiefs, box, padlock, keys, ball pens, small pieces of paper

How is the exercise undertaken?

1. Each participant should find a partner. With handkerchiefs, ask a person **A** of every pair to be blindfolded.
2. Ask person **B** of every pair to bring person **A** to take a walk in a familiar place like a garden or a lawn. Person **B** should be responsible for leading person **A** merely by giving directions and without necessarily holding him or her.
3. Suggest that along the way each pair may talk about training-related experiences. Ask participants to change roles after 15 minutes so that person **B** is now blindfolded and person **A** is the guide for the next 15 minutes.
4. Without letting at least two blindfolded persons know, ask their guides to leave them before they reach the other end.
5. Observe the reactions of the blindfolded persons without guides. (Facilitators must make sure these blindfolded persons get to the session hall safely).
6. Process the activity when all participants are back in the session hall.
7. Ask participants to parallel the blindfolded walk in the garden to the training program. The facilitator may ask the following questions:

    ✓ Along the way, what obstacles did those blindfolded meet? (Parallel these obstacles to problems in the training program).
    ✓ For those who have difficulty trusting their partners, why was this so? (Touch on the sense of commitment of persons such as trustworthiness, reliability, among others, which affects how people perceive persons they can trust).
    ✓ How did the blindfolded persons feel when their guides left them? (Discuss this in terms of people letting down commitments or failing to keep commitment. Discuss commitment in the light of properly turning over responsibilities).

8. Relate the problems, situations, conflicts that cropped-up during the activity to what might happen during the implementation of the FFS on seaweed production project.

9. End the activity by asking the participants to write on small slips of paper at least five things they will do to promote FFS.
10. Put all pieces of paper in a box and secure the box with a lock. Inform the group that the box will be opened after three to four months when they get together again. This will be the time when they may assess the extent of their commitments based on the degree to which they implemented their plans. Participants shall keep the keys of the lock while facilitators may keep the box containing participants' plans.

When is this exercise most appropriate?

Use the activity toward the middle of the training program, when participants need to discuss about commitment and think about how they intend to promote FFS. The use of a box that can be locked to contain participants' list of commitments has an element of suspense that contributes to the effectiveness of the exercise. However, facilitators must make sure to be back in the area to go over the list of plans on the date and time agreed upon. Failure to do so will disappoint participants' expectations.

Exercise No. 6.23

TRUST WALK

What is the purpose of the exercise?

- To generate commitment and active participation anchored on trust from participants for the implementation of a project.

Materials:

- Spacious room or lawn, and handkerchiefs (optional)

How is the exercise undertaken?

Begin by pointing out that: 'The success of our program depends on participant participation'. But participation depends upon trust. To symbolize the importance of trust, let's conduct a trust walk. Is there anyone who doesn't want to participate? O.K., here are our procedures:

- Find a partner, preferably someone you don't know at all or don't know very well. In your pair, decide who will be the leader and who will be the follower. (This step can also be done randomly by having everyone call out 'one' and 'two,' with the 'ones' automatically becoming the leaders and the 'twos' the followers.) The followers are to close their eyes. The trust walk is done silently, non-verbally.
- When the signal is given, the leader will steer the follower around the designated area. The leaders should try to make the trip as interesting as possible and should do so safely. Remember eyes closed, followers, since you trust your leader to insure that no harm befalls you. Then, walk around, for five minutes or so. (The period can be 15-20 minutes in an experiential program that emphasizes sensory awareness and where the outdoors is available to feel the trees and rocks, smell of flowers, and so on.)
- Stop walking and process the action. Followers: How did you feel? Anxious? Fearful? Dependent? Trusting? (Secure several responses.) Leaders: How did you feel about your role and responsibility? Concerned? Silly? Responsible? (Secure several responses.)

Was a system of communication established? Was trust accomplished to any degree? Any general comments or reactions from anyone?

When is this exercise most appropriate?

Use this activity to illustrate how to generate commitment and active participation anchored on trust from participants for the implementation of a project. Several key or skill points to make the trust walk an effective experience are:

- Keep it voluntary. Don't put pressure on anyone to participate. This would defeat the purpose of the exercise, which is building trust.
- Limit the use of this activity to groups oriented toward experiential learning activities.
- Stress the non-verbal or silent aspects of it. This behavior is typically hard for participants to grasp. (Although 'non-verbal' means 'no talking,' we may have difficulty communicating the idea.)
- To make the experience worthwhile, the walk should take at least five minutes. Tell them that you will signal them when the five minutes are up, and that if they quit sooner they don't get much out of the experience.

The facilitator should be ready to adapt the trust walk experience to the needs of the group (e.g., with TOS or TOT participants, the processing of feelings can be shifted to a discussion of how farmers feel in a farmer field school). Or are we only concerned with our feelings as trainers? Also, how do we develop trust with our prospective client?

C. Initiative Exercises[44]

Initiative exercises offer a series of clearly and often fanciful defined problems. Each task is designed so that a group must employ cooperation and some physical effort to gain a solution. Some problems are more cerebral than physical and vice-versa. This problem-oriented approach to learning can be useful in developing each individual's awareness of decision-making, leadership, and the obligations and strengths of each member within a group.

Participants engaged the problem in-groups to take advantage of the combined physical and mental strengths of a team. These initiative problems also can be employed to promote an individual's sense of his own competence, and they also serve to help break down some of the stereotypes which exist so comfortably in our social network. Finally, initiative problems are a paragon for building morale and a sense of camaraderie.

[44]Rohnke, K. 1988. Silver Bullets: A Guide to Initiative Problems, Adventure Games, and Trust Activities. Wilkcraft Creative Printing, Beverly, Massachusetts, U.S.A. pp95-143.

Exercise No. 6.24

MENTAL MAP EXERCISE

What is the purpose of the exercise?

- To introduce participants to and gather information on what they know about FFS on seaweed production.

What are the materials needed?

- Big sheets of paper (e.g., big enough for four persons to draw or write on at the same time, such as Manila paper)
- Drawing materials, preferably permanent markers (e.g., marking pens)
- Masking tapes with which to put drawings up on the walls

How is the exercise undertaken?

Put out two or three pieces of paper on the floor and several pieces of marking pens with each. For 10 minutes, ask participants to think of what they know about FFS on seaweed production. Then give the instruction that anybody can just go to the floor to draw or write his thoughts about FFS on seaweed production. Give enough time for each one to draw or write on the paper. Put up the drawings on the walls and discuss ideas or thoughts written on them.

When is this exercise most appropriate?

Use this activity with a group of 25-30 participants during the orientation session right after leveling of expectations of the participants and facilitators. There are no right or wrong answers. However, the activity gives facilitators an idea as to where participants are (e.g., their concepts or misconceptions on FFS that may be important to consider in the discussion of the training design). It should be interesting to leave the drawings up on the walls for the entire period of the training program. Toward the end of the training program, use the same exercise to compare the differences in participants' ideas about FFS on seaweed production.

Exercise No. 6.25

ANIMAL SOUNDS: FINDING ONE'S GROUP

What is the purpose of the exercise?

- To illustrate individual's need to belong (e.g., need to be accepted).

What are the materials needed?

- 25 small pieces of paper, pencils, or ball pens.

How is the exercise undertaken?

1. Think of five different kinds of animal. These may be dog, cat, duck, pig, and carabao.
2. Write down one kind of animal on each piece of paper. Make sure to have the same number of papers for all the kinds of animal.
3. After writing on the pieces of papers fold each one. Mix the folded pieces of paper together. Then, ask each participant to pick one but not to open the paper that he or she picked.
4. When each one has picked a piece of paper, ask them to look at the kind of animal written. Nobody should let anyone else know what was written on his paper. Nobody should speak to anyone else. Nobody should make any sound at all.
5. Participants can only do the action of the animal that they picked and find their group by looking at the actions made by the other members.
6. Process the activity when each participant has found his group. Ask the following questions to everyone:

   ✓ Did you enjoy the game?
   ✓ How did you feel when you could not find your group?
   ✓ Do you think farmers will want to come back to farmer field school if they feel they do not belong?
   ✓ How can we make farmers feel accepted in the farmer field school?

7. Accept all answers. Accepting all answers will encourage participants to share in the discussion as well as give them the feeling of respect. Emphasize individual's need to belong or the need to be accepted.

When method is most appropriate:

The exercise is most appropriate as an initiative activity in the morning or before the start of the afternoon sessions with a group of 25-30 extension workers, community organizer, and farmers. Use it any time of the day when the group needs to do some perk-up activity.

Exercise No. 6.26

BATTLE OF ANIMALS

What is the purpose of the exercise?

- To demonstrate the value of planning and coordination for a successful teamwork.

What are the materials needed?

- Warm bodies of participants

Figure 42. A group of participants role-plays the act and sound of (A) lions and (b) apes during an exercise on 'battle of animals' for FFS on seaweed production

How is the exercise undertaken?

1. A big group of 25-30 participants is divided into five smaller groups.
2. An animal, its action, and its sound are assigned to each of the small groups, as
3. follows:

   - ✓ Cat = meow, meow
   - ✓ Lion = growl, growl (**Figure 42A**)
   - ✓ Dog = bow wow wow, bow wow wow
   - ✓ Ape = eek, eek (**Figure 42B**)
   - ✓ Cow = moo, moo

4. A facilitator starts the game by pointing to an animal group. That animal group then says in synchrony the corresponding animal sound thrice before calling out

another animal group who, in turn, will respond by saying in synchrony their corresponding animal sound.

5. The process is repeated several times making sure every animal group participates actively.
6. A group who commits mistakes or who does not say the animal sound in synchrony is eliminated. The group that is most systematic and organized wins.

> *Example:* The cat group says: cat, meow, meow/cat, meow, meow/cat, meow, meow to bird, tweet, tweet. The bird group then says bird, tweet, tweet/bird, tweet, tweet/bird, tweet, tweet to dog, bow, wow, wow and so on...

When is this exercise most appropriate?

This exercise is useful in demonstrating the value of planning and coordination for a successful teamwork. The exercise also underscores the value of a systematic as well as organized group. Once a winner is declared, it will be nice to process in the big group the factors that made the winning group win over the rest. Expect different answers. Be sure to relate it to the theme of the exercise.

Exercise No. 6.27

BATTLE OF SPORTS

What is the purpose of the exercise?

- To demonstrate the value of planning and coordination in successful teamwork.

What are the materials needed?

- Warm bodies of participants

Figure 43. Farmer-participants of FFS on seaweed production, in small groups, role-play (A) volleyball and (B) baseball games during their initiative exercise on 'battle of sports'

How is the exercise undertaken?

1. Divide the big group of 25-30 participants into five smaller groups.
2. Assign one sport activity or action to each group (**Figure 43**). You may use the following sports activities or actions:

   ✓ BASKETBALL, SHOOT
   ✓ VOLLEYBALL, TOSS (**Figure 43A**)
   ✓ BASEBALL, BAT (**Figure 43B**)
   ✓ FOOTBALL, KICK

3. Point to any one group to start the game.
4. The group should say its sport and its corresponding action thrice before calling out the sport and a corresponding action of the group it has chosen to respond.

5. The group that is selected does the same (e.g., say its sport and its corresponding action thrice before calling out the sport and corresponding action of another group.

   For example: The basketball group may say, BASKETBALL SHOOT, BASKETBALL SHOOT, BASKETBALL SHOOT TO FOOTBALL KICK. The football group should answer FOOTBALL KICK, FOOTBALL KICK FOOTBALL KICK TO VOLLEYBALL TOSS, and so on.

6. Eliminate any group that makes a mistake in calling out or doing the actions of any of the sports activities. The group that is not eliminated automatically wins.
7. When a winner has been identified, ask the winning group why they think they won over the rest. (Expect different answers). Ask the following questions:

   - ✓ Why did your group not make any mistake?
   - ✓ How did you choose which group you were going to call out next?
   - ✓ Did you have a leader?
   - ✓ Did you plan out? Accept all answers.

8. Accepting all answers will encourage participants to share in the discussion as well as give them the feeling of respect.
9. Emphasize the value of planning and coordination for successful teamwork.

When is this exercise most appropriate:

The exercise is most appropriate as an initiative exercise in the morning or before the start of the afternoon sessions. However, use it any time of the day when the group needs to do some perk-up activity.

Exercise No. 6.28

THE BOAT IS SINKING

What is the purpose of the exercise?

- To illustrate individual needs for belonging (e.g., need to be accepted by others).

What are the materials needed?

- Warm bodies of participants

How is the exercise undertaken?

1. One participant, perhaps a volunteer, should serve as the captain. The captain calls out: 'The boat is sinking. Group yourselves into _____'. (The captain may select whatever number he wants to call out).
2. As the number is called out, the participants group themselves accordingly (**Figure 44**)
3. Eliminate persons who do not find groups to join with. The game ends when there are only one or two people left.

Figure 44. Farmer-participants of FFS on seaweed production group themselves during their initiative exercise on 'the boat is sinking'

4. At the end of the game, ask the following questions to everyone:

   ✓ Did you enjoy the game?
   ✓ How did you feel when you could not be accommodated in any group?
   ✓ Do you think farmers will want to come back to farmer field school if they do not feel accepted?
   ✓ How can we make farmers feel they are accepted in the farmer field school?

5. Accept all answers. Accepting all answers will encourage participants to share in the discussion as well as give them the feeling of respect.

6. Emphasize individual's need to belong or the need to be accepted.

When is this exercise most appropriate?

The exercise is most appropriate as an initiative activity in the morning or before the start of the afternoon sessions with a group of 25-30 extension workers, community organizers, and farmers. However, use it anytime of the day when the group needs to do some perk-up activity.

D. Group Dynamics Exercises

Group dynamics or group process is defined as the interaction of the forces or energies of the environment called process elements, at any given time, which actively influence the individual, the group, and the situation[45]. Elements in this interaction are perceived as either threatening or accepting. In either case, tension can grow within the subject. The more rigid his or her position toward what he or she perceives as threatening, the more tense he or she becomes. Tension can reach an explosive level. It is at this point that release of tension is often affected by aggressive behavior. On the other hand, one who less rigidly responds to pressures from his or her environment is less tense and, therefore, more apt to manifest accepting behavior.

The concepts of valence and tension play significant roles in the study of group dynamics. To a participant, for instance, group acceptance can be a positive valence and group disapproval a negative one. If a group shows characteristics attractive to a participant, it elicits an approach behavior from him or her. If the group behaves threateningly, avoidance behavior may well result in the participant. Group dynamics exercises are meant to help counter negative attitudes and perceptions resulting from group interactions among participants and facilitators during the learning process. Group dynamics activities are either games, trust exercises, or initiative activities that are more often used as group exercises by facilitators in the conduct of TOSs, TOTs, and FFSs in the Philippine. These group dynamics activities are included to[46]:

- Develop the participants into a closer knit FFS team;
- Establish a learning climate that is enjoyable as well as fruitful;
- Help participants experience and be able to identify such aspects of teamwork as mutual support, the importance of individual roles to a team's success, and behaviors that can build or hinder teamwork; and
- Help participants to experience what can be accomplished by working together.

Facilitators implementing FFS Programs in the Philippines have been trained in these group dynamics activities and they make use of those activities that they feel are most appropriate to their situations. Some of these group dynamic activities[47] are provided in the next pages.

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[45]Ortigas, C.D. 1994. Group Process and Inductive Method: Theory and Practice in the Philippines, Ateneo de Manila University Press, Loyola Heights, Quezon City. pp1-10.

[46]Philippine National IPM Program, 1993. The KASAKALIKASAN Program Document. National Agricultural and Fishery Council, Department of Agriculture, Diliman, Quezon City. pp19-30.

[47]Philippine National IPM Program. 1993. Handbook on KASAKALIKASAN IPM Training Exercises Developed, Adapted, and Used by Philippine IPM Trainers. National Agricultural and Fishery Council, Department of Agriculture, Diliman, Quezon City. pp13-47.

Exercise No. 6.29

BUILDING A BRIDGE

What is the purpose of the exercise?

- To describe different types of leadership;
- To make a list of different characteristics of each type of leader; and
- To list down the things that a good leader should not do.

What are the materials needed?

- Cartolina or cardboard, masking tapes, pairs of scissors, marking pens, and pencils for each group.

How is the exercise undertaken?

1. Divide a bigger group of 25-30 participants into five smaller groups. Let the members of each group choose a leader.

2. Meet these leaders in a separate room while the rest of the participants are asked to guess what instructions are being given to the leaders. (Assign roles for each leader to play. One may play the role of an authoritarian or autocratic leader; another one may play the role of a democratic leader. Group leaders are successful if they can play their roles well. For example, group members may react negatively to the autocratic leader).

3. Upon return to their respective groups, give the following instructions:

   ✓ Each group should build a bridge using a piece of cardboard or cartolina.
   ✓ The boards may not be enough but it is up to the group to do something about the other materials they need.
   ✓ Groups may choose wherever they want to work while constructing their bridges.
   ✓ However, after 10 minutes, the group should gather to present their outputs.

4. Ask the following questions during the presentation of outputs:

   ✓ Which group finished its bridge? What contributed to the completion of
   ✓ The bridge? Why were other groups not able to complete their bridge?
   ✓ What type of leadership did each group leader demonstrate?
   ✓ What characteristics of a leader did each of the group leader show?
   ✓ What things should a good leader not do?

When method is most appropriate:

The exercise is most appropriate when introducing a session on leadership. Use it in a training of 25-30 participants. It is also appropriate when team building on cohesiveness and cooperation is needed. This exercise is also useful to describe which type of leadership is appropriate for a particular situation[48]. For example, if there is an outbreak of 'ice-ice' disease in a field school and it is impossible to meet with farmer-participants immediately, an *authoritarian* leadership style is appropriate. In a new group with a strong experienced leader, while group members feel insecure about their own identity or role in a group, a *consultative* style may be more appropriate. If the aim of the program is to help people develop maturity and responsibility, participating in making their own decisions, then the *enabling* style of leadership is essential.

[48]Hope, A. and S. Timmel. 1984. Training for Transformation 3: A Handbook for Community Workers. Mambo Press, Gweru, Zimbabwe. pp69-112.

Exercise No. 6.30

BUILDING TOWERS

What is the purpose of the exercise?

- To state behaviors or attitudes which contribute to and which hinder team building.

What are the materials needed?

- 30 pieces of plastic straw for each group, masking tape, and scissors (place these on a table for everyone to see but not distributed to the groups)

How is the exercise undertaken?

1. Ask participants to group themselves into five smaller groups.
2. Give each group 30 pieces of plastic straw.
3. Tell them that they are given 20 minutes to build a tower. Do not give any elaboration about the tower they are build.
4. The groups have to discuss among themselves how to go about building their towers.
5. Put a roll of masking tape and scissors in front of the room for everyone to see. However, do not call their attention to these materials. The objective of this is to see how the groups make use of resources that might be available to them.
6. As each group finishes its tower, write down the time in terms of number of minutes that it took to complete their output. After 20 minutes, announce that the time is up.
7. Ask all the groups to put their towers in the center of the room so that everyone gets a good view of all the outputs.
8. Process the activity. Parallel the towers to teams or groups. Certain behaviors or attitudes of group members contribute to make a strong team or group:

    ✓ Ask participants what factors contributed so that they completed their towers.
    ✓ Ask them what behaviors or characteristics among group members hindered the completion of the group's outputs.

When is this exercise most appropriate?

The activity is most appropriate for a session focusing on behaviors that contribute to and which hinder team building. Because participants talk about their teams in terms of the towers they built, it does not become threatening to talk about behaviors or attitudes that normally may not be comfortable to discuss.

Exercise No. 6.31

DRAWING: NO LIFTING OF PEN

What is the purpose of the exercise?

- To develop cohesion and cooperation among group members.

What are the materials needed?

- Chalkboard and chalks or newsprint and marker pens

How is the exercise undertaken?

1. Group the bigger group of 25-30 participants into five smaller groups before giving the following instructions:

   ✓ For five minutes, draw a farmer without lifting a pen.
   ✓ Give each participant one minute to do his share in the drawing activity.

2. After giving the instructions, start the game. When the groups have implemented the first set of instructions, give the next set of directions.
3. This time, give each group five minutes to plan together on how to come up with an illustration of a farmer where each group member has a part in completing the drawing. Give each group five minutes more to work on their drawings as planned.

4. Evaluate each group's drawings after five minutes. Ask the following:

   ✓ How did the first drawing look? How does your drawing look this time? Why was this so?
   ✓ How did you come up with your second drawing?
   ✓ What attitudes or behaviors did each member exhibit?
   ✓ Are you happy with the result of your first drawing? Your second drawing?

The first drawing activity showed how each group could work together without a clear plan and direction. However, result of the activity may not really show the figure being asked for. If each group has planned cooperatively on how the activity should be undertaken and each member has an assignment to perform and guidelines to follow, results certainly are better if not best.

When is this exercise most appropriate?

This game is appropriate for a group of 25-30 participants. Use this as a group dynamic exercise, an icebreaker, or a starter for sessions on planning, problem solving, leadership, community organizing, or group work.

Exercise No. 6.32

WINNER TAKES ALL

What is the purpose of the exercise?

- To assess strengths and weaknesses of the group and enumerate things to do to overcome weaknesses of the group.

What are the materials needed?

Set of objects that are non-functional unless they are used together. For example:

- Betel nut, tobacco leaf, lime, and a can to be used as a spittoon
- Left shoe, right shoe, left sock, and right sock
- Ball pen cap, ball pen ink (filler), ball pen body, and piece of paper
- Hot water in a cup (e.g., tape a piece of paper labeled hot water to the cup; the person who picks this may then get the hot water for himself), pack of coffee, pack of sugar, and teaspoon

How is the activity undertaken?

1. Prepare enough items so that each person in the group may pick one.
2. Put all items in a big box and mix them up.
3. Go around the room asking each person to pick one object from the bag or box without looking. When each one has picked an item, give the instructions.
4. Without speaking to anyone, they should look for their groups. No one can ask for anything, but anyone may offer her object if she finds her group-mates.
5. When a group has assembled all the items, they should use or consume the object. Otherwise, their group does not win. For example, the group that gets the betel nut, tobacco leaf, lime, and spittoon should share the items and therefore, chew the mixture. The group that gets the ball pen parts should put all the parts together and each member should use the pen to write on the piece of paper.
6. Process the activity when all the groups have used or consumed their objects.

    ✓ Ask which group finished first and why.
    ✓ Ask which group finished last and why.

7. Discuss strengths and weaknesses of groups in terms of factors that contributed to getting their objects completed and eventually being used.

Certain behaviors or attitudes of group members contribute to make a strong team or group. Ask them what behaviors or characteristics among group members

hindered the completion of the groups' outputs. After discussing weaknesses of the groups, they might want to suggest things to do to overcome weaknesses. There might be instances when participants are not familiar or do not have the habit of chewing betel nut. In these situations, it might be fun to discuss what the group felt when they had to chew the items to comply with the instructions.

When is this exercise most appropriate?

The activity is appropriate for a session focusing on behaviors that contribute to and which hinder team building. Because participants talk about their teams in terms of the objects they completed and used, it does not become threatening to talk about behaviors or attitudes that normally may not be comfortable to discuss.

ENERGIZERS AND ICEBREAKERS

Although a group of participants who know one another quite well may not require energizing and icebreaking activities, groups of outsiders can certainly gain from them. Facilitators, all too typically, merely warm up their groups via various introduction-type procedures. For example: 'Kindly stand up when your name is called and tell us your nickname, job description, organization and why you are here'. This ritual may have some value, but all too often it becomes meaningless because the required responses are inaudible and the participants do not listen or are bored by the routine involved[49]18. This is particularly true if 25-30 or more people offer the introductions.

Another problem is that participants may have needs more significant than merely to learn other participants' names and job descriptions. Since the odds are that the usual introduction won't do much for the participants, it is essential to use more dynamic, experiential activities, such as energizers and icebreakers, for warm-up purposes.

Energizers and icebreakers[50] are learning activities that enable facilitators to begin sessions with impact and comfortably acquaint participants with one another. Participants thus find themselves in a cordial climate allowing them to fully concentrate on the primary learning objectives with minimum tension and anxiety. These activities are also useful in re-energizing learners during low periods, providing a change of pace, and stimulating responsively to new concepts and skills. These may also provoke the flow of 'creative juices' and encourage members to invest more of themselves in the group. Energizers provide the means for a smooth and natural transition between sessions and topics. They also serve as excellent warm-up activities.

The energizers and icebreakers in the following pages are simply understood and easy to administer. They can be used singly, or several may be used depending upon the objectives, the nature of the group, available time, among others. Most of these had been successfully tried in the Philippine National IPM Program in the conduct of TOS, TOT, and FFS activities. To achieve the objectives of an energizer or icebreaker, the facilitator selects the appropriate activity based on the accurate reading of the participants' learning needs. The facilitator ought also to be sensitive to their receptiveness to the selected activity.

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[49]Eitington, J. E. 1984. The Winning Trainer: Winning Ways to Involve People in Learning. Gulf Publishing Company, Houston, Texas, U.S.A. pp1-9.

[50]Ortigas, C. D. 1997. Group Process and the Inductive Method: Theory and Practice in the Philippines. Second Edition, Ateneo de Manila Press, Loyola Heights, Quezon City. pp13-26.

A. Perk-Up Songs (Action Songs)[51]

At other times, the facilitators may lead the group in singing some popular tunes with specific themes related to the learning situation, or favorite tunes that the group may feel like singing at the moment. Singing, dancing, and encouraging the group to stretch and shake for a few minutes will help ease tense muscles.

Participants themselves may have a good number of perk-up songs, waker-uppers, relaxers, and what-have-you to contribute to the sessions. Facilitators need not hesitate in tapping the learners' own creativity and resourcefulness. The following are some of the most common perk-up songs successfully used in local FFS training activities in the Philippines.

[51]Philippine National IPM Program. 1993. Handbook on KASAKALIKASAN IPM Training Exercises Developed, Adapted, and Used by Philippine IPM Trainers, National Agricultural and Fishery Council, Department of Agriculture, Diliman, Quezon City. pp48-63.

Exercise No. 6.33

THERE'S A WELCOME HERE

There's a welcome here (2x)
There's a warm, warm welcome here
There's a welcome here (2x)
There's a warm, warm welcome here
We welcome you (3x)

What is the purpose for singing?

- To demonstrate warm acceptance of guests or visitors.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens.

How is the activity undertaken?

Introduce the melody of the song. Sing it when guests or visitors join the group. After singing, the guests may introduce themselves to the participants or somebody from the group may assume the responsibility of introducing them. Warm acceptance of guests or visitors demonstrates openness or desire to share among group members or participants.

When is this activity most appropriate?

It is best to use the song when somebody new comes to join the activity or just visit and observe what is going on.

Exercise No. 6.34

ENGLISH VERSION: LORD, ON THIS VERY HOUR I PRAY

Lord, on this very hour I pray
The strength to live my best today
Draw near to me that I shall see
The kind of person I shall be

In serving others I may see
That I am only serving thee
Teach me oh, Lord on thy great plan
That I may be a better man

Figure 45. Farmer-participants of FFS on seaweed production pray by singing 'panalangin' as perk-up song.

PILIPINO VERSION: PANALANGIN

Panginoon dalangin ko
Lakas ng pangangatawan
Lumapit Ka ng makita
Uri ng pagkatao ko

Paglilingkod sa kapwa ko
Paglilingkod na rin sa'Yo
Ituro ang tamang daan
Ibako Ka'ng paglingkuran

What is the purpose for singing?

- To provide opportunity for participants to reflect on or become aware of the kind of persons they are.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens for use in writing the lyrics of the song.

How is the activity undertaken?

Introduce the song before the start of the day's activities. While they are singing, ask participants to reflect on themselves. Ask them to think of how they have been

performing their jobs and how they can improve on themselves. Ask them also how they can be of more service to their fellowmen.

When is the activity most appropriate?

Use the activity with a group of 25-30 participants of extension workers, community organizers, or farmers. It is most effective when done at the beginning of the day (**Figure 45**).

Exercise No. 6.35

MAKING MELODIES IN MY HEART

Making melodies in my heart (3x)
For the King of kings

Action (Repeat the melody while doing the specified action)

Cumulative Actions:

- Thumb in
- Elbow up
- Knees bent
- Feet apart
- Tongue out

What is the purpose of the activity?

- To serve as icebreaker (e.g., to perk-up the group) and demonstrate the need for coordination among members in a team activity.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action as announced by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. This is essential among members of the group for the success of any activity or understanding.

When is the activity most appropriate?

The song is appropriate for a group of 25-30 participants. It is good starter for a session on cooperation and coordination or for a session on working with others.

Exercise No. 6.36

BAHAY KUBO

Bahay kubo, kahit munti
Ang halaman doon, ay sari-sari
Singkamas at talong, sigarilyas, at mani
Sitaw, bataw, patani
Kundol, patola, upo't kalabasa
At saka mayroon pang labanos, mustasa
Sibuyas, kamatis, bawang, at luya
Sa paligid-ligid ay puno ng linga

What is the purpose for singing?

- To serve as icebreaker (e.g., perk-up the groups) and to illustrate the need for leadership and coordination as factors contributing to successful group work.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens for writing the lyrics of the song

How is the activity undertaken?

Introduce the song. When participants have become familiar with the tune, divide the whole group into three. Ask each group to sing the song either as an opera, orchestra, or rock. Somebody should act as the conductor. As the conductor, he/she can point to any of the groups to sing the song the way they have been assigned to. The group he/she points to next should continue singing from where the previous group finished, likewise singing in the manner that had been assigned to them. Ask participants what happens when there is no conductor or leader to coordinate the singing of the song. Emphasize the parallelism of singing in-groups following the conductor's baton to successful teamwork as a result of effective leadership and group coordination.

When is the activity most appropriate?

Use the song as a starter in the morning or in a session following a break. Use it with any number of participants.

Exercise No. 6.37

LERON, LERON SINTA

Leron, leron sinta, buko ng papaya
Dala-dala'y buslo, sisidlan ng bunga
Pagdating sa dulo, nabali ang sanga
Kapus kapalaran, humanap ng iba

What is the purpose for singing?

- To serve as icebreaker (e.g., perk-up the groups) and illustrate the need for leadership and coordination as factors contributing to successful group work.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens for writing the lyrics of the song

How is the activity undertaken?

Introduce the song. When participants have become familiar with the tune, divide the whole group into three. Ask each group to sing the song either as an opera, orchestra, or rock. Somebody should act as the conductor. As the conductor, he/she can point to any of the groups to sing the song the way they have been assigned to. The group he or she points to next should continue singing from where the previous group finished, likewise singing in the manner that had been assigned to them. Ask participants what happens when there is no conductor or leader to coordinate the singing of the song. Emphasize the parallelism of singing in groups following the conductor's baton to successful teamwork as a result of effective leadership and group coordination.

When is the activity most appropriate?

Use the song as a starter in the morning or in a session following a break. Use it with any number of participants.

Exercise No. 6.38

THE TIME TO BE HAPPY IS NOW

The time to be happy is now
And the place to be happy is here
And the way to be happy is to make others happy
And to build a little heaven down here

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk-up the group) and illustrate the need for participation of all the members in a team activity.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens for writing the lyrics of the song

How is the activity undertaken?

Introduce the song. When participants have become familiar with the tune, ask them to omit the words that begin with the letter '**H**'. Ask the participants what happens when they omit certain words from the song. Emphasize the parallelism of omitting words from the song to group members who are absent from a team activity (e.g., how their absence affects the teamwork).

When is the activity most appropriate?

Use the song as a starter in the morning or in a session following a break. Use it with any number of participants.

Exercise No. 6.39

MY TOES, KNEES, SHOULDERS AND HEAD

My toes, my knees, my shoulder, my head (3x)
We all clap our hands together.

Version:

- Normal
- Sexy
- Macho
- Japayuki

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group) and to demonstrate the need for coordination among members in a team activity.

What are the materials needed?

- Chalkboard and chalk or newsprint and markers

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action as announced by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. This is essential among members of the group for the success of any activity or undertaking.

When is the activity most appropriate?

The song is appropriate for a group of 20-25 participants. It is a good starter for a session on cooperation and coordination or for a session on working with others.

Exercise No. 6.40

FRUIT SALAD

Melon (4x), papaya (2x), saging (6x)
Fruit salad (2x)

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group) and demonstrate the need for coordination among members in a team activity.

What are the materials needed?

- Chalkboard and chalk or newsprint and marking pens

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action as announced by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. This is essential among members of the group for the success of any activity or undertaking.

When is the activity most appropriate?

The song is appropriate for a group of 20-25 participants. It is a good starter for a session on cooperation and coordination or for a session on working with others.

Exercise No. 6.41

COCONUT

C-O (2x), N-U-T (3x)
C-O (2x), N-U-T, N-U-T

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group) and to demonstrate the need for coordination among members in a team activity.

What are the materials needed?

- Chalkboard and chalk or newsprint and marking pens

Figure 46. Farmer-participants of FFS on seaweed production spell (A) letter 'C' and (B) letter 'T' using their bodies while singing the perk-up song, 'coconut'.

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action (**Figure 46**) as portrayed by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. This is essential among members of the group for the success of any activity or undertaking.

When is the activity most appropriate?

The song is appropriate for a group of 20-25 participants. It is a good starter for a session on cooperation and coordination or for a session on working with others.

Exercise No. 6.42

SI FELIMON

Si Felimon (3x)
Namingwit sa karagatan
Nakahuli (2x)
Ng isdang tampalasan

Version: Changing vowels at a time (e.g., a, i, o, u)

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group) and to illustrate the need for participation of all members in a team activity.

What are the materials needed?

- Blackboard and chalk or newsprint and marking pen for use in writing the lyrics of the song

How is the activity undertaken?

Introduce the song. When participants have become familiar with the tune, ask them to change the vowels of the words in the song one round at a time (e.g., a, i, o, u).

When is the activity most appropriate?

Use the song as a starter in the morning or in a session following a break. Use it with any number of participants. Ask participants what happens when they change from one vowel of the words to another. Emphasize the parallelism of changing vowels of the words to emerging problems as we implement FFS activities (e.g., how do we respond to such emerging problems from time to time).

Exercise No. 6.43

MALO, MALO, MALO

Malo (3x)
Din ginawa malo
Suranggani ti malo ginawa
Malo (3x)
Din ginawa malo
Suranggani ti malo ginawa
Suranggani (2x)
Suranggani ti malo ginawa
Suranggani (2x)
Suranggani ti malo ginawa

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group) and to demonstrate theneed for coordination among members in a team activity.

What are the materials needed?

- Chalkboard and chalk or newsprint and marking pens

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action as announced by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. This is essential among members of the group for the success of any activity or undertaking.

When is the activity most appropriate?

The song is appropriate for a group of 20-25 participants. It is a good starter for a session on cooperation and coordination or for a session on working with others.

Exercise No. 6.44

ANG PATO KO

May pato akong patuka-tuka, pahiwid-hiwid, pakapay-kapay
(Action: a hand extended forward, another hand backward, and then both hands forward to motion the opening and closing of the beaks, then both hands are held to the chest to motion the swaying of the wings, and then finally both hands extended sideward to motion the flying of the duck)

Kuak, kuak, patuka-tuka
(Action: a hand extended forward, another hand backward, and then both hands extended forward to motion the opening and closing of the beaks) (**Figure 47**)

Kuak, kuak, pahiwid-hiwid
(Action: both hands are held to the chest to motion the swaying of the wings)

Kuak, kuak, pakapay-kapay
(Action: both hands extended sideward to motion the flying of the duck)

Figure 47. Farmer-participants of FFS on seaweed production role-play 'patuka-tuka' using their bodies while singing the perk-up song, 'ang pato ko'.

Kuak, kuak, patuka-tuka
(Action: a hand extended forward, another hand backward, and then both hands extended forward to motion the opening and closing of the beaks)

What is the purpose for singing?

- To serve as icebreaker (e.g., to perk up the group); to demonstrate the need for coordination among members in a team activity; and to reinforce awareness that there are regional differences in values and norms.

What are the materials needed?

- Chalkboard and chalk or newsprint and marking pens

How is the activity undertaken?

Introduce the song. When participants have mastered the melody of the song, introduce corresponding actions. The group sings the song and does the action as announced by the song leader. The group may then process the activity. Parallel coordination of singing and doing actions to the significance of coordination and cooperation. Parallel also coordination of singing and doing actions to the significance of having a local FFS program. This is essential among members of the group for the success of any activity or undertaking.

When is the activity most appropriate?

The song is appropriate for a group of 20-25 participants. It is a good starter for a session on cooperation and coordination or for a session on working with others. Use it as a starter for sessions on planning of local FFS programs.

Exercise No. 6.45

PANGANGALAGA NG SEAWEEDS (TUNE: PARU-PARONG BUKID)

I

'Ice-ice na bakterya,
Buhok-buhok sa sanga,
Balawis o kuyog,
Kulapo't iba pa

II

Mainit, lantapin,
Bugabog, amihanin,
Ang mga ito ay maiiwasan natin,
Sa tamang panahon, taniman at pananim,
Mag-AESA lang tayo, matataruk natin

What is the purpose for singing?

- To recall names of biotic constraints (epiphytes, grazers, weed competitors, and diseases) and to encourage participants to observe their fields for the a-biotic factors in seaweed production.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens, masking tapes for writing the lyrics of the song

How is the activity undertaken?

Introduce the lyrics and tune of the song. Sing the song as a group. After singing, relate the song to participants' experience in their seaweed farming.

When is this activity most appropriate?

Use this exercise as a 'de-freezing' activity or as a starter for a session on 'epiphytes, grazers, weed competitors, and diseases of seaweeds.' It is an interesting method to help participants recall or memorize names of biotic and a-biotic constraints in seaweed production.

B. Other Energizers And Icebreakers

Other structured, content or content-free training activities designed to relax participants, get them acquainted with one another and energize them, are also included in this sub-section as additional options to select from[52]. Most of these exercises were designed or adapted by facilitators of the local FFS programs in the Philippine and had been utilized successfully in their conduct of TOSs, TOTs, or FFSs nationwide[53].

[52]Rohnke, K. 1988. Silver Bullets: A Guide to Initiative Problems, Adventure Games, and Trust Activities. Wilkcraft Creative Printing, Beverly Massachusetts, U.S.A. pp95-143.

[53]Philippine National IPM Program. 1993. Handbook on KASAKALIKASAN IPM Training Exercises Developed, Adapted, and Used by Philippine IPM Trainers, National Agricultural and Fishery Council, Department of Agriculture, Diliman, Quezon City. pp48-63.

Exercise No. 6.45

SEAWEEDS, GRAZERS, AND DISEASES

What is the purpose of the exercise?

- To recall names of seaweeds, grazers, and diseases and to serve as icebreaker and 'de-freezing' activity.

What are the materials needed?

- Warm bodies of participants

How is the activity conducted?

1. Ask the participants to arrange their chairs in a circle formation. When they are settled, give the following direction:

   - ✓ When the name of a seaweed variety is mentioned, everybody should sit at attention.
   - ✓ When the name of a grazer is called out, everybody should change seats.
   - ✓ When the name of a disease is said, everybody should stand at attention, his or her face showing an expression of shock.

2. Execute actions quickly. Eliminate participants who are not able to do the actions at the count of three.

When is this exercise most appropriate?

Use this exercise as a 'de-freezing' activity or as a starter for a session on 'Seaweed Varieties, Grazers, or Diseases.' It is an interesting method to help participants recall or memorize name of seaweeds, grazers, and diseases.

Exercise No. 6.46

NAME GAME

What is the purpose of the exercise?

- To discuss what types of names can be more appropriate to different types of situations.

What are the materials needed?

- Pre-prepared cartolina picture, at one side of the cartolina is written a 'Latin' name and on the other side a 'common-English' or 'common-local' name

How is the exercise undertaken?

The participants sit or stand in a circle after getting a pre-prepared cartolina picture from the facilitators. At one side of the cartolina is written a 'Latin' name and on the other side a 'common-English' or 'common-local' name. The general process of the name game is such that it can be a fun way for the facilitators and the participants to learn names of the members of the group. For the first time around, the 'Latin' names will be used. In the process, the group may have to give up the 'Latin' name after 3-4 restarts and trials because it will be so difficult to continue. Let the group try several times, just enough to get frustrated and worried. Have a processing discussion.

When is this exercise most appropriate?

The game is most appropriate when some participants are insisting on using scientific (Latin) names during sessions. When facilitators feel that it would be good to discuss what types of names can be more appropriate to different types of situations. The game may easily generate enthusiasm among participants working as extensionists but may create some resistance among participants with research backgrounds. Thus, the facilitators should explain before ending the session that the main objective of the exercise is to demonstrate that scientific or 'Latin' names are not useful to farmers. It must be stressed also that it is much easier to remember names when they are either in a language that farmers speak or descriptive of something that they can observe about an object.

Exercise No. 6.47

LOVE TEAM

What is the purpose of the exercise?

- To serve as an energizer and to illustrate the value of communication to establish good teamwork.

What are the materials needed?

- Pieces of paper, ball pens, and small box to place pieces of paper

How is the exercise undertaken?

1. This energizer requires a group with equal number of male and female participants. The facilitator will think of as many love teams as required by the number of participants, such as:

   - ✓ Florante at Laura
   - ✓ Samson and Delilah
   - ✓ Romeo and Juliet
   - ✓ Guy and Pip
   - ✓ Martin and Pops

2. The facilitator writes these names on small pieces of paper, one name to a piece. The papers are folded to conceal the names. Those bearing the names of women are kept separately from those with men's names.
3. Each man chooses a piece of paper with a woman's name on it; each woman, one with a man's name (role reversal).
4. The partners of each love team try to find each other using only mime or actions. No verbal communication is allowed. Having accomplished this, each love team prepares a one-minute program or skit.
5. When all the teams are ready, the presentation begins. The pair has presented its skit, and before the next skit's presentation, the whole group tries to identify the love team that has just been mimicked.
6. The whole group chooses the pair with the best presentation. A prize may be given to the winning pair.

When is this exercise most appropriate?

This activity is most appropriate with a group of 25-30 extension workers, community organizers as well as farmers. This can be used as an energizer during breaks for topics on communication skills.

EVALUATION EXERCISES

A great deal of the exchanges and discussions among facilitators during and after a training program focus on how things are going, how the session went, how the participants are doing, or on any of innumerable other points regarding the conduct of the whole program. The processes that will determine the value or the importance of the program to the participants, as well as to the organizers are referred to as evaluation systems. The process of looking back to assess the effectiveness of various learning activities, of the facilitators, and of the conduct of the whole program is an essential component of program management.

Evaluation must be systematically planned. Not only are the procedures systematic; they are built into the program at its inception and are integral to its total design. Evaluation procedures are either summative or formative[54].

- *Summative evaluation*, also known as *terminal evaluation*, measures its object against an absolute norm, definite standard of excellence. A typical example would be a quiz given every end of the week (e.g., the participant's responses are measured against absolutely correct answers).

- *Formative evaluation*, also known as *developmental evaluation*, on the other hand, looks more to descriptive data. It measures observed outcomes against intended outcomes. It is more consistent with the participatory, discovery-based and experiential learning methods, as well as with the philosophy of the group-centered leader. The methodology and philosophy are growth- or development-oriented (e.g., they are premised on the recognition that people are in a constant process of formation and definition). Formative evaluation not only assesses the present level of development but incorporates ways and means for improvement and growth. The following are some examples of formative evaluation exercises used successfully in local FFS program[55].

[54]Ortigas, C. D. 1994. Group Process and the Inductive Method: Theory and Practice in the Philippines. Second Edition, Ateneo de Manila Press, Loyola Heights, Quezon City. pp54-61.
[55]Philippine National IPM Program. 1993. Handbook on KASAKALIKASAN IPM Training Exercises Developed, Adapted, and Used by Philippine IPM Trainers. National Agricultural and Fishery Council. Department of Agriculture, Diliman, Quezon City. pp48-63.

Exercise No. 6.48

WEATHER BUREAU

What is the purpose of the exercise?

- To evaluate the activity or workshop; to identify and reinforce good things, which have happened; and to draw suggestions and recommendations for the improvement of the workshop.

What are the materials needed?

- Blackboard and chalks or newsprint and marking pens

How is the exercise undertaken?

Divide the blackboard or newsprint into two columns. On the heading of the left column, draw a picture of a sunny day (e.g., the sun shining brightly in the sky). On the heading of the right column, draw a picture of a rainy day (e.g., rain falling from clouds in the sky). Ask participants to think of the day's activities. Ask them to write on the left column what they think went well during the day (e.g., the good things that happened in the conduct of the workshop during that day). Then ask them to focus on things that need to be improved or what can improve the next day's sessions and to write them on the right column of the board or newsprint. There are no right or wrong answers in this activity. Provide pieces of chalk or marking pens which participants can use to write their ideas. Anybody can just come up to the board or newsprint and put down his ideas.

When is this exercise most appropriate?

Use this activity, with a group of 25-30 participants, as an evaluation tool at any point during the workshop or training program. Ask participants to consider such items as venue, their co-participants, the facilitators, and the objectives of the workshop, workshop materials, and so on. When participants have become familiar with the mechanics of the exercise, the newsprint may just be posted on the door or the wall. Participants may just write at any time of the day. Read responses at the end of each day to monitor the 'weather condition' (e.g., how participants feel about certain aspects of the workshop or training program). Use the Weather Bureau with extension workers, community organizers as well as farmers.

Exercise No. 6.49

ITEMIZED RESPONSE TECHNIQUE

What is the purpose of the exercise?

- To evaluate the training program or workshop; to identify and reinforce good things, which have happened; and to draw suggestions and recommendations for the improvement of the workshop or training program.

What are the materials needed?

- Blackboard and chalks or newsprint and marking pens

How is the exercise undertaken?

Divide the blackboard or newsprint into two columns (**Figure 48**). On the left column, write down the heading: What went well? On the right column, write down the heading: What needs improvement? Ask participants to think of the day's activities. Then ask them what they think went well during the day (e.g., the good things that happened in the conduct of the workshop or training program during that day). Write down all responses. There are no right or wrong answers in this activity. When all responses have been exhausted, ask participants to focus on the things that need improvement or what can be done to improve the next day's conduct of the workshop or training program. Again, write down all responses.

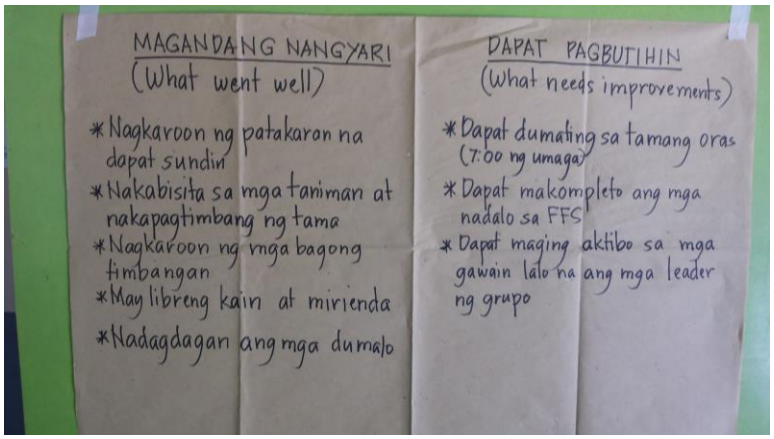

Figure 48. Farmer-participants of FFS on seaweed production identify and list down 'what went well' and 'what needs improvements' in their just concluded half-day weekly session.

When is this exercise most appropriate?

Use this activity, with a group of 25-30 participants, as an evaluation tool at any point during the workshop or training program. Ask participants to consider such items as the venue, their co-participants, the facilitators, and the objectives of the activity, workshop or training materials, and so on. Writing down all responses

encourages participants to share their views. The act of writing all responses demonstrates that all their ideas are respected and considered. The intention of the activity is to call attention to and reinforce the good points that have happened. Use the activity to draw recommendations and suggestions from the group on how to improve the workshop or training program. Use this technique with extension workers, community organizers as well as farmers.

Exercise No. 6.50

QUESTION AND ANSWER EVALUATION

What is the purpose of the exercise?

- To clarify training-related doubts, problems and issues among participants; to express ideas and feelings about the training program; and to elicit suggestions for the improvement of future training programs.

What are the materials needed?

- Pieces of paper, ball pens, empty box or basket for dropping questions or comments

How is the exercise undertaken?

Ask participants to write on pieces of paper any training-related questions or doubts that have been left unanswered. They may also write comments, feelings, and ideas about the training program. Suggestions for future training programs are also welcome. Drop the pieces of paper with the questions, among others, into a box or basket. (Address questions, comments or suggestions that need reactions to the persons concerned. However, the person giving the question or making the comments does not need to write his/her name). Assign a facilitator as a referee. As referee, he/she reserves the right to screen any question or comment deemed irrelevant. The referee reads out the question, comment or suggestion and calls out the name of the person to whom the item is addressed for the corresponding reply.

When is this exercise most appropriate?

The activity is most appropriate when done during the end of a training program. It allows participants as well as facilitators to raise inquiries about matters left unanswered until the end of the training program. It also allows people to freely express ideas and feelings about the training because they do not have to write their names on the pieces of paper. Use this exercise also for farmers in the farmer field school. However, since many of the participants may not know how to write, give time for them to whisper the questions or comments to anyone from the group they choose to. The person to whom the question or comment is whispered is the one who relays it. This will ensure the anonymity of the person giving the question or comment.

Exercise No. 6.51

EVALUATION THROUGH ROLE-PLAY

What is the purpose of the exercise?

- To portray experiences, learning, and skills acquired during the training.

What are the materials needed?

- Warm bodies of participants

How is the exercise undertaken?

Divide the big group of 25-30 participants into five smaller groups. Give each group 15 experiences, learning, and skills acquired during the training. When all the groups have presented, a facilitator may lead in the discussion of the role-plays. Members of the big group may raise questions regarding the points presented by smaller groups. Small groups then clarify these points or answer the questions addressed to them.

When is this exercise most appropriate?

This activity is appropriate for evaluating a session or the whole training program for facilitators as well as farmers. However, if it is used for evaluating the whole training program, the time allotted for the activity should be increased. The use of role-play makes the evaluation process creative and interesting. Furthermore, evaluation becomes a nonthreatening situation. Because of spontaneous dialogue and reactions that the method brings out, using role-play for evaluation makes the process enjoyable. The use of role-play for evaluation will be more effective if it involves as many group members as possible.

Exercise No. 6.52

ANSWERING QUESTIONS WITH QUESTIONS

What is the purpose of the exercise?

- To provide a more enlightened learning opportunity for participants; to allow the participants to develop their own analysis and understanding; and to lead the participants to the answer by asking questions.

What are the materials needed?

- Ball pens, writing pads, any object or problem in the field

How is the exercise undertaken?

In the field, the common question is: 'What is this?' or 'What is that?' There are many ways to answer the question. For most of us, the natural response is to give the name of the object, often in a foreign language (English or Latin). The question is often answered by saying 'Oh, that is a *bacterium*' or 'This is an *epiphyte*'. The result of this answer is that an educational process has been stopped. A better way to answer a question is to ask another question: 'Where did you find it?' 'What was it doing?' 'Were there many of them?' 'Have you seen this before?' The idea is to promote learning by discovery and to lead the participants toward their own analysis.

When is this exercise most appropriate?

The goal of discovery-based learning is to provide a more enlightened educational opportunity for participants. The methodology of learning is very important for achieving the goal of education. One important method is to ask questions that allow the participants to develop their own analysis and understanding. You are stealing the opportunity for education if you reply directly with an answer. Ask questions. Lead the participants to the answer by asking questions. The participants may be led to the wrong impression that the facilitator is technically incompetent and may result to loss of credibility if the learning process is not handled properly. If the topic is unfamiliar to the facilitator, the process should lead to a mutually agreed activity, like simple experimentation, to answer basic questions.

Exercise No. 6.53

FEEDBACKING AND CRITIQUING

What is the purpose of the exercise?

- To improve the participants' analytical, planning, and facilitating skills.

What are the materials needed?

- Chalkboard and chalks or newsprint and marking pens, pre-designed matrix

How is the exercise undertaken?

Facilitate a big group discussion to agree on standard matrix that can be adopted for weekly feed-backing. Devise a matrix form that can be used to gather relevant information about a particular activity. Critique constructively the information provided by each small group in the big group. List down important problems, issues, and experiences shared. Discuss how the information shared can be useful in improving future FFS activities.

When is this exercise most appropriate?

This exercise is very useful after every FFS session or before ending the weekly activities in preparation for planning of next week's activities. This exercise is particularly helpful in improving the participants' analytical, planning, and facilitating skills. Oftentimes, the exercise may appear repetitive and yet the participants may forget to analyze the problems and challenges identified. It is very important, therefore, to come up with concrete recommendations that could be immediately undertaken during the feed-backing and critiquing sessions.

SECTION 7

TECHNICAL AND LIVELIHOOD ASSISTANCE COMPONENTS

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TECHNICAL AND LIVELIHOOD ASSISTANCE COMPONENTS

Technical and livelihood assistance are essential components of the Farmer Field School on Seaweed Production Project for farmers in the coastal waters of Kalongkoan-Calutcot Islands, Burdeos, Quezon. This section gathers topics elucidating the processes undertaken in providing *Technical and Livelihood Assistance Components* to FFS on seaweed production participants. These undertakings are profoundly described in two (2) projects, namely:

- Technical Assistance for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach
- Livelihood Assistance Through Production Loan for Seaweed Farmers

TECHNICAL ASSISTANCE COMPONENT

The technical assistance project ensured that the FFS participants understand and in the process are able to develop appropriate location-specific management options for biotic and abiotic factors affecting seaweed production. It also served as a venue for the participants to appreciate the advantage of collectively working together to solve their common local community problems. This assistance is articulated below:

Technical Assistance for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School (FFS) Approach Project for Seaweed Farmers of Sitio Maydalaga, Barangay Calutcot, Burdeos, Quezon

A. Introduction:

Because of their location, fishing as a source of livelihood for fisher-folks in Sitios Maydalaga, Maybobon, and Calutcot Proper, Barangay Calutcot, Burdeos, Quezon (island villages, part of the Polilio island groups toward the Pacific Ocean), is stable only about half a year, from April to September, during the southwest monsoon season (*habagat*). Sea conditions become unfavorable to fishing, especially with small sea-crafts, during the other half of the year, from October to March, the northeast monsoon season (*amihan*). Hence, high rates of poverty characterize the population in the area. Moreover, pressure for survival encourages destructive fishing practices damaging to dangerous levels the coral resources of the area.

There is, therefore, a need for complementary sources of livelihood for fisher-folks in the village to improve their productivity and thus, alleviate poverty. Taking into consideration their previous experiences, seaweed farming can be a remarkably practical option. In early 2000, seaweed farming was introduced in the area. Large areas of channels between islands were found suited for year-round seaweed farming. The idea of seaweed farming caught on very quickly. With bumper crops and easy access to market, fishermen took to seaweed farming as important complement to fishing. But after a few successful production cycles, seaweed farms in the area were wiped out by pests and diseases, identified later by scientists as a bacterial disease (*Pseudomonas*, Flavobacteria), locally known as 'ice-ice' and an epiphytic red alga (Polysiphonia/Neosiphonia), popularly known as 'buhok-buhok'. In the absence of technical assistance, the seaweed farmers have not been able to revive what they experienced as a lucrative enterprise, a good way out from poverty.

B. Project Objectives:

The overall objective of the project is to revive the seaweed industry in the area (Calutcot-Kalongkoan island groups) by providing timely and appropriate technical

assistance to seaweed farmers in managing their pests, diseases, and other seaweed production and post-production constraints. Among others, the project shall specifically aim to:

1. Develop, by working in partnership with local seaweed farmers, appropriate location-specific production and post-production technology options for seaweed growers to choose from;

2. Design a season-long farmer field school (FFS) curriculum for seaweed production that can be used for sustained training and scaling-up of more innovative seaweed production and post-production technology options;

3. Put in place a cadre of technically empowered fisher-folks who will sustain a socio-economically viable seaweed industry in the area;

4. Get underway a composite team of facilitators (BFAR, LGU, NGO, and fisher-folk organization) who can continuously organize, conduct, and implement farmer field schools (FFS) on seaweed production at community, provincial, and regional levels;

5. Strengthen seaweed farmers' organizations and link them to prospective partners for livelihood opportunities to further maintain the viability of seaweed industry in the area; and

6. Flesh out an action plan of activities to address other concerns related to location-specific seaweed production and post-production technology development, up-scaling, and livelihood opportunities.

C. <u>Strategy:</u>

The project will employ a participatory research/training approach, where selected farmer-beneficiaries will actively participate to learn effective seaweed farming under concrete local conditions. Following the well-developed farmer field school (FFS) model of Integrated Pest and Production Management (IPPM) popularized and successfully used in South and Southeast Asia as well as in Africa, Latin America, and Eastern Europe for terrestrial crops (rice, corn, vegetables, among others), a pool of experts (a research process resource person, a marine biology scientist, community organizers, and seaweeds technologists) will assist farmers in developing a participatory research/training curriculum for seaweed production management.

The seaweed farmers will then set-up their experimental farms, apply, observe, and monitor different seaweed production variables. With periodic but regular

assistance of the experts, farmers' findings will be evaluated and their knowledge consolidated. Aside from their better understanding of seaweed production and management, seaweed farmers will acquire the tools for scientific problem-solving. The farmers' organization will also be strengthened as members work together to address common problems.

Figure 49. Technical experts (A) from partner organizations (B), in partnership with seaweed farmers of Kalongkoan-Calutcot Islands, Burdeos, Quezon, developed a Farmer Field School (FFS) curriculum on seaweed production

D. Implementation

1. Developing a participatory research/training design and curriculum

Initially, the experts visited the study sites, interacted with seaweed farmers, and conducted a 2-3 day workshop to set-up the participatory research/training activities and tasking of the seaweed farmer-participants. As expected, these preliminary undertakings were able to:

a) Form and define responsibilities of a technical and training team on the management of seaweed farm health, productivity, and pest and disease management;
b) Identify and analyze, with seaweed farmer-participants, current production constraints like seaweed vigor, health, pest and diseases, and cultural management;
c) Provide technical foundation of seaweed biology and its 'ideal' farm conditions according to sites and according to different seasons;
d) Provide technical bases for seaweed farmers' experiences and their locally developed management options;
e) Provide general understanding of the conditions of the area for seaweed growing;

f) Agree on initial management approaches and solutions to current seaweed production problems;
g) Organize seaweed farmer-participants into working groups for their field and small group activities; and
h) Agree on a weekly schedule of activities, from seaweed farm and research plots preparation up to harvest time.

2. Composition and role of the technical and training team and partner-agencies/organizations

Composition of the technical and training team (**Figure 49A**):

a) **Dr. Gavino Trono, Jr.**, Emeritus Professor of Mycology, and National Scientist nominee, is a leading seaweed scientist from the University of the Philippines Marine Science Institute (UP-MSI) who will serve as on-call seaweed technical expert [**Mr. Wilfred John Santianez**, Research Associate I, UP-MSI, assisted Dr. Truno];
b) **Mr. Damaso P. Callo, Jr.**, Farmer Field School (FFS) Consultant, is an international expert on agriculture participatory research and adult education approaches who will serve as a regular trainer-facilitator on FFS approaches for seaweeds;
c) **Ms. Rochela C. Lucero**, Region IV-A Seaweeds Coordinator, a seasoned seaweed technologist and a senior technical staff of the Bureau of Fisheries and Aquatic Resources (BFAR), will serve as a regular seaweed technical expert [**Mr. Dionisio B. Zapanta, Jr.**, BFAR Region IV-A Technical Staff assisted Ms. Lucero];
d) **Mr. Rene Salazar**, Community Organizer, is a veteran volunteer organizer and trainer-facilitator who will serve as a co-facilitator on community organizing and empowerment;
e) **Mr. Juanito Gucilatar**, Project Manager, Social Action Center (SAC), Prelature of Infanta, Quezon, is an expert group dynamics trainer-facilitator and community organizer who will serve as co-facilitator on community organizing;
f) **Mr. Alfredo N. Darag, Jr.**, Project Officer, Social Action Center (SAC), Prelature of Infanta, Quezon, is a skilled community organizer-trainer who will serve as a regular co-facilitator and documenter.

Role of partner-organizations (**Figure 49B**) and training team members:

Mr. Juanito Gucilatar, Mr. Alfredo N. Darag, Jr. and the Social Action Center [SAC] of Northern Quezon Prelature of Infanta

a) **SAC-NQ** coordinates, supervises, and implements the project. It also addresses the social, cultural, economic, and political needs of the farmer-participants;

b) **SAC-NQ** assigns **Mr. Juanito Gucilatar** as the Project Manager of the project. He manages the financial and other logistic resources of the project. As a seasoned community organizer, **Mr. Gucilatar** also serves as a Liaison Officer for project concerns with the farmer-participants, the training team, and project partners. He also serves as a regular co-facilitator of the project. He inspires the group, facilitates group dynamics, and instills discipline among farmer-participants.
c) **SAC-NQ** assigns **Mr. Alfredo N. Darag, Jr.**, a skilled community organizer-trainer, as a regular co-facilitator and documenter of the project. **Mr. Darag** works as a Project Officer of SAC-NQ, Prelature of Infanta [**Mr. Aladino Riguyal**, SAC-NQ Agriculturist, serves as alternate documenter in any unlikely absence of Mr. Darag]. As a committed community organizer-trainer, **Mr. Darag** may well be part of a future FFS composite training team for Quezon Province.

Ms. Rocella C. Lucero and the Bureau of Fisheries and Aquatic Resources [BFAR] Region IV-A

d) **BFAR Region IV-A** provides materials and seedlings for the nursery that is now a source of around 7 tons of seedlings for the farmer-participants;
e) **BFAR Region IV-A** also provides 75% of the materials for each farmer-participant for their small individual production/research plots that may become the source of seedling materials and earn modest income for each farmer-participants by the beginning of November 2013;
f) **BFAR Region IV-A** makes available technical equipment (for measuring salinity, water current, water temperature, water depth, turbidity, among others) for use of the farmer-participants in their seaweed assessments;
g) **BFAR Region IV-A** insures the availability of **Ms. Rochella C. Lucero** [Region IV-A Seaweed Coordinator], a highly experienced and technically capable seaweed expert in the region to support the project's participatory research/training's weekly activities. It is <u>important</u> that **BFAR Region IV-A** specifically assigns **Ms. Lucero** and/or her trusted colleague [**Mr. Ernest John R. Laureles**, Assistant Region IV-A Seaweeds Coordinator] to the project on a weekly basis to ensure continuity in the FFS learning process. Such undertaking prepares **Ms. Lucero** (and/or her associate [**Mr. Laureles**]) to lead an FFS composite team that will pursue sustained seaweed livelihood activities at the regional level beyond project life; and
h) **BFAR Region IV-A** realigns its current seaweed activities to support the seaweed FFS initiatives within the project area in order to enhance local project ownership, ensure sustainability, and maximize delivery of appropriate and timely support services to seaweed farmers around the Polilio group of islands.

Dr. Gavino Trono, Jr. and the University of the Philippines Marine Science Institute (UP-MSI)

a) **Dr. Gavino Trono, Jr.**, a well-known marine biologist, seaweed expert, and an Emeritus Professor of Mycology, **UP-MSI** provides excellent scientific background on seaweed farming. Due to his present physical conditions (82 years old) and stature (national scientist), there is less need for Dr. Trono to be present in the weekly monitoring of the seaweed farms/research plots in the project sites. However, the results of the project can even be just presented to him for necessary technical advice at the UP-Diliman campus at the end of each season. For a more sustainable local capacity building effort, an experienced regional technical expert [**Ms. Rocella C. Lucero**] from BFAR Region IV-A can provide effective technical guidance, in lieu of Dr. Truno, on a more regular basis.

Mr. Damaso P. Callo, Jr., Mr. Rene Salazar, Mr. Jose Deles, and the Peace and Equity Foundation [PEF]

a) **PEF** funds major requirements of the project. Through this project, it envisions transforming poor fisher-folk communities into self-sustaining households providing for their basic needs and contributing to the socio-cultural growth, economic development, and effective governance of their sustainable communities;
b) **PEP** deploys **Mr. Damaso P. Callo, Jr.** as a mainstay trainer-facilitator of the project. He is a lead trainer for farmer field school [FFS] facilitation in the country especially for terrestrial crops (rice, corn, vegetables, and other crops). He has helped developed FFS curriculum in participatory plant breeding [PPB] in corn, integrated pest management [IPM] curricula for rice, corn, mango, and several vegetable species, and FFS curricula on agro-forestry and community irrigation management, among others. **Mr. Callo,** who has helped establish the FFS national programs in several countries in Asia and Africa, anchors the participatory technical processes, instills discipline, and has the capacity to develop appropriate research tools for fisher-folks (translating scientific input into participatory processes) and produces a technical manual.
c) **PEP** engages **Mr. Rene Salazar,** as a volunteer co-facilitator of the project. As a veteran community organizer and donor-solicitor, **Mr. Salazar** also serves as main resource person on community organizing and empowerment. He was an organizer of the Southeast Asia Regional Initiative for Community Empowerment (SEARICE), a staunch advocate of local biodiversity conservation and indigenous genetic resources management; and
d) **PEP** similarly engages **Mr. Jose Deles**, as volunteer resource person on community organizing and empowerment. Project partners consider him as a Focal Person of the project. Likewise a veteran community organizer and donor-

solicitor, **Mr. Deles** is a respected project manager and implementer of many internationally-funded community development programs.

The Farmer-Participants and the Samahan ng Nagkakaisang Mangingisda at Magsasaka sa Maybobon [SANAMMMAY]

a) **SANAMMAY members** are among the direct beneficiaries of the project. The organization consists of families who were beneficiaries of the Department of Agrarian Reform's (DAR's) agrarian reform program in Sitio Maybobon (located at Maydalaga Islet, originally named as Kalongkoan Island), Barangay Calutcot, Burdeos, Quezon;
b) **SANAMMAY fishermen-members (17)** from Sitio Maybobon, Maydalaga Islet and **selected fishermen (5)** from Barangay Calutcot Proper, Calutcot Island compose the farmer-participants of the project. **As participants**, they shall provide the labor requirements of the project, regularly attend, and actively participate in the weekly sessions of the participatory research/training. Depending upon their performance during and availability after the project, several of them will be selected to become members of an FFS composite training team to up-scale local seaweed initiatives beyond project life.

Municipal Local Government Unit of Burdeos, Quezon [MLGU-Burdeos]

a) **MLGU-Burdeos** is a major implementing partner of the project. It envisions to takeover project coordination and works to sustain livelihood support activities for seaweed farmers in the project sites through a composite FFS training team to be put in place just before the project ends;
b) To ensure sustainability, **MLGU-Burdeos** assigns **Technical Staff** from the **Office of Municipal Agriculturist (OMA)** and **Municipal Disaster Risk Reduction and Management Office (MDRRMO)** as regular participants, who will attend the weekly FFS sessions of the participatory research/training. Depending upon their performance and commitment, they may be selected as members of an FFS composite training team to sustain municipal seaweed endeavors beyond project life.

3. Conducting the participatory research/training

The actual participatory research/training

Based on the workshop and assigned tasks, the farmer-participants will set up, implement, and monitor their respective seaweed researches. Preliminary results will be recorded, discussed among the farmers, and findings shared with experts during their regular field visits. The fisher-folks shall meet once every week during the establishment of the seaweed plots, during the actual growing of the seaweeds,

to the harvesting stage, and in drying the harvests. The growing length of seaweeds is 10-12 weeks from planting to harvest. The seaweed research shall run for 14 weeks to include the preparatory and seaweed farm establishment, and another week for harvesting and drying.

The first stage is the establishment of the seaweed research plots (cultural management and variety trials). This will include the preparation of posts, nylon lines, floaters and sinkers, tying materials, the selection of disease free seedlings, and the actual establishment of the plots. This is on the first (cultural management trial) and second (variety trial) weeks.

The second stage is the weekly assessment and management of the seaweed plots. The fisher-folks shall monitor the plots, gather data, analyze the data, and make decisions. At the same time, technical and management topics will also be discussed. These sessions shall run for around 5 hours once a week and for 10-12 weeks (one growing cycle).

The third and last stage is harvesting, drying, and storage. The whole cycle of the research/training shall run for 14 weeks.

The whole cycle shall run for 14 weeks. The participatory research/training shall run for two seasons or for a total of 28 weeks. The first shall be conducted at the end of the northeast monsoon, and the next shall be during the southwest monsoon. This is aimed at finding management and technical solutions to different growing conditions (water quality, salinity levels, water depth, among others) of the two main seasons.

The role of the seaweed scientist, participatory research expert, and regional seaweed technologist

a) The seaweed scientist (Dr. Truno) shall participate only during the curriculum development and shall be updated by the training team for his technical advice through a short meeting at his office at the end of each season; first after 14 weeks (first cycle) from seaweeds seedling establishment, and the second after harvesting of the seaweeds in the second season (second cycle).
b) The participatory research expert (Mr. Callo) and regional seaweed technologist (Ms. Lucero and/or Mr. Laureles) shall participate in the curriculum development, and shall, respectively, assist the farmer-participants in substantially internalizing their learning (experiential, participatory, and discovery-based) activities and in providing appropriate technical backstopping on seaweed production (cultural, pests, and diseases) management once a week for 28 weeks (2 research/training cycles).

c) Based on agreed upon schedule, the experts (participatory research expert [Mr. Callo] and regional seaweed technologist [Ms. Lucero]) will regularly interact with the farmer-participants during their weekly agro-ecosystem analysis (AESA) and collectively assess the progress of the experiments. After a recommended research cycle, lessons (appropriate location-specific management options) learned will be consolidated and reused in the succeeding cycles.

E. <u>Expected Project Outputs</u>

a) Appropriate location-specific production and post-production technology options for seaweed growers to choose from;

b) A season-long farmer field school (FFS) curriculum for seaweed production that can be used for sustained training and scaling-up of more innovative seaweed production and post-production technology options;

c) A composite team of facilitators (BFAR, LGU, NGO, SAC, and fisher-folk organization) who can continuously organize, conduct, and implement farmer field schools (FFS) on seaweed production at community, provincial, and regional levels;

d) A cadre of technically empowered fisher-folks and revitalized seaweed farmers' organization who will sustain a socio-economically viable seaweed industry in the area;

e) An action plan of activities to address other concerns related to location-specific seaweed production and post-production technology development, up-scaling, and livelihood opportunities and an organizational development plan (to manage processing, marketing, technical support, credit management, among others); and

f) Fisher folks' family-based seaweed farming business, farm plan, and credit scheme to assist each family established and managed family seaweed farms.

ITEMS/PARTICULARS	PEP COUNTERPART (PhP)			PROPONENT/ LOCAL COUNTERPART (PhP)
	Requested Cost	Projected Actual Cost	Requested Supplemental Cost	
1. Research/Training Curriculum Development	**58,000**	**69,000**	**10,000**	**24,000**
a) Honoraria of Scientist-Experts	30,000	40,000	10,000	-
b) Travelling Expenses of Scientist-Experts	22,000	23,000	-	-
c) Incidental Expenses	6,000	6,000	-	-
d) Food, Accommodation & Transportation within Islands (SANNAMAY Counterpart)	-	-	-	24,000
2. BFAR Assistance	-	-	-	**112,000**
a) Per Diems & Travelling Expenses of BFAR Technical Experts	-	-	-	112,800
b) Nursery Establishment	-	-	-	30,000
c) Supplies & Materials for Experimental Seaweeds Establishments	-	-	-	84,000
3. FFS with Periodic Field Monitoring & Workshop by Experts	**334,000**	**360,000**	**159,000**	**-**
a) Seaweed Aquaculture Expert (Travelling, Other Expenses & Honoraria)	133,000	-	-	-
b) Participatory Research Expert (Travelling, Other Expenses & Honoraria)	201,000	306,000	105,000	-
c) Manual Writing by the Participatory Research Expert	-	54,000	54,000	-
4. Community Organizing/Development Supervisor	**50,000**	**150,000**	**100,000**	**(50,000)**
a) Honoraria for Preliminary Visits, Project Development, Organizational Support, Periodic Visits & Networking	-	50,000	50,000	(50,000)
b) SAC Management Cost (Travelling Expenses & Communication)	50,000	50,000	-	-
c) Field Management & Process Documentation Cost	-	50,000	50,000	-
5. SANNAMMAY Additional Counterpart	-	-	-	**42,000**
a) Labor Cost in Nursery & Experimental Plot Establishment	-	-	-	25,000
b) Acquisition of Seedlings from Calatagan, Batangas	-	-	-	5,000
c) Board & Lodging of Experts				
d) During Regular Monitoring				12,000
TOTAL COST (PhP)	**442,000**	**579,000**	**137,000**	**178,000**

LIVELIHOOD ASSISTANCE COMPONENT

The livelihood assistance project assured the FFS participants to confidently apply their FFS learning experiences as they endeavor on a whole family farm venture to revive their lucrative local seaweed industry. This component is described below:

Production Loan Project for Seaweed Farmers of Samahan ng Nagkakaisang Mangingisda at Magsasaka sa Maybobon [SANAMMMAY]

A. The Beneficiaries

The direct beneficiaries shall be the 21 fisherfolks who are participants in a participatory research project. These fisherfolks are members of the SANAMMMAY fisherfolks association. The research aim to systematically understand and develop solutions to current biotic and abiotic stresses of seaweeds that caused the collapse of the industry in the islands of Lamon Bay around 10 years ago. The research shall run for two consecutive seasons (from planting to harvesting) of around 3 months each season. Once a week during the research, the fishermen shall monitor and gather data from research plots.

The secondary beneficiaries shall be the 117 household members of SANAMMMAY who shall learn from the first 21 fisherfolk household to return to seaweed farming. The wider potential impact of the project shall be the revival of seaweed farming in the island barangays of Burdeos in particular, and to the islands towns and barangays inside Lamon Bay of Quezon province.

B. Background (Please Part I)

<u>The Organization, Site, Short History and Current Condition of Seaweed Farming in the Area</u>

The Uala islands group of Barangay Calutcot of the municipality of Burdeos, Quezon province once had a thriving seaweed farming industry from the 1990s. The industry collapsed due to the disease called 'ice-ice' and due to epiphyte infestation called 'buhok-buhok' around 2002-03.

Before the collapse of the industry, fisherfolks had a reliable source of income even during the northwest monsoon (Amihan) when winds and waves are strong and fishing is dangerous. It also greatly reduced the destructive method of fishing like the use of cyanide and dynamites. The local fishing communities themselves were active against these practices to protect the health of their seas that are vital to seaweed farming.

The SANAMMMAY fisherfolks organization recently decided to revive seaweed farming. One member of their organization never stopped to farm seaweeds often helped and joined by a few fishermen. While this effort was very small compared to thousands of families engaged in seaweed farming before the collapse, it provided lessons to farmers. However, the fishermen felt that they need a more systematic approach to validate their experiences and to learn from scientists before they can invest their limited labor capital.

A participatory research on seaweed farming, combining the experiences of local fisherfolks with the more systematic knowledge of scientists, and implemented through an empowering learning process was launched last August 2013.

Supporting Institutions for the Participatory Research

a. The Peace and Equity Foundation provided funds to conduct 2 seasons (from planting to harvest) of research plots, to organize the fisherfolks, and to provide honorarium, transportation, and other costs for scientists and participatory research facilitator.
b. The Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture provided materials to set up a seaweed seedling nursery, and materials for setting up of small trial production plots for individual farmers participating in the research. BFAR is also providing technical officers to help guide the participatory research. Equally important is the delivery by BFAR of 8 new seaweed varieties from their research station in Batangas for adaptation trials in the SANAMMMAY sites.
c. The University of the Philippine Marine Science Institute allowed one senior seaweed scientist and one research assistant to participate in the setting up of the participatory research curriculum and to help analyze the growing conditions of the waters around the islands.
d. The Social Action Center of the Prelature of Infanta serves as the project financial manager, and also provides for systematic documentation of the whole process.
e. The Municipal government of Burdeos provided the initial food for the first two days of the research, and promised to develop and legislate policies to ensure the revival of the seaweed industry.

Developments

The project was launched last August 2013, for two days. The objectives were to:

a. To initially systematize the experiences of the fishermen
b. To provide scientific and technical input and combine these with local experiences

c. To identify and analyze the production bottlenecks and stresses and to study the condition of the seas around the islands
d. To draft the initial research objectives and methods of research
e. To finalize the schedule and tools of the research and to identify additional materials needed for the research plots
b. To organize the fishermen into four research teams

Initial Results

The summary points are the following:

a. The fishermen, as a group, systematically validated their observations of stresses and problems of seaweed farming among themselves, and the;
b. The fishermen's observations were validated by the scientific input from Dr. Trono of the UP Marine Science Institute and from Ms. Rosella Lucero of the BFAR;
c. The fisherfolks are organized into 4 research teams;
d. Each team established 2 research plots, one plot as production trial using the two existing seaweed varieties in the community, and one plot to test the 6 different varieties from BFAR. The production trial plots were planted last September 2 and the varietal trial plots shall be planted on September 11.
e. BFAR also provided resources for the establishment of two nurseries where the farmers sourced their seedlings. BFAR also provided materials for production trial plots of around 300 meters per fisherman.

Highlights of Initial Activities:

After one production cycle (August-November), the farmer-participants and the training team members are convinced that seaweed farming can be successfully revived in the Calutcot-Kalongkoan areas. Among others, the intervention resulted to more innovative, location-specific, and best farmers' practices for managing seaweed pests, diseases, and other production constraints during the southwest monsoon season (*habagat*). These include the following:

a. More location-specific production technology options for the southwest monsoon season (*habagat*), by working in partnership with local seaweed farmers, for seaweed growers to choose from;

b. A number of seaweed varieties for seaweed growers to select from, whose agronomic performance are as good or better than current farmers' varieties;

c. A farmer field school (FFS) curriculum on seaweed production for sustained training and scaling-up of more innovative seaweed production technology options in succeeding production cycles;

d. An initial cadre of 21 technically empowered fisher-folks to sustain a socio-economically viable seaweed industry in the area;

e. A seaweed farmers' organization (SANAMMMAY) being continuously strengthened and linked to prospective partner for livelihood opportunities to further maintain the viability of seaweed industry in the area; and

f. An action plan of activities for the succeeding production cycles to address other concerns related to location-specific seaweed production technology development, scaling-up, and livelihood opportunities.

C. Rationale for the Loan Project

a. The fisherfolks need to be assisted to establish their own household seaweed farms and reestablish seaweed farming at the household level;
b. The conditions and months of the year when seaweed health is weaker and vulnerable to diseases and pests is now clearly established to be the months of March to May reducing risk of farm failure;
c. The management for healthier seaweeds with less pest and disease infestation like: the depth of the farm, the ideal sea movement of current and waves, the management of sunlight intensity, among others, are now clear;
d. Each of the 21 fisherfolks now manages small trial production lines (within the production trial plots) planted last September 2, 2013. These trial production plots shall provide solid guidance to household farms and provide the seedlings for these farms;
e. The 8 new varieties in the trial plots shall also be the source of new seedlings for multiplication at the production level.

D. Project Objectives

a. To establish household level seaweed farms guided by on-going lessons from the participatory research on seaweed farm management;
b. To provide household level experiences in seaweed farming revival as household level models for other farmers within the surrounding islands;
c. To provide capital support to small fisherfolk families to establish their seaweed farms on or before the middle of October 2013, and to harvest in the last week of February 2014 just before the summer season of pests and diseases set in.

E. Strategy

a. Each of the 21 fisherfolk households involved in the on-going participatory research was provided with a loan of ten thousand pesos (P10,000.) each on October 2013. The total loan amount was established through participatory discussions to determine the details of the expenses to be incurred based on a loan ceiling of P10,000 per farmer-participant (**Figure 50**);

Figure 50. Participatory discussions conducted with FFS seaweed farmers of Kalongkoan-Calutcot Islands, Burdeos, Quezon, to establish details of their expenses for a loan ceiling of P10,000 per farmer-participant

b. The timing of the loan is important. The seedling the fisherfolks shall use are from their small production trial plots planted on September 2, 2013 and from the varietal adaptation plots planted on September 11. The best seedlings shall come from plots that are 6 to 7 weeks old or around the end of October 2013. The latest farm establishment should also aim to harvest before the end of February 2014 to avoid the 'unhealthy' summer months (less water movement, intense sunlight, among others).
c. The loan of P10,000 shall provide capital to purchase the lines, sinkers and floaters needed on the farm;
d. The amount of P10,000 is ideal for a family farm of around 2,000 meters (divided into 20 meters per row) of seaweed. Seaweed farming is labor intensive where fisherfolks need to inspect the farm every day, repair damaged lines, sinkers or floaters, adjust depth, help move the seaweeds if the current and waves are weak, among others.
e. The payment of the loan shall be at harvest time, around the end of February 2014, after post-harvest drying, and the loan shall be paid to PEF before the end of March 2014.
f. The interest to be charged shall be at 12 percent per annum.

g. About 90 percent of the loan shall be in the form of materials like lines and floaters that shall be bought in bulk. This will ensure that the loan will not be used for other important family needs.

F. Institutional Arrangements

The project proponents shall be the SANAMMMAY fisherfolk association. The project holder shall be Social Action Center of the Prelature of Infanta. This project loan is therefore an application by the SAC to PEF. The project implementer and credit manager shall be the adviser of the SANAMMMAY fishermen organizations (the same way as the current project is implemented).

G. Amount of Project Loan and Grant Applied

a. Loan: for 21 fisherfolks at P10,000 each	P210,000
b. Grant: for management cost	25,000
Total	**P235,000**

GLOSSARY

Aquaculture refers to the cultivation of aquatic animals and plants, especially fish, shellfish, and seaweed, in natural or controlled marine or freshwater environments; underwater agriculture.

Agro-ecosystem analysis (AESA) refers to weekly study of crop agro-ecosystem components, such as plant morphology, agronomy, herbivores, natural enemies of the herbivores, diseases, rats, weather, water, weeds, etc., in a 'learning field', which will lead into a process useful for decision-making.

Angiosperm means (etymologically), a plant that produces seeds within an enclosure; they are fruiting plants, although more commonly referred to as flowering plants. Flowering plants, also known as *Angiospermae* or *Magnoliophyta*, are the most diverse group of land plants. Angiosperms are seed-producing plants like the gymnosperms and can be distinguished from the gymnosperms by a series of synapomorphies (derived characteristics). These characteristics include flowers, endosperm within the seeds, and the production of fruits that contain the seeds.

Avoidance is a fundamental principle in pest and disease management, which alters environment by making it less favorable to growth and development of a pest or a pathogen.

Bacteria are considered the simplest of plants. They are tiny (microscopic), consist of only one cell, and multiply by cell division as frequently as every 10-15 minutes. They lack green pigments and cannot produce their own food. Most of them gain entry through wounds or natural openings found on surface of plants. Once inside, bacteria multiply rapidly, break down plant tissues, and usually move throughout plant.

Bacterial diseases refer to diseases that are caused by bacteria. The most common symptoms of bacterial diseases on plants are maceration or disintegration of tissues, 'water-soaked' appearance, and 'foul' odor.

Bio-harvesting (see nutrient bio-extraction).

Bio-remediation (see nutrient bio-extraction).

Case study is a technique designed to give group training in solving problems and making decisions. The facilitator's role is typically catalytic rather than didactic.

Competition is a condition or an interaction where there is a suppression of one organism as two species struggle for limiting quantities of nutrients, oxygen, or other common requirements.

Composting refers to a process involving breakdown of organic materials through action of decomposers (e.g., microorganisms and macro-organisms) to form small bits of organic matter called compost.

Conservation is most important and readily available biological pest control practice available to tomato growers, which is best achieved by reducing chemical use and promoting cultural practices that will allow natural enemy population to increase.

Cost and return analysis is an analysis of production cost relative to net return in an enterprise. Usually, the lower the cost of production, the higher is the net return for a particular enterprise.

Cost of production refers to amount of labor, power, and material input costs in each operation for every enterprise.

Cultural control is the modification of the environment by making the area less attractive to pests (e.g., tillage, planting date, crop rotation, etc.).

Ecology is the study of organisms at a given locality and their interactions with each other and with the physical environment.

Ecosystem is a biological community considered in relation to its physical environment.

Eelgrass refers to any perennial submerged marine plants of the genus *Zostera*, especially *Z. marina*, having grass-like leaves, belonging to family *Zosteraceae*.

Exclusion is a fundamental principle in pest and disease management, which includes exclusionary measures to prevent a pest or pathogen from entering and becoming established in a non-infested or non-infected area.

Exercise is a structured learning experience marked by a learning goal, high participation, and structure. Its overall purpose is to generate data from participant analysis.

Facilitator is a trainer or specialist who, as a change agent, structures learning situations and experiences with the end result of enhancing the learner's capabilities to be sensitive to his or her own processes and behavior. He or she

functions in a way to allow participants to assume responsibility for his or her own learning. The term is in contrast to the more didactic instructor, teacher, lecturer, presenter, etc.

Farmer field school (FFS), by design, is a 'school without walls', where about twenty five farmers meet once a week for the duration of the cropping season from planting to harvest. In each weekly session of an FFS, the farmers, working in-groups, conduct agro-ecosystem analysis (AESA), team building activities and special topics. Special topics are designed based on immediate problems encountered by farmers in their farming activities. Trained FFS facilitators allow farmers to be experts, facilitating them to bring forth and examine their own experiences.

Fungal diseases refer to diseases caused by fungi. The general symptoms of fungal diseases on plants are the presence of 'cottony-like' and 'dry' appearances (e.g., leaf spots) of infected plant parts.

Fungi are tiny, simple plants commonly called molds. Since they do not have green color, they lack the ability to make their own food. They depend upon living host plants for food. Thus, they are parasites, and in the course of their feeding, most produce diseases on their host plants.

Grading refers to the sorting of vegetable produce according to a set of criteria recognized by the vegetable industry.

Gross return refers to the product of price and volume relative to the type of produce in every enterprise.

Integrated crop management (ICM) refers to all management strategies that are ecologically, economically, and socially acceptable. Therefore, integrated pest management (IPM) and integrated soil management (ISM) are integral part of ICM.

Integrated pest management (IPM) is a pest management strategy that builds on biological control as its foundation. In practice, it develops farmer's ability of making critical and informed decisions that renders production systems more productive, profitable and sustainable. Thus, it makes farmers experts in their own fields.

Integrated production pest management (IPPM) is a crop management strategy that builds on cultural and biological control as its foundation. In practice, just like IPM, it develops farmer's ability of making critical and informed decisions

that renders production systems more productive, profitable, and sustainable. Similarly, it makes farmers experts in their own fields.

KASAKALIKASAN is the acronym for Kasaganaan ng Sakahan at Kalikasan. It means Nature is Agriculture's Bounty. It is the Philippine Government's program that seeks to popularize Integrated Pest Management (IPM).

Labor and power cost refer to the amount of labor and power spent in each operation for every enterprise which is expressed in man-days, man-animal days, or man-machine days.

Mangrove refers to any tropical tree or shrub of the genus *Rhizophora*, the species of which are mostly low trees growing in marshes or tidal shores, noted for their interlacing above-ground adventitious roots.

Market chain refers to market intermediaries (e.g., households, neighbors, village collectors, traders, wholesalers, etc.) where different types of plant products (e.g., mature, immature fruits, flowers, leaves, etc.) pass through between farmers or producers and their different types of consumers.

Market competition refers to the dynamics among potential customers with similar needs and sellers offering various ways of satisfying those needs. The development of successful market competition strategies depends to a large extent on planner's ability to segment markets.

Market information refers to all available data from primary (e.g., obtained from new research surveys whenever new problem arises) and secondary (e.g., often available for free, or for a fee that is usually far less than cost of obtaining primary data) sources that can be used by marketing manager to help them make effective marketing decisions.

Material input cost is the total cost of all materials used in each enterprise such as seeds, fertilizers, and herbicides, among others.

Net return or net income refers to the difference between gross return less and total cost of labor and materials in every enterprise.

Nutrient bio-extraction (also called bio-harvesting) is the practice of farming and harvesting shellfish and seaweed for the purpose of removing nitrogen and other nutrients from natural water bodies.

Nutrient management means any strategy or method that will lead to effective and efficient use of nutrients in crop production.

Organic, in this text, refers to particular farming and processing systems described in organic certification standards and not in the classical chemical sense. The term 'organic' is nearly synonymous in other languages to 'biological' or 'ecological'.

Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including bio-diversity, biological cycle, and soil biological activity. It emphasizes use of management practices in reference to use of off-farm inputs. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within a system

Organic fertilizer refers to a product of biological decomposition or processing of organic materials from animal and/or plants that can supply one or more essential nutrient elements for plant growth and development. In organic farming, it is considered as the only natural, complete, and chief source of plant nutrients.

Organic matter decomposition refers to a process by which plant residues are broken down, thereby preventing an unwanted accumulation and allowing release of nutrients held in organic combinations within these residues for use by plants. Perhaps one of the most significant contributions of soil fauna and flora to organic vegetable productivity is that of organic matter decomposition.

Participatory technology development (PTD) is the process of collective and collaborative inquiry with the purpose of initiating community actions on solving local problems.

pH is an expression of soil reaction (e.g., acid, neutral, or alkaline), which is the negative logarithm of the hydrogen ion concentration. Acidity denotes an excess of H+ ions over OH- ions and alkalinity denotes the opposite. At neutral reaction, the H+ and OH- ion concentrations are equal.

Physiological disorders refer to all plant abnormalities or disorders that are caused by one of combination of non-infectious organisms, nutrient deficiencies or toxicities, and chemical injuries or toxic residues.

Physiological maturity is when seed have accumulated all food reserves, is at its state of maximum dry weight, and highest vigor and quality level.

Pricing arrangement refers to how various types of prices differ, how they relate to each other, and how they affect profits as sales volume of organically-grown vegetable products varies.

Productivity refers to the increase in yield resulting from improved decision-making skills among farmers associated with integrated pest management (IPM) practices such as selection of appropriate varieties, use of biological control agents (e.g., *Diadegma* or *Cotesia*), correct timing of fertilizer application, and sound water management.

Profitability refers to the increase in farmers' net income associated with increased yields and/or decreased production costs as a result of the IPM program.

Protection is a fundamental principle in pest and disease management, which is achieved through interposing a protective barrier between pest or pathogen and susceptible plant.

Pruning is a practical cultural management strategy, which includes the removal of all diseased and weak plant parts (e.g., leaves, stems, flowers, or fruits).

Record keeping is an essential activity in farming that furnishes valuable information about past performance in specific areas of farming operations, which can be used together with other data in determining future operations. Record keeping is important because: (1) it increases farmer's efficiency by providing him a basis in deciding where to put his resources; (2) it can be used for planning and budgeting; (3) profitability of various operations can be revaluated; (4) it shows where a farmer's money comes from and where it goes; (5) a farmer's capacity to pay is best shown by his farm records; and (6) settling questions becomes easy if all transactions are well recorded.

Resistance is a fundamental principle in pest and disease management referring to the development and use of cultivars that can thwart or impede activity of a pest or a pathogen.

Resistant variety means any crop variety that can resist the adverse effect or damage caused by insect pests, diseases, and adverse environment.

Return on investment (ROI) refers to the ratio between net return or income and the total cost of production in every enterprise.

Rouging refers to the removal of off-types in crops intended for seed production. It also means the removal of diseased plants with the accompanying pathogens

for disease management. Rouging must be done continuously if it is to be successful.

Sanitation is a practical cultural management practice aimed at reducing either the source(s) of inoculums or the exposure of the plants to infection. Sanitation excludes use of chemicals or biological control agents (BCA).

Seaweeds are marine resources of various economic importance; they are either used as food and non-food, or as sources of raw materials in many industries such as pharmaceuticals, cosmetics, feeds and fertilizers including uses for various food applications. It is an important component of the marine ecosystem along with the mangrove and coral reefs and can be viewed in two perspectives, from its ecological value as well as its economic uses.

Seaweed farming is the practice of cultivating and harvesting seaweed.

Specialist refers to a facilitator of a Training of Trainers (TOT), who is a graduate of an intensive four-month, six days a week season-long Training of Specialists (TOS) in non-formal education techniques for integrated pest management (IPM) in rice, corn, vegetables, among others.

Standards are norms, set of guidelines, requirements and principles that are used as in organic agriculture and processing. Standards are actually norms or guidelines by which a product or process can be labeled as 'organic'.

Sustainable agriculture means any principle, method, and practice that aims to make agriculture economically viable, ecologically sound, socially just and humane (equitable), culturally appropriate, and grounded on holistic science.

Therapy is a fundamental principle in pest and disease management referring to treatment of plants infested by a pest or infected by a pathogen.

Thinning refers to a cultural management practice, which involves the removal of undesirable plants to ease out overcrowding of seedlings, allow better penetration of sunlight, permit proper aeration or more rapid drying of dew or rain on foliage after a down pour, and minimize nutrient competition.

Training of specialist (TOS) is an intensive four-month, six-day a week season-long training course in non-formal education (NFE) techniques and integrated pest management (IPM) for extension and crop protection specialists.

Trap crops are alternate or susceptible crops planted within a particular vegetable area to attract some specific destructive pests of a particular vegetable crop thereby reducing their adverse effects to that particular vegetable crop.

Training team refers to a group of facilitators who work together to see to it that the learning process supports the objectives of the learning activities.

Training of trainers (TOT) is an intensive four-month, three days a week season-long training course in non-formal education (NFE) techniques and integrated pest management (IPM) for extension workers.

Trainer refers to a facilitator of a farmer field school (FFS), who is a graduate of an intensive four-month, three days a week season-long Training of Trainers (TOT) in non-formal education techniques for integrated pest management (IPM).

Varietal adaptability refers to the ability of a specific crop variety to grow productively under specific local conditions such as resistance to local pests, diseases, and environmental stresses.

Viruses are infectious particles that attack many forms of life, including bacteria and plants. They are so tiny that they can only be seen with an electron microscope.

Virus diseases refer to diseases that are caused by viruses. The general symptoms of virus diseases on plants are leaf discoloration, stunting, leaf-rolling or twisting, and vein clearing.

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ANNEXES

Annex A. List of Participants in a Workshop on Curriculum Development for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach held on 15-16 August 2013 at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon

NAME	GROUP	ADDRESS
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7. Jonathan B. Laviña	IV	Maybobon, Calutcot, Burdeos, Quezon
8. Robert B. Laviña	III	Maybobon, Calutcot, Burdeos, Quezon
9. Eduardo D. Macagaling	II	Maybobon, Calutcot, Burdeos, Quezon
10. Alex R. Mundo	I	Calutcot Proper, Calutcot, Burdeos, Quezon
11. Rodel B. Pujeda	IV	Maybobon, Calutcot, Burdeos, Quezon
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13. Edwin L. Resare	II	Maybobon, Calutcot, Burdeos, Quezon
14. Ernesto S.R. Taroma, Sr.	III	Maybobon, Calutcot, Burdeos, Quezon
15. Erwin Taroma	IV	Maybobon, Calutcot, Burdeos, Quezon
16. Gil A. Telejada	I	Calutcot Proper, Calutcot, Burdeos, Quezon
17. Manuel A. Telejada	I	Calutcot Proper, Calutcot, Burdeos, Quezon
18. Marty A. Telejeda	II	Maybobon, Calutcot, Burdeos, Quezon
19. Benito T. Tena, Sr.	III	Maybobon, Calutcot, Burdeos, Quezon
20. Joven J. Tena	III	Maybobon, Calutcot, Burdeos, Quezon
21. Rafael T. Tena	I	Calutcot Proper, Calutcot, Burdeos, Quezon

Annex B. List of Consultants and Resource Persons in a Workshop on Curriculum Development for Participatory Research and Learning of Seaweed Farmers Through the Farmer Field School Approach held on 15-16 August 2013 at Maydalaga, Kalongkoan Island, Calutcot, Burdeos, Quezon

NAME	DESIGNATION/ ORGANIZATION	CONTACT NUMBER
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Annex C. List of Technical Resource Persons and Facilitators in the Farmer Field School and Participatory Research and Learning on Seaweeds Production held on August 2013 to May 2014 at Kalongkoan- Calutcot Islands Burdeos, Quezon

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1. Mr. Jose T. Deles, Jr.	Volunteer Community Organizer-Resource Person, Marikina City	email: j_deles@yahoo.com
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Annex D. Farmer Field School (FFS) Curriculum on Seaweed Production

A. Characteristics of an FFS on Seaweed Production:

A farmer field school (FFS) is a 'school without walls'. The FFS on seaweed production brings seaweed farmers together to carry out an intensive training on integrated cultural management (ICM) methods and issues over the life cycle of seaweed. Thus, FFS farmer-participants meet for 14-16 weeks (a whole cropping season), from site selection to post-harvest. Each FFS group has at least a family size 'learning field' containing a farmer-run comparative study of ICM and other relevant field experiments. Each week, seaweed farmers practice agro-ecosystem analysis (AESA) in their 'learning field' which includes seaweed health, water quality, weather, nutrient management, pest and disease surveillance, and observation and collection of pests, diseases, weeds, grazers, among others.

Through direct experience and critical analysis, seaweed farmers interpret their observations in the AESA to make seaweed management decisions. Thus, FFS trains seaweed farmers to become experts in their own seaweed farms. The FFS training team (e.g., composed of facilitators and technical experts) is assisted by agricultural technicians assigned in a seaweed production area where the FFS on seaweed production is located[54]

[54]Callo, Jr., D.P. 2008. Accomplishment Report: Season-long Training of Trainers (TOT) for Facilitators of Farmer Field Schools (FFS) on Integrated Pest Management (IPM) for Corn-based Production System. Local Government Support Program to ARMM (LGSPA) of the Canadian International Development Agency (CIDA), Davao City, Philippines. 94p.

. The principles that guide an FFS learning process are:

- *The field is the primary learning resource.* All learning activities take place in the seaweed farm and are based on what is happening in the seaweed farm.

- *Experience forms the basis for learning.* The activities that take place in the seaweed farms and the seaweed farms form the basis for discussions and analyses by seaweed farmers who arrive at concepts which they test and improve through further seaweed farming activities.

- *Decision-making guides the learning process.* Training focuses on analysis of seaweed ecosystem. The combination of analytical methods, ecological principles, and basic ICM methods helps seaweed farmers gain insights into the ecological interactions in a seaweed farm and provide them with greater confidence in making seaweed management decisions.

- *The training curriculum is based on local conditions of the FFS.* The FFS curriculum and materials are based on their appropriateness, the local conditions, problems, and needs of seaweed farmers in the FFS.

- *Training last the entire seaweed cropping season.* Seaweed farmers acquire a firm understanding of relevant ICM concepts for each growth stage of the seaweed as well as the factors that influence seaweed management decision-making at all stages of seaweed's growth.

The andragogic and experiential approach of the FFS is a direct contrast to the pedagogic, diffusionist, and top-down extension methods of the Green Revolution. Government agencies involved in the Green Revolution were basically target-oriented and rigid in fulfilling their mandates. These agencies prescribed small farmers to use inputs in accordance with centrally-determined recommendations, resulting in a 'de-skilling' of rural communities. Farmers were expected to be passive recipients of new technologies rather than active innovators.

An FFS on seaweed production consists of 25-30 seaweed farmers meeting for half day each week to share and discuss AESA observations and plan out activities for the following week. The seaweed growth stage and agro-physiological issues related to these stages form the core of the FFS curriculum. Field monitoring through AESA culminates with the development of an agro-ecosystem drawing that is used for analysis. These are then shared through small and large group discussions guided by facilitators.

In the small group discussions, seaweed farmers share their ideas on what is happening in the seaweed farm and why these things are happening. Facilitators circulate among the group and help seaweed farmers analyze their observations by posing problems and scenarios. In the large group discussions, the small groups share their ideas with the whole FFS group. Facilitators help participants in the discussions, posing 'what if' scenarios. They also share additional information related to seaweed growth and ecosystem not covered by the group discussions.

Aside from serving as an experiential learning tool for seaweed farmers, FFSs also cater to the socio-cultural aspect of seaweed production. Hence, group dynamics exercises are regularly included in FFS activities. Group dynamic exercises are aimed to:

- Develop participants into a closer knit team;
- Establish a learning climate that is enjoyable as well as fruitful;
- Help participants experience and identify aspects of teamwork such as mutual support, the importance of individual roles to a team's success, and behaviors that can build or hamper teamwork; and
- Help participants experience what can be accomplished by working together.

Together with group dynamics exercises, special topics are likewise an integral component of FFS activities. Special topics sessions concerns specific problems like destructive diseases, epiphytes, weeds, and grazers or a field study being carried out in the 'learning field'. Special topics usually reflect individual FFS needs. Some special topics are planned ahead of the FFS while others are developed as the FFS progresses.

A typical profile of a farmer field school (FFS) on seaweed production, which was adapted from FFS for terrestrial crops (rice, corn, cotton, coconut, vegetables, mango, and other crops) at any given day[56]:

[56]Bruan, A.R., G. Thiele, and M. Fernandez. 2000. Farmer Field Schools and Local Agricultural Research Committees: Complementary Platforms for Integrated Decision-Making in Sustainable Agriculture. Agricultural Extension Network Department for International Development (DFID), Overseas Development Institute (ODI), London, United Kingdom. 15p.

- *Field observation: 07:00-08:00 am*. Seaweed farmers form small groups, makes observations of the whole seaweed farm, and then examine agreed number of seaweed plants per plot, recording agronomic data per seaweed plant, type and number of pests or diseases, and any other details.

- *Agro-ecosystem analysis: 08:00-09:00 am*. Each group prepares drawing of their field observations including information on the condition of seaweed plants, pests and diseases; weather, current, salinity, and other seawater conditions.

- *Presentation and discussion: 09:00-10:00 am*. Each small group presents their drawings and discusses their observations and conclusions in the whole group. The whole group reaches consensus about seaweed management practices that they will carry out during the coming week.

- *Break: 10:00-10:15 am*. A short break allows participants and facilitators to refresh and invigorate themselves in preparation for the succeeding activities.

- *Group dynamics exercise: 10:15-10:30 am*. This activity aims to stimulate attention and participation, as well as strengthen group communication and increase solidarity.

- *Special topics: 10:30-11:30 am*. The facilitator guides the group in experiments, lessons, exercises, and discussions on special topics related to what is actually occurring in a seaweed farm.

- *Evaluation and planning: 11:30-12:00 nn*. This activity allows the group to identify 'what went well' and 'what needs improvement' of the day's activities and plans activities to be undertaken in the coming week.

B. Season-long Activity Guide for an FFS on Seaweed Production:

I. WORKSHOP ON CURRICULUM DEVELOPMENT FOR PARTICIPATORY RESEARCH AND LEARNING OF SEAWEED FARMERS THROUGH THE FARMER FIELD SCHOOL (FFS) APPROACH

PREPARATORY FFS ACTIVITY (WEEK 0)		
TIME	**DAY 1: PROJECT OVERVIEW**	**DAY 2: CURRICULUM DEVELOPMENT**
AM	▪ Arrival of Participants, Resource Persons, and Facilitators ▪ Opening Prayer and National Anthem (Training Team)	▪ Arrival of Participants, Resource Persons, and Facilitators ▪ Opening Prayer and Recapitulation (Training Team)
	▪ Project Inception and Orientation	▪ Site Visit and Assessment of Seaweed Growing Areas ▪ Site Selection and Activity Identification for FFS on Seaweed Production
LUNCH BREAK		
PM	▪ Sharing of Experiences and Learned Lessons ✓ Expert Views on Current Technological Innovations ✓ Farmers Best Practices and Experiences in Seaweed Growing ✓ Current Issues and Concerns in Seaweed Production ▪ Wrap-up of the Day' ▪ Closing Prayer	▪ Curriculum Development for FFS on Seaweed Production ✓ Technical Topics Identification ✓ Field Activity Identification ✓ Training Process Adaptation ▪ Workshop Evaluation and Planning for Next Week's FFS Activities ▪ Closing Prayer

II. SEASON-LONG FARMER FIELD SCHOOL (FFS) FARMER FIELD SCHOOL (FFS) AND PARTICIPATORY RESEARCH AND LEARNING ON SEAWEED PRODUCTION

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 1: SESSION NO. 1 (SEAWEED PRODUCTION)**	**WEEK 2: SESSION NO. 1 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 – 10:00 AM	▪ Opening Program (Host Team) ✓ Opening Prayer ✓ National Anthem ▪ Seaweed Field Activities (Whole Group) ✓ Area Visit and Observation of Proposed Production Sites	▪ Opening Program (Host Team) ✓ Opening Prayer ✓ National Anthem ▪ Seaweed Field Activities (Whole Group) ✓ Area Visit and Observation of Proposed Variety Adaptation Trial Sites
	▪ Participatory Discussion: ✓ Production Plots Layout Design ✓ Production Plots Establishment	▪ Participatory Discussion: ✓ Variety Adaptation Trial (VAT) Plots Layout Design ✓ Variety Adaptation Trial (VAT) Plots Establishment
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: 'Ballot Box' Pre-test Exercise	▪ Group Dynamics: Animal Sounds
	▪ Participatory Discussion: ✓ Leveling of Expectations and Norm Setting ✓ Identifying Small Groups Members and Team Leaders	▪ Participatory Discussion: ✓ Forming the Weekly Host Teams ✓ Determining Host Team Functions
	▪ Special Topics: Seaweed Nursery Establishment and Management	▪ Special Topics: Seaweed Varieties and Their Characteristics
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 3: SESSION NO. 2 (SEAWEED PRODUCTION)**	**WEEK 4: SESSION NO. 2 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 7:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
7:30 - 10:00 AM	▪ Designing Agro-ecosystem Analysis (AESA) Monitoring Form for Seaweed Production Plots (Whole Group)	▪ Designing Agro-ecosystem Analysis (AESA) Monitoring Form for Seaweed Variety Adaptation Trial (VAT) Plots (Whole Group)
	▪ Observation and Data Gathering for AESA No. 1 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 1 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: The Boat is Sinking	▪ Group Dynamics: Whispering Game
	▪ Consolidation and Presentation of AESA No. 1 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 1 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 1 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 1 Recommendations on Seaweed VAT Plots (Whole Group)
	▪ Special Topics: Ecological Factors Affecting Seaweed Production	▪ Special Topics: Methods of Seaweed Cultivation
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 5: SESSION NO. 3 (SEAWEED PRODUCTION)**	**WEEK 6: SESSION NO. 3 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 2 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 2 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 2 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 2 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 2 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 2 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Total Recall	▪ Group Dynamics: Battle of Animals
	▪ Special Topics: Problems Adversely Affecting Seaweed Production	▪ Special Topics: Integrated Cultural Management Practices in Seaweed Production
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 7: SESSION NO. 4 (SEAWEED PRODUCTION)**	**WEEK 8: SESSION NO. 4 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 3 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 3 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 3 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 3 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 3 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 3 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: First 'Moving Exam' Exercise	▪ Group Dynamics: Second 'Moving Exam' Exercise
	▪ Special Topics: Pests and Diseases of Seaweeds and Their Management	▪ Special Topics: A-biotic Factors Affecting Seaweed Production and Their Management
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 9: SESSION NO. 5 (SEAWEED PRODUCTION)**	**WEEK 10: SESSION NO. 5 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 4 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 4 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 4 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 4 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 4 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 4 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Longest Line	▪ Group Dynamics: What is in a Box?
	▪ Special Topics: Facilitating FFS Problems of Absenteeism	▪ Special Topics: Grazers, Weeds, Dirt, and Their Management
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 11: SESSION NO. 6 (SEAWEED PRODUCTION)**	**WEEK 12: SESSION NO. 6 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 5 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 5 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 5 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 5 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 5 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 5 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Building A Bridge	▪ Group Dynamics: Name That Job
	▪ Special Topics: Developing Folk Media Presentation	▪ Special Topics: Planning for Field Day and Graduation Ceremonies
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 13: SESSION NO. 7 (SEAWEED PRODUCTION)**	**WEEK 14: SESSION NO. 7 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 6 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 6 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 6 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 6 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 6 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 6 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Third 'Moving Exam' Exercise	▪ Group Dynamics: Final 'Moving Exam' Exercise
	▪ Special Topics: Harvest and Post Harvest Practices in Seaweed Production	▪ Special Topics: Developing Livelihood Projects for Seaweed Farmers
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 15: SESSION NO. 8 (SEAWEED PRODUCTION)**	**WEEK 16: SESSION NO. 8 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 7 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 7 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 7 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 7 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 7 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 7 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Small and Big Coconut	▪ Group Dynamics: Samson and Delilah
	▪ Special Topics: Determining Production Costs in Seaweed Production	▪ Special Topics: Cost and Return Analysis in Seaweed Production
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES		
TIME	**WEEK 17: SESSION NO. 9 (SEAWEED PRODUCTION)**	**WEEK 18: SESSION NO. 9 (SEAWEED VARIETY ADAPTATION TRIAL)**
7:00 - 8:00 AM	▪ Observation and Data Gathering for AESA No. 8 on Seaweed Production Plots (Small Groups)	▪ Observation and Data Gathering for AESA No. 8 on Seaweed Variety Adaptation Trial (VAT) Plots (Small Groups)
8:00 - 8:30 AM	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation	▪ Opening Program (Host Team) ✓Opening Prayer ✓National Anthem ✓Recapitulation
8:30 - 10:00 AM	▪ Consolidation and Presentation of AESA No. 8 Results on Seaweed Production Plots (Small Groups) ▪ Fine-tuning of AESA No. 8 Recommendations on Seaweed Production Plots (Whole Group)	▪ Consolidation and Presentation of AESA No. 8 Results on Seaweed VAT Plots (Small Groups) ▪ Fine-tuning of AESA No. 8 Recommendations on Seaweed VAT Plots (Whole Group)
10:00-10:15 AM: C O F F E E B R E A K		
10:15 - 12:00 AM	▪ Group Dynamics: Battle of Games	▪ Group Dynamics: 'Ballot Box' Post-test Exercise
	▪ Special Topics: Procedures for Availing Seaweed Production Loans	▪ Special Topics: Formulation of Policies for Seaweed Production Loans
	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer	▪ Evaluation of the Day's Activities and Planning for Next Week's Activities ▪ Closing Prayer

SEAWEED FFS ACTIVITIES	
TIME	**WEEK 19: SESSION NO. 10 (FIELD DAY AND GRADUATION EXERCISES FOR FFS ON SEAWEED PRODUCTION)**
AM	FIELD DAY FOR FFS ON SEAWEED PRODUCTION
12:00-1:00 PM: L U N C H B R E A K	
PM	GRADUATION CEREMONIES FOR FFS ON SEAWEED PRODUCTION
	PARTICIPANTS' EVALUATION OF THE SEASON-LONG FFS ON SEAWEED PRODUCTION ACTIVITIES