INTERNATIONAL NETWORK FOR FAMILY POULTRY DEVELOPMENT

RÉSEAU INTERNATIONAL POUR LE DÉVELOPPEMENT DE L'AVICULTURE FAMILIALE

RED INTERNACIONAL PARA EL DESARROLLO DE LA AVICULTURA FAMILIAR

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Editorial

INFPD is now affiliated with WPSA!

E.F. Guèye
Editor-in-Chief

The proposition of the World's Poultry Science Association (WPSA) board to integrate the International Network for Family Poultry Development (INFPD) as a Working Group of WPSA was discussed at the meeting of the INFPD Executive Committee which was held in Dhaka, Bangladesh on October 24, 2002. Members present at the meeting were: Robyn Alders, E. Babafunso Sonaiya, E. Fallou Guèye, Anders Permin, Jonathan Bell and Emmanuelle Guerne-Bleich. Everyone welcomed the proposition, recognising the great advantage to family poultry that such an affiliation would engender. WPSA agrees also with the INFPD Executive Committee to keep the name and acronym of the network as they are while it becomes a working group within WPSA. In the three working languages (English, French and Spanish) adopted within the network, the current names and acronym are very suitable and easily remembered.

It should be mentioned that this is the outcome of a long development, under the tireless co-ordination of Prof. E. Babafunso Sonaiya. Other committed persons (René Branckaert, Werner Bessei, Nureldin Musharaf, Jonathan Bell, Peter Spradbrow and Olanrewaju B. Smith) have also provided consistent and steady support to our network, since its creation. The network, which started as the African Network for Rural Poultry Development (ANRPD) or RADAR ('Réseau Africain pour le Développement de l'Aviculture Rurale', in French), was set up during an International Workshop on Rural Poultry Development in Africa held in November 1989 in Ile-Ife, Nigeria. To extend membership and coverage of the network into Asia and Latin America, the name was changed into International Network for Family Poultry Development (INFPD) or RIDAF ('Réseau International pour le Développement de l'Aviculture Familiale', in French; 'Red Internacional para el Desarrollo de la Avicultura Familiar', in Spanish) at the RIDAF General Meeting which took place in M'Bour, Senegal, in December 1997. During this latter meeting, contacts between WPSA and INFPD were formally established as one of the WPSA's Vice-Presidents, Prof. A. Cahaner of the Hebrew University of Jerusalem, Israel, attended our General Meeting and was elected into INFPD Advisory Committee. Since 1992, ANRPD/INFPD organized symposia during World's Poultry Congresses (1992, 1996, 2000), with financial support provided by the Food and Agriculture Organization of the United Nations (FAO). It is also expected that INFPD will organize a symposium during the XXII World's Poultry Congress which will take place in Istanbul, Turkey, from 8 to 13 June 2004.

Another important point to note is related to WPSA and INFPD dues for INFPD members. It was resolved that INFPD should be kept accessible to non-poultry scientists (i.e. sociologists, social anthropologists, socio-economists and human geographers.) who are already members of the network and may not wish to join WPSA. The WPSA dues for such members will not be enforced as they opt to be members of INFPD only. Although it was decided to increase regular WPSA registration fee from US$ 15 to US$ 20, a substantial reduction of WPSA membership fees for members of developing countries to US$ 10 has been

approved. This reduction is available to members subscribing to WPSA through INFPD. Thus, US$ 10 will be remitted to WPSA and US$ 5 be kept as INFPD membership fee. The US$ 5 will cover the subscription for the Newsletter and Directory and other benefits accruing to INFPD members. All INFPD members are kindly invited to pay their dues (i.e. US$ 15 for developing countries) so that we can all be proud of our integration into WPSA! Further information relating to the INFPD integration into WPSA is available under the section **INFPD News** (see "INFPD becomes a Global Working Group of WPSA").

For now, let me congratulate you all on this major achievement in the life of our network!

Research & Development Contributions

The effects of coccidiostat prophylaxis on immune response of chickens to Newcastle disease vaccine

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INTRODUCTION

Newcastle disease (ND) is an acute, mild to severe, highly infectious and contagious disease of poultry and other birds caused by a *Paramyxovirus* (Novilla and Navorro, 1969; Spradbrow, 1987; Cross, 1991). Despite the advances in the production of potent vaccines and rigorous vaccination programmes, outbreaks of ND continued to occur in many areas (Chu and Rizk, 1972; Elssa, 1985). It has been postulated that failure in the control of the disease could be considered as a result of underlying factors which might interfere with the responses of birds to vaccination. Many of these factors have been identified while others remained obscure. Notable among the factors include: the immaturity of immune system of chicks, residual maternal antibody interference, immunosuppression due to early exposure to immunosuppressive disease agents and drugs as well as the possibility of antigenic differences between field virus and vaccine strains (Chu and Rizk, 1972; Elssa, 1985; Giambrone and Closer, 1990; Baba *et al.*, 1998).

Sulphonamides and nitrofurans are groups of drugs used extensively in coccidiostat preparations for prophylactic control of poultry coccidiosis. The residual effects of continuous administration to poultry have not been adequately investigated. Nevertheless, chronic sulphonamide poisoning in birds has been associated with splenomegaly, haemorrhages on the skeletal muscles, nephritis, prolonged blood clotting time, anaemia and icterus (Goth, 1981).

The effects of prophylactic drugs on immune response of humans to vaccination have been documented. Concurrent administration of chloroquine (for malaria) with human diploid cell rabies vaccine to Peace Corps Volunteers in Africa resulted in poor response among vaccines (Taylor *et al*., 1984). However, routine anti-malarial doses of chloroquine did not affect antibody response to yellow fever 17D vaccine (Barry *et al*., 1991).

MATERIALS AND METHODS

The aim of this study was to determine the effects of four prophylactically administered coccidiostat preparations (Coccidin$^{(R)}$, Amprolium$^{(R)}$, Esb_3 30%$^{(R)}$ and Embazin-forte$^{(R)}$) on immune response of chickens to ND vaccine. The chemical compositions of the coccidiostats are as follows: Coccidin$^{®}$: Sulfaquinoxaline (15g) and nitrofurazone; Amprolium$^{®}$: Amproli hydrochloridium (200mg); Esb_3 30%$^{®}$: N1-(6-chloro-2-pyranizyl sulphanilamide) (100g) and Embazin-forte$^{®}$: Sulfaquinoxaline, diaveridine and vitamin K. The preparations are routinely used against coccidiosis in poultry and were obtained from reputable marketers in Nigeria.

Fifty (20-week-old 'black hacho') cockerels from ND-free parents were divided into 5 equal treatment groups. Four of the groups were each consecutively administered with a coccidiostat according to the

manufacturer's regimen (duration of prophylactic treatment ranged between 3 and 6 days). Treated birds were later inoculated orally with ND 'La Sota' vaccine (obtained from National Veterinary Research Institute, Vom, Nigeria) on the last day of each coccidiostat administration. The birds in the 5th group served as untreated controls and were also vaccinated.

All the chickens were bled on days 0, 7, 14, 21 and 28 post vaccination (P.V.) for the determination of the total and differential leucocyte values as well as haemagglutination-inhibiting (HI) antibody titres. The leucocyte values were estimated using the method of Schalm *et al*. (1975), while the HI test was performed on the test sera using the modifications (Baba *et al*., 1998) of the procedure of Allan and Gough (1974). Sera were tested at 1:10 dilution against the ND virus antigen (La Sota vaccine). Four to eight haemagglutination units of the antigen were used in the test. Sera which were positive at 1:10 dilution were titrated to endpoints.

RESULTS AND DISCUSSION

There was no significant difference ($P>0.05$) in the leucocyte values before and after administration of coccidiostat to the different treated groups (Table 1). However, there was a significant decline in the lymphocyte values within the Embazin-forte and Esb_3 30% treated groups.

Table 1: Haematological values in different groups of experimental chickens before and after coccidiostat and vaccine administration

Coccidiostat	Average differential leucocyte count*		Average packed cell volume*	Average total leucocyte count*
Amprolium	Heterophil	15 (14)		
	Eosinophil	0 (0)		
	Basophil	6 (5)	24% (23%)	1.3 x 10^4mm^3 (1.54 x 10^4mm^3)
	Monocyte	6 (3)		
	Lymphocyte	63 (60)		
Coccidin	Heterophil	5 (6)		
	Eosinophil	0 (0)		
	Basophil	4 (5)	23% (22%)	1.44 x 10^4mm^3 (1.34 x 10^4mm^3)
	Monocyte	5 (3)		
	Lymphocyte	76 (72)		
Esb_3 30%	Heterophil	11 (10)		
	Eosinophil	0 (0)		
	Basophil	7 (7)	23% (22%)	1.25 x 10^4mm^3 (1.00 x 10^4mm^3)
	Monocyte	5 (5)		
	Lymphocyte	75 (59)		
Embazin-forte	Heterophil	23 (16)		
	Eosinophil	0 (0)		
	Basophil	6 (6)	25% (23%)	1.54 x 10^4mm^3 (1.24 x 10^4mm^3)
	Monocyte	5 (5)		
	Lymphocyte	70 (58)		
Control	Heterophil	22 (20)		
	Eosinophil	0 (0)		
	Basophil	5 (5)	23% (22%)	1.42 x 10^4mm^3 (1.35 x 10^4mm^3)
	Monocyte	6 (4)		
	Lymphocyte	65 (65)		

* Values without brackets represent those obtained before coccidiostat and vaccine administration, and values within brackets are those obtained after treatment

Definite differences were noted in geometric mean titre (GMT) values of HI antibody among the various treated groups (Table 2). In all groups, the GMT values of detectable antibody declined significantly within 7 days after development when compared with the control group. This phenomenon could be attributed to the residual effects of coccidiostat on the immune system which might subsequently prevent sufficient immune response of host cells to the live attenuated vaccine. The lack of immune response, in spite of continued antigenic stimulation, might bring about the subsequent decline in the antibody titre.

Table 2: Geometric mean titre (GMT) of HI antibody among different treatment groups of chickens before and after coccidiostat and vaccine administration

Treatment group	GMT values on different days (post vaccination)				
	(0)	(7)	(14)	(21)	(28)
Amprolium	10	278	105	105	67
Coccidin	10	160	92	40	40
Esb_3 30%	10	95	81	20	20
Embazin-forte	10	57	40	23	20
Control	10	221	197	184	124

The GMT values in the Embazin-forte and Esb_3 30% treated groups were significantly lower when compared with other groups and the control, and there was general and marked decline in the GMT values in all groups on day 21 post vaccination and subsequently. Furthermore, it was observed that there were numerical decreases in the lymphocyte values among chickens treated with Embazin-forte and Esb_3 30% with a concomitant poor antibody response to ND vaccine among chickens in the group which could be attributed to the higher concentration of sulphonamide in the two preparations. Although the protective capacity of HI antibody in vaccinated chickens was not evaluated, it is possible that the HI antibody levels in Embazin-forte and Esb_3 30% treated chickens were not protective.

CONCLUSION

From the results of this study, it is apparent that most of the coccidiostat preparations used in coccidiosis prophylaxis in Nigeria have no significant effects on the immune response of chickens to ND vaccine. All the chickens in the various treatment groups including the controls seroconverted after vaccination. Moreover, the interactions between coccidiostats, particularly Embazin-forte and Esb_3 30%, and immune response of chickens to ND immunization deserve further investigation. For instance, we are currently making attempts at determining the cellular immune responses based on the reactivity of peripheral mononuclear cells from treated birds to ND virus antigen *in vitro* as measured in the lymphocyte transformation test.

REFERENCES

Allan, W.H. & Gough, R.F.A. (1974): A standard haemmagglutination inhibition test for Newcastle disease: a comparison of the macro and micro methods. *Veterinary Records* 95: 120-123.

Baba, S.S., El-Yuguda, A.D. & Akoma, M.B. (1998): Serological evidence of mixed infections with the viruses of Newcastle disease and Egg-drop syndrome-76 in village chickens in Borno State, Nigeria. *Tropical Veterinarian* 16:137-141.

Barry, M., Pattersson, J.E., Tirrell, S., Cullen, M.R. & Shope, R.E. (1991): The effect of chloroquine prophylaxis on yellow fever vaccine antibody response: Comparison of plague reduction neutralization test and enzyme linked immunosorbent assay. *American Journal of Tropical Medicine & Hygiene* 44(1): 79-82.

Chu, H.P. & Rizk, J. (1972): Newcastle disease - a world poultry problem. *World Animal Review* 2:33-43.

Cross, G.M. (1991): Newcastle disease. *Veterinary Clinics of North America*: *Small Animal Practice* 21(6): 1231-1239.

Elssa, Y.M. (1985): Disease control problems in the middle East. *World. Poult*ry, Dec. 1985, pp. 33-37.

Giambrone, J.J. & Closer, J. (1990): Effects of breeder vaccination and immunization of progeny against Newcastle disease. *Avian Diseases* 34: 114-119.

Goth, A. (1981): Sulfonamides. In: Medical Pharmacology 10th Edit. Mosby Year book Pub, London, UK, pp. 622-625.

Novilla, M.N. & Navorro, J.A. (1969): A preliminary study on the identification and classification of Newcastle disease virus (NDV) strains obtained from field outbreaks in The Philippines. *The Philippine Journal of Veterinary Medicine* 8(1&2): 25-35.

Schalm, O.W., Jain, N.C. & Carroll, E.J. (1975): *Veterinary Haematology*. 3rd Edit. Lea and Fabiger Pub. Philadelphia, USA, pp. 39-40.

Spradbrow, P.B. (1987): Newcastle disease: an overview. In: Newcastle disease - a new feed pellet vaccine (Copland, J.W., Ed.), ACIAR Monograph No. 5, Australia, pp 12-18.

Taylor, D.N., Wasi, C. & Bernard, K. (1984): Chloroquine prophlaxis associated with a poor antibody response to human diploid cell rabies vaccine. *The Lancet*, June 23, p. 1405.

Improvement of domestic poultry keeping in Bangladesh

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ABSTRACT

Contrary to high-tech, industrial poultry keeping, domestic poultry keeping in the villages of Bangladesh is highly profitable and brings a steady trickle of petty cash for household use to the female keepers. It therefore deserves support, which can be given in the form of the distribution of day-old chicks of exotic breeds, reliable disease- and pest-control at low cost and marketing support.

Key words: Animal protein, Bangladesh, domestic poultry keeping, genetic upgrading, participatory group discussions, petty cash

1. INTRODUCTION

In one editorial of the INFPD Newsletter (Guèye, 2000) the "key role of family poultry in improving

livelihoods of poor people in low-income food-deficit countries" is mentioned. The present article deals with the case of Bangladesh. McArdle (1969) proposed for India replacement of all village cocks by exotic ones as a means to upgrade village poultry keeping. Such genetic improvement was later modified in Bangladesh to the exchange of a number of village cockerels for exotic ones (Smith, 1978; Tan and de Zeeuw, 1981; Tan and de Zeeuw, 1982). A justification for the preference for cockerel exchange over egg- or day-old chick distribution was not given.

Mortality is the greatest drawback to domestic poultry keeping (Maho *et al.*, 2000). Vaccination against some diseases, medication against parasites and diseases, feeding of concentrates, controlled management, conditioned environment and the use of highly productive breeds are conventional means to increase productivity in high-tech poultry keeping. Whether and to what extent these would apply under village conditions were among the aims of a reconnaissance survey in Bangladesh (ter Horst, 1986). Many of the findings therein are corroborated by Rangnekar and Rangnekar (2001).

The purpose of this study was to investigate whether and how village- and high-tech/industrial poultry management could be matched, in order to widen the otherwise limited scope for improvement of village poultry keeping. In the villages of developing countries domestic poultry is an important source of petty cash and animal protein. Contrary to high-tech poultry keeping, the domestic poultry industry is conducted virtually without inputs of money and does not compete with other labour. Women and children conduct it. Income from village poultry thus almost equals profit. With participatory group discussions, the situation in Bangladesh has been studied and analyzed.

2. MATERIALS AND METHODS

In consultation with persons knowledgeable about village poultry keeping, a list of one hundred basic points of interest was prepared. As method for soliciting information on poultry keeping in the villages, participatory group discussions were used. Groups of ten, not more than fifteen, women were invited for a period of five days to take part in discussions. The points of interest were gradually brought up in free discussions among the participants. They received the equivalent of daily wages and a midday meal. One hundred and eighty eight (188) women have been interviewed. In this way, data from eighty different locations in the districts of Sylhet, Comilla, Rajshahi and Satkhira have been collected. These districts are fairly representative of Bangladesh's conditions.

The participants came from different strata in the population. Most of them were poor and chicken keepers. Some participants were too poor even to rear chickens. For many reasons, it was and is impossible for a foreign expert as well as for male extension workers of the Livestock Services to conduct such discussions with the women directly. For emphatic Bengali women, familiar with conducting group discussions without leading them, it proved to be possible.

At first, there was a barrier as is normal between strangers, group members as well as the discussion leader. Gradually the confidence was won, and the discussions on poultry could start. On the first day, neutral subjects were discussed, like the preference for a certain type of chicken or the construction of a night house. On the last day, the more confidential subjects of income and indebtedness were introduced into the discussions. By means of these discussions a good picture has been obtained of the ins and outs of village poultry keeping. The data obtained have the value of being authentic and representative. Statistical confidence was not sought.

3. RESULTS

3.1 Model

Profit from poultry keeping equals gross yield minus costs. Gross yield is number of units times price per unit of production respectively times the value per unit in other aspects such as the nutritional value. Running costs are inputs and labour costs. Profit thus can be increased by

a) raising the productivity, that is increasing the number of units for sale or use,
b) a higher price per unit of production, and
c) reducing costs.

How much room for manoeuvre does the keepers, the poor village women, have within this model?

3.2 Increasing productivity

From experience, the following parameters about domestic poultry keeping can be assumed:

a) a village hen will lay 30 eggs per year,
b) from 30 eggs, 25 will hatch,
c) mortality between hatching and maturity is 70%.

With these assumptions, the existing productivity can be estimated as follows:

a) a flock of 15 hens and 1 cock will produce 450 fertile eggs per year,
b) of 450 eggs, 120 will be used for reproduction,
c) from 120 hatching eggs, 100 chicks will hatch,
d) from 100 chicks, 30 will reach maturity: 15 cockerels and 15 pullets,
e) 15 pullets will replace the mature hens,
f) of the original 15 mature hens, 10 will survive,
g) one cockerel will replace the mature cock,
h) if from 450 eggs laid, 120 are used for reproduction, and 30 will get lost or be spoilt or stolen or broken, the 300 remaining will be for sale or consumption.

So, from 15 hens and 1 cock, the yearly proceeds for sale or consumption are: 300 eggs, 10 mature layers, 1 mature cock and 14 cockerels. That means from the average village poultry bird: 18.7 eggs, 0.7 mature birds and 0.9 cockerels per year. It can be seen that productivity would considerably increase when a village hen would lay more eggs, when the growth rate would increase, and especially when mortality would be reduced.

3.2.1 Increasing productivity by domestic means

Brooding: Care for the broody hen is given by providing a good nest, e.g. a broken pot, in a quiet place, out of reach of children and dogs, with some rice and clean water put next to her. She should sit on not more than 10 eggs, or on not more than 8 bigger improved eggs. Brooding should be regulated such that the chicks are 2 months old at the onset of either the rainy season or winter to make optimal use of the grains found in harvested fields. In case a brooding hen dies, the women look for another broody hen, possibly from neighbours, to finish the job.

Broodiness is undesirable if egg production is the aim. The women reported a number of drastic measures to break broodiness: (i) the hens were e.g. dipped in cold water, (ii) a heavy weight was put around their necks, (iii) they were tied to a post in the sun, or (iv) a feather was put through their beaks.

Hatching and care for the chicks: Hatching percentages of 85% are normal, and values of 75-80% are considered satisfactory. The chicks are surrounded by the care of the women, but the possibilities to improve survival are limited. Poor women try to keep the chicks alive by taking them into bed when the mother hen dies. Chicks should remain warm and should not

get wet. It is bad practice to put the chicks with the chickens in a night house, particularly when ducks are also kept there because they will become diseased and infested more easily. Chicks can be kept together with the mother hen in a box lined with gum, for instance under the bed or in a coop. Chicks, especially white chicks, are sometimes stained red, to reduce their visibility for birds of prey. Some bushes on the homestead will give chicks and chickens an opportunity to flee.

Care for chickens: The poor in the village live on such small plots that there is no scope for the chickens to get their food by scavenging. Trespassing into the gardens of neighbours is minded very much because it can lead to the loss of chickens. The best period for rearing chickens is at harvest time. The season is dry, which will reduce the incidence of disease, and predators cannot hide in standing crops. There is a lot of feed to be found in the form of fallen grain. The scavenging of chickens in the harvested fields is minded less by the owners than scavenging in market garden plots.

Chicken night houses have to be sturdy and well locked for fear of zero-, two- and four-legged predators. The houses often lean to the dwelling and are made of bamboo and mud. Bamboo matting gives a drier floor. The opening should be on the east side, to allow the morning sun to warm the chickens and the chicks. Often the night houses are crowded, which increases the spreading of diseases and pests. Desinfection of the walls and roof with a flaming rag and the spreading of wood ash on the floor and under the wings will give some control of lice.

Every opportunity to allow the birds to get some extra feed should be used. For instance, cockroaches, weeds and snails can be considered.

Reducing mortality: The single most negative parameter in chicken keeping is mortality, particularly chick mortality. Chick mortality is always present, with peaks in the rainy season due to disease and in the winter due to cold. Mortality of adult chickens is connected with epidemics, like an outbreak of Newcastle disease (Ranikhet). Fowl pox, fowl cholera, coccidiosis and Marek's disease also take their toll. The disease situation is grim.

Keeping the chicks warm and dry will improve their lot. All kind of commodities are used as medicines: turmeric, kerosene, chillies, juice of tamarind and some wild plants have been mentioned. The positive effects are reported to be meagre. A quite common practice is to sell sick birds. Dead birds are thrown in the field.

3.2.2 Increasing productivity by scientific means

Genetic upgrading: Domestic (deshi) chickens are small, and hens get broody quickly, which limits the number of eggs laid to about 30 per hen and per year. But they have characters inherited from the wild fowl that improve their chances of survival under village conditions. It is generally considered wise to maintain sufficient of these domestic characteristics by crossing deshi birds with exotic ones (Rhode Island Red, Australorp, White Leghorn, White Sussex, Barred Plymouth Rock, to name a few exotic varieties present in Bangladesh). Naked-neck is a character preferred for meat production. We call the cross of village chickens with exotic birds. Improved chickens are bigger and more productive than deshi chickens.

The technical possibilities to introduce exotic genes into the chicken population of a village are implemented by means of:

a) cockerels,
b) pullets,
c) day-old chicks,
d) fertile eggs, and
e) semen.

The mentioned technical possibilities all bring exotic genes into the village. Crossing an exotic cock with a deshi hen will result in fewer and smaller eggs, and thus smaller chicks, than crossing a deshi cock with an exotic hen. When using a deshi cock, a dwarf gene may be transmitted to the next generations, in which case there will not be the increase in bird size that otherwise may be expected. The potential for genetic upgrading through pullets is obviously far less than through cockerels.

The sequence of steps in the realization of adult improved birds is the following:

a) exotic cock crosses with exotic layer,
b) resulting in exotic eggs, that hatch and
c) yield exotic chicks, either cockerels or pullets.
d) These chicks grow to maturity. Then either
e) exotic cock crosses with deshi hens, or exotic pullet crosses with deshi cock
f) Crossing exotic with deshi yields improved eggs and chicks,
g) that grow to maturity.

The financial means of governments in developing countries are limited. From the point of view of the most profitable use of public money, the possibility should be chosen that is easiest to carry out. Moreover, from the premises of a poultry farm of a given size, the greatest number of adult improved birds in the villages at the lowest cost-price should be produced. Different parts of the above mentioned production process can take place inside the (government) poultry farm. For instance, the farm can produce and distribute exotic fertile eggs only, or can rear exotic cockerels for distribution. To be able to calculate the outputs of the different possibilities, a number of estimates for mortality, production and hatching percentages, have to be made:

- depletion of exotic cocks and layers in the farm and in the village is 10% per month,
- under reasonable conditions of management, exotic layers will produce eggs:

age in months	6	7	8	9	10	11	12	13	14	15	16	17	
eggs per month	5	12	18	17	16	15	13	12	10	9	8	5	(140 eggs per year)

- eggs hatched by deshi hens will be 84%,
- hatching percentage in incubator will be 70%,
- a shed of 100 m^2 can house at one time respectively: 500 young cockerels till about 5 months of age, 300 layers plus 30 cocks, or 800 young pullets and 800 young cockerels till 2 months of age.

The technical possibilities compare differently in terms of feasibility. Artificial insemination must be considered as impractical under the rural conditions in Bangladesh and other developing countries. The genetic upgrading from the distribution of improved genetic material will be inferior to the improvement by exotic birds. Cockerels, inseminating the 10 hens of their flock, are to be preferred over pullets. The most likely possibilities thus remaining are: distribution of exotic fertile eggs, of exotic day-old chicks or of exotic cockerels.

Exotic fertile eggs: A shed houses 300 layers and 30 cocks. Production per year per layer is 140 fertile eggs. Hatched by deshi hens 84 % = 117 day-old chicks will result. Depleting at the rate of 10% per

month, after half a year 62 will remain as adult birds; half cocks, half layers. The production capacity of the shed thus is 9,300 exotic cocks and an equal number of pullets per year.

Exotic day-old chicks: As above 300 layers will each produce 140 fertile eggs per year. Hatching in the incubator will give 98 day-old chicks, of which after half a year 52 remain. The production capacity of the shed is thus 7,800 cocks and an equal number of pullets per year.

Exotic cockerels: A shed can house 800 young cockerels and 800 young pullets till 2 months of age. The shed is not entirely available because a few layers and cocks have to produce the necessary eggs: 18 layers and 2 cocks, producing 2,300 eggs, of which 70% will hatch in the incubator. They use only 7% of the floor space. The remaining 93% of floor space can house 744 young cockerels and 744 young pullets. After 2 months, pullets and, taking mortality in the shed into account, some of the cockerels can be culled. Five hundred cockerels of 6 months can be distributed twice a year, bringing the production capacity of the shed at 1,000 cockerels per year (plus a number of young pullets and some young cockerels).

Rearing exotic cockerels for distribution is clearly far less productive in terms of genetic improvement than producing either exotic fertile eggs or day-old chicks. It is also costly and difficult. Already at a young age the cockerels start fighting. Preventing this would require considerable constructions, for which the funds and the space are lacking. Because of these difficulties managers of poultry farms are known to have distributed cockerels at a too young age. These birds then contributed more to the merriment of the villagers than to production because the mature and tough village hens chased these youngsters. Another factor decreasing the improvement through cockerels is selling of these birds in the market. Young and tender animals are consumed, and the intended genetic improvement is thus defeated completely.

It will depend on the circumstances whether fertile egg distribution can be preferred or day-old chick distribution. Fertile eggs can be transported very carefully over short distances, while the transport of day-old chicks is less delicate and possible over longer distances. Where eggs can be distributed in the vicinity of a shed, and the woman buying the eggs can find a broody deshi hen to put the fertile eggs under at night, this method can be preferred. The foster mother will take good care of the chicks. But generally day-old chick distribution is to be preferred because of the possibility of transport to remote areas under difficult conditions. Rearing day-old chicks, if they cannot be adopted by a deshi hen, however is problematic under village conditions and in most cases would require the input of some feed, special management and, if possible, vaccinations.

It goes without saying that when exotic chicks are reared for the future upgrading of the stock, deshi cocks should as far as possible be removed from the scene. And in any case, scrawny and older deshi cocks with undesirable characters should be culled.

Several exotic breeds come into consideration. Which is to be preferred depends on the purpose of chicken keeping. Is it consumption or selling? What gives more profit in terms of nutrition or financial proceeds? We can adopt as point of departure for a comparison: 100 eggs. Under village conditions, this will give 84 chicks, of which 44 chickens of 6 months will remain. It is not difficult to see that the market value or the nutritional value of 100 eggs is far less than of 44 grown chickens. So, rearing chicks to maturity is far more profitable than selling or using the eggs. There are however two conditions that must be fulfilled to make this statement true: 1. the costs for rearing chickens should not exceed the difference in market

value, and 2. rearing chickens from fertile eggs to grown birds should be feasible. In practice, under the conditions in the villages, this means that the chicks should be able to scavenge their food during a period of six months and that care for and management of the chickens should bring only low costs.

Where rearing broilers is to be preferred, the breed should be true to type. Therefore, White Leghorn is less suited than the fleshier, coloured breeds Rhode Island Red, Barred Plymouth Rock, Australorp and the like. The advantage of bigger and fleshier chickens is their faster growth. They reach a desired size earlier. In Bangladesh, young broilers of that size are preferred because the parts, e.g. drumsticks, cost less and because cooking time will be short. Hybrid chickens, that would involve the recurrent purchase of new stock, obviously are out of question for village chicken management.

Vaccinations and medication: Vaccinations are possible against Newcastle disease, fowl pox, fowl cholera and Marek's disease. The history of the application of the thermolabile vaccine against Newcastle disease will illustrate the difficulties encountered with vaccinations in the field. The problems associated with the transport of the vaccine in a viable state from the laboratory to the villages are many:

- the cold chain from the laboratory to the premises of the District Livestock Officer (D.L.O.) does not always function properly;
- the refrigerated transport from the D.L.O.'s office to the office of a lower officer can be even more problematic;
- moreover, keeping the vaccine cold in his office is problematic when there is no refrigerator;
- distributing the vaccine into the villages gives problems because the vaccine can only with difficulty be kept cool. The villages are remote, transport is troublesome and time-consuming;
- to protect the vial from light and high temperatures, it sometimes is put inside a banana or a piece of banana stem. It is also sometimes put inside a bottle of cold water that is placed in a bag with rice husks;
- in the village, it is not possible to keep the vaccine non-refrigerated for periods longer than 4 hours. Within this period of viability, the vaccine should be applied. This causes organizational problems with the collection of a sufficient number of chickens in the allotted time;
- the vaccine should be diluted with cold distilled water. Measuring 100 ml for 1 vial can be done accurately only with difficulty;
- the quality of the water poses another problem. Distilled water usually is not available. Boiled water is next best, but it should have completely cooled. In practice just tube well water is used.

It is not surprising that the women who were interviewed had bad experiences with these vaccinations. The service had been very unreliable, both in regularity and effectiveness, and the vaccinators used to illicitly ask for payment for administering vaccinations. A thermo-stable vaccine would eliminate some difficulties encountered in the transport. The experiences with the other vaccines (easier to apply) are however not encouraging either. It will remain a problem to distribute equitably, evenly and reliably the vaccines when the villages are remote and very difficult to reach and when the vaccinators are inclined to ask for relatively high fees.

Mentioning these problems gives at the same time an indication for their solution. When the transport does not influence the quality, it is a matter of political will and organization to bring the vaccines and medicines into the village reliably and at a price that is accessible to the poultry keepers.

Some non-governmental organizations have managed to create a working system. The transport of vaccines

within the Livestock Services has been improved. Older women and widows are freer to move around in the village than younger ones. In the villages, a network of such women is created, and this network makes a living from administering vaccinations and distributing day-old chicks.

3.3 Increasing prices

Eggs or chicken meat can be consumed or sold. Sons, the husband and/or a guest consume eggs and meat. Daughters occasionally eat some, the housewives rarely eat eggs or meat. The laudable idea to improve the nutrition of pregnant and lactating mothers by improving village chicken raising has not yet been realised in Bangladesh. For poor women, eating eggs and meat is a luxury that can rarely if ever be afforded. Selling poultry products (eggs and chicken meat) gives the opportunity to buy some rice or other basic commodities. Selling from the house gives a lower price than selling in the market. But the women prefer selling from the house because in that case they get the proceeds into their own hands. Selling in the market would often involve a male family member, and in that case it is not at all sure that the women will get the money back.

Getting the money into their own hands means the liberty to spend according to their own wishes. The role of traders to make selling from the house possible is important. Women are better investors than spenders, and, in this respect, it is more important who gets the money than how much. The money is spent on the welfare of the family. It forms a steady trickle of income for small necessities (petty cash) (van Vugt, 1991a; 1991b). The traders fix the price, a price that is at least one third lower than the market price. Still, selling to traders is popular. Chickens can be sold in case of emergencies.

It is very important that the women get a better price for eggs or chickens. Experience shows that cooperatives that incorporate marketing function best when the initiative and management are in the hands of the women themselves.

3.4 Reducing costs

Costs are very low and should remain so if this village poultry industry is to be as profitable as it now is. Any proposal for improvement of village poultry keeping should keep this in mind. As the situation is, there is no scope for improvement of the profitability by the reduction of costs, because they are virtually non-existent.

Poultry keeping needs a small initial investment for the purchase of birds. Sometimes this is earned by shared ownership: the woman who takes care of the management is rewarded by half the proceeds or half the offspring.

4. COMPARING VILLAGE AND INDUSTRIAL POULTRY KEEPING

It is not a matter of indifference in which direction the poultry keeping in a country is influenced to develop. Should it be in the direction of modern, high-tech/scientific, industrial poultry keeping or by assisting village poultry keeping? Modern poultry keeping brings heavy investments with it and needs a high-quality infrastructure of input-supply and veterinary care, while marketing has to be developed. Village poultry keeping has been able to exist over the centuries without any investment or outside dependency, and it will continue to do so when not pushed out of the market.

When with large government assistance and subsidies

the poultry industry and its marketing system have been developed, village poultry keeping starts to decline. Not because it is a less profitable enterprise, on the contrary as we have seen. But it happens in several Asian countries because of the higher level of management and organization of the poultry industry. For some consumers who prefer products from the commercial poultry industry argue that these products are cheaper and easier to obtain. But it should be realized that this is an artificial result, obtained with the assistance of bank guarantees, easy loans, subsidies, tax facilities and easy access to inputs. Village poultry keeping has to do without all this outside assistance and promotion. If only a part of all the efforts that go into industrial poultry keeping could be devoted to the assistance of village poultry keeping, it would be able to hold its own ground.

Industrial poultry keeping also needs the inputs of modern biotechnology at a high level of quality and dependability. The supply and quality of feed are sometimes unreliable, and the veterinary coverage and the supplies of medicines and vaccines can be equally unsatisfactory. When these inputs fail, the industry collapses. Village poultry keeping does not have these dependencies.

In several developing countries there is a net food grain deficit that has to be bridged by imports. It is difficult to justify diverting food grains that are fit to feed hungry human beings to poultry. Industrial poultry keeping is based on the availability of food grains. It can be asked how dependable this is as a basis for commercial production, particularly in the weaker developing countries. Village poultry, on the contrary, scavenge most of their feed in forms that are unavailable to and/or not fit for humans.

The poultry industry claims to have made big gains in production and consumption (Reddy, 1990). But it has not been assessed how much village production has been lost as a consequence. What happens on a national scale in developing countries by the promotion of industrial poultry keeping is:

- the concentration of production in a few hands instead of in the hands of countless village women, who thereby lose an important source of income,
- a shift from a low to a high investment type of production, and
- a shift from a type of production with a high margin of profit to a low margin of profit.

5. CONCLUSION

The shift from village technology to modern biotechnology is a very costly one that gives smaller benefits and more losses to the nation and the majority of the producers. For millions and millions of poor women it means the loss of additional income and of the possibility to buy some basic necessities or to have some ready cash in case of emergencies. It is clear that more efforts should be directed at increasing the productivity, e.g. by the provision of improved stock, dependable vaccinations and the elimination of the main bottlenecks in marketing: the lower dependability, attractivity and availability of the village poultry produce as compared to the poultry industry.

6. REFERENCES

Guèye, E.F. (2000): Moving towards higher standards. Editorial. INFPD Newsletter 10(1&2): 2

Horst, K. ter, (1986): Reconnaissance survey on village poultry keeping. SRIPIP, Directorate of Livestock Services, Dhaka, Bangladesh. 86 pp.

Maho A., Boulbaye, N. & Etobia, J. (2000): Newcastle disease and parasitosis in family chickens in Southern

Chad. INFPD Newsletter 10(1&2): 2-6

McArdle, A.A. (1969): Some suggested points which may assist poultry training courses. A suggested simple approach to upgrading stock in a village. Leaflet No.5. UNICEF, India, 5 pp.

Rangnekar, S.D. & Rangnekar, D.V. (2001): Developing traditional poultry production in tribal belt of western India. First INFPD/FAO Electronic Conference on Family Poultry: 1-7.

Reddy, C. (1990): The development of the industry in India. Poultry International, August 1990, 2 pp.

Smith, C. (1978): Poultry production among smallholders in Migori, Kenya. A case study of a cockerel exchange project. National Poultry Development Programme, Ministry of Agriculture, Nairobi, Kenya, 69 pp.

Tan, E.H. & de Zeeuw, H. (1981): Report of the poultry mission to Bangladesh. IAC, Wageningen, The Netherlands.

Tan, E.H. & de Zeeuw, H. (1982): Project formulation mission to Bangladesh. IAC, Wageningen, The Netherlands.

Vugt, T.M. van (1991a): Milliards in pin-money; the case of village poultry keeping. Yearbook Assoc. Alumni Econ. Fac. TU, 9 pp.

Vugt, T.M. van (1991b): Small is beautiful but often not small enough. First International Conference on Permaculture, Nepal, 6 pp.

Private and public sector partnership in poultry production: how can the commercial poultry industry provide support to rural poultry production?

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SUMMARY

Over the last thirty years there has been significant growth in poultry production in India (broiler population of 4 million in 1971 rising to 700 million in 2000). A large share of this growth is attributed to the development of successful public-private sector partnerships. In 2001, the Food and Agriculture Organization of United Nations commissioned Tamil Nadu University of Veterinary and Animal Science (TANUVAS) to conduct a case study on public-private sector partnership in poultry production to document approaches in this booming and dynamic sector. The objective of this case study was to identify suitable and sustainable approaches that could be replicated and applied to help small-scale farmers in developing countries develop their poultry production activities.

The study found that the key-limiting factor for farmers in starting poultry production is access to credit, inputs and the marketing of their product. There are advantages in broiler production under partnership arrangements or contract farming for both parties. Broiler farmers do not have to worry about market trends, their only investment is in provision of suitable housing. The 'integrator' (contractor) supplies all other inputs at his own cost, including veterinary services. For the integrator mass production is developed which is essential to remain competitive in the market place. It was noted that the type of approach being applied in Tamil Nadu State might be of limited applicability in developing countries due to high-risk aversion of investors and lack of technical expertise. When considering these partnerships one must also bear in mind the highly visible trend towards control of broiler production by a few large-scale companies.

1. INTRODUCTION

Considering the leading role played by Tamil Nadu in intensification of poultry production (broiler production) in India, the FAO selected Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) to conduct the case study entitled 'Best practices survey on application of private sector partnership to support intensification in poultry production and marketing in the Indian sub-continent'.

2. OBJECTIVES OF THE CASE STUDY

1) To collect and analyze data on the existing poultry production systems in Tamil Nadu to identify conventional and emerging partnerships of different levels and systems in broiler and layer poultry production;
2) To establish indicators on the key policy, socio-economic, technical and institutional determinants of success or deficiency in such partnerships;
3) To set "best-in-class" indicators of specific aspects of partnership performance in poultry production;
4) To identify and describe best partnership practices and organization;
5) To make proposals for further modeling and development of partnership for poultry production systems in Tamil Nadu.

3. SAMPLING METHODS

Given the close relationship between climate and intensification in poultry production, proportionate sampling technique was adopted to decide the number of broiler farms to be surveyed under the project in each of the seven agro-climatic zones of the State of Tamil Nadu. Hundred and nine broiler farms were surveyed for the study, and information was collected through different techniques.

4. TECHNIQUE OF THE SURVEY

The survey to assess the 'best public-private sector partnership practices' to support intensification in poultry production and marketing was carried out through personal interview method employing semi-structured questionnaires developed for the purpose. Separate questionnaires were developed for broiler farm enquiry with the help of the experts in the field, pre-tested among the respondents and corrected before they were finally applied. The questions were designed to elicit information on demographic factors of poultry farmers including gender participation, size of farm, kinds of existing partnerships with other private sector stakeholders, economic performance of birds, perceptions on partnerships and also such data required to work out appropriate indicators for making comparison. Accordingly, data were validated, classified, grouped and analyzed using appropriate statistical tools. Economically important parameters were collected for making comparisons wherever necessary and included:

Technical parameters

a) Body weight at marketing

Body weight at marketing is an important economic parameter as the broiler is sold on a live weight basis.

b) Feed efficiency

As feed constitutes about 70% of total cost of production of a broiler, efficiency of feed utilization determines ultimate profitability in broiler production.

c) Mortality (%)

Mortality at market was worked out as number of broiler death as a proportion of number of broiler chicks brought in at start.

Economical parameters

a) Cost incurred per kg

This is the mean cost incurred by the given individual broiler farmer under a partnership/non-partnership system to produce one kg of live broiler up to market age.

b) Net return per 1000 broilers

It is the net return per 1000 broilers obtain as difference between total returns (including sale of manure, feed bags) and total cost

5. RESULTS

Until 1990, broiler production was entirely in the hands of independent farmers who were arranging all the required inputs and rearing the broilers in their premises. Their level of broiler production was planned to meet the local demand only. Since the demand for poultry meat remained seasonal, influenced by both the positive and negative influence of festival seasons, the farmers tried to adjust their production level to minimise losses and reap maximum benefit whenever possible. Sometimes the broiler selling prices went down even below the production cost forcing some of the farmers to close down their farms.

The variation of demand and consequent unpredictability in market price of broiler meat forced everyone involved in broiler production (farm owners, feed manufacturers, traders, etc.), to think and find out the

means of overcoming this situation.

The integrator delineated the production activities to individual farmers, but retained the ownership of the birds produced. Some novel arrangements were also made to ensure adequate returns to the broiler rearing farmers, integrated in the process.

The broiler farmer

a) owns broiler shed and equipment;
b) buys litter material;
c) attends to rearing activities (brooding, feeding, watering, etc.);
d) bears cost of electricity/fuel for brooding.

The integrator supplies the following inputs:

a) day-old broiler chick (the integrator owns a breeder farm and hatchery to produce these);
b) broiler feed required by the birds (the integrator owns a feeding unit);
c) medicines and vaccines (the integrator buys quality medicines and vaccines and supplies them to the farmers as per requirement);
d) veterinary services required (emergency and routine) (the integrator engages qualified veterinarians for the purpose);
e) the integrator takes back the finished broiler and markets the birds mostly through traders.

The study revealed that the integrator is the owner of the broilers grown up in the farmers' premises, since he supplies the costly inputs like chicks and feed which account for about 85-90% of cost of production and pays separately for the farmers' efforts.

Under contract growing, the integrator has taken over all activities, requiring technical competency including production and supply of quality chicks, quality feed, back-up veterinary service, supply of quality vaccines (stored properly at sub-zero temperature, which is not usually possible in small-scale operations). The integrator hands over the activities of rearing to the farmers, which needs less technical competency and is labour-intensive.

The practice of integration or contract farming also begun in rural areas. More and more people started constructing broilers houses in their field and come forward readily to integrate themselves in the arrangement of contracting farming. As this has made the supply of inputs like chicks, feed etc. from other companies irregular, and the broiler farmers who were earlier doing entire broiler production activity on their own were forced to switch over this system of contract growing, or close down broiler production and look for alternate farming business.

More than 80% of the total (180 million broilers produced in Tamil Nadu) are currently produced under partnership farming arrangement (between broiler farmers and integrators). The data was therefore grouped as those from partnership farms and from non-partnership farms to analyse the advantages or otherwise of such a partnership through both technical and economic assessment.

The 109 broiler farms surveyed for the project were classified into three groups as small (less than 3,000), medium (3,001-10,000) and large (above 10,000) depending on their capacity to rear broilers. Efficiency of broiler production in partnership and in non-partnership systems was compared through mean broiler performance and by working out other economic parameters.

Broiler performance was given with a higher body weight at marketing under partnership (1.86kg) than under non-partnership (1.63kg) and also through feed efficiency ratios 2.00 versus 2.17 as well as lower mortality 4.47% versus 6.89% through better quality veterinary care provided by integrators in those farms.

Farmers opinions on reasons for being comfortable with the partnership are shown in Table 1

Table 1: Farmers' reasons to integrate their farms

Reason	Mean score	Ranking
• Lower risks	64.14	1
• Lower recurring expenses	58.00	2
• Timely supply of quality inputs	51.68	3
• Extensive technical know-how	50.67	4
• Prevention of wide price fluctuation	48.00	5
• Remunerative price	47.58	6
• Creation of infrastructure	44.23	7
• Lower need for the farmer to keep track of the market trends	43.25	8
• Removal of exploitation by middlemen	41.83	9
• Forecast of disease outbreak	40.00	10
• Other reasons	50.97	11

Lower risks involved in partnership farming were perceived as the single most important reason for their preference. The need for lower investment towards recurring expenditures was ranked second, followed by timely supply of quality inputs such as feed and technical know-how provided.

6. CONCLUSION

Based on the quantitative analyses carried out on the data collected through the survey and from the discussions held with various players, it can be said that the integrated system has changed the face of the industry in Tamil Nadu State of India. From a low to a massive production that is not only produced around the main market centres but has also moved to even remote villages, where labour is cheaper (increased rural employment), jobs are created and even wastelands could thus be profitable utilised for broiler production. Integrators have opened the production to adopt newer and cheaper techniques.

Higher profitability under the system has attracted more farmers and more integrators into the business resulting a very fast growth in broiler production in the State from 4 millions broilers in 1971 to 700 millions in 2000. The comparative cost of production of broilers has remained high for unintegrated conventional broiler producers. Many of them have either been closed down or brought into integrated system.

Considering the present rate of growth, the broiler industry structure in the area would soon become a pure oligopoly consisting of a few companies producing essentially the same commodity. The competitors would have then to strive to gain a competitive advantage by achieving lower costs through pursuing a higher volume strategy.

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Research Reports

Introduction

The following report contains a presentation of research results produced by eight Master of Science (M.Sc.) students at The Royal Veterinary and Agricultural University (KVL) during fieldwork in Bangladesh between 1st July 2001 and 1st May 2002. The students carried out parts of their research in collaboration with the Departments of Parasitology, and Pathology of the Faculty of Veterinary Science, and the Department of Poultry Science of the Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh, Bangladesh.

It is the first time that eight young animal scientists and veterinarians have worked together to solve problems directly related to rural poultry production under difficult logistic conditions in the Northern provinces of Bangladesh. It is also the first time that problems identified in the field with the context of livestock projects supported by DANIDA (Danish International Development Assistance) in Bangladesh have been fed back to the educational system in Denmark, creating the basis for a new M.Sc. course in rural poultry production and health, supported by a number of research and educational institutions in Denmark and hosted by the Royal Veterinary and Agricultural University in Copenhagen.

PLDP and Bangladesh

The Participatory Livestock Development Project (PLDP) covers the northwest and north central regions of Bangladesh, and involves poultry related activities in 89 upazilas of 17 districts. The overall development objective of the PLDP project is to enhance the status of women and reduce poverty in Bangladesh. The immediate objectives of the project are:

1. to provide micro-finance and technical services through NGOs for livestock enterprises suitable for the poor;
2. to support the Department of Livestock Services (DLS) in reorienting its approach to the delivery of services to the poor;
3. to develop the capabilities of DLS, NGOs and rural communities to plan and manage livestock development activities; and
4. to alleviate poverty and improve economic status through self-employment.

The programme provides loans averaging 46 USD each to 364,000 beneficiaries through 10 NGOs. The three main NGOs are the same as in SLDP (Smallholder Livestock Development Project)-1. The credit funds are channelled from Asian Development Bank through a semi-autonomous apex micro-finance organisation in Bangladesh, the Palli Karma-Sahayak Foundation (PKSF), to NGOs who are registered as partners with PKSF and have a livestock credit programme experience. PKSF has been specifically established by the Government of Bangladesh (GoB) to fund NGOs.

The target beneficiaries of PLDP are:

- women from poor and landless farmer households and female-headed households;
- poor landless farmers who operate less than 0.2 hectares of land and depend on the sale of their manual labour for more than 10 days per month as their main source of income; and
- poor marginal farmers with between 0.2 and 0.4 hectares of land and an average daily income of less than 0.35 USD per day or 128 USD per

year.

Of the 364,000 beneficiaries, over 70 percent are women, and their income will be increased by at least 30 percent as a result of membership in the credit scheme.

Research needs assessment

A number of DANIDA fielded missions in July 1998 and February 1999 pointed out the need for institutional and human resource development in relation to the semi-scavenging poultry models being implemented on a large scale. One of the suggestions was to establish a tailor-made M.Sc. course focusing on rural poultry production.

The following eight research projects cover a range of important problems related to the scavenging and semi-scavenging poultry production in Bangladesh, notably problems relating to disease and production aspects. The order of the presentation of summaries is not a sign of the importance of the projects.

For more information or questions relating to these research reports, please contact:
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[In the present issue of this Newsletter, summaries of four research projects are published, and the remaining four other summaries will appear in the next issue of this Newsletter (Vol. 13 No. 1) – ED]

Research summaries

Effect of vitamin A supplementation on vitamin A status, growth parameters and disease resistance of layer-type chickens in Bangladesh

Md. Ataur Rahman Bhuiyan

INTRODUCTION

Poultry is very rapidly affected by vitamin A (retinol) deficiency, which will seriously affect growth rate, feed utilization, development of bone, movements, vision, reproduction, resistance against diseases, and mortality. Vitamin A deficiency may be caused by several factors. In natural feedstuffs, vitamin A is only present in animal products, notably liver, eggs, fish meal, and fish oil. Provitamins A, of which b-carotene is the most prudent vitamin A source, are only present in plants. The commercial source of vitamin A is an ester of retinol, either retinol acetate or palmitate. These are susceptible to light, oxygen, heat, moisture and pressure during processing. Soya-beans contain a lipoxidase that readily destroys the carotenoids present in the feed unless quickly inactivated.

OBJECTIVE

- The present studies are based on two experiments, which were designed to study the role of the dietary vitamin A level regarding the poor performance, high mortality and susceptibility to diseases of rural chickens under the existing production conditions in Bangladesh.

MATERIALS AND METHODS

Experiment 1 was performed with 600 Sonali chickens (a cross of male Rhode Island Red x female Fayoumi), which were divided into two groups and reared with three farmers for 10 weeks. Group 1 received the basal diet without added vitamin A until 42 days of age, when chickens were treated orally with 500 IU vitamin A for 5 days and thereafter received 500 IU vitamin A kg^{-1} feed until the end of the experiment. Group 2 received 1500 IU vitamin A kg^{-1} feed during the whole experiment.

Experiment 2 consisted of 720 day-old Sonali chickens, which were divided into four groups initially. Groups 1 and 2 were left unvaccinated against IBD, and Groups 3 and 4 were vaccinated with infectious bursal disease virus (IBDV) vaccine on days 14 and 21 of age. All groups were vaccinated with Newcastle disease vaccine at days 4, 28 and 60 of age. Groups 1 and 3 received 1500 IU vitamin A kg^{-1} feed, and Groups 2 and 4 received 500 IU vitamin A kg^{-1} feed for 10 weeks. At day 32, each group was subdivided into Groups A and B. All group A birds were challenged at day 35 with IBDV. All group B birds remained as control animals. The influence of vitamin A on humoral immune response (IgG) to Newcastle disease vaccine and IBDV vaccine was determined in some of the chickens by using ELISA test kits specific for each disease.

RESULTS

The results of experiment 1 showed that birds performed poorly without supplemented vitamin A. Typical vitamin A deficiency symptoms appeared in Group 1 within day 18-39 at different time and severity for the three farmers. Overall mortality was 29%, with 26.2% in Group 1 and 2.8% in Group 2. Feed consumption, body weight gain and feed conversion ratio were significantly poorer in Group 1 than Group 2. Mortality was much higher when deficient birds were affected with coccidiosis, and response to treatment was poor. Retinol levels in blood plasma and liver at 42 days of age in Group 1 were very variable and not detectable in 10 out of 12 birds. The oral supplementation of vitamin A to Group 1 increased the liver concentration of vitamin A to a higher level than for Group 2, while the retinol concentration in blood plasma was similar in the two groups (0.16-0.39 $\mu g\ ml^{-1}$).

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that 500 IU vitamin A kg^{-1} feed is below the requirement of Sonali chickens, and under the hot and humid conditions in Bangladesh 1500 IU vitamin A is on the borderline of sufficiency. Supplementation of the feed with vitamin A along with vaccination against ND and IBD will improve the performance of Sonali chickens. The optimum dietary levels of vitamin A, however, have to be determined under relevant production conditions in Bangladesh with local poultry breeds. However, still the level of vitamin A in the scavenging feed resource base at village level needs to be determined.

It is highly recommended to supplement feed with vitamin A along with vaccination against ND and IBD, and to improve the general performance of Sonali chickens. However, the stability of both natural occurring vitamin A in feed ingredients and retinol acetate in premix has to be investigated under the warm and humid conditions occurring in Bangladesh. Furthermore, the requirement of vitamin A and the vitamin A activity of b-carotene in local feed ingredients have to be determined under relevant production conditions in Bangladesh with local poultry breeds.

Study on the effect of feed supplementation to laying hens under rural conditions

Shawkat Ali

INTRODUCTION

Indigenous chickens are traditionally reared as scavengers in the villages of Bangladesh with poor egg production as a result. However, introducing high yielding crossbreds under rural conditions needs some supplementary feeding to optimise their egg production. Little attention is given about the nutritional status of these crossbred birds under scavenging conditions.

OBJECTIVE

- The present study was designed to assess the egg production potential and egg quality of crossbred hens under scavenging conditions with different levels of feed supplementation.

MATERIALS AND METHODS

Seventy-two laying hens (crosses of male Rhode Island Red x female Fayoumi) were distributed to 18 farmers. The farmers were divided into 10 locations. The farmer's houses, which were very close to each other, were considered as a location. Each farmer received 4 hens, and each hen was allocated to each treatment. The treatments were: *ad libitum* feed (120 g) with intensive conditions (T1), 60 g feed supplementation with scavenging conditions (T2), 30 g feed supplementation with scavenging conditions (T3) and fully scavenging without supplementation (T4).

RESULTS

Egg production was significantly higher in T1 than in the other treatments. But no significant differences were found between T3 and T4. Similar results were found in shell colour. Again, egg weight was significantly higher in T1 than other treatments, and the lowest value was obtained in T4. No difference was found between T2 and T3. Opposite result was found in yolk colour, where yolk colour was significantly lighter in T1 but darker in T4. However, no differences were found between T2 and T3 in yolk colour. Albumen height and Haugh unit were significantly higher in T3 and T4 than T1 and T2. No significant differences were found between T3 / T4 and T1 / T2. The shell thickness and body weight gain during experimental period shown the same pattern being significantly higher in *ad libitum* group than scavenging birds. No significant differences were found between scavenging birds.

CONCLUSIONS AND RECOMMENDATIONS

The higher egg production in the *ad libitum* fed group indicates that there is a shortage of feed under scavenging conditions. However, the egg production between farmer and location was significantly different in the present study. Actually the effect of farmer and location is the availability of feed resources around the farmer house. As there were no significant differences between farmers within a location, this indicates a great variation of feed resources between the locations. Profit was higher in fully scavenging, but considering one-year laying period the T2 treatment may be more profitable.

The present results further indicate that at least 60 g of feed supplementation is needed for the scavenging crossbred birds to ensure a viable production. However, the amount of supplementation is also dependent on location, that is availability of feed resources

around the farmer's house.

It is further recommended that at the key rearer level, it is better to supply steamed bone meal and oyster shell together rather than oyster shell alone in a cafeteria system. As oyster shell supply only Ca, but bone meal supply both Ca and P.

Effect of feeding systems on the egg production of Fayoumi hens in Bangladesh

Rashed Hasnath

INTRODUCTION

Poultry as an industry for the common producers has become very popular during the past few years. But one of the reasons for set back in poultry industry is high feed cost. Feed represents the major cost of production of poultry meat and eggs (between 65-75%). Farmers often cannot cope with feed cost and are traced to close their farms. The present research work has been designed to develop sustainable feeding systems that may improve the socio-economic conditions of resource-poor farmers and landless households in Bangladesh.

OBJECTIVES

- To investigate feeding practices in Model Breeding Units
- To investigate the quality and quantity of fertile eggs and day-old chicks.

MATERIALS AND METHODS

One hundred and sixty two 36-week-old Fayoumi were used in the present study to investigate the effects of feeding regimes on the performance of laying hens. They were randomly allotted into three farms (model breeders), together with male Rhode Island Red. Each farm ran two different feeding regimes of 1) *ad libitum* and 2) restricted level of 80% of *ad libitum* feeding under the same shed, under the same management and environmental conditions.

RESULTS

Average live weight, egg weight and feed conversion ratio showed significant difference between *ad libitum* and restricted feeding regimes. Egg production, laying house mortality, egg shape index, egg shell weight, egg shell thickness and some selected egg quality characters (albumen index, yolk index and Haugh unit) showed no difference between the two feeding regimes. Egg shell percentage showed significant difference between the two feeding regimes.

In hatching characters, fertility and hatchability percentages showed significantly lower values in restricted fed groups than *ad libitum* fed groups. But the quality of the day-old chicks showed no significant difference between the two feeding regimes.

CONCLUSIONS AND RECOMMENDATIONS

Economically, it is viable to restrict the feeding of Fayoumi laying hens in intensive village production systems since this will reduce the cost of production. However, the level of restriction should be moderated by the performance of the birds. It is concluded that Fayoumi laying hens can be restricted to 80% of *ad*

libitum feeding without severe adverse effect on performance.

Egg production performance of different breeds and breed combinations of chicken in semi-scavenging production systems

Akhtar-Uz-Zaman

INTRODUCTION

In a semi-scavenging production system an ongoing research is needed to evaluate different breeds and their combinations under these though conditions where temperature, humidity, feed availability and composition varies throughout the year.

OBJECTIVE

- The aim was to study the production performance of RIR x Fayoumi (Sonali), Naked Neck (NN) x RIR and NN x Fayoumi crossbred and the Fayoumi breed in a semi-scavenging production system.

MATERIALS AND METHODS

Fourteen-week-old replacement pullets of the breed/breed combinations were distributed among the key rearers under the Participatory Livestock Development Project (PLDP) at 3 different geographic locations of similar environmental conditions at Badalgachi thana in Bangladesh. The chickens were supplemented with 15, 30 and 45g feed/hen/day, determined by the existing production and feeding practices of the key rearers.

RESULTS

RIR x Fayoumi attained late sexual maturity (222 days versus 195 days) but produced more eggs of the best quality with highest benefit/cost ratio. The same crossbred showed the greatest resistance to diseases with heaviest weight at every bimonthly period of body weight measurement. None of the other breed/breed combinations were found to have a genetic potential as RIR x Fayoumi (Sonali). Location did not have any effect on egg production and mortality but on egg quality, in relation to shell thickness and yolk colour. At 1st bimonthly period of body weight measurement (two months after the age at sexual maturity), location situated at the river side areas showed significantly higher body weight (1305g vs 1193g). Egg quality was found better with the increased of age of the hens.

Rate of lay significantly increased with increased levels of supplemented feed. Highest level of supplementation (45g) was more beneficial in relation to egg production and egg weight. On the other hand, levels of supplementation did not show any effect on body weight. The present study showed that breed effect was higher than that of the levels of supplementary feed and location. However, RIR x Fayoumi (Sonali) crossbred has a higher potential for egg production, but required more supplementation to exteriorize this potential.

CONCLUSIONS AND RECOMMENDATIONS

In order to improve the genetic potential of a breed combination, it is important to improve the origin

breed under the environment it has to produce. Therefore, a selection procedure to maintain the production potential of RIR and Fayoumi should be adapted for better yield of RIR x Fayoumi (Sonali). At the same time, management, availability of scavenging feed and rate of supplementation are the important factors necessary to be improved. The type of test presented in this study is an ever ongoing project as new breed combination/hybrid will be available on the market all the time. It is very important to do this test in the environment in which the production takes place in practice as a considerable Genotype x Environment interaction. In many studies, the scavenging management is one of the environmental sources.

Based on the findings of the present study, it is recommended that under the improved village conditions (i.e. with supplementary feeding), Sonali (RIR x Fayoumi) is highly suitable for the semi-scavenging production system.

INFPD News

INFPD becomes a Global Working Group of WPSA

Since the 1992 World's Poultry Congress (WPC), there has always been a symposium emphasizing family poultry. The WPC is organized by the World's Poultry Science Association (WPSA). These WPC symposia (1992, 1996, 2000) were funded by the Food and Agriculture Organization of the United Nations (FAO) and organized by the International Network for Family Poultry Development (INFPD). In 1998, the INFPD proposed to the WPSA Executive Council that it should become a Working Group (WG) within WPSA. At the 11th European Poultry Conference that held in Bremen, Germany, (September 2002), the WPSA Executive Council finally agreed to approve this proposal. The decision was conveyed to the INFPD Coordinator by a letter from the Secretary/Assistant Treasurer of WPSA. On October 24, 2002, during the INFPD Workshop held in Dhaka, Bangladesh, the INFPD Steering Committee met to discuss the issue and decided to ratify the integration of INFPD with WPSA. The INFPD Coordinator has communicated this decision to the WPSA Secretary.

The WPSA was established in 1912 and, with 67 country branches, two federation of branches – in Europe and Asia-Pacific regions and about 7,000 members, has become the main organization that strives to advance knowledge and understanding of all aspects of poultry science and the poultry industry. Of the 67 countries, only 7 are from Africa (Benin, Egypt, Ghana, Mauritius, Nigeria, South Africa and Sudan) while even fewer, 5 are from Latin America (Argentina, Brazil, Colombia, Mexico and Peru). INFPD, on the other hand has members and contacts in 38 African countries and 7 Latin American countries (Bolivia, Cuba, Ecuador, Guatemala, Mexico, Nicaragua and Peru). As a non-profit making organization, the WPSA relies for its income almost entirely on membership subscriptions.

These are the implications of the INFPD integration into WPSA:

1) INFPD has become a global Working Group (WG) of the WPSA while retaining its official name, acronym and logo.

2) The coordinator of INFPD becomes the chairperson of the WG while all the officers of INFPD (Editor of the Newsletter and Steering Committee members) will perform the same functions within the WG. The rules of WPSA requires that each WG has at least 4 officers which must include Chairperson, Secretary or Secretary/Treasurer. INFPD will now elect officers into these positions at the next general meeting scheduled to coincide with the XXII WPC holding in Istanbul, Turkey in June 2004, and inform WPSA of the elections.

3) INFPD is the first global working group in WPSA as previously WGs only existed under the European Federation of WPSA Branches. It is this global nature that justifies the need for INFPD to maintain an Executive (or Steering) Committee whereas each European WG has only a chairperson and a secretary. The INFPD is subdivided into three regions of the developing world (Africa, Asia-Pacific and Latin America), mainly for meetings (to reduce travel costs) and

also to deal with region-specific subjects. The chairpersons and secretaries of these regional sub-divisions will become members of the INFPD Executive/Steering Committee. It is considered possible and even desirable that these regional sub-divisions of the INFPD be informally or formally affiliated with relevant Federations of WPSA Branches (e.g. the Asia-Pacific INFPD can satisfy the proposal by the Asian-Pacific Federation to establish a Rural Poultry Working Group).

4) The current four objectives of INFPD will remain as objectives of the GWG. These are, as related specifically to family poultry sector:
   - the documentation of results and the dissemination of information;
   - the coordination of training programmes;
   - the identification of research and development priorities, funding sources and cooperation and collaboration opportunities; and
   - the development and evaluation of research and development protocols.

   A fifth objective will now be proposed to be:
   - the collaboration with and participation in all the activities of WPSA and its various Federations, WGs, and other organs such as World's Poultry Science Journal (WPSJ), etc.

5) All current members of INFPD will automatically become members of WPSA and pay the annual WPSA membership fee that applies to their region of domicile. There is an additional US$ 5 annual membership fee for INFPD applicable globally irrespective of domicile. Starting with the 2003 financial year, the payment of both membership fees can be done either through WPSA country Branches, the INFPD sub-regional networks, where either exists; or through the INFPD Secretariat. Correspondences and transactions for the INFPD Secretariat should be addressed to:

INFPD Secretary/Treasurer
c/o Network for Smallholder Poultry Development,
The Royal Veterinary and Agricultural University,
Dyrlaegevej 2, DK 1870 Frederiksberg, Kobenhavn, Denmark
Phone: (+45) 35 28 37 61; Fax: (+45) 35 38 37 62; E-mail: poultry@kvl.dk

The INFPD Steering Committee is still discussing the possibility of members who may be satisfied with only membership in INFPD and want a waiver of membership in WPSA. It is hard to envisage such a request but each case will have to be judged on its own merit.

6) Being members of WPSA, the members of the new WG will be eligible for all the WPSA benefits: World's Poultry Science Journal, travel fellowship, etc. The INFPD itself, as a WG, will be eligible to invite speakers from the WPSA "speakers list".

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17th Central American and the Caribbean Poultry Congress in La Havana, Cuba

The Congress was held from 1st to 4 October 2002 at the Convention Center in La Havana, Cuba. The general theme of the Congress, which has Spanish as the official language (with translation in/from English), was "New Millennium Challenges facing the Sustainability of the Regional Poultry Production". The Congress was structured upon workshops, conferences and plenary sessions that brought multidisciplinary perspectives on poultry health, meat and eggs production, feed resources, feed industry, processing of poultry products, nutrition, poultry breeding, management of poultry flocks, family poultry, marketing, transport, socio-economics, etc.

On 1st October 2002, a pre-congress symposium was entirely devoted to family poultry. A large audience participated in presentations and discussions. Fifty participants came from seven Latin American (Ecuador, Bolivia, Nicaragua, Guatemala, Mexico, Peru, Cuba), three European (Italy, The Netherlands, Denmark), two African (Senegal, Nigeria) and one North American (Canada) countries.

This FAO-sponsored symposium was structured upon three parts:

(a) Opening ceremony was chaired by Dr. Myriam Perez, Chairperson of the Congress Scientific Committee. It was attended by many dignitaries including the FAO Representative in Cuba, the President of the World's Poultry Science Association (WPSA) and the FAO Animal Production Officer (Small Animals).

(b) Plenary session with a Chairman (Prof. E.B. Sonaiya, INFPD Coordinator) and a Secretary from the Congress Organising Committee. Eleven papers were presented by speakers from Nigeria, FAO, Senegal, Denmark, Netherlands, Nicaragua, Bolivia, Ecuador and Cuba.

(c) Open discussion: Each presentation was followed by very interesting discussions. This was made possible thanks to excellent facilities for simultaneous translation provided by organisers. The following decisions were made democratically:

1) FAO should facilitate an electronic conference exclusively in Spanish to further promote the involvement of Latin American workers in INFPD activities. As a prelude to this conference, baseline surveys will have to be conducted by individual countries in Latin America, and the obtained results will be reported during this electronic conference. The surveys will be collecting data on the following: Family poultry population and flock characteristics/composition; Genetic resources in all poultry species; Health and diseases; Feed resources; Housing and management; Reasons for keeping poultry; Family poultry markets and utilisation; Available information and extension; Government regulations affecting family poultry; Family poultry development policies and projects; and Details on ongoing projects.
2) Data generated from surveys will also be used to develop a project proposal to be presented to commercial poultry producers for funding. These projects will be dealing with risks relating to family poultry diseases and the benefits of their control for commercial flocks.

Furthermore, it was suggested that a training course should be mounted. Its aim will be to provide Latin American poultry experts with required skills in family poultry research and development. More poultry experts from Latin America are invited to join INFPD and be active members.

■ For information or questions relating to presented scientific papers as well as posters, please contact:

Drs. Myriam Pérez Pla or Manuel Pampin, Instituto de Investigaciones Avicolas, Gaveta postal 1, Cp 17200, Santiago de las Vegas, Ciudad de La Habana, Cuba, Tel: 57-90-34, Fax: (+537) 57-90-80, E-mail: <viiacan@ceniai.inf.cu>

- If you wish to submit your name to become a member of INFPD, please contact:
  E. Fallou Guèye, E-mail address: <efgueye@refer.sn>

INFPD Workshop in Dhaka, Bangladesh

A workshop on the Bangladesh Semi-Scavenging Smallholder Poultry Model as a tool for fighting poverty and promoting food security was held in Dhaka, Bangladesh, from 20 to 24 October 2002. The theme of the workshop was "People Fight Poverty with Poultry: Learning from the Bangladesh Experience". The objectives of the workshop were: (1) to provide an opportunity for close familiarity with the Model; (2) to carry out a S.W.O.T. analysis of the Model; and (3) to initiate a Poultry Model Support Group within INFPD. The workshop was structured upon 6 plenary sessions, one final session, three working groups and one-day field trip. There were about 90 family poultry workers from five Asian (Afghanistan, India, Sri Lanka, Thailand, Bangladesh), nine African (Benin, Kenya, Malawi, Mauritius, Mozambique, Nigeria, Senegal, South Africa, Tanzania), three European (Denmark, Italy, United Kingdom), and Asia-Pacific (Australia) countries. Delegates represented National Agricultural Research Systems (universities, research institutions), consultancy companies, governments, NGOs and UN agencies.

Proceedings are being edited and will be published soon. Further information can be obtained from the following persons:

- INFPD – "E. Babafunso Sonaiya" <fsonaiya@oauife.edu.ng> or <fsonaiya1@yahoo.com>
- FAO – "Emmanuelle Guerne-Bleich" <emmanuelle.guernebleich@fao.org>
- Network for Smallholder Poultry Development – "Anders Permin" <ape@kvl.dk>

International Diary

2nd World Waterfowl Conference in Alexandria, Egypt

The 2nd World Waterfowl Conference will be held at the Alexandria University, Alexandria, Egypt, from 7 to 9 October 2003. The conference is organized for scientists and people involved in waterfowl production worldwide. The conference is an integral part of the ongoing search for sustainable waterfowl production systems, which aim to improve balance between bird welfare, productivity, product quality, environment and acceptance by producers and consumers. The conference, which has English as official working language, will be structured upon eight sections: (1) Genetics and breeding, (2) Nutrition and feeding, (3) Reproduction, (4) Production systems, housing and pollution control, (5) Ethology and welfare, (6) Diseases of waterfowl, (7) Composition and product quality, et (8) Product marketing.

Information relating to submission of abstracts, registration, accommodation, scientific and cultural programmes, exhibitions, etc. can be obtained from the Chairman of the Organizing Committee at the following address:

Prof. M.A. Kosba, Department of Poultry Science, Faculty of Agriculture, Alexandria University, Aflaton St., El-Shatby, 21545, Alexandria, Egypt, Tel: (+203) 592 5405 (Work) or (+203) 546 7074 (Work) or (+2010) 644 6339 (Mobile), Fax: (+203) 543 9229 or (+203) 592 2780, E-mail: <mkosba@hotmail.com>

IX World Conference on Animal Production in Porto Alegre, Rio Grande do Sul, Brazil

The IX World Conference on Animal Production will take place in Porto Alegre, Rio Grande do Sul, Brazil, from 21 to 31 October 2003. The theme of the conference is "Animal Production for the Well-being of the Human Population". More than 2000 distinguished researchers in animal production from all over the world will participate in this important event. The purpose of the conference is to provide an opportunity to exchange knowledge and to present the last advances in technology and animal science (including family poultry) with various cross-scientific disciplines. The conference, which has English as official working language, will be structured upon plenary, symposia and posters sessions.

Information relating to submission of abstracts, registration, accommodation, scientific and cultural programmes, exhibitions, etc. can be obtained from the Organizing Committee at the following address:

Prof. Jorge López (President) or Prof. Sergio Nicolaiewsky (Chairman)

Av. Bento Gonçalves, 7712, Caixa Postal 776 9001-970, Porto Alegre, RS, Brazil, Tel: (+55) 14 3316 3609 (Nicolaiewsky), Fax: (+55) 14 3316 3888 (Nicolaiewsky)

E-mail: <wcap2003@ufrgs.br> or *<jlopez@orion.ufrgs.br>* or *<nicola@vortex.ufrgs.br>*

Regular updates and information are also made available on the Internet at: *http://www.wcap2003.ufrgs.br*