Food and Agriculture Organization of the United Nations

Global Forum on Food Security and Nutrition
• FSN Forum •

Summary of the online discussion no.128 • 25.05.2016 – 19.06.2016

Pulses are praised for their health, environmental and economic benefits. How can their full potential be tapped?

About this online discussion

This document summarizes the online discussion *Pulses are praised for their health, environmental and economic benefits. How can their full potential be tapped?* which was held on FAO's Global Forum on Food Security and Nutrition (FSN Forum) from 25 May to 19 June 2016. This discussion was organized in the context of the International Year of Pulses, and was facilitated by the International Year of Pulses Secretariat.

The discussion looked at pulses' contribution to household food security and nutrition around the world, focusing on how their consumption can be promoted; along these lines, participants were asked to share pulse recipes. Regarding the production side, the discussion dealt with the challenges producers face and how these could be addressed. It also called for studies to be submitted on the role of pulses in climate change adaptation and mitigation.

Over the four weeks of discussion, participants from 32 countries shared 58 contributions. The topic introduction and questions proposed, as well as all contributions received, are available on the discussion page: www.fao.org/fsnforum/activities/discussions/pulses

General remarks on the potential and benefits of pulses

Worldwide, the consumption of pulses has declined due to changing dietary patterns and the fact that production has not been able to keep up with population growth (Randy Duckworth). Yet in the attempt to supply the world population with nutritious, healthy food that is produced in a sustainable manner, encouraging the production and consumption of pulses is crucial because of their many beneficial characteristics in terms of nutritional value and environmental impact.

In terms of nutritional aspects, pulses have been an important source of plant-based protein in developing countries, where access to animal-based proteins is often lacking. In particular in African and Asian countries the often cereal-based diets can be complemented very well by the consumption of pulses (Dr Amanullah). This is especially the case for children, who are often fed watery, cereal-based porridges that lack the nutrients needed for growth (Fernanda Grande, Manuel Moya). Worldwide, the fact that pulses have a low glycemic

index and a low fat content could make them a major player in the fight against non-communicable diseases like diabetes, cardiovascular diseases and obesity (Kadambot Siddique, Arun Kumar Das, Fouad Maalouf).

From an agro-ecological perspective, and particularly in the context of climate change, the benefits of pulses are substantial as well. First, pulses' broad genetic diversity allows for the development of high-yielding and climate-resilient varieties. Also, their positive impact on soil health is well known, in particular their ability to naturally fix nitrogen, which fertilizes the soil for both intercropped crops and crops to be cultivated subsequently. This in turn lowers the need to use chemical nitrogen fertilizers (contribution from France); reducing the production and application of these fertilizers decreases GHG emissions (David Bergvinson, Rattan Lal, Shoba Sivasankar, contribution from France, Huseyin Arslan).

In addition, because pulses extract water from a shallower depth, more water is left for the crops to be cultivated the next season (Huseyin Arslan), and because pulses can improve the aggregation and structure of the soil, this can improve the water-use efficiency of these crops as well (Rattan Lal, David Bergvinson, Shoba Sivasankar). Last, the fact that pulses increase microbiomass carbon (Rattan Lal, David Bergvinson) and provide nitrogen-rich residues allows for an increase in the rate of soil carbon sequestration (Rattan Lal).

Notwithstanding the numerous benefits of pulses, in agriculture the focus has traditionally been on cereals. Recognizing their potential, the discussion participants widely agreed on the need for increased investment in research and in the pulses sector in general, in order to optimize their use and promote their cultivation and consumption.

Consumption of pulses

The changing role of pulses in food security and nutrition

In developing and emerging countries pulses are an important part of the diet; this is the case for example in Costa Rica, where they are a key ingredient in daily meals (Manuel Castrillo), and in Ethiopia, where pulses are part of curries and of snacks served at the coffee ceremony (Asnake Fikre, Hagos Moyhammedseid Juhar). In Iran, pulses are an important part of sustainable food and feed production (Seyyed Hossain Sabbaghpour), and in India – the largest importer of pulses in the world (Roberto Neiva Tavares) – people significantly depend on them as a cash crop and as a source of protein for marginal households. However, *inter alia* a shortage of supply and adverse weather effects have led to sharp increases in prices (Dhanya Praveen, BK Singh), which has been hampering poor peoples' access to pulses (Gurpreet Singh). This is the case for example in Egypt, where a 55 percent increase in the national production of broad bean would be needed in order to meet self-sufficiency (Fouad Maalouf). Yet besides resorting to other foods for economic reasons, in some cases people voluntarily choose to substitute pulses with other products because of their negative image. In Western Africa for instance, people who have moved from the countryside to the towns sometimes regard pulses as "food for poor people" and for "people from the village" (George Bazongo).

The rising middle class in emerging economies like India and Mexico often chooses to consume different products as its incomes increase and as a wider variety of products becomes available (Bhubaneswor Dhakal). The general trend is that with rising income levels, peoples' dietary preferences shift towards animal- instead of plant-based protein. As for developed countries, pulses have not been very present on the menu (Huseyin Arslan). Even in Canada, one of the major producers and exporters of pulses, domestic consumption has remained considerably low (Robynne Anderson).

How to increase consumption of pulses

Discussion participants strongly agreed on the need to promote the consumption of pulses, which requires developing a multisector and multilevel strategy that prioritizes the interests of developing countries (Nguyen Van Kien). One of the participants elaborated on how approaches should be tailored to factors influencing consumer behaviour:

- In **developed countries**, there are various trends through which to promote the consumption of pulses, including the "simpler, healthier foods trend", flexitarianism, environmental consumerism, the "gluten-free trend" and the "hidden vegetables trend" (Randy Duckworth).
- In **emerging economies**, higher incomes and an increase in the availability of different products could promote consumption of pulses if they have not traditionally been part of the local diet. Yet in countries where eating pulses has been common, consumption is likely to be affected negatively. One thus needs to take into account consumers' aspirational needs by

providing more choice: for instance if people have more money to purchase snacks, then one should work together with snack food manufacturers to include pulse-based products (Randy Duckworth).

- In **developing countries**, the consumption of pulses is highly income-elastic, so the focus should be on establishing market linkages and stabilizing incomes for domestic producers. Another way to stimulate long-term consumption is by incorporating pulses in food aid programmes that address chronic malnutrition (Randy Duckworth).

Participants also shared the following general suggestions on how to promote the consumption of pulses:

- People should be educated on the health benefits of the consumption of pulses (Lal Manavado, George Bazongo) in terms of lowering cholesterol and reducing heart disease and colon cancer (Fouad Maalouf).
- Recipes that include pulses should be developed under the leadership of the Ministry of Agriculture and of Health, and should be popularized by health organizations and NGOs as well (George Bazongo). Meal-providing (public) institutions should also intensify the use of pulses (Lal Manavado).
- Pulses should be introduced in the regular diet of children (Salome Yesudas).
- People should be educated on how pulses can be prepared (Lal Manavado, Samuel Adjei-Nsiah, Stacia Nordin).[1] For example, new recipes could be introduced through cross-cultural events (Gurpreet Singh).
- Precooked pulse products adapted to changing dietary systems should be developed (Bhubaneswor Dhakal).
- The availability of pulses in local shops should be promoted (Manuel Moya).
- Investment is needed in value addition / processing in order to diversify the use of pulses (Manuel Castrillo, Asnake Fikre, Arun Kumar Das). For example, developing food-processing technologies would also support the reintroduction of traditional pulse-based dishes (Emile Houngbo).

Production of pulses

Production challenges

A number of participants stressed that the productivity of pulses is far below its potential. In order to understand the challenges related to pulse production one should consider not only the field level, but also the farm level and the entire farming system, as pulses are often grown among other crops in which farmers also invest their resources (Esther Ronner). The challenges mentioned by participants are indeed often interrelated, and include the following:

- In general, there is strong **competition from cereals in particular**, which are more profitable (Dr Amanullah, Massimo Iannetta). Thus farmers often choose to grow pulses in rainfed conditions (with consequently low yields), and are not inclined to cultivate them in irrigated conditions because cereals have higher yields (Gurpreet Singh, David Bergvinson). Also, pulses have received little funding (Fouad Maalouf)

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1 For instance, the difficulty of the long overnight soak of beans can be overcome by a quick soak technique: Cover picked dried beans with water (approximately 2 cups of beans per 2–3 litres of water). Bring to a boil, lower the heat and simmer for 1 to 5 minutes. Remove from heat, cover, set aside and let soak for at least 1 hour. Drain and use the quick-soaked pulse like any other soaked pulse (Michelle O. Fried).

and policy support, nor has there been much private sector involvement (Asnake Fikre, Peter Steele, George Bazongo).

- There is a **lack of effective research**, so there is inter alia limited germplasm evaluation and improvement of varieties (Dr Amanullah, Asnake Fikre).
- **Farmers lack knowledge** (Moshfaqur Rahman), for example of improved pulse cultivars and related technologies (David Bergvinson), and of drying and storage techniques (Germain Grégoire Eloundou Tsanga). The insufficient knowledge is due to inadequate extension services (Dr Amanullah).
- **Unsophisticated production methods** hamper productivity (BK Singh, Dr Amanullah). In particular, the low level of mechanization of cultivation systems – and the resulting labour intensity (Emile Houngbo, David Bergvinson) – restrict the majority of the farms in Cameroon, for example, to sizes of between 1 and 3 hectares (Germain Grégoire Eloundou Tsanga).
- **Seed systems are poorly developed** in terms of multiplication, certification and distribution (David Bergvinson, Dr Amanullah, Germain Grégoire Eloundou Tsanga, Asnake Fikre). Other inputs are also difficult to access (David Bergvinson).
- The **yield of pulses is relatively low**, due to:
  - a lack of high-yielding varieties (David Bergvinson, BK Singh, Dr Amanullah, Emile Houngbo, Germain Grégoire Eloundou Tsanga);
  - poorly adapted varieties (George Bazongo): the domesticated varieties are generally not tolerant of soil infertility (John Howieson), and varieties that can resist excessive vegetative growth under high-moisture conditions are lacking (David Bergvinson);
  - abiotic stresses, like cold and drought stress (Seyyed Hossain Sabbaghpour);
  - biotic stresses, like parasite attacks in the field and during stocking (Emile Houngbo, David Bergvinson), fusarium wilt, and Ascochyta blight (Seyyed Hossain Sabbaghpour).
- **"Exotic poisoning"** has been taking place in the following ways:
  - The replacement of organic input-based varieties of major crops (like rice) with chemical input-responsive varieties in mixed cropping systems (including pulses) has destroyed the organic matter-based mycorrhiza on which pulses depend for their growth.
  - Due to the external introduction of exotic varieties, evolving genetic properties can no longer become adaptive or endemic to the local context.
  - The introduction of exotic varieties has brought exotic pests which have destroyed ecological conditions that support landraces.
  - Exotic varieties have been cross-bred with genetically superior landraces (Bhubaneswor Dhakal).
- **Industrial development is limited**, because investment is lacking in training, infrastructure and reliable industrial producer organizations. Generally, industrial leadership for regional production is lacking as well; in Southern Africa, for instance, there is no discernible regional value chain (Peter Steele).
- **Inadequate (knowledge of) marketing channels** (Germain Grégoire Eloundou Tsanga) leaves farmers to sell their produce to traders at very low prices (George Bazongo). In general, the farm gate price of pulses fluctuates significantly (David Bergvinson).

Ways to address production challenges

A number of participants stressed the need to consider the local context in designing interventions addressing the difficulties producers experience. Pulses may not necessarily be "the answer", as there may be more appropriate alternatives (Logan Cochrane). Yet, agreeing on the importance of optimizing the potential of pulses, the need to create a broader supportive environment for

(potential) farmers was often highlighted; in developing and implementing policies, all key stakeholders should be involved (Manoj Kumar Behera). Specific suggestions regarding how producers should be supported included the following:

- **Research and development** should be encouraged (Robynne Anderson, Dhanya Praveen, David Bergvinson) in the public as well as private sector (Randy Duckworth) in order to 1) reduce the yield gap between pulses and cereals (Massimo Iannetta); 2) optimize mixed small-scale farming, giving pulses the importance they are accorded in the local culture (Lal Manavado); and 3) better understand insect-plant interactions, allelochemicals/toxic compounds in plants (which are very important for pulses), and the interaction of these toxics with detoxifying enzymes in lower/higher animals (Ahmad Mahdavi).
- **High-yielding, abiotic/biotic stress-resistant varieties should be developed** (Dr Amanullah, Corina Carranca, Emile Houngbo) to suit the local conditions (Manuel Castrillo); they should in particular be adapted to infertile soils (John Howieson). Non-endemic varieties should not merely be introduced for economic reasons, because of uncertainty regarding their interaction with local species (Lal Manavado). Preferably, one should focus on the development of underexploited varieties (Kuruppacharil V. Peter, Stacia Nordin).[2] Subsequently, these quality seeds need to be made available, e.g. through village seed banks (Pradip Dey, Stacia Nordin).
- **Extension services and technical assistance** should be improved (Lal Manavado, Manoj Kumar Behera, George Bazongo). In order to encourage farmers to cultivate pulses and to improve their production methods, capacity building efforts are needed (Dhanya Praveen, Pradip Dey) in which smallholders and women are central (Pradip Dey).
- **Higher and more stable incomes for farmers** should be realized by means of 1) laws assuring fair prices (Lal Manavado), for example through minimum support prices for pulses (Gurpreet Singh); 2) weather-based price insurance for pulses (Pradip Dey); 3) geographic origin protection and other strategies to add value to local production (Massimo Iannetta); 4) the establishment of producer cooperatives to avoid unfair prices (Lal Manavado, George Bazongo); and 5) providing storage facilities, so the produce can be sold later at a better price (George Bazongo).
- **Commercialization should be stimulated** (Germain Grégoire Eloundou Tsanga), which *inter alia* entails investing in value addition (Stacia Nordin). For example, low-cost, cluster-based dal mills could be introduced to allow for processing of pulses (Pradip Dey).

Pulses and climate change

Many participants stressed the important role pulses can play in the context of climate change. Particularly their genetic diversity, which allows for adaptation to changing growing conditions, and their benefits regarding soil health were highlighted. Various examples of the development of varieties adapted to a changing climate were mentioned. For example, the Portuguese institute for germplasm resources and plant breeding studies (INIAV) has produced several varieties that are well adapted to different climatic conditions, including five for chickpea, two for peas, one for broad bean, one for lentil, one for cowpea, and one for white lupine (Corina Carranca). In Iran, the new drought-tolerant chickpea variety "Sameen" and the cold stress-tolerant "Saral" have, among others, been released (Seyyed Hossain Sabbaghpour). In addition, Robynne Anderson shared a number of studies on drought tolerance (all are included in the resources list), in particular on the effects of drought and the water use of pulses:

- A meta-analysis of Daryanto, Wang and Jacinthe (2015) investigated the **effects of drought** on legume yields:
  - Water availability and yields were positively correlated, but yield impact varied with the legume species and the phenological state during drought.
  - Lentil, groundnut, and pigeon pea exhibited lower drought-induced yield reduction compared with legumes such as cowpea and green gram.
  - Adaptability of a species to drought did not always correspond to dryland origins.
  - Phenological plasticity could be an important trait for selecting drought-resistant species, given irregular rainfall patterns and the large observed impact of drought during the reproductive stage.

2 Pigeon pea, vegetable soybean, cluster bean, velvet bean, yam bean, lablab bean, sword bean, yard-long bean and cowpea are examples demanding research attention (Kuruppacharil V. Peter).

- A study of Cutforth *et al.* (2009) examined the **drought tolerance** of peas, chickpea, canola, mustard and wheat in Saskatchewan, Canada.
  - Compared with wheat, canola and mustard, peas and chickpea were better able to adjust to moderate to severe water stress.
  - Pulses maintained positive turgor and metabolic activity over a wide range of water potentials.
- The research of Angadi *et al.* (2008) also took place in Saskatchewan and looked into the **water use** of three pulses (chickpea, lentil and peas) as well as that of canola, mustard and wheat:
  - Compared with the high water use of wheat, canola and mustard, chickpea and lentil had medium water use and peas had low water use.
  - Peas and wheat produced the most grain biomass and had the highest water-use efficiency.
  - Chickpea and lentil had good grain yields under dry conditions and performed better than other crops under drought stress.
  - Pulse crops, especially peas, were well suited to the drier parts of the semiarid prairie.

Conclusion

Discussion participants highlighted the immense potential of pulses and elaborated on their benefits for human health and the environment. Many ideas were shared on how to stimulate their consumption and production. In general, there was a broad consensus on the need to support pulse producers and the pulses sector as a whole in order to promote the availability and accessibility of this nutritious food for all people, in particular in the context of a changing climate.

The contributions received will feed into initiatives organized during the International Year of Pulses, which aims to raise awareness on their benefits, encourage an increase in their production and consumption, and likewise highlight the need for enhanced investment in research and development and in extension services.

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VIDEOS

FSN Forum Webinar on Pulses
http://bit.ly/1U7sEuS

Global Pulse Confederation – These Are My Pulses | Selçuk Şahin, Turkey
https://www.youtube.com/watch?v=iq-z-8LCv2o

ICRISAT mandate crops
https://www.youtube.com/user/icrisatco

ICRISAT – Pigeon pea: A pulse revolution in Padasoli
https://www.youtube.com/watch?v=zQyLfPvEhIM&feature=youtu.be

ICRISAT 100 voices – video series on topical issues
http://www.icrisat.org/100-voices

International Year of Pulses 2016: A stable price for a staple crop (ICRISAT DG David Bergvinson)
https://www.youtube.com/watch?v=-VNoTwMjfLI&feature=youtu.be

No Policy is an Island: Finance and Food Security in India by Dr Andre Butler
http://www.icrisat.org/take-2-highlights-of-science-seminar

WEBSITES

Capacity Development Network in Nutrition in Central and Eastern Europe
http://www.capnutra.org

CGIAR Research Program on Grain Legumes
http://grainlegumes.cgiar.org

Global Pulse Confederation – Pulse recipes
http://pulses.org/recipes

ICRISAT's contribution to the SDGs
http://www.icrisat.org/sdg

ICRISAT – GEMS
http://gems.icrisat.org

ICRISAT – Integrating pigeonpea to supplement nutrition needs in children
http://www.icrisat.org/integrating-pigeonpea-to-supplement-nutrition-needs-in-children

ICRISAT IYP page
http://www.icrisat.org/iyp

ICRISAT – Pulse recipes
http://oar.icrisat.org/195

Koki recipe
http://www.editions2015.com/cameroun/recette-koki.php

Meatless Monday
http://www.meatlessmonday.com/about-us/why-meatless

N2Africa
http://www.n2africa.org

ANNEX: Recipes

Pulse sprouts (Gurpreet Singh)

The best way to grow sprouts is by first soaking the seeds for over 8 hours and later tying the seeds in a clean cotton cloth for another 8 hours, until the seeds show their first sprout long enough to enjoy raw. Enjoy the sprouts with a little olive oil sauté and curd – there's nothing better to start your day.

Koki (Germain Grégoire Eloundou Tsanga)

INGREDIENTS

1 kg of koki, small white beans
1 litre of water
600 grams of red palm oil
1 pepper
Banana leaves for cooking

PREPARATION

- Soak your koki in a large quantity of water for about 6 hours.
- Take the grains from the water, peel them and set them aside.
- Prepare the banana leaves as you would to make a pistachio cake.
- Finely crush the koki grains (white beans), pouring them into an oven dish.
- Warm up the palm oil (it needs to be liquefied, not clarified). When the oil is liquid and warm, add half of your koki paste.
- Stir gently with a spoon, add the rest of the oil and a half litre of the water, and mix the paste well so that the colour is even. Add the rest of the water and mix again; the paste must be fluid as a cream.
- Arrange your banana leaves as you would for a ngon, and pour in a portion.
- Cook for about 3 hours over a moderate fire.
- The cake should be yellow-orange, like a ripe mango. Serve with sticks of cassava.

Cowpea paste or *rupiza* (Elizabeth Mpofu)

INGREDIENTS

3 cups of cowpeas
Peanut butter
Salt
Water

PREPARATION

- Clean the cowpeas and roast them in a hot pan on low heat.
- Remove the hulls by grinding the seeds on a grinding stone and then winnowing.
- Crush the dehulled seed on a grinding stone until broken into very small pieces.
- Boil the ground cowpeas until cooked.
- Add salt to taste.
- Using a wooden spoon, stir the cowpeas until a fine paste is formed.
- Add a little water and peanut butter.
- Leave the paste to simmer for 5–10 minutes.
- Serve with potatoes and rice; in Zimbabwe it is usually also served with *sadza*, our staple food.

Cowpea and potato soup (Elizabeth Mpofu)

INGREDIENTS

2 cups of cowpeas
500 g potatoes
4 medium-size ripe tomatoes
2 green peppers
1 medium onion
Vegetable oil
1 teaspoon salt

PREPARATION

- Clean the cowpeas and cook until soft.
- Peel and wash the potatoes.
- Put the potatoes in with the cowpeas.
- Cook together until the potatoes are soft.
- Cut the pepper, onion and tomatoes, and add to the mixture.
- Add salt and cooking oil, and cook for about 15 minutes on low heat.
- Serve as a starter or with a little bit of rice.

Soup with beans (Corina Carranca)

Boil the beans in water (about 350 g already cooked) with some potatoes (four big ones), one onion, two carrots and a radish, with a pinch of salt. When cooked, crush everything and add about 150 g of (cooked) beans, 250 g of (boiled) spinach, and some sliced spicy sausage. Adjust the water content and salt and let it boil for a few minutes. Turn off the stove and add olive oil, as you like.

PUBLICATIONS WITH RECIPES

Pulses: The Perfect Food by Julie Garden-Robinson
https://www.ag.ndsu.edu/pubs/yf/foods/fn1508.pdf

The Power of Pulses by Dan Jason, Hilary Malone and Alison Malone Eathorne
http://www.douglas-mcintyre.com/book/the-power-of-pulses

WEBSITES WITH RECIPES

Pulses.org | Global Pulse Confederation
http://pulses.org/recipes

ICRISAT – vegetable pigeon pea recipes
http://oar.icrisat.org/195

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FAO, 2016 BL632E