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➤ www.fao.org/fsnforum/activities/discussions/pulses

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

Collection of contributions received

in collaboration with



2016
INTERNATIONAL
YEAR OF PULSES

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Topic note

Pulses are important food crops that can play a major role in addressing global food security and environmental challenges, as well as contribute to healthy diets.

In recognition of the contributions that pulses can make to human well-being and to the environment, the UN General Assembly declared **2016 as the International Year of Pulses**.

However, most people do not know **what exactly pulses are**:

According to FAO (1994),¹ pulses, a subgroup of legumes, are crop plant members of the *Leguminosae* family (commonly known as the pea family) that produce edible seeds, which are used for human and animal consumption. Only legumes harvested for dry grain are classified as pulses. For example, grain legumes used mainly for oil production, such as soybean (*Glycine max* [L.] Merr.), are not considered pulses. Likewise, legumes used for sowing purposes (e.g. *Medicago sativa* L.) or as vegetables are not considered pulses.

Pulses are a critical and inexpensive source of plant-based proteins, vitamins and minerals for people around the globe. They have a low fat content, contain zero cholesterol, and are a significant source of dietary fibre. Moreover, they contain no gluten and are rich in minerals and B vitamins, all of which are important for a healthy life.

From an agricultural point of view, multiple cropping systems that include pulses enhance soil fertility, improve yields, and contribute to a more sustainable food system. It is particularly noteworthy that pulses have a very low water footprint compared with other protein sources, and can be grown in very poor soils where other crops cannot be cultivated. Crop residues of pulses, and legumes in general, can also be used as animal fodder, thus increasing the quality of the animal diet.

Furthermore, pulses can play an important role in climate change adaptation, since they have a broad genetic diversity from which climate-resilient varieties can be selected and/or bred.

Pulses form part of the local cuisine in many parts of the world and are a highly traded commodity. However, despite the benefits highlighted above, their consumption at an individual level has seen a slow but steady decline, and production has not increased at the same rate as other commodities such as cereals. North Africa is the only region that has experienced any growth (only slight growth, in fact) in individual consumption.

Recognizing the enormous potential of these crops, the International Year of Pulses aims to raise awareness on the beneficial impact they can have on food security, nutrition and the environment; to encourage an increase in their production; and to highlight the need for enhanced investment in research and development and in extension services.

It also aims to increase the adoption of pulses as a central part of people's meals around the globe, as well as providing information on how to best prepare and consume them.

In order to make the International Year of Pulses truly inclusive and to gather as much information as possible on the use of these remarkable plants, we would like to invite you to contribute your experience and knowledge, in particular around the following questions:

- **Some countries produce large amounts of pulses, but these are not a part of their respective diets. How can the use of pulses be increased in communities where these crops do not play an important role in the local cuisine/traditional meals?**

¹ FAO. 1994. Definition and classification commodities, 4. Pulses and derived products (available at <http://www.fao.org/es/faodef/fdef04e.htm>).

- **Do you have any examples on how the consumption of pulses contributes to household food security and nutrition in your community or country, which may be useful in different contexts?**
- **What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?**
- **Are you aware of any research or studies on the role of pulses in climate change adaptation or mitigation? Please share them with us.**
- **The International Year of Pulses also includes a call for recipes to provide ideas and inspiration on how to consume these nutritious seeds. Would you like to share yours?**

Your suggestions, case studies and references will be used to produce fact sheets and briefs to circulate at events and initiatives carried out at regional and country levels during the International Year of Pulses.

International Year of Pulses Secretariat

Contributions received

1. Manuel Castrillo, Proyecto Camino Verde, Costa Rica

Original contribution in Spanish

Saludo cordial a todos. Ciertamente las legumbres son un alimento de gran importancia nutricional y económicamente accesible; adaptables a gran cantidad de recetas y que igual influyen el suelo de manera muy positiva. Entonces son mayoría las virtudes de las mismas. Desde mi perspectiva - soy asiduo de su consumo -, lo que falta es divulgación de los valores nutricionales y de su facilidad relativa de cultivo y rendimientos, tanto para los agricultores como para los consumidores finales. En Costa Rica, la dieta diaria en los principales platos criollos nos da una ingesta nutricional elevada, (gallo pinto, casados, arroces con vegetales, sopas de frijol blanco, cubaces, etc), falta innovación e investigación para diversificar preparaciones comerciales (polvos, pastas, concentrados, etc.), lo cual daría mayor disponibilidad de usos y consumo propiamente.

Su papel en el cambio climático en nuestro país, creo que no ha sido analizado - resta investigar al respecto -, más por demás, me trae un interesante y potencial recurso a disponer en las alternativas para la adaptación al mismo y es por este medio que resulta valioso la divulgación del tema.

Muchos de los productores de leguminosas - frijoles negros más que todo - están limitados por los costos de producto importado, pues los costos de producción son más altos y la importación goza de beneficios arancelarios, aquí entra en juego el tema de la seguridad alimentaria y el peso de los grandes productores (transnacionales) y el fomento a la producción local, factores de financiamiento y valor agregado antes expuesto. Aparte cada región tiene condiciones geográficas y climáticas diferenciadas, que darán un mejor o peor producto, lo cual llevaría a establecer factores de identificación de variedades, con cualidades propias que no se dan en otros sitios y fomentarían intercambios comerciales, pudiendo generar un " comercio inteligente ", basado en necesidades y capacidades entre países y regiones, cosa que en el pasado se hacía sin tanta especulación financiera y política.

Mientras llegan más opiniones, me daré a la deliciosa tarea de buscar recetas - Y probarlas claro ! - para compartirlas.

Saludos y buen provecho !

Manuel Castrillo
Proyecto Camino Verde
Costa Rica

English translation

Dear all,

Certainly, pulses are affordable plant foods of high nutritional importance; suitable for a large number of recipes and very beneficial for soils. As a regular consumer, I believe we need to disseminate their nutritional values, relative ease of cultivation and fairly straight yields, both for farmers and end consumers. In Costa Rica, the daily diet based on main creole dishes (gallo pinto, casado, rice with vegetables, white bean soups, cubaces, etc.) is highly nutritious. Innovation and research are needed to broaden the range of commercial preparations (powders, pastries, extracts, etc.) and diversify the use and consumption of pulses as a result.

The impact of pulses on climate change in our country has not been analysed yet and should therefore be investigated. It is an interesting alternative for climate change adaptation and raising awareness on the benefits of pulses for this purpose is useful.

Many pulses producers –particularly of black beans– are constrained by the costs of imports, leading to higher production costs. Food security, the influence of large producers (transnational), the promotion of local production, the financing conditions and the creation of added value come into play. Besides, each region has its own geographical and meteorological conditions which will affect the end product. Different varieties can be identified according to these conditions, with distinctive and exclusive features. Commercial activity can be stimulated, yielding a "smart trade" based on the needs and capabilities of each country and region. This was done in the past without so much financial and political speculation.

Whilst more contributions are being received, I will be happily looking for recipes –and tasting them as well- that I will be sharing with all of you.

Best regards and enjoy your meal!

Manuel Castrillo
Camino Verde Project
Costa Rica

2. Antonia Trichopoulou, Hellenic Health Foundation, Greece

Dear all,

Please find attached a publication on Pulses that you might find interesting.

Antonia Trichopoulou

Attachment:

<http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/2009%20Mediterr%20%20Nutr%20Metab%20PULSES.pdf>

3. Asnake Fikre, Ethiopian Institute of Agricultural Research, Ethiopia

Some countries produce large amounts of pulses, but these are not a part of their respective diets. How can the use of pulses be increased in communities where these crops do not play an important role in the local cuisine/traditional meals?

View: One of the critical issue to look into is working on social factors and customs. There are hundreds if not thousands of traditional preparations and consumption habits in the world of pulses. So with the recently emerging issues in making pulses part of the diets of the riches as a consequence of health, driving the culture that encourage mass population could be improved. It is about the food industrial application part of pulse , that still is too far behind, that make its utilization limited. It is also important to make a learning processes of pulses from most consumers to least consumers tradition.

Do you have any examples on how the consumption of pulses contributes to household food security and nutrition in your community or country, which may be useful in different contexts?

View: yes. There are different preparations and consumption habit in my community. In Ethiopia, coffee ceremony is always accompanied by snacks, which often is made out of pulses. Curry /shiro/which is best compatible staple food with Enjera, have already been co-evolved over centuries and well serving as staple food of the community. Ethiopia as producer of some 15+ species of pulses,

and with some 80 different traditional community of 100 million population, could demonstrate the diverse but strong utilization of pulses as food and nutrition sources.

What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?

view: the seed system is poorly developed. poor investment is made in pulse research and development. poor involvement of the Pvt sector. weak policy support on radically changing the sector.

soln: The public system is mainstreaming an innovative approach of seed system enhancement by coordinating the farming community into seed production sources, with limited incentives. The Pvt is expected to share some of the areas in seed. The govt/pvt is to make substantial investment in the sector to respond best for market, consumption and agricultural health. The R4D part has to be capacitated like happening in other crops.

Are you aware of any research or studies on the role of pulses in climate change adaptation or mitigation? Please share them with us.

view yes: some of the attribution with pulses is by substituting the chemical N source fertilizer b/c of their ability to fix N₂ from the air. By this it contributes for reduction of GHG emission into the air.

The International Year of Pulses also includes a call for recipes to provide ideas and inspiration on how to consume these nutritious seeds. Would you like to share yours?

View; we did competition at national level of recipes made out of pulses. The idea was to enhance its application among the public. We learnt a lot on the industrial pathways of the competitors recipes/products that can easily be transferred into a standard industrial products. We had also the chance to collect taste preference and got interesting feedbacks.

Attachment:

<http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/FAO%20Responses.doc>
[x](#)

4. Kadambot Siddique, UN FAO Special Ambassador for the International Year of Pulses 2016, Australia

Dear Moderator,

Please find attached paper related to pulse production. I hope that this will provide the basis for discussion on the above subject.

Best wishes.

Kadambot Siddique

Professor Kadambot Siddique, AM CitWA FTSE FAIA FNAAS
Hackett Professor of Agriculture Chair and Director

UN FAO Special Ambassador for the International Year of Pulses 2016

Attachment:

<http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Innovations%20in%20a%20gromony%20of%20food%20legumes%20Siddique%20et%20al-Published.pdf>

5. Lal Manavado, Norway

What Pulses Could Contribute to an Environmentally Sustainable Global Food Supply

Legumes, the source of pulses, have a variety of advantages over most of the other crops. Their well-known ability to utilise atmospheric nitrogen enables the farmers to save on fertilizers and allows the use of crop residues to enhance the soil fertility and porosity in an environmentally sustainable way.

Moreover, there are a large number of legume species which could be grown under a wide variety of geographical and climatic conditions, like the xerophytic Carob at one extreme, and to the Andean Lupines believed to have been in use for millennia at the other. Archaeological evidence indicates that the pulses have been included in the food cultures of Sumerians, ancient Egyptians, Indus valley civilisation, etc.

Household food security is ascertained with reference to the food culture to which the people involved conform. This may appear hard to accept at its face value, but, a foreign traveller in distant rural areas could easily find well-stocked small holdings, where people are friendly and hospitable while the visitor has to go hungry owing to the differences in their food cultures. Local food culture identifies what food items are best raised in a given location by a group of people who subscribe to a certain set of shared beliefs.

When the local food culture includes pulses, it implies the crop can be successfully raised and consumed by those living there. This is the first pathway by which it contributes to household food security. Like other components of a culture, the food culture of an area may diffuse over an extensive area through education in its real sense, human migration and trade, travelling, etc.

As a result, new types of pulses like Mung beans and split red lentils have now become more or less household food items in Europe and elsewhere. Expansion of the health food industry and its vigorous publicity campaigns as well as the spreading of various sects of vegetarianism have further increased the importance of pulses as a food source. Their importance seems to be highest in South Asia including Nepal, while they are a significant food source in Mediterranean, Portugal, Mexico and South America.

As far as I know, there is still a significant shortfall between the supply and the demand for pulses, which if met in an environmentally sustainable manner, could benefit everybody in several ways. At the same time, a reasonable substitution of animal food by pulses throughout the world would have the same spin-offs as the former. Taking them up collectively, their benefits include:

1. Environmentally beneficial, sustainable way of food production that may become a part of a farming package to attract youth to agricultural pursuits.
2. Their partial substitution of animal food would reduce the strain on the ecosystem services the current meat production imposes on them.
3. Legumes could reduce the need for nitrogen fertilisers and provide excellent mulch, or also serve as a crop/shade plant that would improve the local climate by regulating the ground-space heat exchange in the area, which is crucial to the maintenance of its salubriousness.

There are several varieties of edible vetches, and some of them have been successfully used as an effective ground cover in rubber plantations as well as a source of food. Since the banana plantations display more or less the same soil and climatic conditions, the same mixed cropping may be introduced to improve the soil and provide an additional source of food.

Legumes could play an important role not only in mitigating the adverse effects of environmental degradation like local/regional/global warming, but also in increasing the available ecosystems services. If carefully selected, they may serve as an adjunct to the local food supply or become a secondary source of income.

For instance, the Tamarind thrives under the arid environs of South Asia and is a plant endemic to the area. During the day, it provides the vital green cover that lowers the solar heat uptake by the barren soil, which raises the local temperature. At night, its leaves are folded, allowing a free air-flow, which enables the heat to escape into the air creating a gentle breeze. The pulp of its ripe pods is used as a condiment.

At the same time, no species that are not endemic should be introduced merely for economic reasons. There are great gaps in our understanding of how a new species may interact with the local species, and some of them may turn out to be catastrophic. It is always prudent to keep in mind that both the flora and fauna of an area depend on each other for their continued existence in some way, and we are still ignorant of the complete picture. Introduction of the legume *Prosopis* spp. in India and its consequences for the continued existence of the Indian wild ass is

An example of what could happen when a new species is introduced into an area without due consideration.

However, I think planting of suitable variants of Carob on the Mediterranean basin, and extending it beyond it into Portugal could mitigate the excessive summer heat there while yielding a useful article of commerce. I advocate the use of existing legume species, perhaps improved by traditional breeding, but certainly not those whose genes have been modified.

Fortunately, regardless of the kind of use into which legumes are put, most of them are not difficult to cultivate, an adequate supply of water being the most important, especially for the seedlings. Moreover, as a dry and non-perishable item, pulses do not require sophisticated storage facilities or means of transport. At least in some parts of the world, some types of pulses, eg. Mung bean, black-eyed beans, and red split pulse, have a huge demand.

Secure land tenure, access to sound viable seed at a reasonable price, appropriate advice and training, an adequate supply of water, and financial resources seem to be the most significant problems the legume farmers encounter. Further, I think they are often compelled to sell their produce at unreasonably low prices to the middlemen who make exorbitant profits at the expense of the producer and the end-user.

I envisage a two-pronged approach to promote the cultivation and consumption of pulses, which may be extended to include the other useful legumes like Carob and Tamarind in order to increase the environmental benefits we all could derive from it. Achievement of an optimal result would depend on a simultaneous undertaking of the following actions:

Promotion of pulse consumption:

1. Active public education concerning the direct and the indirect benefits of their consumption, and inform the public of the fallacy of regarding pulses as 'health food'.
2. Facilitate the inventive uses of pulses in cookery, and actively disseminate the know-how so produced.
3. Encourage meal-providing institutions like schools, hospitals, etc., to increase their use of pulses.

Promotion of production:

1. Inclusion of the appropriate types of pulse in the package of produce proposed in connection with the discussion on how to help 15-17 year olds to take up agriculture.
2. Establishment, extension or maintenance of the infra-structure required to raise and dispose of pulses. In fact, pulses are among the least technology-intensive of crops, which makes them eminently suitable for countries with high unemployment and prevalence of hunger.

3. Enforceable and enforced laws that embody justice and fair play with respect to land tenure, the possibility of selling one's products for a fair price, and access to financial resources at favourable terms.
4. Pro-active agricultural extension services that may encourage farmers to take up the cultivation of pulses, provide advice, on-the-job training and technical assistance, and in extreme cases, even seed.
5. Encouraging the producers (this applies to all agricultural production) to establish and run cooperatives to store, process (often partially), transport and sell their own produce to avoid unfair food prices for the producer and the end user, as well as to reduce waste inherent in 'the modern food systems'.
6. Expanding the use of vetches yielding edible seeds as a ground cover and a soil enhancer in plantations of tropical fruits (bananas) and other suitable cultivars.
7. Though not pulses, many hardy leguminous plants like Carob and Tamarind are very useful in reclaiming barren and semi-barren land, re-establishing the plant cover that regulate the ground-space heat exchange, water retention, etc.
8. Research on optimal mixed farming on small scale (family farm level) where pulses are given the importance they are accorded by the local food culture, and disseminating the know-how gained.

I hope this might be of some use.

Cheers!

Lal Manavado.

6. Roberto Neiva Tavares, FAO, Italy

To keep the ball rolling, and in the attempt to, at least partly, address most – if not all – of the questions proposed in the forum, here are three articles originating from around the world about pulse production and consumption patterns and their health benefits.

1 – “Factors influencing pulse consumption in Latin America”, written by Pascal Leterme from the National University of Colombia and L. Carmenza Muñoz from the International Center for Tropical Research, both based in Colombia, deconstructs consumption patterns in one of the highest consuming regions in the world. Higher and lower consumption can be due to a multitude of reasons, among them their high nutrition factor, their cultural importance in the region, their prevalence in rural areas and in lower income populations, etc. The authors then suggest how patterns may vary depending on urbanization and economic development and stress pulses' health benefits as a reason to encourage increased consumption.

This article is available at

http://journals.cambridge.org/download.php?file=%2FBJN%2FBJN88_S3%2FS0007114502002532a.pdf&code=77edf1706aa915ece6bbbf916a408e1

2- “Pulses Production in India: Present Status, Bottleneck and Way Forward” by Anil Kumar Singh, SS Singh, Ved Prakash, Santosh Kumar and SK Dwivedi from the Indian Council of Agricultural Research. The Indian population is largely vegetarian and India is the largest importer of pulses in the world. In this article Singh et al. comment on the need to encourage increased pulse production in India, not only to meet demand but also for its potential benefits on crop rotation, intercropping, among others, including in changing climates.

This article is available at

<http://www.indiaenvironmentportal.org.in/files/file/pulses%20production.pdf>

3- “Pulses: The perfect food” developed for the Northern Pulses Growers Association in the United States by Julie Garden-Robinson, Ph.D from North Dakota State University. Finally, this more light hearted publication stresses the nutritional and health benefits of pulse consumption and makes several suggestions on how to prepare them and incorporate them in your diet. The publication is then complemented with an assortment of pulse-based recipes

This article is available at

<https://www.ag.ndsu.edu/pubs/yf/foods/fn1508.pdf>

Cheers,

Roberto

7. Eleanor Boyle, Sustainable Food, Attainable Health, Canada

Thank you for this international initiative to promote pulses. I'm delighted to be part of the discussion group. I'm from Canada, which is a major grower and exporter of pulses. According to an excellent new book called *The Power of Pulses* <http://www.douglas-mcintyre.com/book/the-power-of-pulses>, Canada is the world's largest exporter of pulses, only 10% of which stay at home. That's because the vast majority of Canadians – like citizens in many countries – don't sufficiently appreciate their potential of these powerful food species. So I'll watch this site for suggestions on how we can effectively promote this dietary shift.

The book mentioned above was written by Canadian seed expert and author Dan Jason along with Hilary Malone and Alison Malone Eathorne. The book demonstrates the health and environmental benefits of beans, peas, chickpeas, favas and lentils, and also outlines how people can grow, save, cook, and eat their own.

<http://www.saltspringseeds.com/blogs/articles/84023366-foreword-to-the-power-of-pulses>

As author of the book *High Steaks: Why and How to Eat Less Meat* (New Society, 2012), I have written about the environmental and health benefits of pulses, but am inspired by this FAO project to write more. Thanks very much, and I look forward to the discussion.

Eleanor Boyle, PhD, Educator and Writer, Vancouver, BC, Canada

8. Arun Kumar Das, Caloriecounts.org, India

Type 2 diabetes is a global public health crisis that threatens the economies of all nations, particularly developing country like India. Fuelled by rapid urbanization, nutrition transition, and increasingly sedentary lifestyles, the epidemic has grown in parallel with the rise in obesity followed by type 2 Diabetes. The dynamics of the diabetes epidemic are changing rapidly. Once a disease of the West, type 2 diabetes has now spread to every country in the world. Once “a disease of affluence,” it is now increasingly common among the poor in India with the total of 65.1 million. Once an adult-onset disease almost unheard of in children, 19.2% rising rates of childhood obesity, 11% in adolescent and 20% of all adult in India have rendered it from recent research. A healthful eating pattern, regular physical activity, and often pharmacotherapy are key components of diabetes management and prevention. We know, we can not restrict a person to eat specific foods. The more we restrict, the more they thrive for the same. It may be easy to change the religion of a person but change in food habits and food culture is quite difficult.

So there is a need of efforts to identify and promote intake of culturally-acceptable high-quality staple foods could be crucial in preventing diabetes. Low glycemic index based food like Pulses and lentils

can play a major role in combating the incidence and mortality associated with Diabetes and allied complications.

Promoting industries / entrepreneurs to produce low glycemic indexed based foods, value addition to pulses (Pulse based value added products) to meet the dietary, affordability and taste requirement of a person can only make the envisioned nutrition transition successful to combat the incidence of Non communicable Diseases.

I found institutions like CIGI, Canada and some others are working similarly. But there is a need of incubation to entrepreneurs to spread the same. Establishing industry, academic and enterprenurs interface can feed the Diabetics affordably and countries like India, china, others (With high number of Diabetics) can be saved from high mortality.

9. Samuel Adjei-Nsiah, International Institute of Tropical Agriculture, Ghana

Although most communities produce pulses but hardly consume them because they do not know how these pulses could be processed for food. To increase the use of pulses in their diets, conscious efforts must be made to train these people on how such pulses could be processed and used in their food preparations.

10. Nathaniel Moore, Harbour Publishing Co Ltd, United States of America

Happy Year of Pulses!

I would like to inform you about the new gardening / cookbook book called "The Power of Pulses" published this spring by Douglas & McIntyre in Canada. More information is available here: <http://www.douglas-mcintyre.com/book/the-power-of-pulses>.

Nathaniel

--

Nathaniel Moore

Publicist

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Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Pulses_PR.pdf

11. Kuruppacharil V. Peter, World Noni Research Foundation, India

There are a number of underexploited and underutilized legume vegetables of considerable nutritive value. Vegetable pigeon pea, vegetable soybean, cluster bean, velvet bean, yam bean, lab lab bean, sword bean (Canavalia bean), velvet bean, yard long bean and cowpea are a few such protein rich crops demanding research attention. Majority are water saving and stress tolerant crops. These crops can supplement protein in protein deficient foods. More can be read in the series "Underutilized and Underexploited Horticultural Crops" published by NIPA India (www.nipabooks.com).

(K V Peter)

Prof KV Peter Ph D FNAAS.FNAsc.FNABS.FHSI.
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Former Vice Chancellor, KAU
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12. John Howieson, Murdoch University, Australia

Causes of the global Nitrogen crisis:

Too little BNF, too much Haber Bosch. Why?

The ultimate cause is that crop legumes are generally not tolerant of soil infertility, relative to the cereals. The pulses we have domesticated require fertile soils to grow well. This generalisation applies to the temperate as well as the tropical pulses.

This greatly limits legume profitability and hence adoption, as growing cereals on poor soils is safer than growing pulses. In particular, it disadvantages poor farmers on the planet, who generally farm the infertile soils.

This in turn leads to increased use of Haber Bosch N in developed Agriculture (and greatly contributes to N pollution), and reduced legume yield in developing countries.

Solution

to domesticate a different set of legume options for infertile soils

Providing the opportunity for new food legumes in developing countries, and increased uptake of legumes (more flexibility) in developed nations.

We need research programs to domesticate legumes adapted to the poor soils (low clay content, low CEC, low fertility, low pH) but domestication programs must be market driven.

From Prof Howieson Murdoch University, Perth Western Australia

From his presentation to the International N Fixation Conference, California 2015.

13. Salomeyesudas, Nalla Kerai (Good Greens) Executive Director, India

There are many varieties of pulses are available from dry land farms

Horse gram, field bean, cow pea, lentil, lathyrus sativis and many types of beans.

Apart from making them as boiled or curry, gravy recipes many more snack and sweet items are made out of these pulses.

In tribal and rural areas lot of variety goes into preparations: laddus, vada, bajji, roti, spicy powders, as mixture of thickening agents

It is important to introduce them to children as regular diets

Reviving of traditional storage of pulses is urgent need of the hour

Storing in mud plastered bamboo baskets sealed with mud

Storing in bamboo baskets in between 2 layers of foxtail millet also protects them for long time

Revival of storage methods and recipes will put pulses in front row of the food basket

Thank you

Salome Yesudas

food and nutrition scientist

Hyderabad, Telangana, India

14. Robynne Anderson, International Agri Food Network, Canada

Some countries produce large amounts of pulses, but these are not a part of their respective diets. How can the use of pulses be increased in communities where these crops do not play an important role in the local cuisine/traditional meals?

This is especially true for my home country, Canada, one of the largest pulse producers in the world, where the pulse consumption is comparatively low. The 2016 International Year of Pulses is the single largest opportunity to increase awareness on the many health benefits that pulses offer, as well as their versatility and taste as a cooking ingredient. Governments, health organizations, cooking institutions, food media and the public in general could all play a role to promote pulses.

Many initiatives are taking place in Canada to celebrate the Year. Several illustrate how can pulses be included in daily menus with little to no effort. No time for soaking? No worries, take a can of your favourite pulse (chickpeas, beans, lentils or dry peas) and add it to your vegetable soup, to your morning toast, as a garnish or even to your brownies. Look for pulse flours and get creative when baking.

Considering that Canada has strong links to other countries given its immigration history, many Canadians are still preserving their cultural identities, including the cuisine. Pulses are used throughout the world in many traditional meals, perhaps what we need is a little reminder of the connection between these nutritious seeds and the traditional recipes.

Do you have any examples on how the consumption of pulses contributes to household food security and nutrition in your community or country, which may be useful in different contexts?

Pulses are a cornerstone of nutritional security for the hungry and malnourished, and of better diets to maintain healthy body weights. This UN International Year of Pulses is an excellent opportunity for governments around the world to start including pulses in their food security and nutrition policies. Pulses are a high fibre, low fat source of protein, contain important vitamins and minerals like iron, potassium, and folate, and two to three times as much protein as cereals like wheat, corn and rice. For all of these wonderful reason it is recommended to eat at least ½ cup of pulses per day.

What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?

Many crops don't attract their 'fair share' of investment, this is unfortunately true for pulses. The shame is these crops, often known as 'orphan crops' because they get ignored by funders, are potentially vital in the fight to deliver the UN's Sustainable development Goals (SDGs) because of their nutrition-density, affordability and positive impact on soil.

The 'Global Pulse Productivity & Sustainability Survey' suggests annual investment in pulses hovers at \$175m, whereas billions are invested into other crops such as corn. Not only in Canada, but globally we need a 10-fold increase in pulse research funding. With over 800 million people suffering from acute or chronic undernourishment, increasing pulse research is vital. We can only meet the world's protein needs with better varieties of chickpeas, peas, beans, and lentils.

Are you aware of any research or studies on the role of pulses in climate change adaptation or mitigation? Please share them with us.

• Vadez V, Berger JD, Warkentin T, Asseng S, Ratnakumar P, Rao KPC, Gaur PM, Munier-Jolain N, Larmure A, Voisin A-S, Sharma HC, Pande S, Sharma M, Krishnamurthy L, Zaman MA. 2012. Adaptation of grain legumes to climate change: a review. *Agronomy for Sustainable Development*, 32(1): 31-44.

Grain legume production is increasingly confronted with land degradation / competition, soil nutrient deficits, higher and more variable temperatures, and, especially in the semi-arid tropics, water scarcity. Grain legume responses such as water use (e.g., leaf/root resistance to water flow) and vernalization (i.e., onset of flowering, regulated by responses to day length and ambient and low temperature) will affect the severity of climate change impacts in coming decades. New germplasm is needed to improve grain legume water use efficiency (biomass or grain produced per unit of water) through control of leaf water losses under high vapor pressure deficit (i.e., high plant-atmosphere pressure gradients drive water out of the leaves at a faster rate) and increased atmospheric CO₂ concentration. (Water-sparing varieties will be beneficial where crops grow on stored soil water, but can lower yields where crops grow on current rainfall in a short rainy season.) Breeding programs to improve plant adaptation (e.g., balance crop duration with available soil water and maximal light capture) should be based on key mechanisms underlying crop phenology and nutrition (e.g., interdependence of C and N). As climate change accelerates, phenology will not change in those genotypes regulated largely by photoperiod, will come earlier in ambient temperature-sensitive types, and will be delayed in those responding to vernalization. In chickpea (and possibly lentil), temperature sensitivity has been strongly correlated to mean vegetative phase temperatures in habitat of origin and, among relatively temperature insensitive varieties, there is a strong compensating relationship with day length response. With increasing frequency of high-temperature events, crops may experience supra-optimal temperatures that delay flowering and exacerbate terminal drought stress. Vernalization response has been eliminated in chickpea and narrow leaf lupin, while other legume crops such as faba bean and pea retain their vernalization response. Overall, it is difficult to predict where and by how much crop phenology is likely to be affected given weak understanding of adaptation of grain legumes to environmental triggers in different habitat types. In the semi-arid tropics, high temperature and prolonged moisture stress in recent years are associated with drought at flowering and reproductive growth stages and large increases in dry root rot in chickpea. High intermittent rain in the last 5 years (>350 mm in 6-7 days) in July-August is associated with outbreak of *Phytophthora* blight of pigeonpea. The semi-arid topics face increase risk of disease in chickpea (anthracnose, collar rot, wet root rot, stunt diseases) and in pigeonpea (*Phytophthora* blight, *Alternaria* blight). Ecophysiological models are needed to identify genotypes appropriate to new growing conditions (e.g., varieties capable of setting / filling seeds at high temperature and responding to altered geographical distribution of pests, diseases, and weeds). Rather than looking at specific traits independently, methods are needed to assess how different traits interact to influence performance under water limitation (e.g., drought research in chickpea has focused only on root morphology).

- Daryanto S, Wang L, Jacinthe P-A. 2015. Global synthesis of drought effects on food legume production. PLoS ONE, 10(6): e0127401.

Drought has had adverse effects on food legume crop production in major pulse-producing regions of the world (e.g., India, China, many African countries), where rainfed agriculture is common. This study investigated how effects of drought covary with legume species, soil texture, agroclimatic region, and drought timing, through meta-analysis of 110 field studies (1980 to 2014) on yield responses of legume monocrops to drought. Water availability and yield reduction were positively correlated, although yield impact varied with legume species and phenological state during drought. Overall, lentil (*Lens culinaris*), groundnut (*Arachis hypogaea*), and pigeon pea (*Cajanus cajan*) exhibit lower drought-induced yield reduction compared to legumes such as cowpea (*Vigna unguiculata*) and green gram (*Vigna radiata*). Under >65% water reduction, lowest yield reduction occurred with lentil (21.7%) and groundnut (28.6%) and highest yield reduction occurred with faba bean (40%). Under 60–65% water reduction, lowest yield reduction occurred with pigeon pea (21.8%) followed by soybean (28.0%), chickpeas (40.4%), cowpeas (44.3%), green grams (45.3%), and common beans (60.8%). Under <60% water reduction, field pea experienced only half the amount of yield reduction observed when compared with chickpea. Drought that occurred during reproductive stages (i.e., from flowering to maturity) resulted in yield reduction (43.4%) similar to the reduction observed when drought occurred throughout the growing season (42.1%). Yield reduction averaged 37.3% and 26.89% for droughts that occurred during the early and late reproductive stages, respectively. Droughts resulted in 63.8% legume yield reduction in medium-textured soils (i.e., high productive potential) compared to 30.9% in fine-textured (i.e., more difficult water extraction by plant roots) and 19.8% in coarse-textured (i.e., low productive potential) soils. No significant differences in legume yield reduction were observed for different major climatic regions (non-tropical vs. tropics or drylands vs. non-drylands), although meta-analysis was applied to studies for which agricultural input (e.g., pest control and fertilizers) was not a limiting factor. Significant difference in pulse productivity was observed between developed (mostly non-tropical region) countries (1.8 tons ha⁻¹) and developing (mostly tropical region) countries (0.8 tons ha⁻¹). Adaptability of a legume species to drought does not always correspond to dryland origins and groundnut (tropical origins) showed better adaptability compared to common bean or black gram, even under higher level of water reduction. Two mechanisms of drought resistance in legumes include: (i) drought avoidance via efficient stomata regulation (e.g., common bean, cowpea, chickpea, pigeonpea, lupin), which can limit photosynthesis and shoot growth, and (ii) drought tolerance via osmotic adjustment (e.g., common bean, faba bean and cowpea), which usually allows root growth to proceed under drought condition. Authors conclude that phenological plasticity could be an important trait for selecting drought-resistant species (i.e., able to maintain high yield following a period of water stress), given irregular rainfall patterns and large observed impact of drought during reproductive stage.

- Angadi SV, McConkey BG, Cutforth HW, Miller PR, Ulrich D, Selles F, Volkmar KM, Entz MH, Brandt, SA 2008. Adaptation of alternative pulse and oilseed crops to the semiarid Canadian Prairie: Seed yield and water use efficiency. Canadian Journal of Plant Science, 88: 425-438. [Summary copied from Pulse Canada online Science Library]

This 2008 research paper, published in the peer-reviewed Canadian Journal of Plant Science, studied water use by pulses and other crops. The ability of crops to adapt to different water conditions is important because moisture for crop growth is frequently in short supply. The study included three pulses (chickpea, lentil, and pea) as well as canola, mustard, and wheat. Three different moisture conditions were studied: drought, normal rainfall, and irrigation. The study took place in Saskatchewan over four years. Of the crops studied, wheat and pea had the highest yields and highest water use efficiency, while pea used the least amount of water. Chickpea and lentil produced good yields even when water was limited. Under severe drought conditions, where some crops did not produce any appreciable yields,

chickpea and lentil were able to maintain at least some yields. The study concluded that pulse crops are well-suited to low moisture conditions.

Key findings:

§ Compared to high water use by wheat, canola, and mustard, chickpea, lentil had medium water use and pea had low water use (34 and 13 mm less water than high and medium users).

§ Pea and wheat produced most grain / biomass and had 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 pea, are well suited to the drier parts of the semiarid prairie.

· Cutforth HW, Angadi SV, McConkey BG, Entz MH, Ulrich D, Volkmar KM, Miller PR, Brandt SA. 2009. Comparing plant water relations for wheat with alternative pulse and oilseed crops grown in the semiarid Canadian prairie. *Canadian Journal of Plant Science*, 89: 826-835. [Summary copied from Pulse Canada online Science Library]

Published in the Canadian Journal of Plant Science in 2009, this peer-reviewed study examines the drought tolerance of different crops. Drought tolerance is important because precipitation in the Canadian Prairies can be low and unpredictable. The crops studied were pea, chickpea, canola, mustard and wheat. Each crop was grown under three different water conditions: drought, normal rainfall, and irrigation. It was conducted in Saskatchewan during a two year period. The paper first provides some background about how individual plant cells are affected by water stress before examining each crop's response to drought in detail. The study found that pea and chickpea had the greatest ability to withstand water stress, followed by wheat and then the two oilseed crops. This research shows the advantage of growing pulses in drought-prone areas.

Key findings:

§ Compared to wheat and Brassica oilseeds, pea and chickpea were better able to adjust to moderate to severe water stress.

§ Pulses maintained positive turgor (i.e., combined strategies of cell wall elasticity and osmotic adjustment) and metabolic activity over a wide range of water potentials.

· Miller PR, McConkey BG, Clayton GW, Brandt SA, Staricka JA, Johnston AM, Lafond GP, Schatz BG, Baltensperger DD, Neill KE. 2002. Pulse crop adaptation in the Northern Great Plains. *Agronomy Journal* 94: 261-272. [Summary copied from Pulse Canada online Science Library]

Miller and colleagues reviewed the current research on the production of peas, lentils, beans, soybeans, and chickpeas in western Canada and the northern USA. Published in Agronomy Journal in 2002, this article summarizes how pulse crops affect environmental sustainability in terms of crop yields and efficiency of water use. Key areas for further research are also outlined. Overall, research shows that pulse crops consistently provide a nitrogen benefit to wheat that is grown after a pulse. This nitrogen benefit is demonstrated by higher wheat grain yields and higher wheat protein content (nitrogen is a major building block of protein). This is important because nitrogen supplied by a pulse crop reduces the need for nitrogen fertilizer, an input that is energy-intensive to produce and is responsible for a large portion of the greenhouse gas emissions in agriculture. Peas, lentils, and chickpeas were specifically highlighted as crops that efficiently use water. Research suggests that these three pulse crops respond to drought conditions better than spring wheat. By using less water, pulses conserve water for use by subsequent crops. This is particularly important because water is a major limiting factor in growing crops in the northern Great Plains.

Key findings:

§ In the Northern Great Plains, rotational benefits of pulses on wheat result from complex pulse interactions with soil water, soil nutrient supply, and pest cycles. Pulse crops can have mixed effects on weed cycles.

§ Under very different N-limiting growth conditions, higher grain yields and protein content for wheat grown after a pulse crop indicate pulses consistently provide N benefit.

Peas, lentils, and chickpeas efficiently use water (conserving water for use by subsequent crops) and respond to drought conditions better than spring wheat (i.e., can grow at lower relative water content).

Johnston AM, Clayton GW, Miller PR. 2007. Introduction to "Pulse crop ecology in North America: Impacts on environment, nitrogen cycle, soil biology, pulse adaptation, and human nutrition". *Agronomy Journal*. 99: 1682-1683. [Summary copied from Pulse Canada online Science Library]

Published in Agronomy Journal in 2007, this is a short article that provides a broad overview of the benefits of pulses as well as key directions for future research. It is the introduction to a symposium about pulse crops held at the annual conference of the American societies for agronomy, crop science, and soil science. To begin with, the current status of land seeded to pulses in North America is reviewed. In the period from 1991 to 2006, the area seeded to pulses increased more than seven times. The nutritional benefits of pulses are then discussed. In addition to their high protein and fibre contents, pulses also contain compounds called phytochemicals that promote good health. Next, the environmental impact of pulses in terms of reducing greenhouse gas emissions is considered. The article also covers the positive impact pulses have on beneficial soil microbes that enhance plant growth. Finally, the ability of pulses to adapt to changing climate conditions is examined. Overall, pulses are playing an increasingly important role in North American agriculture.

Key findings:

§ From 1991 to 2006, area seeded to pulses in North America increased 7-fold (400,000 ha to 3 million ha).

§ Benefits of pulses include: breaking pest cycles common to monoculture; reducing use of N fertilizer; increasing marketing opportunities.

§ Pulse crops provide residual N via roots and residues (significant N is removed through harvest of high-protein pulse grains). Actual N contribution from pulses may often be <20 kg N ha⁻¹, which doesn't fully explain improved cereal yield in rotation with pulses.

§ Pulse crop rhizosphere activity enhances P and Zn uptake and increases soil microbial activity overall. Pulse crop residues more readily decomposed by microbes.

§ Reduced use of N fertilizers in pulse-inclusive crop rotations decreases (a) fossil fuel use in N fertilizer manufacture, transport, etc, and (b) N₂O emission from soils.

§ Ability of pulses to adapt to changing climate conditions (and available soil water, shifting weed populations, soil fertility changes). Crop management practices (seeding date, fertilizer rate, variety selection) are more important than CO₂ fertilization effects.

§ Directions for future research: Characterize genetic diversity of nutrient and phytochemical composition; breeding / selection strategies (e.g., increasing N₂ fixation). Role of pulses in influencing nonpulse crop growth and development and impact on plant health and soil biology. Estimating the N credit from pulse crop residue. Variable absorption by livestock of beneficial phytochemicals in pulse crops.

The International Year of Pulses also includes a call for recipes to provide ideas and inspiration on how to consume these nutritious seeds. Would you like to share yours?

I have found cooking inspiration in The World's Greatest Pulse Dishes recipe collection available at Pulses.org. It has delicious recipes from all over the world, and a special collection of recipes from India, with easy to follow instructions.

15. Huseyin Arslan, Global Pulse Confederation, Turkey

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

e-Consultation

Submission by Huseyin Arslan

President of the Global Pulse Confederation

Some countries produce large amounts of pulses, but these are not a part of their respective diets. How can the use of pulses be increased in communities where these crops do not play an important role in the local cuisine/traditional meals?

It is true that pulses are consumed by the kilo in Africa and Asia, but surprisingly absent on Western menus. This ancient food crop has formed an essential part of diets all over the world for thousands of years, from Esau's biblical bowl of lentil stew to the dhal Mahatma Gandhi lived on. And when it comes to today's dietary and environmental challenges, pulses have many answers as they are high in protein and fibre, and low in fat. In addition, they require a fraction of the water that many other popular parts of global diets demand, meaning their cultivation is also sustainable in a world of scarce natural resources.

The earliest production of pulses can be traced as far back as 7500 BC, when lentils indigenous to South Western Asia and the Mediterranean region were first farmed. Evidence of lentil production was also discovered in Egyptian pyramids and dry peas were found in a Swiss village that are thought to date back to the Stone Age. It is believed that chickpeas spread from the ancient Mediterranean area between Morocco in the west and the Himalayas in east during the period prior to 3000 BC.

The word "pulse" may originate from the Latin word "puls" for thick soup. Lentils, beans, chickpeas and peas are enjoyed in many ways, including simple stews.

Thanks to a recent renaissance in creative ways to cook with pulses, there are numerous new and exciting ways we can pack them into our daily diets in flours, appetizers, mains, desserts and even cocktails, here are a few ideas:

- **Pancakes:** Seasoned chickpea flour can make a nutritious, gluten-free alternative to breakfast pancakes that can be topped with sweet or savoury foods.
- **Snacks:** To beat the mid-morning munchies, oven-roast some pre-cooked lentils with sunflower oil, chili flakes, garlic powder and a pinch of oregano for a punchy, crunchy snack.
- **Burgers:** For a healthier, burger or vegetarian option, kidney beans can be mashed, seasoned and oven cooked. Borlotti, butter beans or chickpeas can also be used. Beans can be used as a complementary ingredient. Create a 100% black bean burger, OR add 50% black beans to your beef for a new approach!
- **Potatoes:** White beans added to mashed potatoes are an awesome way to mix up the traditional dish. Blending pulses as a partner or a replacement is a great way to improve protein intake without changing your meal plan.

- Purees: Blend peas with broccoli and mint to make a nutrient packed alternative to mashed potato to accompany bruschetta.
- Cakes: Black beans can be a secret ingredient to a rich, gluten-free chocolate cake.

Today, pulses are the main component of many national dishes. Below are a few examples of traditional recipes made from pulses. The complete collection can be found on pulses.org in the National Signature Dish section:

- Brazil: Black beans are slow-cooked with meat and sausages to make the stew feijoada. In Bahia, black eyed-peas are seasoned and fried to make spicy acarajé.
- Myanmar: Yellow split peas are ground to make flour, mixed with water and left to set, making a yellow tofu that can be eaten fresh in a salad or deep fried.
- China: Kidney bean rolls named yun dou juan are very popular in Beijing.
- Colombia: Red beans are often cooked with pork, white rice, ground meat, fried egg, plantain and avocado among other ingredients to make dishes such as bandeja paisa.
- Ethiopia: Powdered chickpeas or broad beans are mixed with onion, garlic and ginger or chilli peppers to make shiro, a favourite dish during celebrations.
- Egypt: The spicy stew made from fava beans, ful medames, is the national dish of Egypt and is traditionally eaten at breakfast.
- France: Puy lentils are featured in many national dishes • India: Dhal, a stew prepared from spices and split lentils is a staple food across all of Southern Asia, traditionally eaten with rice.
- Italy: Traditional Minestrone soup uses borlotti beans along with an array of vegetables.
- Israel: Falafel - deep fried balls made from ground chickpeas or fava beans – are considered the national dish of Israel are popular as a street food across the globe.
- Japan: Azuki beans are mixed with sugar to create a sweet paste called an which is used in desserts.
- Macedonia: Butter beans, onion and red pepper are combined to make the national dish tavče gravče.
- Spain: Cocido madrileño mixes chickpeas with meat and vegetables to make a popular winter dish. • Turkey: Chickpeas are blended to make the world famous dip hummus
- Venezuela: A staple throughout Latin America, black beans are seasoned with cumin and oregano as well as onions and garlic to make frijoles negros.

For more information:

http://pulses.org/pulse-hub/fact-sheets/download?path=iyp_factsheet_worldcuisines.pdf

The Global Pulse Confederation has been working diligently to celebrate the International Year of Pulses and to use the year in particular as a platform to share the benefits of pulses with consumers who would not yet have pulses as part of their diets. To do so, hundreds of recipes were collected, including 66 World's Greatest Pulse Dishes and 29 Best of India recipes. It is important to share with consumers how to store, cook and be creative with pulses. There are so many varieties of pulses and recipes, the options are endless. It is a matter of communicating well with the consumers on how they can be easily incorporated in their diets. ½ cup per day of pulses brings important health and nutritional benefits.

For more information:

<http://pulses.org/recipes>

· **Do you have any examples on how the consumption of pulses contributes to household food security and nutrition in your community or country, which may be useful in different contexts?**

In most developing countries, pulses play a fundamental role as a low-fat, high fibre source of protein, an essential component of traditional food baskets. Pulses, by contributing about 10 percent in the daily protein intake and 5 percent in energy intake, are of particular importance for food security in low income countries where the major sources of proteins are non-animal products. In addition, pulses also contain significant amounts of other essential nutrients like calcium, iron and lysine. Pulses are included in all 'food baskets' and dietary guidelines. The World Food Programme (WFP) for instance includes 60 grams of pulses in its typical food basket, alongside cereals, oils and sugar and salt. Over 60 percent of total utilisation of pulses is for human consumption. But the importance of pulses in human diets varies from region to region and country to country, with a general trend of higher consumption in lower income nations. The share of food use in total utilisation of pulses in the developing countries is over 75 percent, compared to 25 percent in the developed countries.

Complementing animal feed with improved varieties of pulses has shown to significantly improve animal nutrition too, yielding better livestock, which in turn supports food security – a study in West Africa showed that animals fed cowpea hay, along with rice feed meal, during the dry season gain 95kg, compared to 62kg for animals that did not receive the cowpea fodder. The manure was also of improved quality and the study estimated that farmers which used cowpea fodder could benefit from an extra 50kg of meat a year and over 300kg of cereal grain from the improved soil quality. Pulses are locally adapted and can be grown by local farmers for their own nutrition as well as for sale, which is important to improve food security. They are highly accepted crops, which can keep well in storage. Pulses because of their role in improving sustainability, notably through soil management, also impact food security. Soil degradation is a major threat to food security in many areas. Africa is particularly impacted by soil degradation, yet pulses are part of traditional diets and often grown by small farmers. By improving the crop patterns using pulses, farmers can improve their yields and limit the long-term threat to food security that soil degradation represents.

· **What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?**

Pulses are a source of income and nutrition for farmers. Pulses contribute to raising income of farmers around the world, both in developed and developing countries. Across the many different types of pulses, suitable varieties with potential for household consumption, livestock feed, soil building, or income generation can be identified for most agricultural systems. In many countries, pulses are cultivated by women. Pulses provide these women a nutritious food source, and provide an additional income source.

Pulse crops add diversity to crop production. Crop diversity decreases the risk farmers face from environmental and market fluctuations. Pulses increase the range of products a farmer can eat or sell. Pulses in intercrops can contribute to higher overall system productivity – including 'overyielding' through more efficient use of resources – and profitability. Adding pulses to a crop rotation can significantly boost cereal yield and grain quality by increasing plant-available nitrogen, disrupting pest and disease cycles, and improving soil nutrition and structure.

Adding pulse crops to a crop rotation improves a farm's environmental stewardship. Nitrogen from pulse crops stays longer in the soil to boost production of other crops, while fertilizer-supplied nitrogen needs to be applied every year. Growing pulse crops in rotation with other crops enables the soil to support larger, more diverse populations of soil organisms, maintaining and improving soil fertility and suppressing pathogens. Pulses extract water from a shallower depth, leaving more water deep in the soil for the following year's crop. This increases the water use efficiency of the entire crop

rotation. To increase overall water use efficiency, producers can strategically combine cereal and other crops with pulses.

Here is an example of a farmer from my home country Turkey: <https://www.youtube.com/watch?v=iq-z-8LCv2o>

· **Are you aware of any research or studies on the role of pulses in climate change adaptation or mitigation? Please share them with us.**

Global pulse production will be affected by climate change. Pulse crop production will be increasingly affected by higher temperatures, drought, disease and pest pressure, and carbon dioxide concentration. Specific plant responses will vary in important ways and genetic variability within crops and wild relatives can facilitate breeding for climate change resilience. Many pulse crops are well adapted to semi-arid conditions globally and can tolerate drought stress better than most other crops.

To avoid yield loss or crop failure, producers can make use of natural variety among pulse crops in their response to environmental stresses. With increasingly volatile weather, farmers can adapt by choosing from a wide array of pulse varieties to match plant traits (e.g., water use efficiency, heat tolerance) to growing conditions (i.e., the right pulse in the right place). Under climate change, producers can adapt crop management practices (e.g., seeding date, fertilizer rate, variety selection) to suit available soil water, shifting weed populations, and soil fertility changes. In well-designed rotations with cereals, pulses may act as a 'break crop' that is protective against pest and disease damage, reducing need for pesticides.

· **The International Year of Pulses also includes a call for recipes to provide ideas and inspiration on how to consume these nutritious seeds. Would you like to share yours?**

The Global Pulse Confederation has collected hundreds of recipes on pulses.org. We invite all to use them and be creative with pulses. We also accept more recipes to be submitted by our visitors.

16. Gurpreet Singh, Aga Khan rural Support Programme India, India

I have tried to answer all the questions with my personal experience.

Apart from kidney beans Africa has low consumption of other pulses while this is also a fact that large amount of Pigeon pea is exported to India and other countries from Eastern Africa while locally it is not much consumed. Pulses has been traditionally been an integral part of vegetarian food culture across Indian states from north to south and east to west. The food habits are part of a culture which emerges over a period of time. To make the pulses popular among African nationals other than just kidney beans, new recipes can be introduced through cross cultural events. I remember one of my Ugandan friend liked the way pulses are cooked in Indian style.

Being brought up in a first generation out of poverty household, I still remember pulse was among daily dietary food in my household. Still today pulses are important source of food in Indian marginal households; it is considered poor man's protein. There have been some research that with the increase in life style the consumption of pulses declines as they tend to have more vegan food items in their food. In India for a major segment of society it still is a integral part of the protein source and the recent price rise of pulses have also affected the lower income households short duration financial health. How it can still remain affordable to the poor is a matter of inquisition and a looming challenge for India

Pulses are largely grown in rain-fed situation of India. Even though the current increase in retail prices of pulses the farmer is not so much allured to cultivate pulses in irrigated conditions. The reason

pertained to it is lower production of pulses when compared to the cereals. In irrigated condition cereals such as Maize, Rice Wheat can fetch higher production and thus net income, so farmers do not choose pulses as sole crop. There are a few varieties which have been developed to meet the challenge. Rain-fed areas are by default under pulses production. I propose two solutions for buttressing farmers to produce more pulses; firstly making sure the farmer get assured prices for the pulses they grow through minimum support price as announced for cereals, secondly promoting intensively intercropping or border cropping of some pulses in cropping system which are longer in durations – Cotton, Castor, Sugarcane, Ginger. Not only the method will give additional income to the farmers but will also make optimum utilization of resources – water, labor, soil etc.

To adapt to climate change anomaly such as higher soil run off due to shortly-spanned-intensive rainfall which are likely in climate change, pulses has great role to play. In India AKRSP-India is promoting pulses such as Pigeon pea on undulated farm bunds to prevent the loss of bunds and followed by rich soil. Though we are in current implementation no substantial research report be produced.

I am ravenous eater of different pulses sprouts. The best way to get sprouts formation is 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 shows its first sprout long enough to enjoy raw. I although enjoy sprouts with a little olive oil sauté and curd, nothing best to start your day.

17. Shoba Sivasankar, CGIAR Research Program on Grain Legumes, India

Dear FSN Forum,

Please find below some information that had been put together at the beginning of the year for the IYP.

Thank you

Shoba

Pulses for the Health of the Planet

Pulses are nutrient-dense crops that improve human diets, while their unique ability to fix nitrogen in the soil is valuable in crop rotations and for sustainable natural resource management. Several pulses are also resilient to adverse climate such as drought and heat, and grow in the dryland regions of the world. This makes them important food crops that adapt easily to the rising temperatures and increasingly frequent droughts under the changing climate of the planet.

Pulses are rich in protein, oil, and micronutrients including iron and zinc. They supply amino acids that are deficient in cereals, sharply improving protein quality when eaten together. The high iron and zinc content is especially beneficial for women and children at risk of anemia. Pulses also contain bioactive compounds that show some evidence of helping to combat cancer, diabetes and heart disease. The exceptional palatability of pulses is important. For example, as severely malnourished children lose their appetites, chickpea paste is used as a base ingredient in emergency famine relief foods.

Pulses can biologically fix nitrogen from the atmosphere, thus meeting their own nitrogen fertilizer need. This reduces both the costs and the environmental impacts of chemical fertilizer use. Inclusion of pulses in farming systems increases the effective capture, productive use and recycling of water and nutrients such as the end-of-season residual soil moisture in maize, rice and wheat fallows.

Pulses thus have important roles in human diet, on the farm and for the sustainability of agriculture.

Some of the planet's most commonly consumed pulses are Chickpea, Common Bean, Cowpea, Faba bean, Lentil and Pigeon Pea.

Chickpea is the world's second-largest cultivated food legume, with developing countries accounting for over 95% of its production and consumption. Chickpea grain is an excellent source of high-quality protein, with a wide range of essential amino acids, and the crop has a high ability to fix atmospheric nitrogen.

Common bean is the most important grain legume for direct human consumption with 23 million hectares grown worldwide, and approximately 12 million metric tons produced annually, of which 8 million tons are from Latin America and Africa. In the developing world beans are smallholder crops, and in Africa these are cultivated largely by women. Annual consumption is as high as 66 kg per person, and in many areas common bean is the second most important source of calories as maize.

Cowpea is the most important grain legume crop grown in sub-Saharan Africa, where it is mostly grown in the hot drought-prone savannas and very arid Sahelian agro-ecologies. Cowpea is a protein-rich grain that complements staple cereal and starchy tuber crops, and is highly drought tolerant.

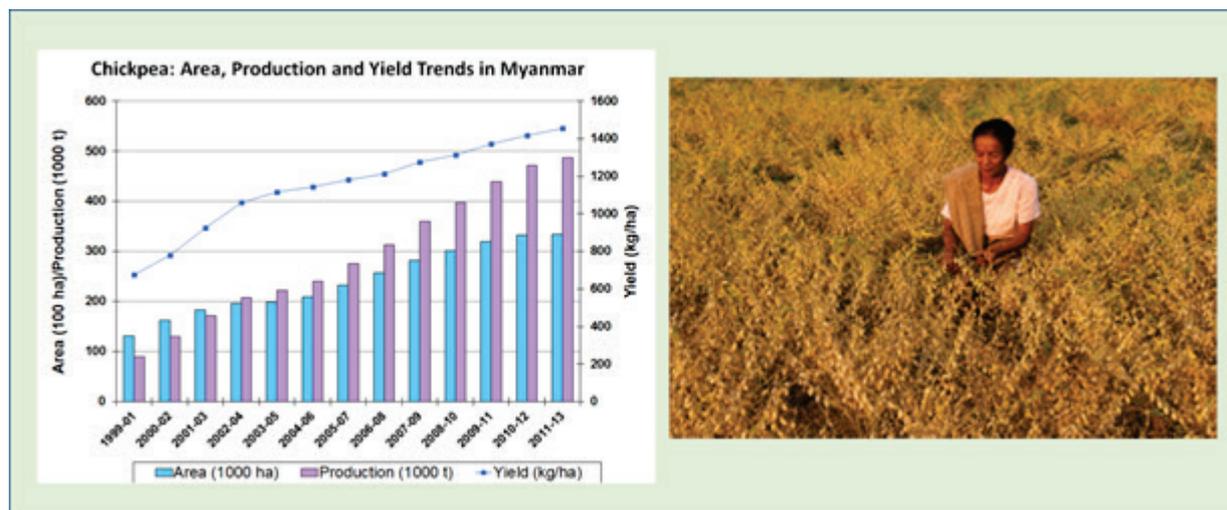
Faba bean is one of the oldest crops domesticated in the Fertile Crescent of the Near East, expanding around the world during the Neolithic period. It is consumed as boiled grains and as vegetable green seeds/pods, dried or canned. It has a protein content of 24-30 per cent, more than three times that of cereals. Faba bean is a staple breakfast food in the Middle East, Mediterranean region, China and Ethiopia.

Lentil is one of the world's oldest cultivated plants, originating in the Middle East, and spreading through Western Asia into the Indian subcontinent. The crop has great significance in cereal-based cropping systems because of its nitrogen fixing ability, its high-protein grain, and its straw for animal feed. Protein content ranges from 22-35 per cent.

Pigeon pea is a staple grain legume in South Asian diets and is also widely grown and consumed in household gardens of Africa. With protein content ranging above 20 per cent, pigeon pea plays an important role in nutrient-balancing the cereal-heavy diets of the poor. Pigeon pea is also important in some Caribbean islands and some areas of South America where populations of Asian and African heritage have settled.

The **CGIAR Research Program on Grain Legumes** is a global partnership invested in agricultural research on pulses from the lab to the field to the farm to increase their productivity, and to further enhance their climate adaptability and soil-nitrogen-fixing capacity. The partnership includes four CGIAR Centers (International Center for Tropical Agriculture [CIAT], International Center for Agricultural Research in the Dry Areas [ICARDA], International Crop Research Institute for the Semi-Arid Tropics [ICRISAT], and, International Institute of Tropical Agriculture [IITA]) working hand-in-hand with National Agricultural Research Systems and other strategic partners to deliver improved pulse varieties to the small-holder farmers of Africa, Asia and Latin America. The program aims to improve food and nutrition security, income and sustainable natural resource management of smallholder farmers that grow chickpea, common bean, cowpea, faba bean, groundnut, lentil, pigeon pea and soybean.

Early-Maturing Chickpea in Myanmar and India

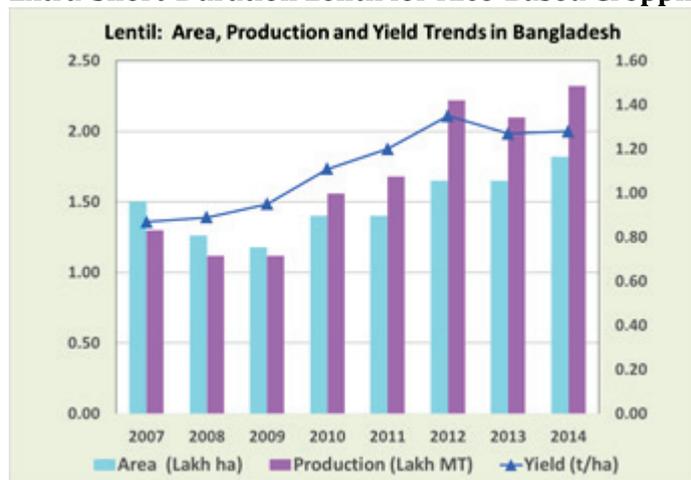


Over 95% of the chickpea area in Myanmar and Andhra Pradesh is now under early-maturing varieties. During a period of 15 years from 1999 to 2013, the chickpea production has increased 7.2-fold in Myanmar and 5.8-fold in Andhra Pradesh. This is the result of a 3.3-fold increase in area (101,000 to 335,000 ha) coupled with a doubling of productivity (670 to 1460 kg/ha) in Myanmar, and a 4.7-fold increase in area (146,000 to 680,000 ha) together with 25% increase in productivity (890 to 1115 kg/ha) in Andhra Pradesh. Myanmar restarted export of chickpea in 2001 after almost no export for over two decades. The country has exported on average 50,000 tons of chickpea (valued at US\$ 24.0 MM) every year since 2001. Andhra Pradesh is helping India meet its domestic demand that continues to remain higher than the domestic production. The chickpea varieties developed and released for early maturity, high yield, and resistance to Fusarium wilt by ICRISAT and national partners in India and Myanmar directly contributed to this changing trend.

Wilt-Resistant Pigeon Pea in Eastern and Southern Africa

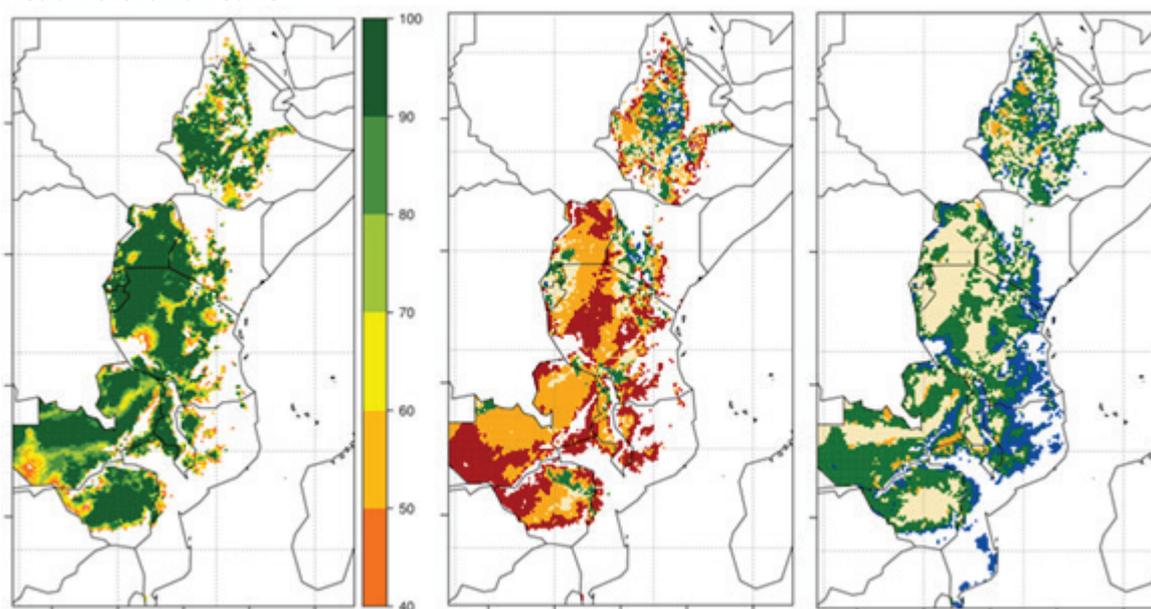
During the last fifteen years, the area and production of pigeon pea in Eastern and Southern Africa have increased by 109% and 146%, respectively. Countries in the region export about 200,000 t of grain/year valued at \$ 140 MM. Traditional pigeon pea varieties in Eastern and Southern Africa that have been low-yielding and late-maturing, with susceptibility to pests and diseases, are now replaced with 32 improved varieties that are high-yielding, early maturing and resistant to Fusarium wilt. These varieties, developed and released by ICRISAT and national partners, have had rapid adoption in Kenya, Malawi, Mozambique, Tanzania and Uganda, increasing the incomes of smallholder farmers.

Extra-Short-Duration Lentil for Rice-Based Cropping Systems in Bangladesh



Lentil (*Lens culinaris* Medik. ssp. *culinaris*) has been an integral part of the rice-based cropping systems of the Indo-Gangetic plain of South Asia, mainly because of its ability to thrive comparatively well under water-limiting environments. The rice-rice system provides a short-season window of 100-110 days in which an extra-short-duration lentil variety (90-100 days) can successfully be grown. Similar opportunity also exists in the fallows of the rain-fed rice-growing areas that are dominated by medium to long-duration rice varieties. The top-soil layer generally dries completely at the time of the rice harvest reducing the feasibility of a post-rainy season crop. Under such limitations, extra-short-duration lentil varieties provide an excellent opportunity to increase lentil production and sustain productivity of the rice-based systems by converting the mono-cropped rice areas into double-cropped areas. The increased adaptability of these varieties to marginal soil conditions helps to increase overall system productivity, sustainability and profitability. ICARDA, together with national partners in South Asia, has combined extra-early maturity of lentil with agronomic traits by pre-breeding to identify extra-early segregates and their utilization within the mainstream breeding program. Adoption of these varieties (BARI M4, BARI M5, BARI M6 and BARI M7) by Bangladeshi farmers has led to an increase in lentil production from 119,639 tons in 2011 to 173,886 tons in 2015, the annual growth rate being 10.9%.

Heat-Tolerant Beans



Major effects of high temperatures on common bean (*Phaseolus vulgaris* L.) are expressed as inhibition of pollen fertility. Modelling of the adaptability of current common bean cultivars suggests that rising temperatures will likely disrupt bean production in Nicaragua, Haiti, Brazil, and Honduras, while in Africa, Malawi and the Democratic Republic of the Congo would be the most vulnerable, followed by Tanzania, Uganda, and Kenya. A field evaluation of more than 1000 materials under high temperatures by CIAT in Colombia identified about 30 experimental breeding lines with superior production. Most of these lines were derived from interspecific crosses of common bean with a sister species, the tepary bean (*P. acutifolius*), a little known crop from the deserts of Mexico and southwest USA. Some of these breeding lines maintain pollen viability with up to 5°C higher night temperatures than those normally considered to be limiting (18°C at night). A modelling exercise to estimate the benefits of this heat tolerance was undertaken using the EcoCrop model, assuming a more conservative genetic gain of adaptation to 3°C higher temperatures. The analysis indicates that heat tolerant bean varieties would counter most (if not all) of the negative impacts of climate change (Figure 1). While currently cultivated bean varieties are projected to suffer a 20-50 % loss in suitable area by 2050s, heat tolerant breeding lines are projected to suffer little (< 5%) or no suitability loss by the same period. Even by the end of the century, improved lines show < 10 % area loss. Thus, enhancing the capacity of common bean to resist high temperatures through interspecific crosses is a very promising adaptation strategy globally. EcoCrop, however, is a very simple model of climatic suitability that does not account for daily extremes and does not provide any indication of potential impacts on crop productivity. Therefore, further work is required to determine the extent to which daily extremes can limit the potential benefits shown here; and also to quantify potential productivity gains associated with heat tolerance improvement.

Historical and future (2050s) common bean suitability simulations for East Africa Left: suitability of currently cultivated common bean for historical climate; middle: projected impact of climate change for control (no-adaptation) simulations; and right: projected impact of climate change for adapted common beans. For middle and bottom panels: red=areas that become unsuitable, orange=areas that remain suitable but reduce their climatic suitability, beige=areas that stay suitable with equal suitability to historical, green=areas that stay suitable but increase their climatic suitability, and blue=new areas.

Combining Bio-Pesticides for Cowpea Pest Management

The bio-pesticide, neem oil, is usually sprayed as a bio-pesticide either as pure oil or mixed with lighter oils to facilitate its application by spin-disk sprayers. This method is not suited for crops with lower growth habit such as cowpea, because of the high losses due to drift, neither can neem oil alone keep under control the various insect pests attacking cowpea. Over the last few years IITA and partners have developed the application of neem oil in emulsifiable form which can be mixed with other compatible bio-pesticides. The mixture of emulsifiable neem oil and the pod-borer specific *Maruca vitrata* Multiple Nucleopolyhedrovirus (MaviMNPV) from the World Vegetable Center (AVRDC) was first tested in the lab, with encouraging results, and subsequently in the field. The combined effect of the neem oil on aphids and thrips, and that of the virus on the pod borer, sometimes exceeded the control achieved by a standard chemical pesticide. These results have been confirmed by large field trials by national partners in Burkina Faso and Niger.

The CGIAR Research Program on Grain Legumes, officially started in July 2012, is supported by [CGIAR Fund Donors](#)

18. Bhubaneswor Dhakal, Nepal

Hello moderator

Multipurpose benefits of pulses were understood from ancient times. My point is a bit different from your problem. You might have heard that farmers in developing countries grow pulses species as inter-cropping, mixed cropping or relay-cropping with cereal and other crops. Inputs and other management practices affect production of other crops in such systems. Nowadays many Nepali farmers have experienced failure of some legume crops in their farm. Based on discussion with the farmers the problem is caused by exotic poisoning of agro-ecological systems. The local varieties used to thriving in soil with poor fertility have been disappeared. These problems cannot be understood by working on the computer of head quarter or visiting rural areas as a development tourist. The problem is not limited to the pulses species. If anybody wants to know details please visit farms, experience the real life problems and discuss with the farmers. However, research, development support and policy advising agencies have been strategically imposing the varieties and other practices those they developed and valued. They have little cared or ignored how they spoiled adaptive systems and made farmers vulnerable. Developing high yielding varieties may not necessarily increase consumption of poor people though it can increase profit to large farmers and commercial growers. I suggest you to work first for addressing the problems instead of doing new propaganda.

Based on my family experiences, changing dietary systems and availability of alternatives have reduced consumption of pulses. When our family had low level of green vegetables especially in dry seasons (January to June) our parents used to cook sprout of soybean and other beans in addition to a soup (Daal) of pulses. The consumption of sprout item has been dramatically decreased with increasing availability and access of fresh vegetables. Consumption of some amount of pulses especially in the form of soup with rice is common practices in Nepal. Roasted soybean or peas with pupped corn was supplementary item in snacks. The trend of consuming popped corn is decreased. The people migrated in overseas have also started eating rice one time in a day. Therefore pulses consumption practices of Nepali people are decreased. The change might have some negative effect on vegetarian's health. Development of new cooked products fitted well in changing dietary systems might increase the level of consumption of the pulses.

Many thanks for reading my comments and suggestions.

Bhubaneswor Dhakal

19. Emile Hounbo, Agricultural University of Ketou (UAK), Benin

Original contribution in French

Les légumineuses sont dotées de vertus alimentaires, spirituelles et agronomiques indéniables. Elles sont riches en protéines qui sont des nutriments nécessaires pour la croissance de l'homme. Il y a aussi beaucoup de légumineuses qui sont utilisées en Afrique pour des sacrifices et des pratiques rituelles. Nombre de mets qui servent à entretenir des relations spirituelles avec les « vodun » sont à base du haricot. Au Bénin, les « zangbéto » (ou fétiches gardiens de nuit) sont reconnus comme grands consommateurs de haricot (*Phaseolus vulgaris*). Les jeunes feuilles de haricot étaient très prisées en tant que légumes riches et moins coûteuses pour la sauce au Bénin. Par leurs racines qui fixent l'azote de l'air, les légumineuses fertilisent le sol et de ce fait permettent de lutter contre la dégradation des sols et d'assurer une bonne croissance des cultures. Pourtant des problèmes subsistent quant à leur adoption massive et au développement de leur production. Trois raisons principales justifient à notre avis cet état de chose.

1. Les légumineuses actuellement cultivées sont souvent de rendement faible. Ce faible rendement est déterminé par le potentiel génétique limité de production de ces variétés et par le fait que les légumineuses sont souvent très attaquées par des parasites (bruches, charançons, ...) au champ et en conservation. Exemples: haricot (*Phaseolus vulgaris*), niébé (*Vigna unguiculata*).
2. La production des légumineuses demande beaucoup de travail. Cette réalité ajoutée à leur faible rendement, fait que les légumineuses ne rémunèrent pas bien le travail. Cette réalité décourage leur culture. Exemples : haricot mungo (*Vigna radiata*), haricot commun (*Phaseolus vulgaris*).
3. La préparation des mets à base de légumineuses est généralement compliquée et demande souvent une certaine technicité et spécialisation des personnes qui doivent les cuisiner. Exemple : Magni magni, Ataklè et Adowè au Bénin. C'est pourquoi ces mets sont pour la plupart en voie de disparition.

Face à cette situation, deux solutions pourraient être adoptées.

1. Mettre au point des variétés de légumineuses à haut rendement et résistantes aux attaques de parasites. Cela permettra d'améliorer la rentabilité économique de leur production et, par ricochet, leur production massive.
2. Promouvoir les mets traditionnels faits à base de légumineuses et qui sont en voie de disparition. Il s'agira d'introduire dans les pratiques culinaires actuelles les mets traditionnels faits à base de légumineuses. Exemple : Ataklè, Magni magni au Bénin. Le développement de technologies de transformation agroalimentaire devrait aussi venir en appui à cette action. L'amélioration des techniques de transformation pourra motiver l'adoption par la nouvelle génération de la production de mets autrefois délaissés. Cette promotion de la diversité culinaire à base de légumineuses induira à coup sûr l'accroissement de la demande de ces mets et par ricochet l'accroissement de l'offre par une culture plus étendue par les agriculteurs.

English translation

Pulses are endowed with undeniable nutritional, spiritual and agronomic virtues. They are rich in proteins which are nutrients necessary for man's growth. There are also many pulses that are used in Africa for sacrifices and ritual practices. Several dishes used to interact spiritually with the "Vodun" are made from beans. In Benin, the "zangbéto" (or nocturnal protection fetishes) are seen as large consumers of beans (*Phaseolus vulgaris*). The young leaves from bean stocks were esteemed for being rich and cheap for making sauces in Benin. Thanks to their nitrogen fixing roots, pulses fertilize the earth and, in so doing, help to fight soil degradation and promote proper crop development. However, there are still problems regarding their largescale adoption and increase in production. In our opinion, there are three reasons that justify this current situation.

1. Currently grown pulses are often low yielding. This low yield is determined by these varieties' limited genetic potential and because they are often very attacked by parasites (weevils, beetles...) in the fields and during stocking. Examples: bean (*Phaseolus vulgaris*), black-eyed peas (*Vigna unguiculata*).
2. Pulse production requires a lot of work. This fact, coupled with their low yields, means that pulses do not remunerate work well. This reality discourages their farming. Examples: mung beans (*Phaseolus radiata*), common beans (*Phaseolus vulgaris*).

3. The preparation of pulse-based dishes is generally complicated and often requires a fair amount of technique and specialisation from the people who have to cook them. Examples: Magni magni, Ataklé and Adowè in Benin. This is why most of these dishes are being forgotten.

Faced with this situation, two solutions could be considered.

1. Develop high yielding and parasite resistant pulse varieties. This would improve economic profitability for their production and, in turn, massive production.
2. Promote traditional pulse-based dishes that are disappearing. This would mean reintroducing traditional pulse based dishes into current culinary practices. Example: Ataklé, Magni magni in Benin. The development of food processing technologies should also help support this initiative. The improvement of processing techniques could encourage the new generation to produce previously abandoned dishes. This promotion of pulse-based culinary diversity would increase demand for these dishes and, in turn, more widespread farming.

20. Dr. Amanullah, The University of Agriculture Peshawar, Pakistan

Dear FSN Forum,

I am more than happy on the international year of pulses by FAO/UN. I am sending my published work on pulses and soybean so far (see attached file). My two good new research papers on pulses are coming soon. I am also interested to write a book on the Pulses of Pakistan. However, due to unavailability of funding not able to print it.

Dr. AMANULLAH PhD (Pak) & Post-Doc (USA)
Associate Professor
Department of Agronomy
Faculty of Crop Production Sciences
The University of Agriculture Peshawar
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Attachment:

<http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Research%20work%20by%20Dr%20Amanullah%20on%20pulses.doc>

21. Seyyed Hossien Sabbaghpour, AREEO, Iran

Legumes are important in sustainable production of food and feed in the Islamic Republic of Iran. They are important source of good quality protein in the diets of people and are valuable as animal feed. Legumes also increase and sustain the productivity of the soil and in rotation with cereal reduce chances of build-up of diseases, insect pests and obnoxious weeds for the following cereals crops.

Pulse produced in Iran are mostly consumed within the country, usually production is more than sufficient to meet the country's demand (Sabaghpour, 2015b). The excess food legume production is exported to other countries. Food legumes due to its higher protein content is used in many dishes.

Chickpea, lentil and bean are grown on 550,000, 120,000 and 98000 hectares in Iran (FAO, 2013). Chickpea and lentil areas have ranks fourth and eighth in the world. Major chickpea and lentil areas (97% and 94%) are planted in rainfed condition and are grown in rotation with cereals mainly wheat and barley. **There is high potential areas (about three million hectares) for producing pulses (chickpea and lentil) in dryland areas in rotation wheat and barley under dryland condition.**

But due to food legume production are more than sufficient, farmers prefer to plant food legume about 670,000 hectares in Iran.

Mean productivity of chickpea and lentil 968 and 1140 kg/ha in world, But are 536 and 608 kg/ha in Iran. The rainfed yield for chickpea and lentil are about 39% and 41% of the irrigated area. These are indications that improving moisture conservation in rainfed area may improve the rainfed yield. Major reason for low productivity of these crops in Iran, is terminal drought stress. Most of the farmers grow chickpea and lentil on marginal areas in the spring season (Sabaghpour, 2015b). In spite of decrease rainfall and unsuitable distribution rainfall but productivity of chickpea and lentil have increased from 482 to 536 and 463 to 608 in last decade due to transfer technology to farmer field (Sabaghpour, 2015b). Major areas of beans, faba bean and mungbean are under irrigated field in Iran. Average bean productivity are 791 and 2582 kg/ha in world and Iran respectively (FAO, 2013).

Main challenge for food legume (chickpea and lentil) production are drought, cold, ascochyta blight and fusarium wilt

Drought is the common abiotic stress limiting chickpea production in different parts of Iran. Chickpea and lentil frequently suffers from drought stress towards the end of growing season after flowering, during pod setting and seed formation, drought is accompanied by heat stress in rain-fed conditions (Sabaghpour, 2004). Terminal drought stress reduce productivity of chickpea considerably in spring planting in comparison to autumn and entezari sowing. In spite of superiority of autumn and entezari planting to spring planting in respect of high water use efficiency and less suffer of terminal drought stress (Sabaghpour, 2002). Research on exploration of possibility of autumn planting of chickpea and lentil in milder environments and Entzari planting in harsh (sever cold) environments has given fruitful results with good successes. Transfer of these technologies to farmers is in progress and in some areas farmers are getting almost 50% or more productivity with adoption of winter- or Entzari –sowing. Therefore four chickpea varieties such as Hashem (Sabaghpour *et al.*, 2005), Arman (Sabaghpour *et al.*, 2006a), Azad (Sabaghpour *et al.*, 2010), Adel (Sabaghpour 2015b) and two lentil varieties including Kimiya (Sabaghpour *et al.*, 2013) and Bilesevar (Sabaghpour, 2012) were released for planting in autumn in milder environments and Entzari –sowing in harsh (sever cold) environments. **Transfer spring to Autumn or Entzari planting may in climate change adaptation or mitigation.**

Drought escape is the most important success for breeders so far in comparison with other mechanisms. Famers usually are not able to plant chickpea in the beginning of March due to high moisture in field. Therefore, they often have to plant chickpea in the end March in Iran. Flowering time in chickpea will start in the first of May which rainfall will stop in many years (Sabaghpour *et al.*, 2006b). But some farmers prefer to plant chickpea in spring (March) due to weeds problem. Major successes due to breeding have been achieved, in the selection for drought escape. A new drought tolerance chickpea variety "Sameen" (Sabaghpour, 2015a) has been released for planting in spring in cold areas of Iran.

Cold stress is one of the most important abiotic stress in cold region of the world. About 40 percent of chickpea area of Iran is sown in cold area (Sabaghpour, 2005). The yield of autumn planting is higher than spring planting due to benefit of winter rainfall and higher water-use efficiency (Sabaghpour, 2002). The lowest absolute minimum temperature at cold areas of Iran often occur in December, January and February. Absolute minimum temperature has different range from -10Co to -30Co with snow covering in different cold area of Iran. Due to local chickpea and lentil varieties could not tolerance to cold stress, farmer had to plant these crops in spring. A new improved chickpea variety (Saral) has been released for autumn planting in cold area of Iran.

Ascochyta blight (*Ascochyta rabiei* [Pass.] Labr.) is a major yield reducer for chickpea in north (Glostan), northwest (Oroumieh), west (Kermanshah, Lorestan and Ilam) and southern parts of Iran both in winter and spring planted chickpea, however it is more severe in winter sown

crop (Sabaghpour 2015b). Occurrence and severity of this disease depend largely on the cultivar and weather condition in a given year. Ascochyta blight incidence was 100% in the epidemic years in farmer's fields on local varieties in the Mediterranean region of Iran. Hashem, Arman, Azad, Adel chickpea varieties which are resistance to ascochyta blight, erect growth habit and high potential yield have been released for cold moderate, moderate, semi warm areas of Iran in the last decade. Ascochyta blight is not important on lentil and bean and mungbean in Iran. Ascochyta blight and Botrytis are major yield reducer for faba bean.

Fusarium wilt (*Fusarium oxysporum* Schlecht. emend. Snyder & Hans.f.sp. *ciceri* [Padwick] Snyder & Hans) is another important disease mainly in spring chickpea in the northwest of Iran. A survey conducted in 1998 on fusarium wilt disease (Akem 1998) in north and northwest of Iran showed that 19% of the chickpea fields have fusarium wilt incidence in the range of 5-60%. A chickpea variety "Sameen" is tolerance to fusarium wilt, tolerance to drought stress, large seed size and high potential yield has been released for planting in cold area in spring planting.

Fusarium wilt is a major yield reducer for lentil Ardebil province (Bilehsavar) which 50 percent of lentil field had fusarium will incidence in the range of 20-80% in 2002 (Sabaghpour, 2006). A lentil variety "Bilehsavar" (Sabaghpour, 2012) is tolerance to fusarium wilt, large seed size and high potential yield has been released for planting in for cold moderate, moderate, semi warm areas of Iran.

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22. Teordardo Calles, FAO, Italy

Dear participants,

I am very happy that members of this forum are not only expressing their opinions about pulses but are also sharing interesting material about pulses around the world. This information will help us to sharpen the focus of the second half of the 2016 International Year of Pulses.

Participants to this discussion clearly agreed that pulses are of crucial importance for humankind. However, as expressed by Mr. Dhakal, this year should go beyond the raising awareness campaign and work towards helping the most vulnerable farmers. In order to achieve this, research and extension on underutilized pulse species, which in many cases are well adapted to local environmental conditions, should be promoted, as suggested by Prof. KV Peter, and traditional pulse-based dishes that are disappearing should be supported, as pointed out by Prof. Hougbo. In other words, we need to increase the number of pulses that can be grown in marginal areas as suggested by Prof. Howieson.

However, I also believe it is of particular significance to make children realize the importance of pulses, as expressed by Ms. Yesudas; then they will be able to appreciate this kind of food and hopefully this will support dietary shift as noted by Dr. Boyle.

This discussion will be ongoing until 19.06.2016 and therefore we would appreciate if you could keep contributing and extend this invitation to your colleagues.

Teodardo Calles

Technical expert for the online discussion

23. Germain Grégoire Eloundou Tsanga, Center for Communication and Sustainable Development for ALL (CECOSDA), Cameroon

Original contribution in French

Sous le Thème: Les légumineuses sont appréciées en raison de leurs bienfaits sur la santé, l'environnement et l'économie. Comment tirer le meilleur parti de leur potentiel? Nous dirons que :

Les légumineuses : des cultures intéressantes d'un point de vue agro écologique et nutritionnel :

Les légumineuses ont par nature, la capacité à capter l'azote de l'air, à le fixer dans le sol avant de le réutiliser en partie pour leur propre synthèse protéique. Elles permettent donc de fabriquer des protéines et d'enrichir le sol en azote sans apport extérieur d'engrais. A titre d'illustration, on estime

qu'une culture de légumineuses précédant une culture de blé permettrait de réduire de 20% l'apport en engrais azoté sur la culture céréalière.

Les légumes secs issus des légumineuses sont des produits riches en protéines végétales de qualité : ils permettent ainsi d'enrichir et de diversifier les apports en protéines chez l'Homme.

En déclarant « 2016 : année internationale des légumineuses », l'Assemblée Générale des Nations Unies a par ailleurs tenu à promouvoir ces qualités auprès des États et de la population mondiale.

Dans sa promotion de lutte contre la sous-alimentation et la malnutrition au sein des communautés locales Camerounaise, le centre pour la communication et le développement durable pour tous (CECOSDA) a mené une enquête concernant la diversité des cultures que les paysans développent dans leurs exploitations. Il en est ressortit que :

La plupart des légumineuses sont des plantes attribuées à la famille des *Fabaceae* comme l'arachide (*Arachis hypogaea*) est en premier lieu, suivie du soja (*Glycine max*), le haricot (*Phaseolus vulgaris*) et le niébé (*Vigna unguiculata*) qui sont les plus cultivés dans les localités camerounaises. Chaque localité au Cameroun a sa préférence alimentaire sur ces quatre variétés de légumineuses et une parmi elle est un peu plus consommée que l'autre en fonction des cultures et des régions. Dans certaines régions camerounaises comme le Centre l'arachide est la plus consommée des quatre légumineuses les plus cultivés dans le pays. À l'ouest nous avons le niébé préparé sous forme de gâteau que l'on appelle en langue locale le « le KOKI » ou « L'EKOKI » c'est un met très prisé en région BAMILEKE. Au ressort de cette enquête menée par l'équipe du CECOSDA, il a été remarqué que la consommation des légumineuses était fonction des habitudes alimentaires des communautés. Pour favoriser une meilleure utilisation de ces denrées dans le régime alimentaire des populations locales il est important de faire de campagnes de sensibilisation, de fournir les paysans en semence tout en leur accompagnant dans le processus de production et de commercialisation.

L'équipe technique du CECOSDA en charge du volet sécurité alimentaire encourage les ménages des communautés locales à en consommer comme source de protéine végétale pour lutter contre le braconnage dans les zones réserve forestière du Cameroun. Ce pendant la culture de ces aliments est la plus importante pour ces populations.

- La principale difficulté que rencontre la plupart des paysans des communautés repose sur l'obtention des semences et plus particulièrement des semences améliorées à haut niveau de rendement. Parmi ces difficultés les plus couramment évoquées par les agriculteurs sont:
- Manque de matériel semencier amélioré et à haut niveau de rendement ;
- Les méthodes de travailles très rustiques ;
- La faible mécanisation des systèmes de cultures limite la plupart des exploitations entre un et trois hectares ;
- Manque de bonne connaissance aux méthodes de séchage et stockage après récolte ;
- Manque de connaissance des circuits de commercialisation ;
- Manque de voie de communication pouvant favoriser l'écoulement de ces produits après récolte.

Ces nombreuses contraintes sont un frein pour les agriculteurs. Le CECOSDA en tant qu'organisation œuvrant dans la lutte contre la malnutrition et l'insécurité alimentaire organise les paysans en groupe (GIC) pour mieux se faire entendre et les initie dans la rédaction des petits projets qui sont subventionnés par l'Etat qui met tout à la disposition des communautés lorsqu'un projet est validé.

D'après plusieurs études, les légumineuses ont la capacité de fixer l'azote atmosphérique et de le redistribuer dans le sol à travers des nodules présents dans leurs racines. La culture des légumineuses rend un grand service à l'environnement et nécessite une faible fertilisation des engrais chimique et de plus la consommation de ces plantes peut permettre de couvrir le besoin en protéine et ainsi de réduire les émissions de GES occasionné par l'élevage.

En ce qui concerne les recettes à base de légumineuse, l'une des recettes les plus répandues de chez nous est le **KOKI** fait à base des graines de Niébé (<http://www.editions2015.com/cameroun/recette-koki.php>).

Ingrédients

1 kg de koki, petits haricots blancs

1l d'eau

600ml d'huile de palme rouge

1 piment

Feuilles de bananier pour la cuisson

Préparation

Trempez vos grains de koki dans une grande quantité d'eau durant 6 heures environ

Retirer les grains de l'eau, les émonder (retirer leur peau) et les réserver

Préparez vos feuilles de bananier comme pour le gâteau de pistache

Ecrasez finement les grains de koki (haricots blancs), versez-les dans une terrine

Faites chauffer votre huile de palme (il s'agit de la liquéfier, pas de la blanchir). Lorsque toute l'huile est liquide et tiède, versez-en la moitié dans votre pâte de koki.

Tournez doucement avec une cuillère, ajoutez le reste d'huile et la moitié de l'eau, mélangez bien la pâte de façon à ce que la couleur soit homogène. Rajoutez le reste d'eau et mélangez à nouveau, la pâte doit être fluide comme une crème

Parez vos feuilles de bananier comme pour le ngon et versez-y une portion

Faites cuire 3h à feu moyen

Le gâteau doit être jaune orange genre mangue mûre. Servez avec des bâtons de manioc.

English translation

Regarding the subject: Pulses are valued for their benefits for health, environment and the economy. How to make the most of their potential? We would say:

Pulses: crops of interest from an agro-ecological and nutritional point of view:

Pulses have by nature the capability of taking the nitrogen from the air, and fixing it in the soil before using it in part for their own protein synthesis. They are therefore able to produce proteins and enrich the soil with nitrogen without the external contribution of fertilizers. As an example, it is estimated that a crop of pulses preceding a crop of wheat allows a reduction of 20% in the quantity of nitrogenous fertilizers on the cereal crop.

The dried vegetables coming from pulses are products rich in quality vegetable proteins: they thus make it possible to enrich and diversify the benefits of proteins for human beings.

When 2016 was declared the International Year of Pulses, the UN General Assembly sought moreover to publicize these qualities to the Governments and population of the world.

In its promotion of the fight against undernourishment and malnutrition among Cameroonian local communities, the Center for Communication and Sustainable Development for All (CECOSDA) conducted a survey regarding the diversity of the crops that farmers raise in their cultivations. The results are:

The majority of the pulses are plants of the family of the Fabaceae such as the peanut (*Arachis hypogaea*) in first place, followed by soyabean (*Glycine max*), the common bean (*Phaseolus vulgaris*) and the cowpea (*Vigna unguiculata*) which are the most cultivated in the Cameroonian localities. Each locality in Cameroon has a food preference out of these four varieties of pulses and, one among them is a little more consumed than the others according to the land cultivated and regions. In certain Cameroonian regions like the Centre, peanuts are more consumed of the four pulses most cultivated in the country. In the West, we have the cowpea prepared in the form of a cake which in the local language we call the "KOKI" or the "EKOKI", it is a product well appreciated in the BAMILEKE region. As a result of this survey carried out by the CECOSDA team, it has been noted that the consumption of pulses was a function of the dietary habits of the communities. To encourage better use of these crops in the dietary regime of the local population it is important to conduct campaigns to raise awareness, to provide seeds to the farmers at the same time, to guide them in the production and commercialization process.

The CECOSDA technical team in charge of the food security dossier encourages the local community households to consume them as a source of vegetable protein in order to fight against poaching in the forest reserves of Cameroon. Nevertheless, the cultivation of these foodstuffs is the most important for the population.

The main difficulty encountered by the majority of community farmers is to find seeds and in particular the improved high yielding seeds. Among their problems, the most commonly raised by the farmers are:

- Lack of improved and high yielding seeds;
- Working methods are very unsophisticated;
- The low level of mechanization of the systems of cultivation restricts the majority of the farms to between one and three hectares;
- Lack of sound knowledge about drying and storage methods post-harvest;
- Lack of knowledge of marketing channels;
- Lack of means of communication that could encourage the flow of these products after harvesting.

These many restrictions are an obstacle for the farmers. The CECOSDA, as an organization working in the fight against malnutrition and food insecurity, organizes the farmers in groups (GIC) to be heard better and to initiate them in the drafting of small projects that are subsidized by the State, which puts everything at the disposal of the communities once a project is validated.

As shown by many studies, the pulses have the capacity to fix atmospheric nitrogen and to redistribute it in the soil through the nodules that are present in their roots. The cultivation of pulses is of great benefit to the environment and needs only a small amount of chemical fertilizers, and in addition, the consumption of these plants provides for all the protein required and in that way reduces the emissions of GHG caused by rearing livestock.

Regarding recipes based on pulses, one of the most wide spread recipes in our country is **KOKI**, made using cowpea (<http://www.editions2015.com/cameroun/recette-koki.php>).

Ingredients

1kg of koki, small white beans

1 liter 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 though to make a pistachio cake

Finely crush the koki grains (white beans), pour 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 half liter of the water, mix the paste well so that the color is even. Add the rest of the water and mix again, the paste must be fluid as a cream

Arrange your banana leaves as for a ngon and pour in a portion

Cook it for about 3 hours over a moderate fire

The cake should be yellow orange like a ripe mango Serve with sticks of cassava.

24. Md. Moshfaqr Rahman, Freelance Researcher in Social Sciences, Bangladesh

Sir;

Ans of 1) Cattle food is yet not recognize as crop. We have to touch this first. Then so forth.

2)Yes, Bangladesh is trying for crop in drought time-this pulse work better.

3)Farmer's problem in Bangladesh-they don't have cash crop idea or information. We have to first include those then a management as company must communicate & service provide to the. FAO can provide investment.

4)This is fit for drought weather. Yes I know it climate change value now need investent.

5)I prefer to but to where if this is the platform then my idea-I'm turning disaster to market. This is a good option for market to help this turning to market. also farmers have cash crops option.

Regards,

Md.Moshfaqr Rahman

Expert on Government, Corporate, Emerging technology, Eco-DRR, EbA & Remote Sensing.

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25. Fouad Maalouf, ICARDA, Lebanon

Pulses are important crops in the culinary of some countries but due to policies subsidizing cereals crops, farmers tend to go for monocropping. Another point historically the International fund for legume crops were very little while cereals were highly funded.

In Egypt for example each person consumes in average 11.5 kg of faba bean, the current production is far below the requirement to meet the self sufficiency. There is need to increase the production by 55% to meet local self sufficiency of this crops. In some years where is this shortage at international market of faba bean the prices increases in the level of the countries (year 2015-2016 in Egypt) and therefore healthy and balanced food for poor in Egypt is becoming scarce.

Lentil prices goes up in importer countries like Sudan and Egypt with very high cost in dollars. so the introduction/or rehabilitation of this crops in Egypt

Countries where there is huge production of the legume crops but no consumption, there is a need to make awareness about the benefit of legume crops in term of reducing heart diseases, lowering cholesterol and present colon cancer

Attachment:

Notes on Pulses for North Africa.

Traditionally, North African countries (Egypt, Morocco and Sudan and Tunisia) have an agrarian economy. The agriculture sector contributes substantially to national GDP and is the main source of food incomes to the rural population. It also plays key roles in sustainable production of small cereals production system by fixing nitrogen and breaking disease and weed life cycles. Food legumes productivity has been low as a result of biotic (weeds, insect-pests and diseases) and abiotic stresses (drought and heat); low policy support and limited access to improved production technologies, inputs and extension services; poor post-harvest management; no knowledge on value addition; and inefficient markets. This has led to declining legume area and production and mismatch in the demand-supply of major food legumes, posing a serious challenge to household food and nutritional security and also forcing governments to spend foreign exchange to import to fill the supply gaps in the regions. Among many food legume crops grown in North Africa, faba bean accounts for 53% of the total legume production, followed by chickpea (9.2%) and lentil (5.3%) and are targeted in the proposal to enhance sustainable food production through up-scaling of improved varieties, augmenting quality seed production and adoption of integrated crop management (ICM) practices.

The project will evaluate newly released high yielding improved varieties and ICM practices in major production zones in target countries and demonstrate their yield superiority to resource-poor farmers under the cereal based farming systems within the context of conservation agriculture.

It will also introduce and evaluate new ICARDA breeding lines having multiple grain quality (seed size and color), better cooking quality and stress resistance, environment friendly traits; -an energy-saving trait; high micro-nutrient dense (high iron and zinc) - vital for a healthy life; machine harvestable - reducing drudgery and marketability- high-income opportunity. This will provide continuum to the food legumes improvement program in cereal-based cropping systems of Egypt, Morocco, Sudan and Tunisia.

The elite lines will be evaluated in on research stations and in farmers' fields along with low-cost integrated crop management technologies and will be subjected to farmers' participatory selection in partnership with NARS. These production technologies will be linked with post-harvest technologies to reduce post-harvest losses and maximize the market value of the final produce through value addition. The project intends to demonstrate and establish small-scale processors at the community level to process and package these legumes as a value-added product in local markets. To date availability of

and access to quality seed remain a major bottleneck for legumes as neither the public nor the private sector is interested in legume seed delivery due unreliable and limited demand.

26. Pradip Dey, Indian Society of Soil Salinity and Water Quality, India

Dear All,

Good day!

Pulses, mostly grown as rainfed crops, are important for protein security and soil revitalisation properties due to symbiotic nitrogen fixation throughout the world. Major pulses include chickpea or Bengal gram (*Cicer arietinum*), urdbean or black gram (*Vigna mungo*), lentil (*Lens culinaris*), pigeonpea or red gram (*Cajanus cajan*), mungbean or green gram (*Vigna radiata*), lablab bean (*Lablab purpureus*), moth bean (*Vigna aconitifolia*), horse gram (*Dolichos uniflorus*), pea (*Pisum sativum*), grass pea or *khesari* (*Lathyrus sativus*), cowpea (*Vigna unguiculata*), broad bean or faba bean (*Vicia faba*) and kidney bean or *Rajma* (*Phaseolus vulgaris*). Given below are seven point strategies to improve pulse production.

- Availability of quality seeds: Availability of quality seeds of improved cultivars in a village seed bank concept will enhance the productivity.
- Plant nutrition: Pulses generally respond very well to starter dose of nitrogen (20 kg/ha) for enhancing plant uptake when roots are small and thereby promoting early vigor. Placing phosphorus and potassium in the root zone as per STCR approach of yield targeting based on soil test values (<http://www.iiss.nic.in/downloads/stcr%20Crop%20wise%20Recommendations.pdf>) will help in realising yield based on resource endowment of farmers.
- Check runoff losses: In water scarcity areas, yield of pulses is sensitive to runoff losses. Reducing runoff through mulch and other water conservation approach to enhance the residency period of water in a parcel of land will help in improving pulse production.
- Capacity building: Smallholder farmers, especially women, should be central to all capacity building programme for improving pulse production technology.
- Disease and pest: A 2x2 approach by addressing two diseases viz., wilt and root rots and two pests pod borers and pod fly is very important.
- Being mostly grown as rainfed crop, the high risk in production due to vulnerability to weather as well as abiotic and biotic stresses, weather-based price insurance for pulses is a must to encourage farmers to go for pulse production.
- Encouraging PPP in pulse production and introduction of low cost *dal mill* in a cluster mode will be helpful.

With warm regards,

Pradip Dey

27. Nien Nguyen Van, Plant Resources Center (PRC), Viet Nam

Dear All,

Under my knowledge of plant genetic resources for future. I would like to deliver my opinion on this topic as below

Pulses crop species particular and wild plant species of family leguminosea general are great values in food security and nutrition. Furthermore, they also bring huge and hidden benefits of environment, economics, culture and biological diversity, etc. Therefore, to full potential use of this resources, inventory, conservation, evaluation and exploitation are firstly carried out synchronously in overview and comprehensive strategy, plan, awareness, action and capacity building.

The secondary, global matters today are also required full and responsible participation and cooperation of whole institutions, organization, country, union, association, sector, area, etc. at all levels.

Finally, benefits sharing amongst parties should be fair and right to international law/ norms. Whereas, benefits of poor and developing countries are conducted and putted in highest priorities.

Thank you for taking time and consideration.

Best regards,

KIEN

Mr. Nguyen Van Kien

Plant Genebank Management Division

Plant Resources Center (PRC)

Address: An Khanh, Hoai Duc, Hanoi, Vietnam

28. Ahmad Mahdavi, University of Tehran, Iran

Dear Teodoro,

Thanks for your presentation in the webinar. I was and am involved in the insect- plant interactions, allelochemicals/ toxic compounds in plants (that is very important for pulses) and interaction of these toxics with detoxifying enzymes in lower/ higher animals. Since pulses are very important part of human food I think we need to go deeply to these aspects of pulses to discover better use of them but also to avoid some toxic ones.

Best regards,

Ahmad Mahdavi, Professor Emeritus at University of Tehran,

PhD, insect/ pesticides/ environmental regulatory toxicologist,

UNEP focal point for Environmental Education in the University of Tehran.

29. Kadambot Siddique, UN FAO Special Ambassador for the International Year of Pulses 2016 (second contribution)

Dear all,

Please find below a list of papers on the subject.

Grain Legumes (pulses) offer a food-based solution to decreasing risk of some non-communicable diseases such as diabetes, cardiovascular disease and obesity. Major benefits from legumes are achieved at an intake of about 30 g per day or more.

Kind regards.

Professor Dr Kadambot Siddique
The UWA Institute of Agriculture

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30. Fernanda Grande, FAO, Italy

I would like to provide my answers to two questions posed during the webinar "Pulses for Food Security and Nutrition" and that we could not answer due to lack of time.

Question posed by Mohamed:

What are the specific advantages of pulses for small children?

Pulses represent a good source of plant-based protein, B vitamins and minerals which are important nutrients for growth. A common problem regarding complementary feeding, especially in some developing countries, is that young children are fed thin, watery cereal-based porridges that cannot supply them with the energy and nutrients they need for growth. Therefore pulses are a good choice to include in complementary feeding as part of a diversified diet.

Question posed by Mona Dhamankar:

Is it true that one needs to eat large quantities of pulses in order to meet the recommended daily allowance of protein? as compared to animal protein?

Yes, it is true. Protein content of meat, for example, is double the content of cooked beans. So to have the same amount of protein, a person needs to eat a larger portion of pulses. Moreover, it is also important to remember that in order to increase the protein quality of meals we can consume pulses with cereals to have a “complete” amino acid profile.

The recording to the full webinar is also online and available at this link: <http://bit.ly/1U7sEuS>

31. Manoj Kumar Behera, NRMC India, India

Dear All,

Thanks for initiating the discussion on pulses at this crucial time!

The production and consumption of pulses are increasingly getting more attention across the world. What led to this critical situation and why the risk of inadequate consumption of pulses is more alarming for a majority of people across the world, especially the poor and marginalised? Was this because of our policies and programmes which often focus more on cereals like paddy and wheat or it is because of the limited research and technologies available for pulses as compared to the cereals or because of a neglected and mismanaged supply chain? Yes, we have to admit that we have neglected the production of pulses over the years by providing incentives and quality extension services for cereals and in doing so we have also motivated the farming communities towards increased adoption of cereals based farming systems. As a result of which the poor people has to pay a double price for the commonly consumed pulses. Where they can get money for increasing pulses consumption when rice is available at Rs 1-3 per kg in most states of India through the government subsidised schemes. So the solution for the small and marginal holders is the inclusion of pulses in their farming systems, which often enhances farm resilience and productivity of soil in the context of climate change. At this backdrop, actions should start in the form of suitable policies and programmes with adequate incentives and extension services to the farmers, especially the small and marginal ones and mass campaign to augment increased adoption of pulses based farming systems. More funds should be kept for research and extension on pulses based farming systems. Integrated farming systems like Agroforestry should be prioritised especially in the community-owned lands and government wastelands. Involvement of all key stakeholders including civil society, women's networks, farmers federations and community based organisations must be ensured in the policy designing and implementation framework. Besides, period monitoring and sharing of best practices can help in achieving the goals in the timeline.

Regards,

Manoj, India

32. Hagos Mohammedseid Juhar, Mekelle University, Ethiopia

Greetings:

It gives me great pleasure to contribute something on this Forum. In my country Ethiopia, pulses are a very important part of the food system. From my experience, every farmer grows a combination of cereals, pulses, oil seeds etc in a piece of land.

Pulses are consumed almost in every household in different forms. Among them we have "Shiro wet" which is cooked from the powder of beans and which is the most common all over the country. There are also a lot of advantages our farmers get from pulses. For instance, they are used for intercropping with cereals to improve soil fertility, as green manuring, and as animal feed among many other uses.

Regards
Hagos

33. David Bergvinson, Director General of ICRISAT, India

Pulses are Smart Food

Pulses are under-recognized for their value and their importance in diversification and complementing other foods. They are critical for both farmers and consumers. ICRISAT's research focuses on: (a) improved grain quality, nutritional traits, food safety, nitrogen fixing properties and hybrids. (b) drought tolerance and adaptation to diverse dryland agroecosystems and to differing rotations with cereal crops. Breeding is enhanced with modern genomic and molecular tools, precise phenotyping and crop simulation modeling. ICRISAT works along the whole value chain of pulses in an integrated manner to create a win-win situation for the farmer, consumer and the planet.

Pulses are Smart Food as they are:

Good for you

Pulse crops such as lentils, beans, pigeonpeas and chickpeas are a critical part of the general food basket

Important source of plant-based protein and amino acids for people around the globe

As part of a healthy diet they help address obesity, manage chronic diseases like diabetes, coronary conditions and cancer

Good for the Planet

Highly water efficient, pulses are smart crops that grow in drought prone areas

Helps improve soil fertility by fixing nitrogen and promoting soil microbes

Pulses make a positive contribution in reducing release of greenhouse gases

Good for the Smallholder Farmer

Pulses can better withstand climate change thus reducing risk for the smallholder farmer

Multi-use crop – food, fodder, fuel, building material – helps improve livelihoods of farmers

Particularly important for female farmers, who are the larger share of the labor force in pulses farming.

Click [here](#) to know more.

Some of the identified constraints to pulses production are:

Inadequate knowledge of farmers and extension personnel of the available improved pulse cultivars and technologies related to it.

Inadequate access of farmers to quality seeds and other farm inputs.

Poor adoption of improved cultivars and recommended crop production practices.

Lack of varieties that resist excessive vegetative growth under high moisture/fertility conditions.

High vulnerability of pulse crops to both the biotic (pests and diseases) and abiotic stresses (temperature extremes and aberrant rainfall driven by climate change).

Pulses are largely grown in marginal lands under rain-fed conditions without many inputs leaving low space for any potential improvement.

Inadequate availability of labour-saving technologies (varieties suitable for machine harvesting, herbicide resistance) for pulses.

Pulses are also prone to damage by the storage pests.

Wide fluctuations in the farm gate price of the pulses.

Data on understanding the grain legumes' environment in the target countries have been obtained from baseline studies through household surveys (e.g. Asfaw et al. 2009; Kiresur et al. 2009a, 2009b; Lokesha et al. 2009a, 2009b; Ndjeunga et al. 2010; Simtowe et al. 2009; and Suhasini et al. 2009a, 2009b); situation analyses studies (Kassie et al. 2009; Katungi et al. 2009); literature reviews of published works (Shiferaw et al. 2008a; Abate et al. 2011, 2012; Kassie et al. 2011). Major conclusions from the baseline and situation analysis studies include:

Rural smallholder households dominated by aging populations (avg. 48 yrs) and low levels of education (<4 yrs schooling);

Research systems in SSA region also face the aging population issue, with the average age of researchers >50 years;

Grain legumes account for <20% of the total cultivated area in majority of the target countries (except in Niger, Malawi, and Kenya);

Use of improved, modern varieties was generally low across target countries during baseline studies; unavailability of improved seed and, in some cases, lack of access to credit were identified as major bottlenecks for their adoption;

More than 70% farmers use their own saved seed across target countries; (except Kenya, where own saved seed accounted for just over 34%);

The current investment in Agriculture Research for Development (AR4D) falls short of the recommended 1-1.5% intensity ratio (i.e., investment as percentage of Agriculture output).

The other issue that has emerged is the funding availability for research on pulses. Results of the 'Global Pulse Productivity & Sustainability Survey' indicates that the annual investment in pulses is about US\$175m for the 13 crops in the pulse category, while billions are invested into other crops such as corn. A media release about the report was issued by the Global Pulse Confederation during the Pan African Legume conference in Zambia on 1 March. Several common themes emerged from the surveys, with the overarching visions for pulse crop research not varying a great deal between developed and developing nations. There is a strong desire and action across all national and global research and funding agencies to develop genomics tools for breeding programs, conduct state-of-the-art breeding programs for improvement in genetic gain, pest resistance and quality, improve crop production and crop protection practices, produce food sustainably, transfer information in a useable form, help make farming profitable, and develop new resilience in crops to meet climate change challenges, including drought and heat. In addition, all global funding agencies mention ending chronic hunger, providing nutritional foodstuffs to end malnutrition, and focusing on maternal health and the gender gap. These themes resonate around the world and across economies. The complete report can be accessed [here](#).

ICRISAT has made strong intervention to increase pulse productivity.

a) **CGIAR research program in Grain Legumes (CRP-GL)** is led by ICRISAT to improve:

Productivity and stability of these crops in diverse farming systems.

Marketability of these crops in local, national and international domains.

Nutritional value of these crops. Increased consumption of grain legumes resulting from higher productivity and affordability is enabling smallholder farm families to better meet their nutritional requirements for protein, oil, micronutrients, vitamins, fiber and healthier carbohydrates.

The contribution of grain legume germplasm and management techniques that its sister CRPs utilise to improve sustainability and resilience of farming systems.

The program focuses on addressing the following issues:

1. Addressing abiotic stresses and climate change effects

PL 1. Drought and low-phosphorous tolerant common bean, cowpea, and soybean

PL 2. Heat-tolerant chickpea, common bean, faba bean and lentil

PL 3. Short-duration, drought-tolerant and aflatoxin-free groundnut

2. Capturing unique legume ability to fix nitrogen

PL 4. High nitrogen-fixing chickpea, common bean, faba bean and soybean

3. Managing key biotic stresses

PL 5. Insect-smart chickpea, cowpea, and pigeonpea production systems

4. Generating new opportunities to intensify cropping systems

PL 6. Extra-early chickpea and lentil varieties

PL 7. Herbicide-tolerant, machine-harvestable chickpea, faba bean and lentil varieties

PL 8. Pigeonpea hybrid and management practices

Read more about the CGIAR Research program on Grain Legumes [here](#).

View the Grain legumes – flyer [here](#).

b) Strategy paper on Pulses: At the request of the Prime Minister’s Office, Government of India, to prepare a long-term strategy to increase economic opportunities for rural families in India, ICRISAT prepared a set of six strategy papers: 1) Pulses 2) PMKSY 3) Soil Mapping 5) Agri Markets 5) Crop Insurance and 6) Digital Agriculture. The Strategy paper on Pulses provided a set of recommendations to achieve self-sufficiency in pulses production by 2020.

Achieving self-sufficiency in pulse production in India - [Video link](#).

As a follow up, ICRISAT, as requested by the Government of India, hosted a high-level planning meeting at its headquarters in Hyderabad, which was chaired by Mr Shobhana K Pattanayak, Secretary, Agriculture, Department of Agriculture Cooperation & Farmers Welfare (DoAC & FW), Government of India. Mr Pattanayak called on all value chain actors including farmers, seed companies, private sector and research organizations to find a joint solution to resolve all hurdles and issues that are preventing Indian farmers from meeting their demand for hybrid pigeonpea seeds and other pulses. Read more [here](#).

Talk on the Indian pulse industry by Dr Bergvinson: [Video link](#).

C) Maintaining a gene bank: Identifying germplasm with new sources of resistance to diseases and pests, tolerance to climatic and other environmental stress and improved quality and yield traits for crop improvement. More information on the genebank can be obtained [here](#).

Dr Bergvinson on “From genebank to farmer’s hand” can be read [here](#).

d) Breeding programs: Contribute improved germplasm, breeding lines and cultivars that raise land productivity and yield stability. Varieties and hybrids that are resistant to pests and diseases, drought tolerant, biofortified, etc., contribute to improved yields, better returns and improved nutritive value.

Know more on the center of genomics [here](#). Know more on crop physiology [here](#).

Examples on how consumption of pulses contributes to household food security and nutrition in communities/countries of operation

[Farmers keen on improved pigeonpea hybrid seed, Maharashtra, India.](#)

[Chickpea variety, NBeG 47, the first machine harvestable variety suitable for variable climate.](#)

[Pigeon pea: A pulse revolution in Rajasthan, India.](#)

[High-yielding chickpea varieties transformed Temegnush Dhabi's farm in Central Ethiopia.](#)

Nutrition studies involving 170 children in Malawi and Tanzania, aged 6-23 months, showed their growth and health improved in just 21 days, by feeding a nutritious complementary mix consisting of pigeonpea, finger millet, groundnut, carrot and amaranthus leaves.

Read more [here](#). Watch video [here](#).

Additional information links

ICRISAT IYP Page: <http://www.icrisat.org/iyp/>

Publication on Pulses: <http://oar.icrisat.org/>

Videos of ICRISAT mandate crops: <https://www.youtube.com/user/icrisatco>

100 Voices Video series on topical issues: <http://www.icrisat.org/100-voices/>

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

Pulse Recipes: For interesting pulse recipes [click here](#)

34. Manuel Moya, International Pediatric Association, TAG on Nutrition, Spain

The approach from childhood of this important food type is based in the high number of under-fives all over the world especially in low- middle-income countries (1) and because the long lasting consequences (growth and cognitive) that undernutrition can have at these ages (2, 3).

In LMIC after the first year of life gruel/ congee is widely and almost exclusively used. These normally coming from flours from cereals which are poor in essential amino acids such as lysine and to a lesser extent tryptophan and phenylalanine. If we take into account that cooked chickpeas (protein 8.4 g/100 g) and lentils (protein 8.8 g/100 g) contain lysine respectively 485 mg/ 100 g and 613 mg/ 100 g, the combination of pulses with local and culturally rooted gruels could improve the protein quality consumed. Other pulses should not be neglected, particularly if they are local crops, but they should only be recommended if protein and essential amino acids content is acceptable. This protein improvement cannot be taken as definitive, other nutrient needs at these ages such as fat, Ca, P, Na, K, Fe and niacin should also be planned.

As regards the fourth question 'How could we increase their use?' The response is planning and education. Governments should locally incentivate the crops of pulses due to their resilience in the strict rain fed lands and the elusive import of these products. Their availability in the local shops should be promoted. Education has two main targets: famers and parents, for growing them and for using at home in a rotating way.

HIC also require a redesign action to increase the consumption of pulses due to the fact that processed food and refined carbohydrates are taking over the traditional plant food.

Manuel Moya

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35. Ilse de Jager, Wageningen University, Netherlands

Contribution to FNS-FAO forum

More than one in three children under five in sub-Saharan Africa are stunted. Over two billion people suffer from micronutrient deficiencies worldwide with especially high prevalence in sub-Saharan Africa. The majority of malnourished people live in rural areas for whom agriculture is an important source of the food and income required for nutrition and health. Agricultural interventions have great potential to improve nutrition, but this potential is yet to be unleashed. A feasible option that has great potential to improve nutrition in rural areas is to boost grain legume production of smallholder farmers. The advantage of legumes is twofold: they can fix nitrogen contributing to soil fertility and they are better sources of protein and micronutrients compared with maize contributing to human nutrition. We composed an overview of nutrient values of different important grain legume crops in sub-Saharan Africa, see Table 1 (de Jager 2013)

Many agricultural interventions aim to boost food production of one or several crop(s) and assume this will result in improved household nutrition both by increasing the quantity and/or quality of food available for consumption in the household (own production-food consumption pathway) and by enhancing agricultural income that can be used for food and non-food purchases to support a healthy diet (income-food purchase pathway). In the context of the N2Africa project (www.n2africa.org) in Western Kenya and Northern Ghana, we studied these two routes to better nutrition using a cross-sectional quasi-experimental study design, focus group discussions and path analysis.

We found no association between N2Africa and nutritional outcomes (legume consumption and individual dietary diversity) of Ghanaian and Kenyan infants and young children. In Kenya but not in Ghana, we observed a positive effect of soybean production on child's dietary diversity through the production-own consumption pathway. The different findings in Ghana and Kenya suggest the importance of context characteristics. The study shows that a context where (a) farmers attribute positive characteristics towards the targeted nutritious food, (b) a wide variety of local dishes already include the promoted food, (c) women are involved, (d) the targeted nutritious food is a new crop and a food crop, a project like N2Africa has more potential to indirectly improve child's dietary diversity through the production-own consumption pathway. In Ghana and Kenya, we found no effect through the income-food purchase pathway. An agricultural project promoting a nutritious food resulting in increased agricultural income does not necessarily translate into improved nutrition outcomes. If a larger impact on nutrition is to be made by agricultural interventions, it would require better consideration of context characteristics, better understanding of the cause and effect relations within pathways from increased agricultural production to improved nutrition and better integration of agricultural and nutrition objectives and activities.

As a next step, we studied whether household food production supports household and child's nutrition needs and food-based dietary guidelines in northern Ghana. We found that higher household crop production diversity is associated with higher coverage of nutrient needs of household members, but not with dietary diversity of children 6 to 23 months or nutrition status of these children. Total

household production used for own consumption covered 70.3% of macronutrients and 43.4% of micronutrients household needs and provided less than 40% of fat, calcium, vitamin A, vitamin B2, vitamin B12, folate, and vitamin C needs. Household production used for own consumption has the potential to cover the macronutrient (except fat) but not the micronutrient needs. Based on an optimized diet for children 12-23mo we will calculate foods needed in the household and compare this with household food production. Existing food gaps may give direction to which crops need further production investment or improved market availability for affordable prices.

Table 1: Proximate, mineral and vitamin values of common bean, cowpea, groundnut, soybean, chickpea, pigeon pea and maize

Nutrient	Unit per 100 g edible portion	Common bean* (mature seeds, raw)	Cowpea (common, mature seeds, raw)	Groundnut (all types, raw)	Soyabean (mature seeds, raw)	Chickpea (mature seeds, raw)	Pigeonpea (mature seeds, raw)	Maize (white, whole grain, raw)
<i>Proximates</i>								
Energy	Kcal kJ	333 – 347 ^I 1393 – 1452 ^{IV}	316 – 336 ^I 1340 – 1406 ^I	567 – 578 ^I 2374 – 2390 ^I	413 – 446 ^I 1730 – 1866 ^I	364 ^{II} 1525 ^{II}	301 – 343 ^I 1260 – 1435 ^I	343 – 362 ^I 1440 – 1515 ^I
Water	g	8.9 - 12.4 ^{IV}	11.8 - 12.0 ^I	6.3 - 6.5 ^I	7.9 - 8.5 ^I	11.5 ^{II}	10.6 - 13.4 ^I	10.3 – 13.4 ^I
Total protein	g	16.9 - 23.6 ^{IV}	21.2 - 23.5 ^I	22.4 - 25.8 ^I	34.7 - 36.5 ^I	19.3 ^{II}	18.4 - 21.7 ^I	8.1 – 8.5 ^I
Total fat	g	0.8 - 2.6 ^{IV}	1.3 ^I	45.9 - 49.2 ^I	15.9 - 19.9 ^I	6.0 ^{II}	1.5 ^I	3.6 – 4.0 ^I
Total carbohydrate	g	53.2 - 65.6 ^{IV}	47.2 - 60.0 ^I	14.6 - 16.1 ^I	28.3 - 30.2 ^I	60.7 ^{II}	43.2 - 62.8 ^I	63.3 - 76.9 ^I
-dietary fibre	g	10.3 - 25.2 ^{IV}	10.6 – 15.3 ^I	8.5 ^I	4.1 - 9.3 ^I	17.4 ^{II}	15.0 – 20.2 ^I	7.3 – 9.7 ^I
<i>Vitamins</i>								
Thiamin (B-1)	mg	0.4 – 0.9 ^{IV}	0.7 - 0.9 ^I	0.6 – 0.9 ^I	0.7 - 0.9 ^I	0.5 ^{II}	0.6 ^I	0.3 - 0.4 ^I
Riboflavin (B-2)	mg	0.1 – 0.3 ^{IV}	0.2 ^I	0.1 ^I	0.3 - 0.9 ^I	0.2 ^{II}	0.2 ^I	0.1 - 0.2 ^I
Niacin (B-3)	mg	0.5 – 2.5 ^{IV}	2.1 – 3.1 ^I	12.1 – 15.5 ^I	1.6 – 2.0 ^I	1.5 ^{II}	2.9 - 3.0 ^I	2.0 - 3.6 ^I
Pantothenic acid (B-5)	mg	0.7 – 1.1 ^{II}	1.5 ^{II}	1.77 ^{II}	0.8 ^{II}	1.6 ^{II}	1.3 ^{II}	0.4 ^I
Vitamin B-6	mg	0.3 – 0.5 ^{IV}	0.36 ^I	0.4 – 0.6 ^I	0.4 – 0.8 ^I	0.5 ^{II}	0.3 ^I	0.2 - 0.3 ^I
Folic acid (B-9)	µg	364 – 604 ^{IV}	417 - 633 ^I	110 - 240 ^I	375 – 381 ^I	557 ^{II}	456 ^I	25 ^I
Ascorbic acid (C)	mg	0.0 – 6.3 ^{IV}	0.8 - 1.5 ^I	0.0 ^I	6.0 ^{II}	4.0 ^{II}	0.0 ^{II}	0.0 ^I
Vitamin A	mcg RAE**	0 – 15 ^I	3 ^I	0 ^I	1 ^I	3 ^{II}	1 ^I	0 ^{II}

Minerals								
Calcium, Ca	mg	74 – 240 ^{IV}	82 - 110 ^I	47 - 92 ^I	206 - 277 ^I	105 ^{II}	130 – 257 ^I	6 – 18 ^I
Iron, Fe	mg	3.4 – 10.4 ^{IV}	7.3 - 8.3 ^I	3.9 - 4.6 ^I	6.5 - 15.7 ^I	6.2 ^{II}	4.7 - 5.2 ^I	3.0 - 3.5 ^I
Magnesium, Mg	mg	140 – 222 ^{IV}	184 – 187 ^I	168 – 191 ^I	249 – 280 ^I	115 ^{II}	183 ^I	80 - 127 ^I
Phosphorus, P	mg	301 – 488 ^{IV}	387 – 424 ^I	359 – 376 ^I	536 – 704 ^I	366 ^{II}	269 – 367 ^I	240 - 241 ^I
Zinc, Zn	mg	1.9 – 3.8 ^{IV}	3.4 – 4.6 ^I	2.5 - 3.3 ^I	4.8 - 4.9 ^I	3.4 ^{II}	2.0 - 2.8 ^I	1.5 - 1.8 ^I
Copper, Cu	mg	0.4 – 1.0 ^{IV}	0.7 - 0.9 ^I	0.9 - 1.1 ^I	1.5 - 1.7 ^I	0.9 ^{II}	1.0 - 1.1 ^I	0.2 ^I
Manganese, Mn	mg	0.9 – 1.8 ^{II}	1.5 ^{II}	1.9 ^{II}	2.5 ^{II}	2.2 ^{II}	1.8 ^{II}	0.5 ^{II}
Selenium, Se	mg	3.2 – 28.0 ^{II}	9.0 ^{II}	7.2 ^{II}	17.8 ^{II}	8.2 ^{II}	8.2 ^{II}	15.5 ^{II}

Note. The data is adapted from ‘USDA National Nutrient Database for Standard Reference, Release 24’ by U. S. Department of Agriculture, 2011; from ‘West African Food Composition table’ by FAO, Infoods, ECOWAS/WAHO and Biodiversity International, 2012 & from ‘South African Food Data System’ by South African MRC, 2010. ^IUSDA & West African table; ^{II}USDA; ^{IV}USDA, West African & South African table; *range of varieties of common bean: black bean (USDA), cranberry bean (USDA), French bean (USDA), Great Northern bean (USDA), kidney bean (USDA), navy bean (USDA), pink bean (USDA), pinto bean (USDA), yellow bean (USDA), small white bean (USDA) and white bean (USDA & West African table) & sugar bean (South African table); **retinol activity equivalents (RAE), accounting for the different bioactivities of retinol and provitamin A carotenoids.

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36. Massimo Iannetta, ENEA, Italy

Here enclosed my contribution to the consultation.

Best regards.

Dr. Massimo Iannetta

“Biotechnologies and Agroindustry”- Division Head
Italian National Agency for New Technologies, Energy and Sustainable Economic Development
Centro Ricerche Casaccia, Via Anguillarese, 301 - 00123 S.M. di Galeria (RM)

What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?

The main challenge faced by Italian farmers with regard to the production of pulses is posed by the low income level that they can achieve from leguminous crops. Their productivity is generally quite low and, with few exceptions, the price does not compensate the yield gap respect to cereals or other more profitable field crops. In spite of their many positive features, including high nutritional quality and atmospheric nitrogen fixation, many farmers are reluctant to include leguminous crops in the rotations of their farms. To address this problem we can either raise the pulse price or to increase their productivity. For the first approach geographic origin protection and other strategies to add value to local productions can offer good opportunities. For example, lentils of certified origin from Castelluccio (Central Italy) are generally sold at a higher price in Italy, because generally considered of better quality than other lentils. This marketing strategy is obviously restricted to market niches, but is not fully exploited and offers other opportunities for other pulses. For the second strategy we would

need substantial investments in research and innovation, which can reduce, if not abate, the yield gap between leguminous crops and cereals. As a matter of fact, the investments dedicated to the improvement of maize productivity are many folds higher than those allocated to leguminous crops. This difference explains at least partially their lower productivity. The knowledge recently gathered on leguminous genomics, not to say about the other “omic” sciences, offer an excellent starting base for a big research and innovation endeavor.

37. Esther Ronner, Wageningen University, Netherlands

Pulses, and especially common bean, are important staple crops in many East African countries and provide an important source of protein and calories. Their productivity, however, is still far below potential. Challenges to enhance production of pulses are often not only found at field level, but require understanding of the farm level and farming systems as pulses are grown among many other crops and smallholders rarely invest all their resources in a single crop.

In the densely populated highlands of East Africa, climbing beans offer potential to intensify bean production compared to bush beans. Climbing beans have been successfully introduced in some East African countries (e.g. Rwanda), but there is still considerable potential to extend their cultivation. Through the N2Africa project (www.n2africa.org) we work on the extension of climbing beans in the highlands in eastern and southwestern Uganda. Challenges to expand the production of climbing beans in these areas include access to staking materials, to cash to obtain inputs and to labour. This implies that climbing beans may be more or less suitable for certain types of farmers, and that we may need to offer a ‘basket of options’ of climbing bean technologies that require more or less of farmers’ scarce resources. We are developing such options through a co-design process, consisting of an iterative cycle of co-design, implementation and evaluation of climbing bean technologies.

Some results from the co-design of climbing bean technologies in Uganda:

- Farmers find yield an important criterion to judge the success of a new technology, but use it next to other criteria which differ between poorer and wealthier farmers, men and women, and different areas.
- Men and women value different attributes of technologies; when comparing two climbing bean varieties, women for instance placed relatively more emphasis on characteristics of the leaves (used as vegetable), maturity time and taste, which may reflect women’s involvement in the production of beans for home consumption.
- Although we aimed to find low-cost staking materials as an alternative for wooden stakes, farmers still prefer wooden stakes for their ease of implementation and relatively low labour requirements. This shows the difficulty of finding solutions to address the challenges of the poorest farmers.

As a next step, we tested issues that emerged from the co-design process in agronomy trials:

- As farmers still prefer wooden stakes but also have challenges accessing it, farmers sometimes cut longer stakes in two to plant a larger area. We normally advise farmers to use long stakes, as the longer the stake the better the yield. However, as yield is only one of the criteria that farmers use, we set up an additional experiment to find out to what extent the yield obtained by taller stakes would outweigh the costs for staking.
- Demonstrations of improved technologies in the project all involved sole crops of climbing bean. As about three quarter of the farmers in eastern and southwestern Uganda grows their climbing beans in intercropping with banana, coffee or other crops, we decided to set up an experiment on intercropping of climbing bean with banana. We pruned leaves of banana plants to enable the beans to

receive more light for a better yield. This way, we adjust our experiments to develop recommendations that have better local relevance.

Results of such a co-design process lead to the development of a basket of locally relevant options and diversified extension messages that can be applied in our efforts to address the challenges of smallholder farmers producing pulses.

38. Dhanya Praveen, Environment Protection Training and Research Institute, Hyderabad, India

Thanks for the opportunity. In recognition of its significance in the daily nutritional requirement of living beings, the organization of this forum in the **International Year of Pulses** demands great attention.

In our country India, people have a larger dependence on pulses a food crop as well as cash crop. Due to failure of monsoon, climate change impacts, the rates of pulses have gone up beyond imagination.

1. As far as my working state Telangana (Newly formed State) - is concerned, even though it is a frequently drought hit region, people go in for cotton cultivation which is water intensive. During my field works, I could understand that it is very hard to make the communities follow our instructions and make them understand the need to change the existing mal cropping practices and shift to pulses crop from cotton, considering the need of the hour as part of the changing climate scenario. Capacity building on this aspect is very essential.

2. It is highly essential for the scientific community to understand the physiology of the pulses crops (Green Gram, Red Gram, Black Gram)and develop more (Crop Simulation model based) scientific knowhow on the same as to anticipate the probable changes in crop responses due to likely changes in the climate .

Thank you & Best regards,

Link To New Publication

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0147541#sec022>

<http://www.tandfonline.com/eprint/NWT7pYGazj87fdemW5GB/full>

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39. Rattan Lal, Ohio State University, United States of America

International Year of Pulses

Celebration of 2016 as the International Year of Pulses is timely and important because of the important role that pulses play in enhancing soil health and improving human nutrition and wellbeing.

Pulses and Soil Health:

Soil health refers to its capacity to function as a dynamic and biologically-active entity that affects health of plants, animals and people and generate numerous ecosystem services of relevance to human and nature conservancy. Important among these ecosystem services are net primary productivity,

food and nutritional security, biodiversity, water purification and renewability, carbon sequestration and moderation of gaseous emissions elemental cycling etc. Pulses impact soil health through their impacts on soil physical, chemical and biological properties. Incorporating pulses in crop rotation impacts soil physical properties including aggregation (especially percentage of macro aggregates > 3mm) and soil structure because of the glomalin contents, soil tilth and formation of biophores, enhanced porosity and favorable pore size distribution, and improved aeration and gaseous exchange. Pulses also affect soil chemical properties especially soil fertility through biological nitrogen fixation (BNF), soil organic carbon (SOC) content through input of a high quality residues with a narrow C:N ratio and changes in soil PH. The rate of BNF (Kg N/ha) under pulses can range from 30-120 for lentil, 20-100 for chickpea, 5-70 for dry bean and 80-160 for faba bean. Thus, C:N ratio of crop residues for chickpea and lentils is about 17 compared with that of 40 for oilseed crops and more than 30 for wheat. The C:N ratio of some non-leguminous crops can be >100. Biologically, pulses can also impact microbial biomass carbon (MBC), soil enzyme and accentuate activity and species diversity of soil biota including macro biota (e.g. earthworms and termites) and enhance disease-suppressive attributes of the soil.

Improvements of soil structure by pulses can improve the water use efficiency of the following crops. Experiments conducted in Queensland, Australia documented the water use efficiency (kg/ha.mm) of sorghum of 5-7 when sorghum followed sorghum compared with 10-14 when sorghum followed mungbean and 11-13 after lab lab. Increase in WUE is due to better water conservation in the root zone and avoidance of drought.

Adaptation and Mitigation of Climate Change:

Through their impacts on soil health and functionality, pulses enhance adaptation and mitigation of climate change. Growing pulses can decrease gaseous emissions (e.g., nitrous oxide) by reducing input of nitrogenous fertilizers, improving soil structure and tilth, conserving water and soil, and increasing crop diversity thereby reducing inputs of herbicides and pesticides. Pulses can also increase the rate of soil carbon sequestration by increasing MBC and contributing N-rich residues. The measured rates of SOC in soils of India range from 300 to 400 kg.C/ha.yr. However, inoculating pulse crops with rhizobia can increase emission of nitrous oxide from soil.

Global Food and Nutritional Security:

In addition to about 800 million people who are prone to hunger, there are about 2 billion who suffer from hidden hunger and malnutrition. As an important source of protein and minerals, including pulses in diet is an important strategy to alleviate hunger and improve human health and wellbeing. Substituting pulses for animal-based protein can save a lot of land and grains to feed the growing population of the world.

Pulses are important to soil, environment and human health. Designation of 2016 as the UN International year of Pulses will enhance awareness about the importance of pulses.

Sincerely

Rattan Lal

Distinguished University Professor of Soil Science
Director, Carbon Management and Sequestration Center
President Elect, International Union of Soil Sciences
Adjunct Professor, University of Iceland
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Columbus, OH 43210, USA

40. Logan Cochrane, UBC & IDRC, Canada

Regarding: “What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?”

I would like to add some caution to the promotion of any particular intervention without viewing that action in context. While we fully recognize the nutritional, soil and climate related benefits, this solution, if forced onto farmers without a broader contextualization of their situation may result in negative outcomes. For example, there has been a project working in Ethiopia for many years on pulses, particularly around breeding, farmer seed selection and improved yields. However, uptake remains low despite various training, educational and field demonstration sites. In this case researchers are focusing upon the benefits, but not the costs, or broader challenges being faced. In this part of the country, chronic food insecurity is prevalent and land sizes are very small (0.5 ha or less, on average). Farmers current decide to grow root crops (specifically: enset, taro and sweet potato), which have yields per hectare that are 3 to 8 times greater than that of pulses. For them, despite the carbohydrate dense nature of these crops, the choice is an obvious one: if they grow root crops they may have food shortages 1-3 months of the year, however if they switch to the pulses, the food gap widens due to the decreased yields per hectare. Thus, it is logical for farmers to fully recognize the benefits, yet not adopt. It is worth emphasizing here that the land size is small, and growing seasons limited due to rain-fed agricultural practices, which further limit the options and opportunities. Some have farmers have integrated pulses, potentially a an attempted second crop after the main growing season or as smaller patches of their land. In sum: We should seek to understand the context before advocating that pulses are the answer. There may be alternatives, more suitable and more appropriate, even ones which farmers themselves have already taken action on (such as improved varieties of root crops).

41. Madeleine Smith, The SPRING Project - John Snow International - Research and Training Institute, United States of America

Greetings, and thank you for the very interesting reading, and for the webinar! The USAID SPRING project is working on building the evidence base to better integrate agriculture and nutrition. Our work focuses broadly on how to operationalize the Primary Pathways for Linking Agriculture and Nutrition, which include own production, through income, and women’s empowerment, and how globally we can better define and scale up nutrition-sensitive agriculture interventions. Nutrition sensitive agriculture practices relate the most directly to food production and consumption, and nutrient values, but there are many practices, such as good WASH and environmental management practices related to reducing post- harvest loss, time and energy of women, use of income, and the role of public and private value chain and food system actors. Some of these are inherent in the agricultural systems, while there are many gaps.

Relative to this decision forum, I am working on a formative research study in Northern Ghana to examine the agriculture information systems related to cereal-legume cropping systems (primarily maize, soy, cowpea, and pigeon pea), and how we can better promote nutrition through these systems. We chose these crops because there are a lot of existing materials and research to build on. Our formative research will focus on the gauging the perceptions of farmers and other system actors on how we can “add value” to these related value chains through embedding nutrition-sensitive agriculture content into existing information systems. So, we are interested in extension and rural advisory services content, because even here, there are many gaps in the way content is integrated and how it is promoted, and thus opportunities for helping rural households understand the linkage between soil health, plant health, the environment, and human (and animal) nutrition. We are also equally interested in the role of other system actors, such as input suppliers, aggregators,

retailers, processors, and financial service providers, and others who also have a role in the information systems through training, investing and marketing.

We look forward to sharing this later this year. We are also interested in collecting any specific farm-level extension materials, or materials used among other value chain actors relative to promoting the linkage between human nutrition and pulses.

42. Michelle O. Fried, Slow Food, Ecuador

To increase pulse consumption, the difficulty of the long overnight soak can be reduced by a quick soak technique I have been teaching for decades. Many community women, as well as women from marginal, urban neighborhoods cook pulses more frequently now that they have learned the technique. Unfortunately I do not have documentation to prove the fact; they, however do say that at the altitude of Quito, Ecuador and rural areas in the Andes they are now eating more dried “leguminosas” they call them. Before they say they would have cooked them once a week or once a fortnight, and that now they are eating them as often as three times a week.

Given the lower boiling point at the altitude, and thus longer cooking time, traditionally the culinary culture consumed fresh pulses, particularly fava beans and peas, but beans (*Phaseolus*) as well. Thus traditional cooking techniques made use of the quicker cooking fresh product, rather than the dried one.

Quick soak method:

Cover picked over dried beans with water (approximately 2 cups of beans to 2 to 3 liters of water). Bring to a boil, lower the heat and simmer for 1 to 5 minutes. (thinner-skinned pulses require less simmering than thicker-skinned varieties). Remove from heat, cover, set aside and let soak for at least 1 hour. Drain and use the quick-soaked pulse like any soaked pulse. (By draining the first water, flatulence is also diminished.)

43. Georges Bazongo, Tree Aid, Burkina Faso

Original contribution in French

Bonjour aux modérateurs de cette consultation en ligne et dont les problématique de consommation, de valorisation et de production sont posée.

1) Concernant la faible valorisation et consommation des légumineuses, l'un des problèmes actuels que j'ai rencontré sur le terrain en milieu tout comme en milieu rural, c'est qu'il y a une vraie stigmatisation de ceux et celles qui se nourrissent de légumineuses comme le poids de terre ou le haricots ou niébé par exemple. Ces aliment qui jadis avait nourris des familles entières et permis de traverser de longues périodes de famines se retrouvent aujourd'hui perçu comme un aliment de pauvre et de basse classe par ceux-là même qui s'en sont servis pour vivre au village, aller à l'école et se retrouver en ville. Cette stigmatisation découle de l'absence de valorisation de ces légumineuses stigmatisées dans les recettes exposées pendant les foires alimentaires et il n'y a pas recettes attrayantes capitalisées et vulgarisées. Cette stigmatisation diminue la demande et donc la production. Cette dernière n'est faite que par les femmes pour supplier à l'insécurité alimentaire. Nous avons appuyé une ONG locale au Togo à élaborer un répertoire de mets locaux améliorés à l'aide de soja, ainsi sept mets ont été répertoriés et vulgarisé dans les centres de santé au Nord Togo (Oti et Tonte) et en deux ans, la demande a augmenté. Pour inverser la tendance pour le cas du Burkina Faso et aussi dans des pays comme le Ghana, le Togo, le Mali et le Niger que je connais bien, a) il faut une réelle communication pour rétablir l'image des légumineuses comme n'étant réservées aux pauvres mais des aliments à valeurs nutritives

démonstrées et bonne pour la santé - mettre en avant les effets bénéfiques sur l'état de santé actuel des populations serait un avantage de vulgarisation et b) il faut établir un répertoire des mets à bases de légumineuses sous le leadership des ministères en charge de l'agriculture et de la santé avec l'appui des ONG travaillant dans la nutrition et vulgariser ce répertoire à travers les structures de santé, les ONG et collectivités locales et pour les repas de cérémonies officielles et enfin c) rétablir l'image et la perception de la population par une communication appropriée et au Burkina, les foires comme la journée du paysans, les foires régionales agrosylvopastorales,

2) L'effet premier constaté est que les légumineuses sont des aliments qui viennent au secours des ménages pendant les périodes de soudures au moment où les céréales se font rares et les aliments coutent chers sur le marché. Sans avoir fait une étude de l'état nutritionnel, on peut tout de même dire que disposer et diversifier l'alimentation améliore le statut nutritionnel des populations. Et c'est cet état de fait qui est reconnu aux légumineuses comme le poids de terre ou voandzou. Le suivi de la consommation de soja au Nord Togo en collaboration avec les agents de santé a montré un bon taux d'hémoglobine des enfants et les rendent vigoureux face aux maladies.

3) Les principales difficultés que nous avons rencontrées et les solutions apportées sont:

- la faiblesse des rendements et des productions du le plus souvent à des variétés non adaptées. La solution que nous avons apportée est la production e la vulgarisation de semences de variétés améliorés de niébé et de soja par exemple en collaboration avec la recherche (INERA au Burkina et ICAT au Togo) a la formation de producteurs semenciers et les différents accompagnements avec les semences de base, le suivi technique et la certification. A la suite de ce système formel, le système informel permet une vulgarisation à grande échelle des semences améliorées. Ces variétés améliorées ont permis d'accroître les rendements de niébé de 26% et celui de soja de 38% en un an.

- l'accès à la terre et l'insécurisation foncière notamment pour les femmes et limites leurs capacités productives. La solution apportée a été d'impliquer les hommes comme bénéficiaires et pendant les rencontres d'évaluation des résultats annuels du projet. Ainsi les hommes ont réalisé que si leur femmes avaient plus de terres, elles allaient produire plus et multiplier leur revenu et la consommation à la maison - au Togo comme au Bénin, le soja est une partie intégrante des ingrédients de la sauce pour toutes les femmes- et cela relève de la dignité même du ménage. Ainsi donc, les femmes qui ne pouvait louer que 0,25 ha ont pu accéder de 0,5 à 2 ha rien que pour la culture du soja.

- Il n'y a pas un meilleur accès au marché pour les producteurs/productrices et donc ils sont à la merci des commerçants après les récoltes afin de pater a prix très faibles. La solution que nous avons apportée est l'organisation des coopératives, la formation, l'appui en équipements de transformation pour encourager la consommation locale et générer des revenus et stockés pour vendre plus chers plus tard.

Enfin, il n'y a pas des actions et des moyens conséquents dégagés par les états pour soutenir ces filières. Dans une certaine mesure le niébé mais pas à une échelle importante comme pour les appuis au riz et au maïs.

English translation

Good Day to the Moderators of this online consultation about which the problems of consumption, valorization and production have been raised.

1) Concerning the insufficient valorization and consumption of pulses, one of the present problems that I have encountered in the field in all areas, as well as in the rural areas, is that there is a real stigmatization of those who eat pulses, like Bambara nuts or beans or blackeyed beans, for example. These foods which in the past had fed entire families and helped them to survive long periods of famine

are today perceived as food for the poor and low classes by those who used to live in the village, went to school and now find themselves in towns. This stigmatization results from the lack of appreciation for these stigmatized pulses in the recipes published during food fairs and there are no attractive recipes saved and made popular. This stigmatization reduces the demand and therefore the production. The latter is only carried out by women who encounter food insecurity. We have supported a local NGO in Togo to make a selection of improved local dishes with the help of soya, in this way seven dishes have been listed and made popular in health centers in the North of Togo (Oti and Tonte) and in two years the demand for pulses has increased. To reverse the tendency in the case of Burkina Faso and also in countries like Ghana, Togo, Mali and Niger that I know well, a) real communication is necessary to re-establish the image of pulses as not just for the poor, but as food of proven nutritional value and good for the health - emphasizing the beneficial effects on the present state of health of the population would be one advantage of popularizing them, b) it is necessary to establish a repertoire of dishes using pulses under the leadership of the Ministry of Agriculture and of Health with the support of NGOs that work with nutrition and to popularize this repertoire through health organizations, the NGOs and local organizations and for the meals at official ceremonies, and finally c) to re-establish the image and perception in the eyes of the population by appropriate communication and in Burkina, in fairs such as Farmers day and the regional agro-sylvo-pastoral fairs.

2) The first effect identified is that pulses are foods that come to the rescue of homesteads during times of hunger when cereals are scarce and food in the market is expensive. One does not have to make a nutritional study to say that availability and diversification of food improves the nutritional status of the population. And it is this state of affairs that is recognized with pulses, such as the Bambara nuts or voandzou. The follow-up of consumption of soya in the North of Togo in collaboration with health agents has demonstrated a good rate of hemoglobin in children which makes them resistant to illness.

3) The main difficulties that we have found and the solutions provided are:

- poor yields and production due most often to poorly adapted varieties. The solution that we have provided is the production and popularization of seeds of improved varieties of blackeyed bean and soya for example, in collaboration with research (INERA [Institut de l'Environnement et de Recherches Agricole, Institute for the Environment and Agricultural Research] in Burkina and ICAT [Institut de Conseil d'Appui Technique, Institute of Technical Support Consulting] in Togo) into the training of producers of seed and the different support systems with basic seeds, technical follow-up and certification. Following this formal system, the informal system allows the big scale popularization of improved seeds. These improved varieties have led to increases in the yields of black-eyed beans of 26% and those of soya to 38%, in one year.

- access to land and the insecurity of title, especially for women and the limits of their productive capabilities. The solution provided has been to involve men as beneficiaries and during the meetings to assess the annual results of the project. In this way, the men have realized that if the women have more land, they will produce more and multiply their income and consumption in the home - in Togo and Benin, soya is an integral part of the ingredients of sauce for all women - and that enhances the dignity of the home itself. So, the women that could only rent 0.25 hectares were able to have access to 0.5 to 2.00 hectares, just to cultivate soya.

- There is no improved access to the market for producers (men and women) and therefore they are at the mercy of traders after harvesting so as to sell at very low prices. The solution that we proposed is the organization of cooperatives, training, support with transformation equipment to encourage local consumption and generate income, and storage to sell later at better prices.

Finally, there are no actions and consistent resources provided by the states to support these sectors. To a certain extent, they support the black-eyed bean, but not on any significant scale like they support rice and maize.

44. Randy Duckworth, Global Pulse Confederation (CICILS/IPTIC) United Arab Emirates

How can we increase pulse consumption in communities where pulse crops do not play an important part in traditional cuisine/meals? My response is almost certainly influenced by my background in international agriculture marketing. I suggest the answer to the question differs depending on whether the community in question is part of a developed economy (Europe, Japan, USA, Australia), emerging economy (Brazil, China, India, Indonesia, Mexico), or a lesser developed economy (Bangladesh, Ethiopia, Haiti, Myanmar).

Developed Economies

Consumer behavior researchers argue that trying to directly change consumer behaviors and/or incorporate new traditions (pulse consumption) in developed economies is difficult and costly. Consumers in developed economies have relatively high incomes, a wide variety of food choices available and do not depend on pulses for sustenance. Having said that, consumers in developed economies have greater freedom to make new choices that meet their needs.

In order to meet the needs of consumers in developed economies we must first identify those needs by recognizing the realities and trends that affect their behavior. Consumer behaviors in developed economies are impacted by trends that may differ significantly from those of emerging or lesser developed economies.

Simpler, Healthier Foods Trend. Developed economy consumers are increasingly looking for foods that are both healthier, simpler and more convenient (Food Technology Magazine Food Trends 2016). These consumers are also pushing for “clean” labels and product formulations that contain safe, simple, natural ingredients. And they are looking for labels with foods that are consistent with their environmental and/or moral consciousness – foods that are environmentally sustainable and non-destructive. Of course, pulses meet these needs.

Flexitarians and Environmental Consumerism. Increasingly, in more developed economies of the world we are seeing the rise of part-time vegetarians (also known as “flexitarians”) and environmentally conscious consumers that are making informed choices to reduce their meat consumption because of health, sustainability and other concerns. The growing support and awareness of “Meatless Monday” is an example of this trend (<http://www.meatlessmonday.com/about-us/why-meatless/>).

Hidden Vegetables. Developed world consumers are constantly being reminded by their governments and health professionals that they should eat more vegetables. But many consumers in developed countries frequently shy away from vegetables due to taste expectations or simply because of preference for less healthy options (with fat, salt and sugar) . One way to increase consumption of vegetables – including pulses - is as “hidden vegetables.” One example of this trend is the pasta aisle where we can now find dozens of new pastas that contain spinach, sun dried tomatoes, pulses, etc. Pulse derivatives such as pea protein and pulse flours are perfect means by which to increase consumption of pulses with non-traditional consumers as “hidden vegetables.”

Gluten Free. Gluten free food offerings have had phenomenal growth over the past several years. This has undoubtedly helped create more opportunities for pulse related products since pulses and pulse derivatives are gluten free and can be used in a variety of applications where wheat would normally be used such as snack foods, pastas, pastries, and breads.

Emerging Economies

On order to increase pulse consumption in emerging economies that do not have a tradition of pulse consumption we must first acknowledge the realities of emerging economies. Emerging economies typically have a growing middle class with increasing incomes and typical aspirational consumer behaviors. These aspirational behaviors are not always a positive when it comes to pulse consumption.

Aspirational Food Consumption. Research is clear that as emerging economies' middle classes grow consumer behaviors - particularly in relation to food consumption - become less traditional and more aspirational with greater consumption of animal products, and vegetable oils. In fact, some experts argue that aspiration for a more western diet in emerging countries could have a more detrimental affect on global health and hunger than population growth. As Mexican incomes have grown pulse consumption has declined and Mexico now wears the dubious crown of most obese country on earth.

Trade Liberalization and Urbanization. An argument could also be made that urbanization, trade liberalization and changing trade policies are impacting traditional consumption patterns by expanding consumer choices. Freer, more open trade is changing eating habits by providing an unprecedented level of consumer choices. In other words, consumers that traditionally had a small set of food choices now have many more options. Foods that may have been only available seasonably may now be available year round. And fast food restaurants have grown at an alarming rate in urban areas (Taco Bell reportedly plans to open more than 100 new outlets in Brazil in 2017).

For consumers that have not traditionally consumed pulses the increased exposure to new product choices might be a great thing. But for consumers in countries that traditionally consumed pulses, such as Mexico, increased incomes and the availability of more choices is likely to have a negative impact on pulse consumption and consumer health – unless consumers are provided more options that are reflective of the changing consumer landscape.

Need for More Choices. Having a greater range of consumer choices can certainly be positive if the global pulse industry, food processors and distribution channels are prepared to meet consumers' aspirational needs by providing more consumer choices. If consumer aspirations are to dine out more then the global pulse industry needs to work with quick serve restaurant (QSR) sector to make choices available that include pulses. If more women are part of the workplace in emerging economies such as is the case in Brazil, then the global pulse industry needs to work with food manufacturers to provide more convenient options that include pulses. If consumers have more money available for snacking then the global pulse industry needs to be work with snack food manufacturers to broaden their product line to include pulse based products.

Lesser Developed Countries

Pulses already play a key role in many lesser developed countries since they can be used both for self-consumption or as a cash crop. In countries with poor soils or arid climates there are a number of pulses that can be grown where cereal crops will not survive (e.g., pigeon peas, cowpeas, bambara beans). Pulse crops provide farmers with an option to sell when times are good or to consume their harvest when times are bad. In countries such as Ethiopia, Haiti, and Madagascar pulses serve as both a major nutritional source and additional income source for producers (pulses are high-value crops, usually getting 2-3 times higher prices than cereals).

One of the keys to increasing consumption in lesser developed countries is supporting programs dedicated to improving production and storage, trade enhancement and market linkages, and education (e.g., agricultural extension). The UN World Food Program, USAID and many NGOs have created programs that are focused on providing adequate nutrition to mothers and their young children during the first 1,000 days of life. These programs are designed to reduce the many health and long term development issues that are associated with chronic malnutrition during early

childhood. Working to incorporate more pulses into these early childhood nutrition programs is one avenue for increasing long-term consumption of pulses in lesser developed countries. In addition, programs that support the education of females have proven particularly effective in terms of long-term economic gains and household food security.

Programs that help establish market linkages and stabilize incomes for domestic producers are very important because pulse consumption is highly income elastic in lesser developed countries. Unlike developed markets, the rate of consumption of pulses is highly dependent on prices. If the domestic price of pulses is too high then consumers may choose to consume more of a less expensive protein source or more grains (e.g., rice, corn) or often they may simply consume less food.

Per capita consumption of pulses in lesser developed countries (and the rest of the world) has dropped in both emerging and lesser developed countries. According to the FAO, this is not just a change in dietary patterns but is the result of a failure of domestic production to keep pace with population growth. In order to increase per capita pulse consumption in lesser developed countries we must encourage increased research and development (R&D) in pulse sector since, despite relatively high rates of return, investment in agriculture generally and pulse sector specifically is often neglected in lesser developed countries. And to the extent that R&D exists it is dominated by the public sector. While public sector investment should be encouraged and enhanced we must also support and encourage more private sector investment in lesser developed countries. Any additional investment will almost certainly pay off in terms of increased pulse productivity, improved incomes and increased per capita pulse consumption.

Research Sharing and Technology Transfer.

The ease of sharing information and technology provides an unprecedented opportunity to increase pulse consumption in non-traditional pulse consuming communities – regardless of whether they are developed, emerging or lesser developed economies. For purposes of illustration let's use Japan as an example. With exception of traditional desserts (anko, sweetened beans) there is no tradition of pulse consumption in Japan. Japanese traditional cuisine (washoku) is based heavily on rice, seasonal ingredients, side dishes, seafood and noodles. Popular Japanese noodles are commonly made from wheat, buckwheat, konjac and rice – but not yet from pulses. Companies in the United States are using pulses in the manufacture of noodles, breads and snack foods. With technology transfer Japanese noodle manufacturers might also use pulse derivatives in their noodle products.

Conclusions

Author Patti Dingh said “Change occurs at the edges, without permission.” To me this powerful statement is a recognition that change is not always straight forward but may instead occur on the periphery. To increase pulse consumption in non-traditional consuming countries we must look for these transformative opportunities at the edges. In developed economies we must be mindful of trends that can seriously impact consumption patterns (e.g., gluten free trend, flexitarian trend). In emerging economies, we must look for opportunities to create change that recognize the aspirational needs of consumers with more income and food choice options. And in lesser developed economies we must look to improve production systems with more research and development, create market linkages for pulse producers and educate both producers and consumers (particularly females). By doing so we can increase both incomes and per capita pulse consumption.

45. BK Singh, ICAR-IIVR, India

Good day everyone,

Thanks for this global initiative to promote pulses, and delighted to be part of this group. India is experiencing a sharp increase in the price of various pulses i.e. 100-250% increases during last 15-18 months. As like cereal and vegetable crops, the productivity of pulses are very low because of lack of high yielding varieties/hybrids, poor production practices, ignorance by the policy makers/ Governments, etc. Well known for protein security, soil health and low-water responsive, pulses get less attention by all, especially in India.

Further, diet diversification with Vegetable Legumes especially garden pea, cowpea, lablab bean and snap bean will certainly suffice the purpose.

Regards,

46. Peter Steele, Independent Consultant Agricultural Engineer, Italy

Hello everyone,

Boosting the value of industrial development

This has been another interesting FSN debate, highlighting as-it-does one of the most under-appreciated traditional food sectors - pulses & legumes; plants that have sustained people and their livestock since the dawn of agricultural history. It is useful to develop and take advantage of an 'International Year' given the additional focus that this will bring with the flow-on investment of resourceful people with their intellect, technologies and financial investments.

My contribution centres upon the third of the original questions that were provided with which to stimulate the debate:

What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?

In a brief desk-top study that I undertook to explore the constraints and opportunities for developing more efficient value chains for pulses and legumes in the countries of Southern Africa I summarized my findings as follows:

Given the paucity of time available with which to search, collate and analyse findings, the report briefly focuses upon opportunities for national food legumes industries in Southern Africa in the context of regional issues. On the one hand – there are the industrial realities, expanding populations and per capita consumption of food legumes that is slowly declining, but not sufficient to negate imports which continue to climb. And, on the other hand, there is lack of productivity, yields that have remained unchanged for >25 years, lack of public and private sector support and familiarity with legume crops/foods that borders on neglect. Every country in the region has a value chain for food legumes, but they have become entrenched within traditional life such that they are barely recognized for the potential that exists – and thus this potential remains under-exploited. There is no discernible regional value chain. The South African economy dominates the region; and the nine other countries included within the study work largely in partnership with and/or through South African services, expertise, facilities and/or finance in support of regional development – and if not directly, then indirectly.

There is only so much that can be achieved within an FSN debate of this kind, but if the findings of my study can be further developed by national decision-makers (and others) and, in particular, with use of the action plan proposed, then the study will have had merit. Given the internal nature of studies of this kind, the report that was produced should be considered as '*unpublished*' (see attachment).

As a final point to my contribution, I draw your attention to the threats (from the SWOT analysis model) that typify some of the constraints that impact upon the industrial development of these crops; they are:

Lack of investment in training qualified people, with provision of infrastructure and with establishment of reliable industrial producer institutions; industry slow to establish support services.

Lack of industrial leadership in regional countries; and for regional production.

More food for thought then.

Peter Steele
Agricultural Engineer
Rome, Italy

19 June 2016

Attachment:

<http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/FoodLegumesSouthernAfricaVersion.doc>

47. Teodardo Calles, FAO, Italy

Dear Participants,

The first online discussion of the International year of Pulses (IYP) is coming to an end. As I said before, I am very happy for all interesting contributions made by the participants. We will present a summary of this discussion to the IYP Steering Committee and I am sure that your comments will help us improve the second half of the IYP.

If you know or you are organizing an event on pulses, you can contact me and we can include information about the event in the website of the IYP (teodardo.calles@fao.org). Since we will probably need some additional information about some of the topics discussed here, I will contact you through email personally.

We will have another online discussion between October and November and we hope you can contribute with again.

Teodardo Calles

48. Joan Juma, Kenya

Pulses are produced solely for their seed s, the full potential can be through improving handling during cooking: soaking overnight and because of malting process the consumer gets more nutrients out of it; the soaking also reduces the problem of gas in the gastric system common with most leguminous seed products: the use of leaves most the pulses as vegetable, as one reduces the tender foliage to give way for seed formation or when one thins to get the right population, the leaves may be used as vegetables as they are rich in vitamin A , C, minerals as well as suppling the body with roughage. Example green grams are frequently recommended for detoxifying the body and getting rid of toxics in the system. Green grams are also said to have health benefits which are- fighting breast cancer, weight control, Diabetic friendly, controls blood pressure; and like other pulses a source of protein

Environmentally they fix oxygen in the soil so it is advisable to intercrop it with crops that siphon more from the soil like maize: when seed is harvested the waste may be left on the farm to be cover crop, this stores carbon in the soil which changes to soil organic carbon which is the source of soil fertility; with this results good soil structure, good soil aggregate and with this is good soil moisture retention and penetration and stable soil aggregate; with good infiltration there is less soil and nutrient erosion: soil that is healthy is also at the right structure is able to retain moisture and this means the crop(s) thrive even during soil stress.

This kind of soil may keep carbon below the soil which would otherwise be disposed to the atmosphere negatively affecting environment: when carbon is kept below the ground results in Carbon sequestration- long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change.

Economics of pulses: yield /acre may be about 6-8 bags of 90kgs and currently In Kenya 90kg bag is going for about ksh/= 9000 then from your 6 bags one should be able to get a total of about ksh/=54000 And if its 8 bags then one should be get at least ksh/=72000

Joan

49. Dr. Amanullah, The University of Agriculture Peshawar, Pakistan (second contribution)

Malnutrition is one of the major problems in Pakistan is mainly due to protein deficiency in our diet. Pulses are the major and cheaper source of protein as compared to animal protein. The production of pulses which are high yielding, disease resistant and environmentally adaptable is the key to overcome the malnutrition problem. The development of high yielding pulses cultivars needs an ample and diversified gene bank of pulses germplasm. The poor yields and overall production of many food legumes (pulses) in many parts of the world is attributed to several major constraints which include; strong competition from other food and cash crops which gave better economic returns, lack of effective research programmes and shortage of experienced personnel, and so the inevitable constraints on varietal improvement, plant introduction, and germplasm evaluation, lack of production technologies designed to maximize resource use and so ineffective crop management, inadequate extension services whereby information about new technologies can be channeled to the farming community, and the poor state of seed multiplication, certification and distribution systems. Pulses crops, because of their several unique features, including biological nitrogen fixation ability, as a rich source of vegetable proteins, adaptability to stress conditions, amenability to varying cropping patterns and multipurpose use, such as food, feed and fuel, constitute an extremely important group of crops for increased and sustained food production and food security. Because of the high N concentration in their tissues, pulses crops can increase soil N for subsequent crops or inter-crops. The high protein concentration of pulses products makes them very valuable food for humans and animals. In countries where the price of meat is too high for most people, legumes are the best protein substitute. Food legumes have an important role to play not only in increasing the quantity of food but in improving the quality of cereal based diets in many parts of Asia and Africa. The low yield potential of the existing cultivars of pulses crops (chickpea, lentils, mung bean, black bean, common bean, cow-pea and pigeon pea etc.) and the negative impact of climate change (biotic and abiotic stresses) are the major constrains for increasing availability of pulses. Efforts should therefore be made to improve the yield of pulses especially under stressful conditions.

50. Stacia Nordin, www.NeverEndingFood.org, Malawi

Programmes barely touch the surface on what they could be doing with pulses.

In Malawi only a few hybrid foreign varieties are promoted including artificial and unnecessary 'biofortified' varieties. Instead we should be looking deeper into Malawi's natural biodiversity to value and increase what we already have but what we aren't growing or using enough of. A lot more local multiplication for high quality yields of food and seed, seed banks / libraries / businesses, and value addition.

There are so many ways to use the diversity as well - help people see how to use pulses in dried, powdered, fresh, mashed, and integrated into all sorts of recipes for meals, snacks, baked goods, sprouts, drinks - we need a lot more creativity.

All of the input programmes could balanced the kgs of staple vs. pulses given - aid is often 10 kg of grain and 2 kg or pulses - when we already have too much grain in the diet and not enough protein. Giving the opposite: 10 kg pulses and 2 kg grain, or at least equivalent amounts of each sends a message to the recipients that pulses are important. Partnering the inputs with Agriculture and Nutrition Extension and Advisory Services and seed pass on programmes aids in understanding, feedback mechanisms and sustainable growth and development.

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Stacia Nordin, RD (Registered Dietitian)
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<https://www.facebook.com/nordinmalawi>
<https://twitter.com/NeverEndingFood>

51. Mirjana Gurinovic, Serbia

Dear FSN Forum,

My name is Mirjana Gurinovic MD PhD Nutrition, Scientific Research Advisor, working at the Centre of Research Excellence in Nutrition and Metabolism, Institute for Medical Research, University of Belgrade, Serbia, Belgrade www.srbnutrition.info and I am also chair of the Capacity Development Network in Nutrition in Central and Eastern Europe, CAPNUTRA, Serbia www.capnutra.org

I happy to inform you that we had very succesful event related to International Year of Pulses in Serbia in Belgrade.

Please see below the agenda of the meeting held in Belgrade.

Best Regards

Mirjana Gurinovic

International Year of Pulses 2016 Celebration

AGENDA

Date: Wednesday, 23 March 2016

Time: 15:30 - 18:00

Place: Canadian Official Residence (Užička 33, Belgrade)

15:30-15:40 **Arrival of guests and signing of the guest book**

15:40-15:45 **Welcome speech and introductory remarks**

- *H.E. Philip Pinnington, Ambassador of Canada to Serbia*

15:45-16:05 **Presentation: "Pulses for Nutrition, Health and Environment"**

- *Dr. Eleonora Dupouy, Food Safety and Consumer Protection Officer, Regional Office for Europe and Central Asia, UN FAO*

16:05-16:25 **Presentation: "Nutritional and Health Benefits of Pulses in the Diet"**

- *Dr. Mirjana Gurinovic, Scientific Research Advisor, Center of Research Excellence in Nutrition and Metabolism, Institute for Medical Research, University of Belgrade*

16:25-16:45 **Presentation: "Canadian Pulse Industry"**

- *Mr. Erik de Franciosi, Executive Vice President, Agro-Haribec Inc.*

16:45-18:00 **Cocktail**



52. Corina Carranca, INIAV, Portugal

Remark: At present, pulses belong to the Fabaceae Family, not Leguminosae.

Some countries produce large amounts of pulses, but these are not a part of their respective diets. How can the use of pulses be increased in communities where these crops do not play an important role in the local cuisine/traditional meals?

By demonstration. The Portuguese cuisine is based on the Mediterranean Diet which includes legumes in general, and pulses in particular, either as the main dish or as soup, or even for entries and desserts. We consume soup everyday, and very often the soup is prepared with pulses. Our cuisine including pulses is not new, it is very traditional. In the past, we used frequently pulses in our diet but at present the consumption has been decreasing. Actually, each Portuguese consumes about 4.1 kg pulses, mainly beans (3.2 kg) and chickpea (0.9 kg).

•Do you have any examples on how the consumption of pulses contributes to household food security and nutrition in your community or country, which may be useful in different contexts?

The Portuguese Health Ministry has strongly advertised the beneficial of replacement of animal protein for grain legumes in order to prevent the obesity, and diseases like the diabetes and heart diseases. People have been accepting the recommendation.

•What are the main challenges that farmers in your country face with regard to the production of pulses? How should these be addressed?

Farmers produce pulses depending on the subsidy politics, but also on markets. Actual production of pulses in Portugal represents only 0.4% of world production. In 2004, fababean production was 30,000 t per 3,000 ha, and for peas was 10,000 t per 1,550 ha.

Portuguese farmers know about the economic and environmental benefits of producing the grain legumes. However, in order to produce more pulses new varieties highly productive and more resistant to hydric stress are necessary.

•Are you aware of any research or studies on the role of pulses in climate change adaptation or mitigation? Please share them with us.

Portugal has an institute (INIAV) for germplasm resources and plant breeding studies. This institute has produced several bred varieties well adapted for different climatic conditions such as: five varieties for chickpea, two for peas, one for fababean, one for lentil, one for cowpea, and one for white lupine.

•The International Year of Pulses also includes a call for recipes to provide ideas and inspiration on how to consume these nutritious seeds. Would you like to share yours?

Soup with beans:

Boil in water the beans (about 350 g already cooked) with some potatoes (4 big ones), one onion, two carrots and a radish, with a piece of salt. When cooked, crush everything and add about 150 g (cooked) beans, 250 g of (boiled) spinach and some sliced spicy sausage. Adjust the water content and salt, and let it boil for few minutes. Turn off the stove and add olive oil, as you like.

Chickpea flounder (dessert):



Filling content:

500 g of cooked and skinless chickpea (grain)
500 g sugar
2 egg yolks
½ teaspoon ground cinnamon
1 lemon peel

Pasta:

500 g flour
1 cup white wine
½ cup bathes
½ cup of warm water and salt

53. Elizabeth Mpofu, Zimbabwe

Whilst it is true that the pulses play a multipurpose in the lives of people, there is also the need to share how AFRICAN rural women prepare different dishes for their families. I am sharing some recipes for one of the common pulse crop which is the cowpea (nyemba) in our national language in Zimbabwe. These recipes can be utilized by both communal and urban women.

COWPEA PASTE (RUPIZA)

INGREDIENTS

3 CUPS OF COWPEAS

PEANUT BUTTER

SALT WATER

METHOD

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 winnowing

Crush the DE hulled seed on a grinding stone until broken into very small particles

Boil the ground cowpeas until cooked

Add salt to taste

Using a wooden stick 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, rice and here in Zimbabwe it is usually served with (sadza) which is our staple food.

COWPEA and POTATO SOUP

INGREDIENTS

2 CUPS COWPEAS

500g POTATOES

4 MEDIUM SIZE RIPE TOMATOES

2 GREEN PEPPERS

1 MEDIUM ONION

VEGETABLE OIL

1 TEASPOON SALT

METHOD

Clean the cowpeas and cook until soft

Peel and wash potatoes

Put the potatoes into the cowpeas

Cook together until the potatoes are soft

Cut the pepper, Onion and tomatoes and add to the mixture

Add salt, cooking oil and cook for about 15minutes on low heat

Serve as a starter like that or with little bit of rice

54. Bhubaneswor Dhakal, Nepal (second contribution)

Dear FSN members and moderator

I hope this posting clarifies meaning and problems of “Exotic Poisoning” in agri-ecologies of pulses crops and address your curiosities. Exotic poisoning has affected farmers many ways. Three categories of them are explained here.

Category One

Most small and subsistent farmers in developing societies follow mixed, intercropping, relay cropping and terrace edge cropping practices of pulses major crops. Rice, maize, millet and wheat crops are major crop in Nepal. Traditionally most pulse crop species could sustain in poor soil. Organic matter based mycorrhiza played crucial roles in the success of the crop species and varieties. Nowadays, farmers have practiced inorganic fertilizer to take high yield advantage of exotic varieties of the major crops. The major crops are chemical input responsive or demand high doses of the inorganic fertilizer and different growth stages. Crop research and community support agencies have strategically displaced the organic input based varieties. They have done little work to improve productivity of the varieties and make competitive to inorganic fertilizer and other input based varieties. Some pulse crop varieties and mycorrhiza evolve naturally and become endemic to certain ecological pocket. Application of the inorganic fertilizer in higher dose has destroyed the organic matter based mycorrhiza which has led to crop failure of indigenous varieties and hamper the traditional cropping systems. Farmers have not easy availability of or access to improved varieties of all crop species suitable in mountain regions with diverse agro-ecologies. Some of the farmers want to grow landraces for cultural, medical and taste reasons. Therefore, the promotion of chemical input responsive varieties of major crops and inorganic fertilizer poisoned agro-ecologies of some pulses crop varieties and resulted crop failure.

Category Two

The opportunity of evolving genetic properties to be adaptive or become endemic in particular ecological pocket areas has been destroyed by introduction of exotic varieties and practicing frequent replacement of seeds from external sources. It is not a right forum to discuss detail about it but loss of the opportunity is very critical issue for environmental, socially and economically vulnerable communities and mountain region.

Category Three

Introduction of exotic varieties bring exotic pests which destroy ecological condition to sustain landraces. Considering growing behaviours the problem is most likely have occurred in pulses crops. But it is obvious in species such as vegetable crops. For example, development agencies (government and NGOs) introduced exotic early varieties of cucumber in rural communities without detail risk assessment from agro-ecological perspective. The varieties brought a pest seriously nasty for landraces. Now the pest wiped highly prolific and high yielding local varieties growing conventional season (July to November). The economic and social cost of from loss of the landraces is incomparable to with the benefit of the exotic varieties. Many communities are economically, socially (health perspective) and culturally suffering. The problem bring agencies have ignored the problem. Some critics often argued that foreign agencies strategically introduced this problem to destroy local varieties and create market for their seed.

Category Four

Cross breeding of exotic varieties with genetically superior landraces can be described as a category of exotic poisoning.

Thanks.

Bhubaneswor Dhakal

55. SGAE CIAA, Secrétariat général des affaires européennes, France

Original contribution in French

Chers collègues,

Nous vous prions de bien vouloir trouver, ci-joint, les contributions de la FRANCE à cette consultation électronique.

Très cordialement.

Pierre VELGE

Contribution français à la consultation électronique FAO:

Objet : Les légumineuses sont appréciées en raison de leurs bienfaits sur la santé, l'environnement et l'économie. Comment tirer le meilleur parti de leur potentiel ?

La France contribue à la promotion de l'agro-écologie dans toutes ses dimensions, et a, dans cette perspective, lancé un plan « protéines végétales pour la France 2014 – 2020 »[i] . Il prévoit de : développer la production de protéines végétales et renforcer l'autonomie fourragère de l'élevage français (aides couplées, mesures agroenvironnementales et climatiques, surfaces d'intérêt écologique, ect.) ;

poursuivre les efforts en matière de recherche et d'appui technique auprès des producteurs ; renforcer la gouvernance de la filière.

Les légumineuses revêtent des avantages multiples en termes de santé et de nutrition, d'adaptation au changement climatique, d'agriculture ou encore d'intérêt culturel.

Beaucoup d'espèces de légumineuses s'adaptent parfaitement à des environnements arides et marginaux, par exemple le pois cajan (*Cajanus cajan* (L.) Huth), le pois bambara (*Vigna subterranean* (L.) Verdc.) et les lentilles (*Lens culinaris* Medik.). Elles peuvent donc **améliorer la sécurité alimentaire et la nutrition**, qui sont un problème constant dans ces milieux. Elles sont particulièrement intéressantes pour les agriculteurs, qui peuvent consommer une partie de leurs récoltes, en plus d'intensifier leur production de manière durable et d'adapter les légumineuses en fonction de leurs contraintes.

Dans de nombreux pays en développement, les légumineuses représentent une source de protéines plus accessible que la viande ou les produits laitiers, notamment pour les populations pauvres, qui comptent ainsi sur les aliments d'origine végétale pour couvrir leurs besoins en protéines.

Contrairement à d'autres végétaux, elles peuvent être conservées longtemps sans perdre leur valeur nutritive.

Dans les pays les plus riches, cette substitution pour trouver des sources de protéines moins onéreuses pourrait intéresser les populations les plus démunies, d'où la nécessité de redorer l'image des légumineuses encore véhiculée comme « protéine du pauvre ».

La France souhaite participer au renforcement de leur promotion. En effet, malgré un regain d'intérêt, en particulier dans le cadre de régimes végétariens, les légumineuses sont encore peu consommées en France.

Il est ainsi crucial de sensibiliser toutes les populations à leurs avantages, en particulier les plus jeunes, par exemple via la restauration scolaire. Il serait aussi intéressant de revaloriser le patrimoine gastronomique français, dont de nombreux plats sont composés de légumineuses, ainsi que les spécificités régionales (certifications AOP, etc.).

La culture des légumineuses permet aussi de réduire les émissions de gaz à effet de serre (GES), en particulier des émissions liées à l'épandage d'engrais agricole, via la fixation symbiotique. En France, en 2011, les secteurs de l'agriculture et de la sylviculture représentaient 20 % des émissions

de gaz à effet de serre, dont 51 % sous forme de protoxyde d'azote (N₂O). En introduisant les légumineuses dans les rotations agricoles, les agriculteurs diminuent les apports d'engrais car leur culture ne nécessite pas d'apport azoté et permet de fertiliser le sol pour les cultures suivantes.

Bonnes pour l'environnement et à la fois viable économiquement, les légumineuses sont à prendre en compte dans les rotations culturales. De plus, chaque région peut trouver une espèce adaptée à ses conditions.

En agroforesterie, l'intégration de haies de légumineuses en fait un système de production valable **pour lutter contre l'érosion du sol et la perte en matière organique et en éléments nutritifs** : exemple de la méthode d'*alley-cropping* (système de jachère simultanée) ou bien du caroubier en Méditerranée.

Utiliser les légumineuses **économise également le combustible fossile** servant à produire les engrais azotés, dont la combustion émet des GES, ainsi que les émissions de N₂O lors du processus industriel de production de ces engrais. Elles constituent donc un levier important de réduction des GES en agriculture, soit par la réduction de la consommation de fertilisants azotés de synthèse, dans les agricultures qui en consomment beaucoup soit par amélioration de la fertilité des sols et diminution de la pression sur les terres, dans les autres.

En augmentant les légumineuses en France à 1,3 Mha en cultures et 2,8 Mha en prairies, l'INRA estime la réduction possible des émissions de **gaz à effet de serre** à 1,4 Mt éqCO₂ à l'horizon 2030.

Ce gain potentiel de GES ne tiendrait par ailleurs pas compte de la marge de progrès encore possible en matière d'itinéraires techniques sur ces légumineuses. Passer de 3 % à 7 % de légumineuses dans les terres arables permettrait également de diminuer de 10 % la consommation totale annuelle d'engrais azoté en France.

Exemple de projet pilote, engagé en 2011 pour valoriser les services environnementaux associés à ces cultures : Convertir des hectares de légumineuses en crédits carbone, regroupés par InVi AgroSolutions pour être valorisés sur le marché du carbone. Pour l'instant 11 coopératives et 316 agricultures ont répondu positivement, regroupant une surface totale de 4 723 ha en 2011-2012.

Pour plus de détails :

http://www.unip.fr/uploads/media/Acceder_aux_credits_carbone_avec_chaque_hectare_supplementaire_de_proteagineux.pdf

Publication « Les légumes secs, quelles initiatives territoriales, Réseau action climat », avec le soutien du MEEM, du MAAF et de l'ADEME :

http://www.rac-f.org/IMG/pdf/publi-leI_gumes_secs-web-finale.pdf

[i] <http://agriculture.gouv.fr/le-plan-proteines-vegetales-pour-la-france-2014-2020>

English translation

French contribution to the FAO online consultation:

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

France contributes to the promotion of agro-ecology in all its dimensions, and has, with this in view, launched a plan « protéines végétales pour la France 2014 – 2020 » [vegetable proteins for France][i]. It foresees:

development of the production of vegetable protein and reinforcement of the autonomous feeding of French livestock (coupled support, agro-environmental and climatic measures, areas of ecological interest, etc.);

continued efforts in terms of research and technical support alongside producers; reinforcement of governance in the sector.

Pulses include multiple advantages in terms of health and nutrition, adaptation to climate change, of farming or even cultural interest.

Many species of pulses adapt perfectly to arid and marginal environments, for example, the pigeon pea (*Cajanus cajan* (L.) Huth), the bambara bean (*Vigna subterranean* (L.) Verdc.) and the lentils (*Lens culinaris* Medik.). They can, therefore, **improve food security and nutrition**, which are a constant problem in these environments. They are particularly interesting for farmers, who can consume a part of their harvest, as well as intensify their production in a sustainable form and adapt the pulses according to their constraints.

In many developing countries pulses represent a more accessible source of proteins than meat or dairy products, in particular for needy populations who count on vegetables to cover their protein needs.

Contrary to other vegetables, pulses can be stored for a long time without losing their nutritional value.

In the wealthiest countries, this substitution in order to source less expensive protein could interest the populations most in need, from which arises the requirement to restore the image of pulses still known as the 'protein of the poor.'

France wants to participate in the reinforcement of the promotion of pulses. In fact, despite some growth in interest, in particular in the context of vegetarian diets, pulses are still not much consumed in France.

It is thus crucial to make everyone aware of their advantages, especially the young, for example through catering in school. It will also be interesting to re-evaluate the French gastronomic heritage, where many dishes contain pulses, as well as the regional specialities (Control Designation of Origin AOC/AOP certifications, etc.).

Cultivating pulses leads to a reduction in the greenhouse gas effect (GHG), in particular, the emissions linked to the spreading of agricultural fertilizers, through symbiotic fixation. In France in 2011, the agricultural and sylviculture sectors represented 20% of the emission of greenhouse gases, of which 51% was in the form of nitrous oxide (N₂O). When pulses are introduced into agricultural rotations, farmers reduce the use of fertilizers because their culture does not need the addition of nitrogen and leads to the fertilization of the soil for the next crops.

Good for the environment and at the same time, economically viable, the pulses are to be taken into account in crop rotations. Furthermore, each region can find a species adapted to its conditions.

In agroforestry, the integration of strips of pulses becomes a valuable production system **to fight against erosion of the soil and the loss of organic matter and of nutritional elements**: for example the alley-cropping method (system of simultaneous fallow land) or indeed the carob tree in the Mediterranean.

Using pulses **also reduces the GHG emitting combustion of fossil fuel**, used to produce nitrogen fertilizers, as well as emissions of N₂O from the industrial production process of these fertilizers. Pulses constitute therefore, an important aid in the reduction of GHG in farming, whether by the reduction in the consumption of synthetic nitrogen fertilizers in those agro-systems that use a lot of it or through the improved fertility of the soil and the reduction of pressure on the land, in the other agro-systems.

By increasing the pulses in France to 1.3 Mha in crops and 2.8 Mha in grasslands, the INRA [French National Institute for Agricultural Research] estimates the possible reduction of **greenhouse gas** emissions at 1.4 Million tons equivalent CO₂ by 2030.

This potential gain of GHG would not take into account the margin of progress still possible in terms of technological advances for these pulses. To go from 3% to 7% of pulses in arable land would also lead to a reduction of 10% in the total annual consumption of nitrogen fertilizers in France.

Take the example of a pilot project, initiated in 2011 to evaluate the environmental benefits associated with these crops: To Convert hectares of pulses into carbon credits, regrouped by InVi AgroSolutions in order to be valued in the carbon market. For the moment, 11 cooperatives and 316 agricultural businesses have responded positively, totalling an area of 4 723 ha, in the period 2011-2012.

For more details:

http://www.unip.fr/uploads/media/Acceder_aux_credits_carbone_avec_chaque_hectare_supplementaire_de_proteagineux.pdf

Publication « Les légumes secs, quelles initiatives territoriales, Réseau action climat », avec le soutien du MEEM, du MAAF et de l'ADEME:

http://www.rac-f.org/IMG/pdf/publi-lel_gumes_secs-web-finale.pdf

[Dried pulses, territorial initiatives, Action Climate Network, with the support of MEEM [French Ministry of the Environment, Energy and the Sea], MAAF [French Mutual Insurance for Craftsmen] and ADEME [French Environment and Energy Management Agency]]

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/20160620_Contribution%20fran%C3%A7aise%20%C3%A0%20la%20consultation%20%C3%A9lectronique%20FAO.pdf

56. Shehu Muhammad Dandago, International Institute of Tropical Agriculture (N2Africa – Borno Project), Nigeria

Thanks for the discussion post which is very informative and insightful. Looking forward to future participation which iam unable to do due to being out in the field planting Soybean, Groundnut, Cowpea trials plots of diagnostic,demonstration and adaptation in the project area. Our project N2Africa-Borno Project have various activities on grain legumes ranging from Introduction of legumes production technologies such as inoculation, rightful/correct use of SSP fertilizer, and the general Agronomic practices of legume to small holder farmers with the aims of improving farmers yield and income, improve farmers family nutrition as well as improving soil health in the farmers field. Improved varieties that are drought tolerant, striga resistant, high grains and fodder yield and high oil content varieties of the a fore mentioned crops are also introduced to the farming communities. Also we are into training of youth on the production, processing and Agribusinesses along the said crops value chains.

Thanks.

Shehu Muhammad Dandago.

57. Dr. Amanullah, The University of Agriculture Peshawar, Pakistan (third contribution)

Please find attached a file on IYP-2016.

Dr. AMANULLAH
PhD (Pak) & Post-Doc (USA)
Associate Professor

**Department of Agronomy
Faculty of Crop Production Sciences
The University of Agriculture Peshawar**

Attachment: <http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/ECAG-01-ECO-IYP2016.pdf>

58. Kadambot Siddique, UN FAO Special Ambassador for the International Year of Pulses 2016, Australia

Dear all,

Please find attached recent article I wrote for Australia's largest conservation (No-Till) agriculture farmer group (WANTFA).

Kind regards.

**Professor Dr Kadambot Siddique, AM CitWA FTSE FAIA FNAAS
Hackett Professor of Agriculture Chair and Director
UN FAO Special Ambassador for the International Year of Pulses 2016**

Attachment:
http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Article_Kadamot%20Siddique.pdf