



 Proceedings

Innovations in agriculture to improve nutrition. Share your success stories

Collection of contributions received

Discussion No. 115 from 18 May to 5 June 2015

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Introduction to the topic

The primary role of agriculture is to grow food for human consumption, and the agriculture sector has been largely successful in producing sufficient food to meet the energy (or calorie) needs of the rising global population. However the persistence of undernutrition, and food and nutrition insecurity in many parts of the world, especially sub-Saharan Africa and South Asia, highlights that considerable progress is still required to ensure equitable access to a diversified and nutritious diet.

Agricultural policies have historically supported the production of key staple grains such as rice, maize and wheat. While these staple crops are good sources of dietary energy, they typically fail to provide sufficient micronutrients (vitamins and minerals), and therefore only form part of what is considered a nutritious diet. Recently there has been a significant effort to identify agricultural policies and practices that can improve both food and nutrition security.

Many interventions in agriculture have been designed to have an impact on nutrition outcomes. Home and community gardens, support for livestock and aquaculture, cash-cropping and cultivation of biofortified crops are some good examples. However, we are certain that beyond these well-known agricultural interventions, it is likely that there are many exciting, local and grassroot-led innovations in agriculture and livestock/fisheries production, which currently do not have the necessary evidence base of their impact on nutritional status that would justify their upscaling and broader implementation.

To learn more about such innovative approaches, [Leveraging Agriculture for Nutrition in South Asia \(LANSA\)](#) programme is engaged in cooperation with FAO's FSN Forum in running this online discussion.

LANSA is a multi-partner research effort led by the MS Swaminathan Research Foundation in Chennai, India. The focus of LANSA is to understand the role of agricultural policies and practices in improving nutrition in Afghanistan, Bangladesh, India and Pakistan. A key part of LANSA is the involvement of local partners to conduct research through a [competitive grant funding scheme](#), the second round of which will take place in July 2015.

Goal of the consultation: While we are aware of some agricultural innovations that may support nutrition outcomes we do not know them all! So the goal of this consultation is to ask for your input, based on your expert knowledge, to identify potential ideas of innovations in agriculture that could promote better nutrition of the population in the South Asian region. We specifically are looking for new interventions in agriculture that require formative research to aid their design, and/or research to understand their feasibility before being tested in large intervention studies. We also have an eye on the future and on the likely impact of environmental change on agricultural production. Ideally, the consultation will provide a list of promising interventions in agriculture with a potential for upscaling and that could benefit from further support.

Based on your knowledge and experience (in agriculture, food systems, nutrition, or even just on time spent growing your own food), the questions for this consultation are:

1. Are you aware of an untested innovation in South Asian agriculture that has the potential to have a major impact on nutrition and health in the region?
2. Are you aware of a tested or untested innovation in Africa or other world region that could be introduced or adapted to the South Asian region and has the potential to improve nutrition outcomes in the South Asian context?

3. Among these innovations, are there any interventions in agriculture that might also help to reduce the likely impact of multiple environmental changes on agricultural production in South Asia?

These are challenging questions and we are looking forward to your views and opinions to help us define the priorities for this research call. We really hope that by using this consultative platform we will reach out and elicit responses from you whatever your background or expertise. We need innovative thinkers like you to solve some of the world's largest problems. And there is always the chance that your ideas will drive a whole new research agenda!

We are really looking forward to reading your responses. Thank you for your time and for sharing your knowledge and expertise!

Best wishes,

Professor M S Swaminathan Founder-Chairman MSSRF & LANSA Consortium Advisory Group Member	Dr. Alan Dangour Reader - LSHTM LANSA Pillar 3 Lead Researcher
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Contributions received

1. Santosh Kumar Mishra, S. N. D. T. Women's University, Mumbai, India

Food systems provide for all people's nutritional needs, while at the same time contributing to economic growth. The food and agriculture sector has the primary role in feeding people well by increasing availability, affordability, and consumption of diverse, safe, nutritious foods and diets, aligned with dietary recommendations and environmental sustainability. Applying these principles helps strengthen resilience and contributes to sustainable development.

However, hunger, malnutrition, and poor health are widespread and stubborn development challenges. Agriculture has made remarkable advances in the past decades, but progress in improving the nutrition and health of poor farmers and consumers in developing countries is lagging behind. For instance, in Zambia, 45% children under five years old – almost one million -- are stunted. 'Stunting' is a technical term used by nutrition and public health specialists that refers to low height for age – a key indicator of child health. This is a result of chronic malnutrition, which is usually caused by the lack of good-quality food and poor access to health care particularly in the 1,000-day window between pregnancy and a child's second birthday.

Agricultural programmes and investments can strengthen impact on nutrition if they:

- incorporate explicit nutrition objectives and indicators into their design, and track and mitigate potential harms, while seeking synergies with economic, social and environmental objectives.
- assess the context at the local level, to design appropriate activities to address the types and causes of malnutrition, including chronic or acute under-nutrition, vitamin and mineral deficiencies, and obesity and chronic disease. Context assessment can include potential food resources, agro-ecology, seasonality of production and income, access to productive resources such as land, market opportunities and infrastructure, gender dynamics and roles, opportunities for collaboration with other sectors or programs, and local priorities.
- target the vulnerable and improve equity through participation, access to resources, and decent employment. Vulnerable groups include smallholders, women, youth, the landless, urban dwellers, the unemployed.
- collaborate and coordinate with other sectors (health, environment, social protection, labor, water and sanitation, education, energy) and programs, through joint strategies with common goals, to address concurrently the multiple underlying causes of malnutrition.
- maintain or improve the natural resource base (water, soil, air, climate, biodiversity), critical to the livelihoods and resilience of vulnerable farmers and to sustainable food and nutrition security for all. Manage water resources in particular to reduce vector-borne illness and to ensure sustainable, safe household water sources.
- empower women by ensuring access to productive resources, income opportunities, extension services and information, credit, labor and time-saving technologies (including energy and water services), and supporting their voice in household and farming decisions. Equitable opportunities to earn and learn should be compatible with safe pregnancy and young child feeding.

- facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock (for example, horticultural products, legumes, livestock and fish at a small scale, underutilized crops, and bio-fortified crops). Diversified production systems are important to vulnerable producers to enable resilience to climate and price shocks, more diverse food consumption, reduction of seasonal food and income fluctuations, and greater and more gender-equitable income generation.
- improve processing, storage and preservation to retain nutritional value, shelf-life, and food safety, to reduce seasonality of food insecurity and post-harvest losses, and to make healthy foods convenient to prepare.
- expand markets and market access for vulnerable groups, particularly for marketing nutritious foods or products vulnerable groups have a comparative advantage in producing. This can include innovative promotion (such as marketing based on nutrient content), value addition, access to price information, and farmer associations.
- incorporate nutrition promotion and education around food and sustainable food systems that builds on existing local knowledge, attitudes and practices. Nutrition knowledge can enhance the impact of production and income in rural households, especially important for women and young children, and can increase demand for nutritious foods in the general population.

Most importantly, increasing women's participation in agriculture and related activities is of great significance for improving nutrition and reducing hunger worldwide. Women play a vital role in advancing agricultural development and food security. They participate in many aspects of rural life – in paid employment, trade and marketing, as well as many unpaid activities, such as tending to crops and animals, collecting water and wood for fuel, and caring for family members. Women also manage household consumption and food preparation. But women face many constraints in the multiple activities they pursue – less land ownership, access to credit, extension and other services, and ability to hire labor. Too often, these constraints as well as women's current and potential contributions to agricultural production go unrecognized.

Increasing opportunities for women can have a powerful impact on productivity and agriculture-led growth. Women are just as efficient agricultural producers as men and can achieve similar yields when given equal access to resources, including training and services. For example, in Kenya, researchers found that women could increase their crop yields by approximately 20 percent if given the same access to the same resources as men. In Burkina Faso, it has been estimated that overall household production could increase by about six percent by more equitably distributing fertilizer and labor between male and female-farmed plots. The Food and Agriculture Organization of the United Nations (FAO) estimates that if women had the same access to productive resources as men, they could increase yields on their farms by 20–30 percent. This increase could raise total agricultural output in developing countries by 2.5 – 4 percent and reduce the number of hungry people in the world by 12–17 percent, up to 150 million people.

When women's productivity and incomes increase, the benefits amplify across families and generations. Women tend to devote a larger fraction of their income to their children's health and nutrition, laying the foundation for their children's lifelong cognitive and physical development.⁶ In Nepal, for example, the children of women who own land are twice as likely to be adequately nourished than children in households where women work on family land they do not own or

children growing up in landless households. Mothers who own land are better able to provide more nutritious food to their children and ensure their health and wellbeing.

Strengthening women's power, influence, and decision-making roles within the family and community can be an effective strategy to improve their consumption of nutritious foods and their health. In many parts of the world, women are more likely than men to spend the income they control on food, health care, and education for their children. Thus, increasing women's access to land, ability to make decisions about land use, and control of physical and financial assets will not only increase agricultural production, but also improve child health and nutrition. Empowering women to promote healthy, diverse diets through the production and consumption of nutrient-rich crops using local food systems is critical for ensuring food and nutrition security. The U.N. Food and Agriculture Organization estimates that if women had the same access to productive resources as men, they could increase yields on their farms by 20-30 percent and reduce the number of hungry people in the world by 12-17 percent.

Incorporating gender-sensitive nutrition components into policies and programs can avoid unintended gender impacts that undercut the effectiveness of these initiatives. In addition to providing women and girls with more opportunities to participate, gender-sensitive nutrition programs measure the impact of planned activities on women and men. Efforts to improve women's nutritional status will be most effective if conducted in conjunction with programs that aim to improve the status of women and reduce gender inequalities.

While planning or evaluating nutrition interventions, it is important to understand the social and gender dynamics that could help or hinder their effectiveness. A gender analysis will help answer questions such as:

- What are the demographics of the affected group, disaggregated by sex and age?
- What decisions do women and men make that affect family nutrition?
- Who makes the decisions about breastfeeding - whether or not to breastfeed, when to start, how long to continue? This could be a mother herself, but might be her mother-in-law or husband.

Lastly, integrated agriculture and nutrition programs have great potential to improve nutrition outcomes, but evidence so far is scarce due to weaknesses in program targeting, design and implementation and equally importantly, poor evaluation designs. Using an agricultural platform to improve nutrition is also useful in sustainable development initiatives.

2. Alexandre Tona Tona, Université de Kinshasa, Belgium

Original contribution in French

Il serait intéressant de produire de tables alimentaires locales pour proposer des formules alimentaires sur base des produits locaux qui ne sont pas souvent prises en compte. C'est la responsabilité des acteurs locaux pour chaque coin. Les populations locales doivent être encadrées en tenant compte de leurs habitudes alimentaires. Le correctif a apporté, doit être basé sur l'analyse de leurs repas et essayer de trouver la solution localement, sans trop dépendre de l'extérieur. Il y a de bonnes combinaisons sur base des produits locaux qui ne sont pas vulgarisées par manque des moyens et je suis convaincu qu'un peu partout, les gens travaillent mais il y a un manque de synergie entre différents acteurs.

English translation

It would be interesting to tabulate local foods in order to propose feeding patterns on the basis of local products which are not often taken into account. The local actors must be responsible for every corner of their area. The local population must be supported taking into account their feeding habits. The remedy to be applied must be based on an analysis of their meals and should try to find a local solution, without being too externally dependent. There are good combinations based on local products which are not popularized due to a lack of means and I am convinced that somehow everywhere people are working, but there is a lack of synergy among the different actors.

3. Barbara Harriss-White, Oxford University, United Kingdom

I'm a member of LANSAs advisory group.

This blog (Secure Nutrition, Ed.) is very clear about progress made in FOUR areas that link ag to nutrition: 1. f and v gardens; 2. livestock (poultry); 3. bio- fortification; and 4. cash crops (where they increase income).

1-3 are direct links where and when production is for subsistence (as well as for market).

All 1-4 are indirect links in conditions where marketed surplus results in a) higher incomes which lead to b) better quality food expenditure.

Both those links needs substantiating (This was done by IFPRI and others in the late 1970s and 80s; but exchange conditions have greatly changed since then).

However I am surprised you haven't mentioned other indirect links - and maybe this is where research should be developed.

5. Income-> nutrition - via **agricultural labour**. Research on agriculture wages, incomes and food expenditure.

6. Malnutrition in children - >'**agriculture plus**'. Look at **sanitation**. Alan has worked on this. It has got to be related (even if normatively) to agriculture.

Research needed on human waste and other biodegradable wastes; manure and recycling to agriculture; and on human waste, disease and nutrition (which may neutralise the beneficial effects of ag for nutrition).

(I have just returned from first-hand field research on the social relations of waste in and around a small town so I am very aware of the present costs of liquid and solid pollution and the catastrophe that is in the making.)

7. Nutrition and women -> research on the **gendered control of food** production-distribution-consumption-waste-reconstitution. (Again lots in the 1980s – though not fully systemic - what has happened to it?)

8. Interested that organic ag and SRI aren't in the frame. Perhaps there's another indirect link between agriculture, gaseous pollution and long term conditions of soil, water, energy economy, livelihoods and health.

<http://www.southasia.ox.ac.uk/resources-greenhouse-gases-technology-and-jobs-indias-informal-economy-case-rice>

All best,

Barbara

Barbara Harriss-White: Senior Research Fellow, Area Studies, Emeritus Professor of Development Studies, Oxford University, Co-ordinator, South Asia Research Cluster, Wolfson College, Oxford

<http://www.southasia.ox.ac.uk/resources-greenhouse-gases-technology-and-jobs-indias-informal-economy-case-rice>

4. Maruthi Vegapareddy, Central Research Institute for Dryland Agriculture, India

Dear Sir,

In order to improve the micronutrition of children or rural people,

If we issue part of the wages in the form of "Kind" instead of complete cash mode: In our childhood days we (children) were asked to shell the groundnuts for money and sometimes they give away part of the shrivelled groundnut seeds as "kind" form. Since this task is being done by machines and also due to the law act against child labour, kind form of wages became extinct. This process/mechanisation could be different but issuing the wages parts in the form of "kind" could be brought into practice again.

Thanks

V.Maruthi

Dr (Mrs.) V.Maruthi

Rothamsted International Fellow (U.K.)

Principal Scientist (Agronomy)

Central Research Institute for Dryland Agriculture Hyderabad,(A.P.), India

5. Aimée Hampel-Milagrosa, German Development Institute, Germany

On recent visit to my home country, the Philippines, I was amazed at how a microentrepreneur managed to harness the vitamins and minerals from mangosteen, and provide it in capsule form. Mangosteen has proven to be rich in anti oxidants and tannins that can cure a range of illnesses, from heart problems, joint pains, allergies to cancer. The mangosteen capsules (and now in coffee and tea form) could be procured almost everywhere, however the technology has proven to be exclusive that prices are still non affordable for the masses. I would like to propose testing mangosteen for mass production into capsules or into tea form so that poor people would also avail of it. Alternatively, similar to mangosteen, I would also like to propose testing pomegranate for its properties and for possibility for mass production. Pomegranate is produced in south India and could be an alternative source of natural medicines for the poor.

6. Maruthi Vegapareddy, Central Research Institute for Dryland Agriculture, India

Dear Sir,

India is endowed with many types of millets like pearl millet, foxtailmillet and many more but in a small area. These millets are not only drought tolerant but also nutritious. As it is being done in case of oats and maize- value added foods (may be nutritious flakes/powder which can be prepared into a dish easily (Upma) which if pass through a separate supply chain to reach Anganwadi schools is being proposed for improved nutrition of children.

Once this product is accepted, supply chain expansion can be envisaged bringing some Government hostels under this umbrella leading to increased area under these crops. It is a win-win situation.

7. Wajid Pirzada, SAFWCO Foundation, Pakistan

Dr.

Dear FSN Team,

Greetings from SAFWCO Foundation, Islamabad!

We understand that the looming threat of climate change (CC) is risking food/nutrition security in general in marginal settings and of forest-dependent communities in particular. At the same time, CC related risks has further heightened the debate around role of forests in sustainable development, for forests as sink of Green House Gases (GHGs) have a key role in CC mitigation and well-developed forest-based GHGs sink can help avert risks of CC, including around food security & nutrition.

At the same time there is need to scope, invest in and promote innovative agricultural/livestock skills, practices & technologies that will help mitigate CC on one hand and smoothen paradigm shift to Green economy on the other. Use of clean technologies in agriculture is one such area.

Kindest regards,

Dr. Wajid Pirzada
Executive Director
SAFWCO Foundation
Islamabad, Pakistan.
Blog: www.wajidshah.blogspot.com

8. B Cole, National Algae Association, United States of America

Based on your knowledge and experience (in agriculture, food systems, nutrition, or even just on time spent growing your own food), the questions for this consultation are:

1. Are you aware of an untested innovation in South Asian agriculture that has the potential to have a major impact on nutrition and health in the region? YES
2. Are you aware of a tested or untested innovation in Africa or other world region that could be introduced or adapted to the South Asian region and has the potential to improve nutrition outcomes in the South Asian context? YES
3. Among these innovations, are there any interventions in agriculture that might also help to reduce the likely impact of multiple environmental changes on agricultural production in South Asia? YES

Algae is the fastest growing plant in the universe. It can be grown on non-arable land, recycling 85% of all water used and consumes CO₂. The US taxpayer has spent over \$2.5 billion on algae research over the last 60 years. Algae research grant recipients at major universities have stated "all algae technology hurdles have been met. It's all engineering and scale-up".

The algae technology has been proven. Third world countries have already grown Spirulina for food. What can our non-profit algae education and trade association do to provide a solution to end malnutrition?

The question is: Does the FAO want to continue doing more research for the next 60 years (after algae research grant recipients stated no more is needed) and purchase more algae research reports or do they want to roll up their sleeves and 'fix' the malnutrition problem using algae for food, feeds and other co-products?

9. Jerome Bossuet, Consultant, United Kingdom

Fighting malnutrition requires a holistic and multidisciplinary approach as expressed in a previous [blog post](#). 2 general comments below.

Targeting where impact could be greatest: Malnutrition is higher in rural areas, especially in the drylands where poverty and climate vulnerability is high; women, young children and elderly are particularly vulnerable; pregnant women and breastfeeding mothers are priority targets [1,000 days opportunity window];

A group that is rarely reached out in agriculture programmes: rural workers and subsistence farmers. Which public institutions are in charge to tackle poverty and malnutrition issues? Agriculture or Social Protection? One innovation that could improve diet diversity for these vulnerable groups and should be further studied/impact assessed: Nutri-Kitchen gardening kits [for instance promoted through ICRISAT watershed programme] including for instance vegetable seeds, [low cost drip system](#), support for small chicken husbandry, etc. There is a field of research to design the kit and the type of intervention [public support or social business model] as well as impact assessment.

Such vulnerable groups are not homogeneous so social longitudinal studies to understand trends and drivers of change for better nutrition in the targeted malnourished population are important. See for instance [Minimum nutrition dataset for agriculture](#) (Tata Cornell Initiative) under the Village Dynamics Studies research programme. To understand the change of dietary patterns through the years (from 1970s), across gender and age, and identify statistically potential drivers (policies, introduction of technology, household economics, ...). Read [latest insights of this study](#) [April 2015]

Responsibility of food industry – marketing of nutritious foods:

In agrifood policies, often value chain approach prevails to conceptualize how market forces can work so that poorest can have access to more nutritious foods. The reality is that junk foods tend to be much cheaper than healthier diets [[ODI, 2015 rising cost of healthy diet report](#)]. Urbanization and marketing of urban lifestyle in rural areas mean an increasing homogeneity towards energy-dense easy-to-eat foods and decrease of more nutritious “indigenous crops” like millets. It has health consequences, with rise of diabetes and other food related ailments [[Khoury, 2014](#)]

From the point of view of the poor, the choice to eat nutritious food is not only economic, social norms play a strong role. Drivers of purchase act include: Hedonism (appeal of sugar and oil) and convenience food [eg rice easier/quicker to cook compared to coarse cereals]. There is a responsibility of the food industry, and governments could act through tax for instance. It is important to review and assess the impact of tax on junk food like the tax on sugary drinks in Mexico in 2014.

Funds should be allocated funds to promote nutritious and climate resilient crops like millets, sorghum and grain legumes that are key for dryland farmers. A more diversified farming system (rotation) and growing more water-efficient crops will also improve water and soil resources [See for instance [ICRISAT's smart foods campaign](#) and also in Andhra Pradesh India, the [Millet Network of India's](#) efforts to promote iron-rich millet].

I would also point out the recent study proving that [iron-rich biofortified pearl millet can reverse iron deficiency in school aged Indian children in 6 months](#). It highlights the potential of biofortification, and looked also at the important aspect of bioavailability.

Innovation in Africa that could be transferred in South Asia: The concept of Field nutrition schools, a participatory and practical nutrition programme [scheme of nutrition training of trainers chosen among the targeted rural population] has improved nutrition situation in rural South Mali. [article on Guardian professional network [Rebranding bran: teaching nutrient-rich cooking in Mali](#)]. The theory of change: Better nutrition education of young mothers/pregnant women and men [with adoption of good practices too, eg breastfeeding, pregnancy health follow-up, hygiene] and adoption of more nutritious recipes using local products [dryland cereals + legumes +

fruits/vegetables/tree products rich in vitamins and essential minerals] and better food preparation [eg looking at whole grain sorghum, impact of grain decortication, fermentation or malting on iron/zinc bioavailability]. More details : [An Be Jigi project](#) ; also look at [INSTAPA](#) research project.

How this concept of field nutrition school could be adapted in South Asia? [Dr Swaminathan has called for “community hunger fighters”]

Involving women in practical cookery sessions is powerful, well adapted for illiterate target population. Could be linked to other government initiatives like the promotion of clean stoves in South Asia.

10. Manuel Moya, International Pediatric Association, Spain

Dear Professor Swaminathan, Dear Dr. Dangour,

As a doctor I have no personal stories to relate but as dealing with Undernutrition in under 5s, we are really worried about the low content of essential amino acids in common grains. Therefore I should answer your two first questions as ‘not aware’.

In respect to the third one I must say that one of the problems using maize or sorghum (Africa) grains is the lack of Lysine in them. As there is a gene (cordapA) that increases the production of Lys and also of other amino acids already tested in maize and available from ISAAA.org, I bring to your consideration the possibility to start a pilot program using these genetically modified grains.

Should you require further information please contact me again.

Yours sincerely

Manuel Moya

Catedrático E/ E Professor & Head

Chair of the Technical Advisory Group on Nutrition of International Pediatric Association (IPA)

Editor in Chief of IPA Newsletter

Board of Directors of IPA Foundation

Vice-President of European Pediatric Association

Academician of the Real Academia de Medicina

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11. James T.J, Peermade Development Society India, India

I am happy to share the success story of reviving and propagating local cow pea varieties cultivated by the Tribal groups in Kerala with their participation for their nutritional security. The efforts were supported by ITPGRFA, FAO through its benefit sharing fund,

We have documented four different varieties of cowpea (Vigna sp -local name Njanda, Peenius , Karimpayaru, Thatathi) cultivated by ‘Uraly’ Tribal group in Kerala, These cow pea varieties were

major item in their traditional food habits , but these varieties have vanished from their area due to several season and we found only a few old women were cultivating these varieties . Though the tribal groups , especially women were nostalgic about the recipes based on these crops and their leaves , enough material is not available.

With the support of ITPGRFA , we have supported these identified women to propagate and raise more seeds and we purchased these seeds from them and supplied to other women members and also constituted a revolving fund for cultivating these varieties for giving loans for cultivating these local variety . The response was very interesting and more and more women started showing interest in the cultivation and at present more than 40 women are actively cultivating these varieties and also they started preparing local recipes based on these varieties.

The importance of providing incentives for persuading the women to revive local varieties is one of the key lessons in our intervention

Regards

James

12. Manoj Kumar Behera, NRMC, India

Hi everyone,

Happy to share some of my experiences around the topic. The first one is about the most popular integrated farming model i.e. Coconut based agroforestry in coastal Odisha...here, farmers use to cultivate paddy straw (in kharif) and dhingri (winter season mushroom) mushroom between two rows of coconut plants. This is the most common and popular farming system in coastal Odisha especially in Puri district. This can be an adaptation and mitigation tool in context of climate change.

http://www.crrin.in/crrin_story.htm

Besides, farmers in Dhenkanal area have shown interest in popularizing the off season mushroom cultivation under Bamboo based poly houses which seems to be farmer's friendly and economically feasible (normal size costs around 15000-20,000).

Above all the practice of raising Babul (*Acacia nilotica*) trees along the farm boundary with paddy as the intercrop has enabled the farmers in increasing the production and productivity as well as ensuring nutritional security of livestock which has a lot to do with nutritional security of human beings as well.

You all may well aware of kitchen garden and nutritional garden concept. In Odisha it is most common and you will find it in almost all villages or rural households. The plot is called as "Bari" in local language and mostly comprises of 3-4 tiers (Silvicultural trees, Horticultural/Fruit Trees/, Shrubs, Seasonal vegetables or greens). This has tremendous potential to fill up the vacuum of food and nutritional security of human beings and livestock at the household level.

13. B Cole, National Algae Association, United States of America

Dear Dr. Swaminathan:

We are a non-profit algae education and production trade association made up of commercially-minded algae researchers, algae producers and equipment companies. We have been trying to communicate to the FAO that US taxpayers have spent billions on algae research over the last 60 years and algae is one solution to eliminate malnutrition in children. We offer education, job training and new business opportunities to anyone in your group who is interested in algae farming and indoor biomanufacturing.

Our commercial algae farmers grow algae for food, feed and higher value co-products. Algae are used to clean wastewater and sequester CO₂. It doubles every 24-48 hours and can be harvested every few days. If the FAO is looking for one solution to put into action algae farms can be built on non-arable land that has a source of water (recycling 80% of water used in closed-loop growing systems) and a source of CO₂ anywhere in the world. If you have any interest, please feel free to contact: info@nationalalgaeassociation.com

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

La sécurité alimentaire et nutritionnelle est devenue une épine dans les orties du développement dans le monde en général et en particulier en Afrique et en Asie. Tout porte à croire que les diverses initiatives qui se prennent depuis des décennies ne marchent pas à la vitesse qu'il faut. D'après FAO et al. (2014), on continue de progresser dans la lutte contre la faim dans le monde: on estime qu'environ 805 millions de personnes étaient en situation de sous-alimentation chronique en 2012-2014, soit une diminution de plus de 100 millions de personnes sur la dernière décennie, et 209 millions de personnes de moins qu'en 1990-1992. Sur la même période, la prévalence de la sous-alimentation est passée de 18,7 à 11,3 % dans le monde et de 23,4 à 13,5 % dans les pays en développement. L'Afrique subsaharienne est la région où la prévalence de la sous-alimentation est la plus élevée, et les progrès accomplis ces dernières années y ont été modestes. Dans cette région, environ une personne sur quatre reste sous-alimentée. L'Asie, la région la plus peuplée du monde, compte toujours le plus grand nombre de personnes sous-alimentées. Les auteurs parviennent à la conclusion qu'il faut créer un environnement plus propice à la sécurité alimentaire et à la nutrition.

A notre avis, la vraie cause de la persistance de la sous-alimentation et de la malnutrition en Afrique se trouve dans les mauvais choix stratégiques des pays. Dans beaucoup de pays africains, les choix stratégiques de la production agricole sont orientés sur des spéculations d'exportation, au détriment des productions vivrières. L'Afrique s'engage dans des spéculations qui ne lui procurent pas d'avantage comparatif; des spéculations faiblement consommées par le marché intérieur (donc par les populations) et qui, par surcroît, rendent l'Afrique fortement dépendante de l'extérieur, alors même qu'elle est désavantagée par la faible productivité et la faible part de marché qu'elle peut conquérir. Par exemple, l'Afrique s'illustre dans la production cotonnière alors qu'elle consomme seulement 1 % de la production mondiale de coton et le rendement y est le plus bas dans le monde (Hounbo, 2014). Les innovations agricoles qui amélioreront la situation nutritionnelle en Afrique sont celles qui mettront en avant le développement de la production de spéculations vivrières d'intérêt socio-nutritionnel pour l'Afrique et pour lesquelles celle-ci peut aisément se comparer aux autres continents tant du point de vue de la productivité. La

compétitivité de l'Afrique serait évidente dans ce cas. Un accent particulier doit donc être mis sur la promotion des filières suivantes : riz, datte, manioc, igname, tomate, mangue, orange, pomme de terre et oignon. Il s'agit là de spéculations bien adaptées aux conditions agroécologiques et aux besoins alimentaires majeurs de l'Afrique.

Mais, comment cela pourrait-il se faire ?

Il faudra considérer deux axes d'innovation : l'axe relatif à la définition des politiques agricoles et l'axe relatif à la production agricole communautaire.

Concernant les politiques agricoles en Afrique, il importe de veiller à la mise en place de lois d'orientation agricole dans tous les pays africains. Mieux que les plans stratégiques de promotion agricole en vogue et qui n'ont pas pouvoir de s'imposer à tous les gouvernants, ces lois d'orientation agricole sont susceptibles de s'imposer à tous les gouvernements, d'obéir rigoureusement à la volonté du peuple et de réaliser à terme son rêve. C'est l'absence de ces lois qui justifient le trop engouement pour les cultures d'exportation désavantageuses pour la plupart des pays africains. Car, c'est certain que ces lois d'orientation ne pourront pas négliger la production vivrière qui reste le principal souci des peuples africains. Des pays comme le Mali, le Sénégal et le Cameroun sont déjà dans cette dynamique. Mais, il faut bien que cela se généralise.

La production agricole communautaire dont il est question est de porter une attention particulière aux productions agricoles de groupe : agriculture coopérative, agriculture villageoise, agriculture scolaire. La promotion de ces formes d'agriculture ne peut non plus occulter le volet nutritionnel qui reste la première préoccupation. De plus, les expériences accumulées à travers le temps dans les communautés seront valorisées. Toutes les communautés ont des expériences sur les spéculations viables, adaptées aux conditions agroécologiques et à valeur nutritionnelle majeure. Dans cette logique, l'ONG GRAAP du Bénin entreprend depuis novembre 2011 un projet communautaire d'adaptation aux changements climatiques. L'initiative est fondée sur l'agroécologie comme modèle de production agricole, une approche agricole conciliant l'agriculture avec les exigences écologiques pour entre autres maintenir et valoriser la biodiversité. L'initiative mise spécialement sur les spéculations traditionnelles qui ont un pouvoir élevé d'adaptation aux variabilités climatiques. Elle privilégie aussi la diversification des cultures qui améliore la résilience des systèmes de production qu'elle engendre. C'est ainsi que dans les exploitations du projet les variétés traditionnelles de manioc, de maïs, de gombo, de voandzou, de soja, de niébé, de papayer, etc.... sont préférées aux variétés exotiques. Les bénéficiaires sont principalement les petits producteurs agricoles qui sont reconnus comme les plus vulnérables. Il est renforcé au niveau de ceux-ci la capacité de valoriser de façon optimale les petits espaces. Les jardins, de 0,5 à 1 ha ou moins, ont porté une diversité de cultures qui ont rehaussé les productions des producteurs. L'évaluation effectuée en août 2014 a révélé que la sécurité alimentaire, nutritionnelle et même financière des ménages impliqués a été améliorée. Car, les productions agricoles sont d'abord de grand intérêt nutritionnel pour les producteurs, puis rencontre une forte demande locale, créant un marché local important.

15. Archana Mukherjee, ICAR-CTCRI-Regional Centre, Bhubaneswar, India

Dear All,

I am proud to declare that I couldn't join in time as I was in Trivandrum involved in felicitation programme of the World "Agri Icon"- Prof. M.S.Swaminathan. It is because of him today we are in common platform for-'Innovations in agriculture to improve nutrition'

I suggest you all to go through his Latest Publication 'Indian Agriculture Challenges Ahead'.

Despite of my ill health (Stage -IV Cancer), I get inspired manifold seeing 'ever smiling, ever active (90+) Prof. M.S.Swaminathan.'

I suggested in earlier e-discussion during 24th to 27th February LANSA programme that 'Food Habit' is a complex phenomenon and need to be tackled sensibly.

Therefore to achieve the targets of Food- Nutrition & livelihood security, following activities need to be prioritized-

- Farming system nutrition tuned with Agro-climatic-site specific crop species.
- Crop diversification with locally available under utilized nutritionally enriched crops or their reintroduction.
- Escalation of SHGS (Self Help Groups) to cooperatives.
- Political will & support for promotion of climate resilient, affordable, nutrient rich underutilized crops as fresh as well as processed products for Food-Nutrition & economic sustainability.

With Regards,

Archana Mukherjee

16. Robert Mwadime, Community Connector, Uganda

Addressing challenges of seasonality through value addition

Undernutrition (macro- or micronutrients deficiency) among smallholders is, in most cases, seasonal. Seasonality in malnutrition is caused by many factors including, diseases (some associated with agriculture activities), high labour (affecting energy expenditure and time for child care and cooking good meals), sanitation/hygiene—also affected by seasonal water and fuel availability. Seasonality also affects two major factors in diet quality: access to nutritious foods (fruits and vegetables, and animal protein sources) and food safety. What can agriculture interventions do to minimize undernutrition variation associated with seasonality? The conventional innovations in agriculture would be to provide simple, affordable, irrigation approaches; agronomical methods that preserve water for growing of vegetables; drought resistant varieties or preservation methods of the excess.

I recall an innovation in Kenya in late 1990s by the Nutrition CRSP—with funding provided by the Centre for Higher Education of the United States Agency for International Development—that enabled over 2000 rural Kenyan women farmers to produce a variety of nutritious fruits and vegetables. The intervention also helped cooperatives of women to add value to their produce by processing and locally marketing nutritious, convenient, culturally-appropriate complementary

feeds. The women worked with researchers from local and northern universities to produce feeds of composite flours from (solar dried) the fruits/local vegetables and cereals, and in other areas animal source protein was included in the locally formulated recipes. Researchers support ensured quality and sensory needs of the market are met at acceptable price throughout the year.

17. Frank Pons Appelman, Pons Consulting, New Zealand

One of the crucial factors in improving the nutritional value of our food is to get the crops we grow to function in the field at optimum rates. One of the ways this can be achieved is by the application of trace elements in the right configuration for those crops in their situation. The one size fits all approach does not work. By testing we have to tools to determine quite accurately what the needs of a given crop in a given location are. If we respond correctly then that crop will function at an optimal level in the field. The resulting harvest will then also give food that will meet our criteria for good and balanced nutrition. Over the past forty years I have done many tests which invariably prove that to be the case.

18. Archana Mukherjee, ICAR-CTCRI-Regional Centre, Bhubaneswar, India

Dear All,

In the context of present discussion, I proud to quote the following three systems operational in India & other countries which are most logistic & realistic to achieve “Food-Nutrition & Economically sustainable livelihood”

- The first one is FSN (Farming system for Nutrition), led by Prof. M.S.Swaminathan, ‘Leader of Green revolution’ in India.
- The second one is LANSa, again led by the World Icon in Agriculture- Prof.M.S.Swaminathan & its foundation- ‘MSSRF’.
- The third one is “INEA”(International Network For edible Aroids,funded by European Union),led by the Global Leader, Dr.Vincent Lebot, CIRAD,France. Under INEA-The Goal is to “Adapt Clonally propagated crops to climatic & commercial changes” most befitting in the scenario of climate change. The said programme is launched in April 2011 with the crop “Taro” (Colocasia esculenta) – involving 22 countries across the globe considering its importance as Staple/Vegetable and sustainability to cope with the fragile environment.

The Doctrine of this programme is stepping towards Global Food-Nutrition with ‘Climate resilient clonally propagated crops’. It is based on exchange of biotic,abiotic stress tolerant & commercially acceptable ‘Taro Gene sources’ involving the NARS.

Further the genetic enhancement of Taro for calorie content & micronutrients especially Zinc, Iron & Calcium through ‘Participatory breeding’ involving the farmers & researchers of agro-climatic & commercially site-specific zones under NARS of different countries- “An unique concept “ from grassroots’ to outreach globally.

For Details, Please contact -lebot@vanuatu.com.vu

lebot@cirad.fr

19. Norbert Francois Tchouaffe, Massachusetts Institute of Technology, USA

Dear all,

I am herein sharing with you the link of my paper on strategies to reduce the impact of salt on crops production, published in 2007.

The due paper examines the tolerance of three crops (rice, cotton and chilli) to salt. (NaCl

<http://www.sciencedirect.com/science/article/pii/S0011916406014536>

Your comments are welcome.

Kind regards.

Norbert TCHOUAFFE

Visiting scholar at MIT-DUSP.

144 Pemberton Street

Cambridge, MA.02139

USA

20. Nirmala Yenagi, University of Agricultural Sciences, Dharwad, Karnataka, India

The research on Indian sustainable cereals and millet was undertaken to highlight technological opportunities for value addition and promotion of ethnic foods through home based industries for food and nutrition security under the following projects and outcome is briefed :

1. UPCD Tier-I project of the Canadian International Development Agency "Consolidation of nutrition security in Southern India", McGill University, Canada (2002-2007)
2. Research on small millets under the project entitled IFAD, IPGRI, MSSRF project on 'Enhancing the contribution of nutritious but neglected millet crops to food security and incomes of the rural poor-Asia component: Phase I and II (2000- 2007)
3. Canadian International Food Security Research Fund, IDRC Canada. i.e. "Enhancing food security of rural families through production, processing and value addition of regional staple food grains in India" (2010-2013)

Established strong therapeutic value to regional crops:

Meticulous efforts of assessment of grain quality for chemical composition, nutrition, therapeutic use, processing characters and acceptability of end product at consumer level resulted in diversification of food grain for different end utilization in the management of diabetics, development of high yielding varieties and hybrids with improved quality, suitable for diverse production. Grain quality research has helped to sustain food security through post-harvest technology for conserving food in better form and economic accessibility to food. Product

development was done with applying various principles like community nutrition problems, storage quality, preservation and packaging, food adulteration, quality control, food safety and sanitation, consumer acceptability and market potentiality. Innovative research fetched in development of several technologies, to solve community nutrition problems viz., diabetes, anemia and protein calorie malnutrition.

Created developmental prospective to indigenous food technologies

The present day economics scenario, emerging globalization and growing consumerism have fast changed the perception of food. Today the consumer is looking for food of convenience, easy commercial availability; ready to eat nature, high quality, nutritive, minimally processed. Through research sufficient scientific information has been generated on regional traditional foods and indigenous food technologies with respect to the quality of ingredients, standardization of recipe, packaging of products and exploitation of simple low cost technologies at commercial level to improve the economic status of the rural community.

Establishing and strengthening proper linkage between producer, processor and consumer

Scientific information generated on sustainable regional crops with respect to nutritional, therapeutic and processing qualities has created value to the local food grains as a high quality grain and thus helped in strengthening the proper linkage between grain quality research and agriculture for developing better quality grains suitable for specific end use, value addition and to improve India's socio-economic and health status. Scientific information has been communicated to different segments of population throughout reach activities.

Nutrition awareness on local cereals has improved the knowledge and health status of women entrepreneurs and adolescent girls. Developed value added products are highly acceptable by the community and proven technologies are being popularized through farming community and also has an impact on the nutrition and economic security of women entrepreneurs who have taken food processing as one of the challenging entrepreneurial activity.

Women entrepreneurs have succeeded in supplying value added nutri rich recipes of millets in school feeding programmes. They have also started supplying therapeutic foods to education institutions and hospitals with effective feedback and encouragement by the consumers.

The basic research has helped in developing large number of value added products like ready to eat breakfast cereals, therapeutic foods, micronutrient rich composite flours, ready to use mixes, pre-processed and value added traditional products.

Creation of awareness on entrepreneurial activities to political and local leaders and policy makers has helped in mobilization of financial support from MPs fund in starting food processing incubation centers in few villages.

Few SHG's groups from villages are actively involved in marketing of value added regional cereal products.

Postgraduate students have worked on the quality of local cereals and strengthened the economic value for better marketing. Achieved significant success in popularizing local grains and strengthened the local identity through various communication techniques to the community.

Technologies developed in the area of post harvest technology have reached stake holders through trainings and demonstrations and other communication means. The outcome of research has

empowered the rural and urban community economically, by overcoming the problem of drudgery, increased productivity, improved nutritional status, instilled confidence and created self employment opportunities.

Created infrastructure facility for running of B Tech. (Food Technology) under graduate degree programme in UAS, Dharwad. Development of academic curricula of 4 years degree programme in B Tech. (Food Technology).

Development of Infrastructure facility for conducting training and research under CIDA, MSSRF and IDRC funds.

Facilitated an international exposure to post graduate students towards education and research .

Transfer of developed technologies to elective students of FSN under experiential learning course.

Designed rubber Sheller for de-hulling of millet at household level and multiplication and distribution of ten de-hulling machines to three NGO's under IDRC project.

Introduced post harvest processing units of millet such as de-stoner, grader and emery mill in four millet growing villages to reduce drudgery of women and utilization of millets for household consumption, value addition and marketing.

Introduction of food processing units in villages to run home based food industry.

Developed products from different local cereals can be recommended in combating nutritional problems of the community and supplements the food composition for use in planning therapeutic diets.

The success of value addition to local crops for food and nutrition security, promotion of consumption local staple cereals through innovative post harvesting technologies and strengthening of economic security of rural women entrepreneurs through home based food industries under the above mentioned International projects was mainly because of holistic multidisciplinary approach. This can be up scaled at all India level by strengthening the research and extension of dry land crops. All India Co-ordinated dry land crop improvement projects comes under ICAR, pursue mandated activities in improvement production and protection. Under these projects additional grants should be released for research in the area of value addition, nutrition, post harvest technologies and promotion of technologies. Research and extension should be in collaboration with the additional disciplines from Home Science and Food Technology. Discipline of Food Science and Nutrition, Food processing, post harvest technology and Subject matter specialist of Home Science from KVK's should be included as specially recognized areas to overcome existing malnutrition in India.

21. Alan Dangour, facilitator of the discussion

Dear Contributors,

First may I apologise for my delayed response to your many incredibly thoughtful and helpful comments. Might I add that I too am honoured to be working alongside Professor Swaminathan and I shall ensure to pass on to him all your many generous comments and kind words.

I am taking a few days of holiday with my family in farming country in Wales – a beautiful part of the UK. We're in sheep farming country and speaking with the many farmers around here makes it clear that farming traditions are hard to change. This has always been sheep farming country as long as anyone can remember – the land is not thought to be good enough for anything else. Interestingly, many farmers here also used to own dairy cows – small herds of less than 5 cows per family – until it became uneconomical both for the farmers to tend such small herds and for the lorry to come to each farm to collect their milk on a daily basis.

This has immediately reinforced two important aspects. First that context is critical, the farming method that is successful in one location is often one that has been demonstrated to be successful over many generations, and in this situation it can be very difficult to introduce innovations. And second that without easy access to markets farming systems struggle to survive.

It is therefore interesting to note that your extremely helpful suggestions included ideas to introduce new plants or crop varieties, re-introduce existing crop varieties that have fallen out of favour, and use modern approaches to improve existing farming practices. There is also an interesting focus on the pathways from agriculture to nutrition – specifically the income (market) pathway – does farming improve household incomes and if so what is the best route through which it can enhance household nutrition? I wonder if there is knowledge on how best to improve market access for small-scale farming households and how best to increase household incomes year-round – taking into account the seasonality of income that plays such a powerful role in farming systems.

Finally, for now, as night falls in Wales and I hear the owls hooting outside, what about the impact that environmental changes will have on farming systems. Many farming environments have already started to face the challenges that our changing ecosystem will bring. Are there any early learnings that can be spread to help farmers face this uncertain future?

Many thanks again for your interest in this consultation. Do please spread the word to your colleagues and I look forward to continuing our online discussions.

Best wishes,

Alan

22. Chelsea Graham, Purchase for Progress (P4P), World Food Programme, Italy

Under the World Food Programme's Purchase for Progress (P4P) project, we are undergoing a great deal of work to link nutrition and agriculture. Efforts are many and varied based upon country contexts, but here are a couple exciting and innovative examples:

In Afghanistan P4P supports linkages between smallholder farming and nutrition, with an emphasis on [soya production](#) and by supporting millers to produce fortified flour while buying smallholders' crops. Plus, a mobile factory has been introduced to produce High Energy Biscuits (HEB) for sale on the local market and use in WFP emergency responses. The biscuit factory is sourcing part of the soy and wheat used to make HEB from smallholder farmers participating in P4P. The pioneering design of this factory is particularly exciting. Because it is made of mobile containers that take up minimal space and can be installed quickly they can be used in a variety of rural or conflict environments, where lack of infrastructure might otherwise make it difficult to produce fortified foods locally. [Read more](#)

In Rwanda, Uganda and Zambia we are working closely with [HarvestPlus](#) and national governments to increase the availability of micronutrient-rich staple foods. P4P-supported smallholder farmers are cultivating biofortified crops such as Iron Beans, Vitamin A Maize and Vitamin A Sweet Potato, benefiting from home consumption of these nutritious foods, as well as selling their produce which is used as seed as well as in school meals programmes. [Read more](#)

23. Sonali Phate, MSSRF, India

Dear FSN Forum,

Please find below a success story from MSSRF project of Mahila Kisan Sashatikaran Pariyojana operating in the two districts of Vidharbha region of Maharashtra state.

Regards,

Sonali

Ensuring Food Security through Mixed Cropping

By

Sonali Phate, Food Security Programme area, MSSRF

Anita Sudhakar Lokhande from village Aajgaon in Wardha district is 40 years old and has studied up to Class 11. Her husband holds post graduate degrees in Arts as well as Commerce. Anita and her husband are engaged in cultivating their Land. They have 4 acres of rainfed land and 3 acres of irrigated land. Anita's family comprises of herself, her husband and two children. Her son is pursuing a technical diploma course after completing his schooling while daughter has just completed her schooling.

Anita joined as a member of a Women Farmers Group-Ramai Jagrit Mahila Shetakari Samiti-promoted by MSSRF, in 2012. Anita was following the widespread practices of chemical intensive farming techniques in her farm before joining the women farmers group. As a member of the farmers group she received trainings and guidance on sustainable agriculture practices from the M S Swaminathan Research Foundation. Now, she practices sustainable agriculture on 2 acres of her land. She applies integrated fertilizers (Farm Yard Manure + chemical fertilizers); uses yellow sticky traps for cotton. She placed 5 sticky traps on one acre. Similarly she used pheromone traps for wheat and Bengal gram, in *rabi* season, at the rate of 5 traps per acre. She also prepares and uses bio-pesticides- *Nimastra*, *Bramhastra* and *Nimark* for controlling pests. She sprays the pesticides about 4 times during the cropping season, at times even before pest attack as a preventive measure.

She carefully learnt how to cultivate mixed crop through the trainings and exposures organized by MSSRF. She joined an exposure visit organized by MSSRF to the model farmer's field in village Neri. Shobha Masram, a model Farmer and member of a women farmers group of MSSRF, in village Neri discussed the benefits of mixed cropping with other women farmers. Anita was impressed by the experiences shared by fellow farmer Shobha and decided to adopt similar practices on her field. Till

last year Anita was cultivating soyabean, cotton and pigeon pea in *Kharif* and wheat and Bengal gram in *rabi*. In 2013-14, she practiced mixed cropping on 2 acres of land in *Kharif* and 0.25 acres of land in *rabi*. She had sown chilly, long beans, cow pea, ladies finger, brinjal, tomato, cluster beans, broad beans, black gram, green gram, *Motitura* (minor miller) and sorghum in between cotton rows on 2 acres of land. Anita says that before she started practicing mixed cropping the space between two rows of cotton was unutilized. On 0.25 acres of land, in *rabi* season, along with wheat she cultivated spinach, fenugreek, coriander, radish and onion. She also experienced that with mixed cropping the pest infestation gets naturally arrested. In the year 2014-15 Anita extended field under mixed cropping up to 3 acres in *kharif* and 1.5 acres in *rabi*. She harvested following amount of vegetables along with the main crops in the year 2013-14 and in the year 2014-15.

Details of Production in Mixed Cropping, Anita Lokhande's Field, 2013-14

2013-14			2014-15		
Mixed crop	Acreage	Quantity	Mixed crop	Acreage	Quantity
Chilly, Long beans, Cow pea, Ladies finger, Brinjal, Tomato, Cluster beans, Broad beans Black gram, Green gram, Green Deccan hemp Red Deccan hemp	2 acres	21 kg 36 kg 36 kg 26 kg 50 kg 50 kg 12 kg 10 kg 10 kg 5 kg 10 kg 2 kg	Chilly, Long beans, Cow pea, Ladies finger, Brinjal, Tomato, Cluster beans, Broad beans Black gram, Green gram, Green Deccan hemp Red Deccan hemp	3 acres	15 kg 32 kg 26 kg 100 kg 120 kg 48 kg 16 kg 25 kg 4 kg 2 kg 12 kg 3 kg
Spinach, Fenugreek, Coriander, Radish, Onion	0.25 acre	48 kg 16 kg 12 kg 25 pieces 20 kg	Spinach, Fenugreek, Coriander, Radish, Carrot Onion	1.5 acres	36 kg 48 kg 32 kg 120 pieces 150 pieces 100 kg

Of the 7 acres of land cultivated by Anita, soyabean was grown in 2.5 acres and the production of soyabean in 2013-14 was 31.5 quintal. In the remaining 4.5 acres cotton and pigeon pea were cultivated and the production of cotton in 2013-14 was to the tune of 40.5 qt and pigeon pea was 6.75 qt. Within the 4.5 acres where cotton was the main crop, in 2 acres of land Anita practiced mixed cropping. In *rabi* land under cultivation of wheat was 1 acre and 1.5 acres under Bengal gram production was 8 qt and 4.5 quintal respectively. Out of 1 acre of land under wheat, Anita practiced mixed cropping on 0.25 acres of land.

In the year 2014-15 Anita has grown soyabean on 2 acres and production was 12 quintal. The reduction in soyabean production was due to erratic rain. In the remaining 5 acres she cultivated cotton and soyabean. The production of cotton was 40 quintals and that of pigeon pea was 6 quintals. Within the 5 acres of land under cotton, in 3 acres of land Anita practiced mixed cropping in *kharif*. In *rabi* area under cultivation of wheat and Bengal gram was 1.5 acres and 0.5 acres respectively. The production of wheat was 10 quintals and that of Bengal gram was 5 quintals. In

spite of adverse weather Anita is happy that she could sustain the productivity of her farm to greater extent in comparison to neighboring farmers and ensured food security by mixed cropping.

Details of crops grown and the production are given in the table.

Anita says that fresh green vegetables are not available in the village daily. They used to buy vegetables from weekly market at the block head quarters.. Weekly expenditure for purchasing vegetables for her family was to the tune of Rs. 200. More over the variety of vegetables they could get were very few. Currently, by adopting mixed farming she has reversed the situation. She is able to get enough fresh vegetables daily. The labourers of her farm also frequently take vegetables to their home. She also shares vegetables with neighbors and relatives. So she feels proud that not only her family but even her friends get benefitted by adopting this cropping pattern. Interestingly, this helped her to strengthen her social bonding.

She has also prepared *papad* and *cakes* from green gram and black gram harvested from her farm. She prepared 7 kgs of chili powder and 2 kg of coriander powder with the dried chilies and coriander seeds. She also sold chilly at the rate Rs. 100 per kg. She has processed the cow pea and broad beans produce for use in rainy season. She reports that she didn't have to purchase onion throughout the summer. She is very happy that by adopting mixed cropping she has produced various grains, pulses and vegetables and by not having to pay for these in the market she has saved money. While she has reaped the benefits of availability of diversified food items, she has also ensured sustainability by retaining the vegetable seeds for cultivation later on. She has collected and stored as many as 20 varieties of seeds.

Anita also grows kitchen garden and diverts the waste water of her house in the kitchen garden during summer season. Besides cultivating vegetables she has planted five fruit trees i.e. lemon, Papaya, Custard apple, Guava and Pomegranate in her kitchen garden.

As a farmer, though Anita has always been engaged in farming she has never ridden a bullock cart. Couple of years ago, one day, when her husband had gone to the block head quarters, he was held up and informed her in the evening on phone that it might take few more hours to finish his work. Anita became worried about the bullocks that were in the farm. Finally she took a brave decision to drive the bullock cart and bring the bullocks back home. She shared that she felt awkward as she entered the village because usually women don't ride the carts and everybody was looking at her strangely. But the fact she could ride the cart gave her the confidence and she started transporting the harvested farm produce from her field to her house. She also started taking labourers from the village to her farm. She also feels confident that she can do harrowing, hoeing as well as irrigating the crops- activities usually done by men.

Anita happily shared that adoption of mixed cropping pattern rendered her good yield, acted as a natural pest management strategy and ensured the nutritional food security of her family. This is a case study of an empowered woman who has challenged the societal norms on woman's role in agriculture and rides her bullock cart with an air of freedom.

24. Wajid Pirzada, SAFWCO Foundation, Pakistan

SAFWCO (www.safwco.org) has employed over last 28 years multifaceted approach to food security in rural areas of Sindh, Pakistan. This involved provision of agricultural inputs &

implements, development of water channels & culverts, extension of credit facility for agro-livestock development, community physical infrastructure (CPI) development- farm to road links, seed banks, sprinkle irrigation, value chain management and much more.

Recently, with growing poverty in urban & periurban areas and consequently development of urban slums SAFWCO has started focusing on urban food & nutrition security alongside rural food security using an innovative approach.

SAFWCO successfully introduced hydroponics in an Urban slum in Hyderabad Sindh, inhabited by minority ethnic community-Hindus, have imparted the female household members vocational training (stitching) and provided them sewing machines to earn their livelihoods in addition to WASH infrastructure developed in this slum area known as Ghera Basti ('Settlement in Siege').

Ghera Basti community earlier lived in totally disconnect from mainstream, with their dwellings built around a narrow strip of dark & long street with no latrines and drinking water facilities.

Male members used to sell second hand repaired clothings over bicycles, while the female HH members spent their time in those poor shelter homes.

The community after social mobilization by SAFWCO has organised itself as CBO and development of hydroponics as kitchen gardening facility and vocational training to female community members has helped overcome malnutrition among especially lactating & pregnant mothers, young girls & children.

SAFWCO now looks for support to further develop the infrastructure and capacity of community living in the Ghera Basti.

25. Pabitra Paramanya, India

Now a days agriculture is very challengeable for small farmers in India. In one side per capita land share is reducing so fast due to increasing the population. On the hand food demand in a family is increasing...as a result people are leaving their villages, their farms, their families to earn something in remote city areas/ sometimes migrated permanently even in abroad.

So, who will produce crop ? People more interested to buy food from the market than produce in own farm.. so, day by day demand is increasing and raising food prices. With this climate change also a important factor.

We don't know how poor farmers will give more attention in farming.

But still there is a hope. This is our responsibility to train that farmers and send them to start innovative agriculture which will provide sufficient and nutritive food for all.

I am working in Mennonite Central Committee in India with collaboration of Canadian Food Grain bank. Here I have shared one food security project running in West Bengal, India. The local partner's name is Rural development Foundation. The context has given below.

Context of project areas

Hasnabad Block of North 24 Parganas of West Bengal, India is having a geographical area of 156.44 square kilometers with a population of around 1,77,470 having a population density of 1134 per square kilometer. RDF has been working in 7 villages of Hasnabad Gram Panchayat with the

financial support from MCC. The project area is low lying, undulating islands with meandering river channels as part of Ganga River delta known as Sundarbans. The surface water including river water and soils are saline and as a result farmers can grow only one summer paddy with the monsoon rains. The area is also prone to flood to Cyclone and surge of tidal waves Poor farmers and underprivileged people of the villages do not have food security all the year round. There have been large scale migration of villagers to other parts of the Country for livelihood. The villagers did not get much help from Government during post AILA (Cyclone) during 2009 when there were large scale devastation and had a devastating effect on life and property. The Soil was damaged due to deposition of salt on the farm soil and as a result for 2-3 years the farmers could not raise crops. We have undertaken saline soil reclamation work to improve the soil fit for cultivation and we have been successful to a large extent. We have also worked on rain water harvesting structure and supply of Saline resistant Crop seeds, Gypsum etc. This has generated huge demand for such services from adjoining areas. We have also formed large number of Self Helps, identified women leaders and provided them training on micro finance and micro enterprise development followed by Micro finance support. This has created huge impact among the women The communities have been sensitized on various issues. The outcome of our work has generated interest in the adjoining areas Accordingly we have added 3 more villages of 2 Gram Panchayats

The conditions of the community is very backward, though many of them have land but are affected salinity . the farmers get around 8-9 Quintal of paddy per acres . They do not have knowledge on use of organic fertilizers. There is an urgent need to address the issues which are affecting the daily life of the poor and livelihood of the community

Agriculture is counted as the main occupation of the people . Around 70 % of the population of the district lives in rural area and the main livelihood of the villagers is agriculture. The farmers do not adopt any modern technology for farming and as a result the yield is low. There are no industry in Sunderbans. As a result we are trying to convert mono cropped area into double crop area by constructing rain water harvesting structures, providing training on Agriculture, fishery, Animal husbandry, Handicraft Training, Formation of SHG ,Training to SHG members for undertaking income generating activities and to provide them support with financial and nonfinancial interventions. Thus we want to make a holistic approach to mitigate the Food security problem through generation of production, employment and income of the poor both men and women for proper food security.

Our project area consists of 10 Villages of 3 Gram Panchayat there are 3757 families having a population of 18364. Out of which 1284 are farm families .There are 341 Small farmers, 909 marginal farmers and 34 big farmers. If we can convert the mono cropped area into double cropped area the farmers will be immensely benefited through increase in crop production and yield and the landless laborer will get local employment and will check migration to a large extent However, reclamation of saline soil through organic cultural practices is of vital importance.

See the attached stories.

26. Sumit Karn, Food and Agriculture Organization, Nepal

Dear Prof Swaminathan and Dr Dangour,

Greetings from Nepal...!!

Thank you so much for initiating this discussion forum and I am following it keenly to learn the global experiences on the topic which I believe is still a grey area despite the fact agriculture sector has huge potential to improve the nutrition. As part of ongoing project called "Agriculture and Food Security Project" funded by Global Agriculture and Food Security Programme (GAFSP), we are trying to integrate crop, livestock and nutrition for synergistic effect. It would be too early to make any conclusion as the project is in early stage of implementation, however, there are few innovations this project has adopted in terms of integrating agriculture and nutrition.

The first and foremost initiative we are doing is to use all the contact points of health and agriculture sector to provide nutrition education and behaviour change communication on agri or food based nutrition thereby increasing the knowledge and skill base of farmers and women who are involved in the small farming. The nutrition has been integrated in the crop (major crops) and livestock FFS where the female farmer groups are oriented and demonstrated on improving the nutrition practices. Moreover, they are oriented about the nutritional importance of local production and consumption of indigenous and underutilised crops, vegetables and fruits. Similarly, there are FFS on goat and poultry where the farmer groups meet once a month. During the meeting, the farmers are also given messages on the importance of animal source proteins and micronutrients. For addressing the problem of high rate of micronutrient deficiencies, 1000 days mothers are trained on how to establish home nutrition gardens and poultry at a demonstration field known as "village model farm". Later, they apply this learning in their own land where they grow seasonal vegetables and fruits. Given the poor practices related to dietary diversity in complementary feeding, the mothers are also oriented on how to make nutrient dense complementary feeding for children using local available foods, locally grown vegetables and animal source foods with diversified diet. These are demonstrated regularly. The mother's group is going to establish a food preparation, preservation and processing unit where they would gather once a month to demonstrate locally improved practices for preservation of locally grown food, improved cooking practices and how to minimise nutrient loss during post-harvest, storage and cooking.

In addition, the farmer's group, mother's group especially the 1000-days mothers are reached by regular HH visit, their monthly meetings where they discuss on range of issues related to maternal, infant and young child feeding practices. For this, the frontline workers of both agriculture and health functionaries are trained on "agriculture-health-nutrition". This has resulted in great understanding the importance of agriculture for nutrition security among the health workers while agriculture frontline workers have been convinced about the need of nutrition-sensitive agriculture.

In course of time, I hope this would have significant impact on the nutritional outcome especially in improving the dietary practices at the household level, eventually improving the nutritional status of the vulnerable population. My observation especially with groups involved in goat and poultry FFS has great potential in increased production, income generation and consumption of animal source proteins in rural areas. This is one area that could be explored through rigorous research elsewhere in rural area of developing countries. The project is also promoting some technologies that could be used in agriculture sector which can minimise the work-burden on women thereby increasing their time to care for children, family members and of their own. However, the impact needs to be assessed.

The real success of these interventions and innovations is yet to be realised as the project has just started to implement its activities on the ground.

Look forwards to hearing other's views as well. You could reach me for any detail related to the project activities at:

SUMIT KARN

Nutrition Specialist

Agriculture and Food Security Project

Nepal

27. Archana Mukherjee, ICAR-CTCRI-Regional Centre, Bhubaneswar, India

Success with sweet potato rich in antioxidants (β -carotene, anthocyanin)

Archana Mukherjee

ICAR-CTCRI, Regional Centre, Bhubaneswar-751019, Odisha, India

I would like to share my experiences and cannot consider it as success rather a drop of initiative towards a Vast Ocean of Agri-challenges.

Let us recall the monster 'Super cyclone' in Odisha during October 1999.

Being in ICAR and tuber crops Scientist we extended support through ICAR- contingent action plan to rehabilitate the affected farm facilities. I fortunately or unfortunately got the farthest point to extend support from ICAR- CTCRI RC, Bhubaneswar, Odisha, India to the victims of Jagatsinghpur and Kendrapada the worst affected coastal districts. In Jagatsinghpur, the village 'Kanaguli', I could reach with difficulties and could help then with collaboration of Rama Krishna Mission.

However in Kendrapada, the worst affected island type 'Mahakalpada block' was tough to reach. It is during that time I got the support of MSSRF, Kendrapada unit. Staff of that unit were working and crossing day and night with their country boat to help the victims. They came forward to help us to reach the people of that block. The miseries were beyond narration. In addition to relief materials, we supported them with the improved sweet potato developed by us at ICAR-CTCRI to grow as they lost their paddy and other vegetables. Of the 4 varieties (Kishan, Kalinga, Goutam and Sankar) supplied to them, Gouri and Kishan performed well under saline conditions. Performance of Gouri was the best – 'This mooted me to think in depth as Gouri is enriched with β -carotene'. I started to work on salt tolerant antioxidants rich sweet potato with the support of ICAR Cess fund scheme. We developed salt tolerant β -carotene and anthocyanin rich sweet potato like ST-14 (β -carotene 14 mg/100g) and ST-13 (anthocyanin 90mg/100g).

These are now gaining popularity not only in coastal belts of Odisha but also hilly backward areas like Koraput, Phulbani, in Odisha, Ranchi in Jharkhand, Narayanpur in Chattisgarh, Gorakhpur in UP, Dangoria Charitable Trust in Andhra Pradesh and also North eastern parts of our Country. Figs (1-5) can reflect the joy to work with all.

I am grateful to all those NGOs (MSSRF, WORD, Dangoria Trust, Rama Krishna Missions) and National, International Govt. programme like TSP, DUS, INEA etc., for the support to reach the

people in remote areas. It is our duty to support the people with basic needs “Sustainable food and livelihood”. Our collaborative efforts have enlightened the people of affected and remote areas.

<http://www.fao.org/fsnforum/sites/default/files/resources/Success%20photo.docx>

Thanks to all of you involved in this endeavor.

God bless you all.

With kind regards,

Archana Mukherjee

N.B.: Friends, I have some pre commitment and I have to report for my cancer treatment follow up in TMH, Mumbai. I may not be able to participate in coming few days.

28. Krishna Sannigrahi, CABI, SAI, India

Globally, the food and Nutrition scenario has undergone a sea of change. Over the years, India has progressed from being an underdeveloped country to a developing one and this again brings a lot a change in the nutrition arena. Everything changed as per the requirement or you can say demand driven change and has taken a rigid form of lifestyle, the population and the quality of food. From being a country of people who are mostly home grown and home cooked foods, the drift is now a fast food and faster life. The trends are towards fast foods, take away, fast foods, packaged foods, on the other hands there are tons of on-going research also on organic foods, local produce and fresh foods. Apart from the role of agriculture as a source of food, it serves as an important source of income for a large section of our population. Because of modernization the young generation is least interested to do farming and migrating to the cities for employment. As a result, on a large scale the old farmers do farm and follow the old tradition to cultivate, do not want to accept the new technologies. Successful implementation of any strategy, needs a high level of expertise in technical knowledge, managerial skills with an effective behaviour change communication in order to retain the young ones promoting them to take an interest in agriculture as they are the ones easily motivated to adopt the new concept of agriculture, the older farmers need to be convinced to adopt modern technologies present which has minimized the labour work in the field, the city people should be encouraged to eat home cooked food using various new technologies in the kitchen to ease their workload. Agricultural policies and food prices have a profound impact on food intakes and nutrition. India to reveal the areas where disconnects exist between agricultural policy and nutrition.

29. Mohon Kumar Mondal, Local Environment Development and Agricultural Research Society, Bangladesh

Water resource optimization for climate resilience improve nutrition condition in the saline area of Southwest Bangladesh.

The southwest coastal region of Bangladesh is most disaster prone area and climate hot spot. It has been suffering from negative impacts of climate change like sea level rise, saline area expansion,

irregular rainfall, cyclones and tidal surges which increased salinity in soil and water. Though average rainfall is not changing in a broad range, but farmers could not cultivate agriculture due to poor knowledge on water management. The situation has increased stress of life which forced migration from the coastal sub-districts according to National Population Census 2011. It is alarming which motivate LEDARS to take initiatives.

The purpose of the initiative is to enhance resilience capacity of coastal people.

LEDARS increased capacity of beneficiaries on resilient agriculture through providing skill training on effective water management, provide support to farmers to excavate 54 small ponds, re-excavate 2 canals to reserve rain water, installed 1 deep tube-well, distributes small jar to collect daily used water for homestead gardening and distributes saline and drought tolerant paddy and vegetables seeds. LEDARS provide skill training of 220 women headed families and 1.8 million BDT grants support for sustainable Income Generating Activities(IGA). LEDARS also provide support to remove drinking water crisis through excavate 12 drinking water ponds, installed and re-excavate 19 Pond Sand Filters(PSF), 45 Rain Water Harvesting Systems and 149 Bio-Sand Filter(BSF).

The initiative enhanced resilient agriculture and food security of 40% beneficiaries and create access to safe drinking water of 4039 families in Shyamnagar upazila of Satkhira district, Bangladesh,

The initiatives provide technological and financial support to remove drinking water crisis which reduce water born diseases of family members. The project promoting organic farming which has increased nutrition condition of the families. Our initiatives is increasing school enrollment of the children of selected families through reduce time to collect drinking water and reduce frequent water born diseases and malnutrition of children.

Our initiative got excellent third prize by Water Showcase in World Water Forum 2015.

30. Lisa Kitinoja, The Postharvest Education Foundation, USA

Many innovative agricultural production and marketing projects have been underway in South Asia, with intentions for increasing access to fruits and vegetable crops and improving nutrition. These include greenhouse production, home gardening, intensive raised bed cultivation, linking farmers to markets, etc. But there is another part of the value chain or commodity system that is less likely to be researched or promoted -- innovative postharvest handling, storage, processing and distribution practices that ensure that the high quality foods grown on farms or in home gardens make it to the table and provide nutritious food for rural and urban communities.

Since the 1990s there have been several "Postharvest Technology" focused projects in South Asia that can provide some examples of small-scale innovative practices that link ag and food and support improved nutrition. Dr. S K Roy's 100% utilization concept was described in an earlier FSN forum. See p.15

in [http://www.fao.org/fsnforum/sites/default/files/files/16 Mainstreaming FSN poverty reduction/PROCEEDINGS Mainstreaming FSN.pdf](http://www.fao.org/fsnforum/sites/default/files/files/16%20Mainstreaming%20FSN%20poverty%20reduction/PROCEEDINGS%20Mainstreaming%20FSN.pdf)

Empowering women in the postharvest technology sector can promote improved nutrition for them and their families. "Panchayat and Economic empowerment of rural women by hands on Training" by NagaLaxmi M. Raman* and Neeru Dubey .

<http://iasir.net/AI/RHASSpapers/AI/RHASS14-205.pdf>

A reference work that is full of examples of innovative processing practices for South Asia is: Postharvest Management of Fruit and Vegetables in the Asia-Pacific Region

©APO 2006, ISBN: 92-833-7051-1

<http://www.apo-tokyo.org/00e-books/AG-18 PostHarvest/AG-18 PostHarvest.pdf>

Food losses in South Asia are known to be on the order of 30 to 50%. Investments in time and money that are made to increase food production without paying attention to the postharvest practices that can reduce losses, add value, extend shelf life and protect foods from nutritional loss often will be wasted resources.

31. Mohammad Jafar Emal, IFAD/RMLSP/MAIL, Afghanistan

Dear FSN-moderator,

Please find below the success story on improved food security and income of rural farming families in Afghanistan.

Best regards

Mohammad Jafar Emal,

National Poultry Advisor, IFAD/RMLSP/MAIL

Kabul Afghanistan

Women Farmers Organization (Village Poultry Producer Groups)

By

Mohammad Jafar Emal, National Poultry Advisor, IFAD/RMLSP/MAIL, Kabul, Afghanistan
Backyard poultry development is a significant asset to the rural population of Afghanistan, contributing to poverty alleviation, food security and enhanced nutritional status, which is especially important for disadvantaged groups in less-favorable areas of the country.

In Afghanistan small-scale poultry production has a number of comparative advantages, namely:

- *It needs less capital and land ownership is not a requirement.*
- *Quick financial returns.*
- *Village women can manage and benefit directly from household poultry.*
- *Besides income generation, provides nutrition supplementation in the form of valuable animal protein and empowers women.*
- *Small scale poultry farming units (15-20 birds) require very little hand feeding and can give a fairly handsome return with bare inexpensive night shelter.*

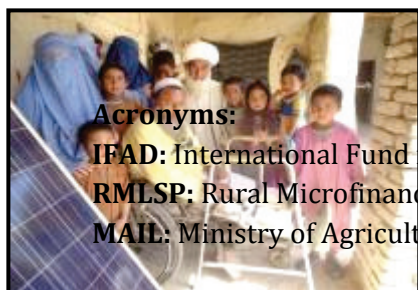
The Government of Afghanistan through the Ministry of Agriculture, Irrigation and Livestock (MAIL) is promoting small holder poultry production as a means of poverty alleviation and food security and gives special emphasis to disadvantaged groups and less favored areas.

The Backyard Poultry development project, funded by IFAD through RMLSP of MAIL, covered and trained 5000 vulnerable rural women in improved family poultry husbandry and organized them in 101 Farmers Organizations called Village Poultry Producer Groups (VPPGs). **The project plays an important role in improved livelihood through increased income and food security of rural households.**

A village Group Leader (VGL) is selected for each VPPG as a facilitator, day-to-day advisor and instructor. Besides, extra trainings in poultry management, these VGLs receives in kind supports, such as poultry feed, vaccines, medicines and poultry equipments for creation of working capital.

Habiba is one of 101 VGLs, who support her 14 family members through family poultry and village's leadership. Her main responsibilities/activities are:

1. Input-output delivery to her relevant group members through established links with Poultry Services Suppliers and Veterinary Clinics,
2. Vaccinations and small treatments against reasonable fee,
3. Supplying poultry feed on reasonable commission base,
4. Collecting eggs from her group members and marketing against reasonable commission,
5. Supplying the young stock for replacement of old stock,
6. Conducting seasonal FFFS trainings on winter feeding, natural hatching and poultry health care,
7. Utilization of income from poultry products for other economic activities such as goats and sheep keeping, embroidery, vendor shops, etc.
8. **Up scaling the production potentials of successful producers through linking them with micro-credit sources and creation of saving banks within the VPPG.**



Acronyms:

IFAD: International Fund for Agriculture Development

RMLSP: Rural Microfinance and Livelihood Support Program

MAIL: Ministry of Agriculture, Government of Bangladesh



32. Akhter Ahmed, IFPRI, Bangladesh

Dear FSN Moderator,

I would like make the contribution provided below.

Thank you.

Regards,

Akhter Ahmed, Ph.D.

Chief of Party

Bangladesh Policy Research and Strategy Support Program

IFPRI/Bangladesh

Positioning Agriculture toward Improved Nutrition and Women's Empowerment

How can Bangladesh's agriculture policies and interventions be designed and implemented to increase positive impact on nutrition? Agriculture provides a source of food and nutrients, a broad-based source of income, and affects food prices. It also has a range of effects on women's health, nutrition, empowerment, and time allocation, which, in turn, affects the care of infants, children, and other family members. Given these links, agriculture has the potential to be a strong driver of women and children's nutrition and health. That potential, however, is not being fully realized in Bangladesh.

From production to consumption, women are key actors within the food system but are historically less empowered in Bangladesh, according to a recent study by the International Food Policy Research Institute (IFPRI). The lack of women's empowerment weakens the links between agriculture and nutrition. In spite of playing an important role in agriculture growth in Bangladesh, women face persistent obstacles and societal and economic constraints that limit their further inclusion in agriculture. By empowering women, ensuring their nutrition status, improving access to clean water and sanitation are all vital for nutrition security. In the absence of such circumstances even nutrition-sensitive agricultural growth will not fully achieve its potential impacts on nutrition status.

IFPRI researchers at the Policy Research and Strategy Support Program (PRSSP) in Bangladesh have designed a pilot study to identify actions and investments in agriculture that can leverage agricultural development for improved nutrition and stimulate pathways to women's empowerment within agriculture. The pilot project focuses on strategic choices in high-value agricultural production (high-value food commodities are also usually rich in essential nutrients such as vitamins and minerals) and in developing "nutrition-sensitive value chains" that enhance or help maintain the nutritional value of agricultural commodities along the value chain, while also focusing on empowering women.

The pilot project implements and evaluates the impact of three alternative modalities for nutrition and gender sensitive agriculture. The modalities are:

1. *Agriculture Production:* Facilitating the production of the high-value food commodities that are rich in essential nutrients. The focus would be on diversifying agricultural production (fruits and vegetables; pulses; oilseeds; and poultry, dairy, fish, livestock)
2. *Nutrition BCC:* Conducting high-quality behavior change communication (BCC) training to improve nutrition
3. *Gender Sensitization:* Undertaking gender sensitization activities that lead to the improvement in the status/empowerment of women.

The Agricultural Policy Support Unit (APSU) of the Ministry of Agriculture (MOA), Government of Bangladesh, and the Department of Agricultural Extension of the MOA will implement the pilot project from mid-2015 to 2017. Using the randomized controlled trial (RCT) method of evaluation, the IFPRI-PRSSP researchers will evaluate the impact of the project on farmers' incomes, household food security, women's empowerment, and child and maternal nutrition. The evidence gathered will be used to inform the design of a national program.

33. Debashish Chanda, Global Alliance for Improved Nutrition (GAIN), Bangladesh

Dear all,

I would like to share our activity in Bangladesh which can play a very promising role to improve nutritional status of our population.

To address the micronutrient deficiency of zinc which is prevalent in Bangladesh, Global Alliance for Improved Nutrition (GAIN) has chosen to enrich rice, which is a staple food in the country. Enriched rice can fit into traditional consumption patterns as it involves limited behaviour change on the part of the consumer and can take advantage of current supply and distribution channels. Taking this into account, GAIN engaged in a series of comprehensive nutrition and market-feasibility studies to assess the effect that particular modifications to the rice value chain would have in improving the nutritional density of rice. Amongst the concepts studied, fortifying rice during the soaking process has shown to have a significant effect on the nutritional quality of rice such that it warrants further investigation and validation. Preliminary market-feasibility research identified several constraints that must be further tested in field and industrial settings. We have already tested this method in an Engelberg mill and now analyzing the zinc content of fortified milled rice and by-products. Should the field validation study bear positive results, this particular innovation that uses a new entry point on the rice value chain could have a transformative effect on human nutrition in Bangladesh.

Thanks & regards,

Debashish, GAIN

34. Omar Ali, Bangladesh Agricultural Research Institute, Bangladesh

Dear Sir

I am sending here with an attached file of a success stories on mungbean for your kind information and necessary action.

With best regards

Dr.Md. Omar Ali
Principal Scientific Officer,
Pulses Research Centre
Bangladesh Agricultural Research Institute (BARI)
Joydebpur, Gazipur.-1701, Bangladesh

BARI Mung-6: a milestone of mungbean production for nutritional security, creation of job opportunity, income generation, poverty alleviation and soil fertility improvement through Rice-Wheat-Mungbean cropping system.

Dr.M. Omar Ali

Bangladesh is one of the most populous and poverty affected country in the world. To meet high demand of food against blooming population, highest emphasis is given to cereal production. As a result, Bangladeshi population suffers from protein malnutrition. The soil is also poor considering nutrients and water content. Whereas, growing of legumes helps to improve these situations. Mungbean (*Vigna radiata* L.) as a food legume has a great role in Bangladesh agriculture for human food, animal feed and sustainable agriculture. Among pulses, mungbean is mainly grown in three seasons of Kharif-I (March-June), Kharif- II (August-October) and Late rabi (15 January- 15 May) in Bangladesh. Kharif-I season is the most important season due to highest area and production and also scope for fallow land utilization. But After harvest of wheat (about 0.4 million ha) lands remains fallow up to monsoon rice due lack of short duration and synchronous maturing varieties. In most cases, after harvest of wheat is delayed for mungbean cultivation and further aggravated by heavy vegetative growth, higher infestation of diseases and insect pests resulting in lower yields. If short duration, synchronous maturing varieties can be developed, this vast area can be brought under mungbean cultivation in Bangladesh. Considering the above need, I engaged as team leader in genetic enhancement of mungbean for these cropping patterns. In this endeavor, I released BARI Mung-6 as mungbean variety in 2003.

BARI Mung-6 is a miracle development of high yielding, short duration (55-60 days), synchronous maturing, disease resistant and also late potential variety of mungbean.³ Before the development of this variety maximum lands remain fallow after harvest of wheat and also other rabi crops upto transplantation of monsoon rice due to lack of late potential variety. But after the development of this variety vast areas of fallow lands have been brought under mungbean cultivation. As a result, where earlier mungbean area and production were 52600 ha and 34000 mt, respectively and ranks was 5th among the pulses but now mungbean area and production are 173000 ha and 181000 mt, respectively and position is 2nd among the pulse may be due to it's high adaptation, farmers appription and rapid areas expansion which increased cropping intensity. It also can be grown in three seasons. By the inclusion of mungbean in the cropping pattern, the soils are also going to enriched in health improvement through atrnospheric N-fixation and decomposition of brown mungbean plants which will be helpful to sustainable crop production. This variety is also created nutritional food security, job opportunity, income generation and poverty alleviation. Finally it is noted that BARI Mung-6 has been created green revolution in mungbean cultivation in Bangladesh. BARI Mung-6 bears the following characters:

BARI Mung-6

- ❖ Plant height: 40-45 cm
- ❖ Pod per plant: 15-20
- ❖ Seed per pod: 12-14
- ❖ 1000 Seeds wt.: 51.00-52.00 gm
- ❖ Duration: 55-60 days
- ❖ Resistant to YMV & CLS
- ❖ Photo Insensitive
- ❖ Protein: 21.2%, CHO: 46.8%
- ❖ Head dhal Yield: 67.2%
- ❖ Synchrony in maturity & late potentiality
- ❖ Yield : 1600-1800 kg/ha
- ❖ Potential to sowing upto after harvest of wheat (up to 2nd week of April)
- ❖ It also can be grown for 3 seasons Kharif-1 (March – June), Kharif-2 (August– October), Late rabi (15 January-15 May)
- ❖ Suitable for all areas of Bangladesh



New potential cropping system and fallow land utilization:

The improved cropping pattern (Rice-Wheat-Mungbean) has been developed by the inclusion of BARI Mung-6. Within short period it has been proved that it is possible to grow mungbean between wheat and monsoon rice. It has also been proved it's potentially in the research field as well as farmers field. Its area and production increasing rapidly which created a miracle development to the wheat growers. Farmers in the rice based areas also revealed that mungbean can be integrated after the wheat harvest. As a result, now days maximum lands after wheat harvest under munbean cultivation, i.e. earlier, fallow lands are now in mungbean cultivation. This technology increased farm productivity and soil fertility is also improved to benefit to the succeeding crops.



Fig: Rice



Wheat



Mungbean

Creation of Job opportunity:

World wide job crisis, Bangladesh is not out of that boundary. In this situation any type of little bit work, in terms of income generation is very much hopeful. Mungbean cultivation is one of the ways to create job through mungben pod picking and post harvest processing especially to the rural women and children in their idle time.



Fig. Mungbean pod picking



Fig. Mungbean pod bagging

Income generation:

Rice-wheat-mungbean crop rotation boost up farmer's economy. Most of work in mungbean cultivation more or less provide income. Mungbean pod picking, threshing and drying activities in relation to mungbean cultivation are the such type of job which have created income generation for the rural people especially poor women and children. It was estimated that by picking mungbean pod about Tk. 9000/ha @ Tk 200-250/day (TK.10-12/kg) can be earned per person. Besides this, additional production of mungbean are using as value aided product like mugankkur and fried dal which provide 3-4 times income over raw mungbean. For the production of value aided product through mungbean, small industries have been developed which will cerate additional income generation activities resulting increase inome of the people. Different industries are using this

variety whose are earlier purchase from foreign country. Japan Govt. also purchasing this variety's seed from Bangladesh. As a result we are earning foreign currency through export.





Post harvest processing of BARI Mung-6

Poverty alleviation:

Use of fallow land by mungbean cultivation provided additional production of mungbean, creates job opportunity by pod picking and post harvest processing, increase income and improve soil health which decrease production cost of succeeding crops. Creation of job and increase income is helping poverty alleviation. Many women and family are now leading healthy life through these works.

Improvement of soil health:

It has also broken cereal based mono-culture in the cropping system. After two picking of pod, it provides 8-10 t/ha green/brown bio-mass which improved soil health through recycling organic matter (Table 1).



Fig: Mungbean plants plough done by country plough

Table-1. Soil fertility status of Initial and after two years cropping cycle (final).

Soil status	pH	OM (%)	Total N (%)	P µg/ml	K µg/ml	S µg/ml	Zn µg/ml
Before mungbean	7.5	1.20	0.063	12	0.17	15	1.9
After mungbean	7.4	1.22	0.068	15	0.17	16.0	2.0

Mungbean for nutritional food security:

Pulses have enormous potential to contribute to the amelioration of poverty and malnutrition. Pulses are an important alternative to vegetables for supplementing the diet of most people in the country. In general pulses remained a major source of proteins while animal food products rich in protein are beyond the reach of poor people. Mungbean also important for the important pulses crop which content 21.20% protein, 46.8% carbohydrate and other nutrient elements and essential lysine also. In Bangladesh, earlier only 12 grams of pulse per capita per day are consumed against the WHO recommendation of 45 grams but now consumption rate about 17 gm per day per head only due to increased mungbean area and production. From the nutritional point of view, mungbean as a pulse member, contributed significantly in the Bangladeshi diet. Bangladesh has a high proportion of population with protein malnutrition. The increased production of pulses (Mungbean) is used as nutritional security of the poorer section of the society. Nutritionists have given thrust for taking cheap plant protein as a substitute of meat. Due to its high protein content (21-20%) and other nutrient elements, its additional production has ensured the nutritional food supply for the people of Bangladesh. Nutritious food like mugankur and fried dal etc. are also produced.

Conclusion:

From the above success stories, it is concluded that BARI Mung-6 has been created green revolution in Bangladesh through its increased area (228.90%), production (432.35%) during about last 10 years, increased nutrition supply, job opportunity, income generation, poverty alleviation and soil health improvement.

Future thrust and needs:

It needs further more research and development activities on short duration mungbean. For the better success of research and development activities, it needs handsome budget through a project.

35. Ghady Chedrawi, FAO, Italy

Hello everyone,

I am glad to be here with you and share an interesting experience that shows how participatory approaches like FAO Dimitra Clubs can highly contribute to improve food nutrition and promote dietary habits.

The Dimitra Clubs are a gender-sensitive participatory approach implemented by FAO that is recognized by development as a good practice. They are groups of women, men and young - mixed or not, who decide to organize themselves so as to work together to bring about changes in their community. They meet regularly to discuss their problems and take action to solve them. These communication spaces for discussion and action have been set up in isolated and remote rural communities of Sub-Saharan Africa (DR Congo, Senegal, Niger, Burundi, and Ghana).

The Dimitra Clubs have had a great success wherever they have been created. The process they stimulate has impact in various fields: improved agricultural practices, food security and nutrition, social mobilization, community governance, transformation of gender relations, behavior changes, and women's leadership. As a result, the clubs facilitate a more gender-equitable access to productive resources, information, services, markets and agricultural innovations.

With regards to nutrition and agriculture issues, the Dimitra Clubs of FAO have been crucial in changing behaviors and improving food security in the communities. For example, in the village of Banizoumbou (Niger), a group of women's members of the Dimitra Clubs obtained a 99-year land lease contract of almost 3 ha of arable land. This was possible thanks to the social dynamics triggered by the FAO-Dimitra Clubs. Today, these women grow nutritious crops and vegetables to feed their families and sell on the market.

To know more about this story, visit:

<http://www.fao.org/gender/gender-home/gender-insight/gender-insightdet/en/c/257888/>

In Oriental Province (DR Congo), 80 Dimitra Clubs were created to tackle poverty, gender and food security issues. One of the results is the new energy and enthusiasm in the villages that are reflected in concrete achievements that improve people's livelihoods. The issue of nutrition has been selected by most clubs and action has been taken. In collaboration with the community radio programme «Mamans et papas réunis» and the implication of traditional chiefs, the clubs have discussed the importance of diet diversity and food taboos. The results have been remarkable, with changes in the food habits. In Botike village, a member of the «Litomba ya Mosala Club» enthusiastically said: «Before we had food taboos: tortoise and today thanks to the club everyone eats it».

One of the main lessons learned with FAO-Dimitra Clubs is that people need to be considered as actors of their own development and not simply as "beneficiaries". Local 'ownership' is essential to sustain capacity but depends on wide-spread and gender-sensitive participation. If both men and women are equally involved at all stages, then programmes have a far greater chance of success.

For further information about this approach please go to the following links:

http://www.fao.org/fileadmin/templates/dimitra/pdf/fiche_cec_2013_en.pdf

Other examples of impact can be found in the Dimitra Newsletter:

<http://www.fao.org/3/a-i4402e.pdf>

36. John Weatherhogg Italy

Sumit Karn's interesting comments from Nepal stirred me up to write myself. He talks of "trying to integrate crop, livestock and nutrition for sunergistic effect" Very correct and crucially important for Nepal where livestock are really about the only resource for improving fertility. It is many years (unfortunately) since I have been in Nepal, but I hope the good work by H.R. Stennett on watershed management (Report FAO-FO-NEP/85/008) - for which he was received the B.R.Sen Award - has

born fruit and not - as so often happens - been quietly forgotten. His work included underplanting of paddy with fodder species so as to get more forage in the stubble after the paddy had been harvested. The main problem was the cultural change and social discipline involved in getting all the famers to undertake the same practices and to share equitably the improve feed for their livestock.

Many thanks for an interesting discussion and comments,

Best regards, John Weatherhogg

37. Krishna Sannigrahi CABI,SAI, India

There is comparatively little current research on indirect effects of agriculture on nutrition, or the effect of policies or governance, rather than technical interventions. Most research is focused on under-nutrition and small farmer households, and few studies target consumers generally, urban populations, or nutrition-related non-communicable diseases. There is very little work on the cost-effectiveness of agricultural interventions. The answer to addressing these challenges starts from addressing leakages in official spending, monitoring of progress and creating linkages among different agencies in several on-going nutrition schemes and projects. Agriculture and Nutrition challenges can be best addressed only after a complete achievement of desired behavioural change goals which somehow have still not reached the lower strata of the Indian society. The maximum challenge to address this problem emerges from the unorganized programmes with the lack of technical expertise knowledge disrupting. Building more support for open data with published case studies in the agriculture and nutrition sectors. This will include starting and continuing conversations with more people in more organisations and from more countries around the world on how thematic networks can really unlock the benefits of open data across the world. Ideally we need to be more focused on agriculture, funding, global policies, malnutrition and nutrition.

38. Sreedevi Shankar Kobaku, ICAR-Central Research Institute for Dryland Agriculture, India .

Malnutrition in the rural communities particularly young married women is of major concern, to eradicate the malnutrition among them, nutrient dense crops should be produced with cost effectiveness and can be addressed through simple biofortification agricultural techniques. Application of PSB to the soil. Study on spinach crop have clearly shown that, application of PSB not only improves yield but also nutritional quality. The application of PSB in combination with FYM or organic treatments is recommended which also helps in lowering antinutritional parameters such as, phytates, tannins and oxalates content in the food crop.

<http://www.fao.org/fsnforum/sites/default/files/resources/Bio%20Spinach%20PDF.pdf>

39. Vidhya Das, India

Dear Sir,

In response to your query, I am attaching an article by me, which was published in the farming matters journal, and can be accessed at: <http://www.agriculturesnetwork.org/magazines/global/farmers-landscapes/tribal-farmers-reclaiming-denuded-landscapes> .

I do hope it will take the discussion forward

Vidhya

Over its years of work with tribal farmers, Agramee has gained the understanding that the best innovations in agriculture for improving nutrition would be to help farmers reclaim their agricultural lands and improve and increase the cultivation of their traditional crops, which ensured a holistic and balanced nutrition of cereals, pulses, and oilseeds, supplemented by tubers, fruits, spinach, and other items from the forest. The following article describes our efforts to help tribal communities reclaim degraded lands for indigenous agricultural crops, and perennial plantations. It was published in farming matters, and can be accessed through <http://www.agriculturesnetwork.org/magazines/global/farmers-landscapes/tribal-farmers-reclaiming-denuded-landscapes> . In the meanwhile, we have taken the processes described herein under further, experimenting with millets and pulses for settled upland cultivation. The processes involve minimum or no soil disturbance methods, and Masanobu Fukuoka's principles of no tilling, no weeding, no chemicals, and no pesticides. Working closely with tribal farmers, we expect that in a few years time, these efforts will have spread amongst tribal farmers, helping them make a major shift away from slash and burn cultivation, and leading to a rejuvenation of tribal eco-systems, and improvement in quality of life within tribal communities.

Reclaiming Tribal Landscapes: Challenging the TINA Myth

By

Vidhya Das

'Podu Chaso' as slash and burn cultivation is called in the tribal regions of Orissa is significant for the biodiversity of crops it has helped to sustain, as also the diversity of cultivation practices it has generated. Crop rotations, intercropping, and other sustainable agricultural practices are a part of the inherited knowledge system of the Podu farmer. More than 1000 varieties of rice ([http://www.mssrf.org/bd/bd-pub/rising%20on%20rice booklet.pdf](http://www.mssrf.org/bd/bd-pub/rising%20on%20rice%20booklet.pdf)) are known to have been preserved by the tribal farmers in the undivided Koraput (now divided into 4 districts, and forming the entire southern tip of the Eastern Indian State of Odisha) region of Odisha. They have several varieties of short duration and long duration upland paddy that grows on the middle region slopes. They also grow some of the most exquisite varieties of scented rice, the most famous amongst them being 'Kala Jeera' so called because the paddy is black in colour before being de-husked. Apart from this, they have short and long duration varieties of Ragi, and the less common millets, including fox tail millet, pearl millet, sorghum, and others I have not been able ascertain the names for. Amongst pulses, they grow several varieties of broad bean, arhar, cow pea, rice bean, urad, and a local variety commonly called 'Bailo'.

Not all of this is grown on hill or mountain slopes, the typical shifting cultivation or swidden land. For example, most of the scented varieties of paddy are low land varieties. Not all of the land under shifting cultivation is mountain land either. But, it is the entire system of agriculture practised by

the tribal communities that has helped preserve this rich bio-diversity of crops, as also the diversity of cultivation, as different systems of cultivation are practised on different types of land and different types of soil.

However, all of this is under increasing threat. Commercial felling has devastated thousands of acres of land of the tribal communities. In addition, the undivided Koraput District has long suffered from lopsided development with rail, road and water reservoirs being built to woo corporate investment at the cost of the tribal land and livelihoods. Studies estimate that just in the Koraput region, more than half a million people have been displaced due to big dams, and more than ten thousand hectares of forest land destroyed. Governments in India have adopted the TINA (There Is No Alternative) philosophy for addressing poverty, based on the claim that despite several efforts, programmes, schemes for land, village and community development, poverty persists in the tribal regions. They underline that the only solution to this is to invite corporate investment. However, most displacement due to multi-million dollar projects investments have only further impoverished tribal communities (<http://infochangeindia.org/agenda/migration-a-displacement/paying-the-price-for-someone-elses-displacement.html>).

In addition, climate change has also affected the rainfall patterns of the region, affecting cultivation practices, and the fragile geo-physiology of these regions. The result of all this, is the near decimation of the 'Podu' system of cultivation, and the livelihoods of the tribal communities, which were in tandem with the local agro-climatic conditions, and the eco-niche of the eastern ghats. All this has brought the tribal communities, to the brink of starvation. In fact hunger stares them in the face for several months in a year, their rich forests have disappeared, their luxurious hill slopes on which they could grow upto 10 different crops in one place in one season have turned to barren patches of rock, and rubble, on which they keep trying their 'Podu', in desperation trying to relive the memories of those bountiful days, in not such a distant past.

What is the way out? Seeking to address the situation with a people centred and holistic approach, Agramee entered into dialogue with tribal farmers, on what could be the alternative that might be sustainable, and eco-friendly, while helping tribal communities preserve their cropping patterns and produce their own food. The dialogue led to the idea of eco-villages. The best initiative came from farmers in Chandragiri Panchayat (Panchayat is a cluster of villages) Rayagada District, in Odisha. Here, farmers pointed out that there was a need for addressing the problem in a multi-pronged manner, whereby the multiple stress on the land and the hill slopes could be managed in a more organised manner. This included better governance of commons, improved land use and soil management, moving towards settled cultivation, and rejuvenating uplands with miscellaneous multi-tier plantations and permanent tree crops that could provide livelihood support as well as cash income. This was a huge task, and a challenge for tribal farmers who have little resources other than the land and their own labour. However the longest journey begins with one step. The first step then was to frame the rules for better governance of resources. Over a process of dialogue, and discussion, the rules emerged: controlled grazing of cattle; no intoxicants including alcohol, 'Gudaku' (A sticky paste made of tobacco and lime) or cigarettes; every child in school; protection of all forests, collective labour for village development; everybody to maintain compost pits for disposing waste.

This was followed by involved discussions on improved land use. Agramee members provided inputs through their long experience on working with tribal communities and tribal lands. Support also came from organisations like IPAF (Indigenous People's Assistance Facility) NABARD (National

Bank for Agricultural Development) and KKS (Karl Kubel Stiftung). The first task everybody agreed was to improve agricultural practices, and soil fertility. Through the practise of shifting cultivation, much of the agricultural lands were almost waste lands. They were being cultivated in rotations of 7 to 8 years, with the fallow period ranging from 3 to 6 years. Even then, the yield in these crops was erratic and uncertain. Often times, even the input costs were not recovered. This necessitated cultivation of hill-slopes, which were common lands, used for grazing, as also accessed for firewood by women. Gradually, women were losing their firewood sources, and food gathering on the forested commons had almost completely disappeared.

A series of consultations with 25 tribal villages was taken up, based on past experience with natural resources and agricultural development programmes. The details of a plan began to emerge. The community felt that they had been very short sighted, in the past, wherein they had neglected plantations, and orchards, and allowed them to die. The loss was underlined by the few, less than 5 % of tribal farmers, who had taken the trouble to maintain their plantations of cashew and mango. These people were getting significant returns today from the sale of cashew and mango, when others were in penury. The village community decided they would take up action at three levels. One at the level of governance, based on the rules formulated as mentioned above, the second would be collective effort to rejuvenate the commons, this was a prime need emphasised by women, and the third would be efforts to move away from shifting cultivation to settled plots, conserving energy and resources on cropped land, and allowing uncropped lands to rejuvenate.

The process was a challenge in the steep stony uplands, much of which was already denuded. However the farmers took it up with courage and determination. They decided to first address the problems of their agricultural uplands. Agramee stepped in with support for fencing, and other land development works. farmers also wanted plant material for developing income generating plantations. So a common design for the farmers' lands was worked out which combined perennial plantations with rainfed cropping, and also included development of the hedgerow with fire-wood and timber trees for an integrated livelihood support to the family.

Women in the community felt that it was not enough to protect just the private lands, they pointed out that this would not provide them with firewood and fodder that was as essential as agriculture. Thus, it was decided to address the question of commons by initiating protection and rejuvenation. Women took the initiative in this, deciding what trees they would plant, and also taking up annual intercropping, which ensuring their commons was properly fenced in, and no cattle could come in.

In Kebedi Village, 35 farmers, which is almost the entire village decided to address the situation through collective effort. Realising that open grazing of cattle was doing much harm, they decided to fence in their areas, to protect and conserve it. Every farmer agreed to take up one acre of up land, and develop it for settled agriculture. Farmers with common borders decided to fence in their lands together. Within 2 years, farmers have been able to find the difference between fenced in lands, and those left for open grazing. Not only have the perennial tree plantations established, they have also been able to take annual crops of lentils and millets, without soil degradation. They are also gradually adopting zero tillage practices, which has improved soil fertility.

Women have come together as a group, for protecting common lands. as a first step, and an example, they have protected 25 acres of uplands through a combination of social fencing, and green and mechanical fencing. The green fencing will reach the stage of forming a complete protective barrier in another year's time. They have combined income generating trees like cashew

with firewood trees, and also intercropped with annual legumes, the returns from which has been shared amongst all.

These efforts have inspired other villages also to take up similar effort. In many villages, people have begun to fence in their lands, and develop it with permanent tree cover combined with annual seasonal crops.

The more important effort is being taken up by women on common lands, which are being reclaimed with huge effort by women's collectives. In the village of Maligaon, women have fenced in 25 acres of land, and have intercropped seasonal legumes with Mango plants. While the mango takes time to mature, they have been taking legume crops from the land. These two villages have set an example for the entire regions, and inspired several other villages also to make similar effort.

Poverty and neglect by the government has set back the community of tribal people in southern Odisha significantly. Under these circumstances, their efforts for reclaiming lands in the hilly terrains of Koraput is a difficult challenge for the people, as also for Non-governmental organisations like Agrabamee who are committed to tribal development and wellbeing and works in Koraput and other tribal districts of Odisha. A beginning has been made with the courage and determination of the tribal people, and specially the tribal women, who have bravely stepped out to save their commons. These are efforts which provide the alternatives to big dams and industry, which need to be recognised, supported and promoted.

40.A. Laxmaiah, National Institute of Nutrition, India

The global agricultural system is primarily concerned with ensuring that sufficient food will be produced to feed the global population. However, to tackle global public health problems associated with both under- and over-nutrition, healthy diets must be available, just not only calorie supply. In order to reach nutrition security, more strategic partnerships between agricultural research departments and health and nutrition research communities are required. Public investment in agricultural research and development has been steadily decreasing, even as the GDP of India is on the rise.

The Indian agriculture sector remains one of the least productive in the world. Continued growth of the agriculture sector is important for maintaining food and nutrition security, and enhancing the purchasing power of the rural population. Expansion of agriculture requires public investment in agriculture and rural infrastructure, and regulation of farm inputs and services.

Good nutrition is often equated with balanced food consumption only. Even if a person consumes enough calories, they may still be undernourished due to lack of essential vitamins, which are provided by a high diverse diet. Increasing the production of nutrient-dense foods, particularly locally adapted varieties rich in micronutrients and protein, is vital for combating nutrition related chronic diseases.

Therefore, promotion of production more of green leafy vegetable and fruits in the backyards of rural houses is very important. We have also seen many success stories in this direction. Horticultural promotion through social marketing approach can decrease micronutrient deficiencies in the world. The magnitude of micronutrient deficiencies are wide spread over among 2 billion populations.

In this connection, we are also carrying out a major study in the states of Orissa and Bihar (Nutrition and Agricultural disconnect).

As per the National Nutrition Monitoring Bureau (NNMB) health and nutrition periodical surveys, revealed that even though the farmers produce many variety of food products like milk, fruits and vegetables, but they never consume in recommended amounts (RDA) due to economic reasons and they sell out entire their produces (elastic foodstuffs) for sake of money. Many of these farmer communities are generally illiterates; it is too much to expect their nutrition literacy. Even literates are nutritionally illiterates. India has more 65% families are farm dependent. If increase their nutrition knowledge, will definitely reduce the undernutrition in India.

The rural and tribal schools may be promoted to grow fruits and vegetables in the school premises and encourage them to consume the same. Most of the vegetable may be encouraged to use in the MDM preparations to enrich their micronutrients.

41. Bibhu Prasad Mohanty, India

I as a motivator and person from Swaminathan School of thoughts promoted 3 things in my career and projects works in strengthening nutrition enriched agriculture. The first approach was to increasing the area of cultivation of non-cereal crops mostly neglected nutritive horticultural species suitable for human being and domestic animals. Making availability of good nutritive feed for animals is a challenge area. But it could be made possible in Jharkhand because of Govt. support. Second aspect, I tried to boost local women SHGs through awareness programs and trainings on nutrition and conducted special trainings on kitchen behaviour and recipes on various nutritive stuff available at local level. As the demand is increased so the pressure for production is increased. I tried to influence Govt and other large parties involve in MDM, hostels, or mass food distribution to include millets and other nutritive stuff for mass use. Here I failed miserably.

Thanks with warm regards

Bibhu

42. G.N.V. Brahmam, India

There is nothing new, in the approach of home gardening & Social marketing in alleviating malnutrition, especially MNDs like VAD. But the fact is, its current application in the community is rather sub-optima. In order to emphasise the need, I am herewith attaching two publications (though pretty old), which are based on excellent work carried out by my colleagues, decades ago.

Dr. G.N.V. Brahmam, M.B.,B.S., D.P.H.

http://www.fao.org/fsnforum/sites/default/files/resources/homegardening_FNBuull.pdf

http://www.fao.org/fsnforum/sites/default/files/resources/social_marketing_FNBull.pdf

43. Jane Sherman, Food and Agriculture Organization of the UN, Italy

Show us the way!

It is great to hear so many stories of improved agriculture, improved strains, better seeds and biofortification. What concerns me is that we are not talking enough about the pathways from agriculture to better nutrition. It is not at all clear that increased productivity, greater income, improved quality or variety of food production necessarily result in improvements in diet and health. We need to know and show why and how this happens or does not happen.

There has been some mention in this forum discussion of promising avenues for converting greater availability into better dietary practice: for example behaviour change approaches, nutrition education, involving women, enabling people to make their own decisions and hands-on home-linked school education. We need to do much much more in these areas, and integrate it better with the food security initiatives it supplements and catalyses.

We also need to test what we do, making sure that these approaches get their own impact evaluation, quite distinct from agricultural/horticultural outputs and availability, so that we can show what mix of actions can best influence dietary change and make it last.

We are not alone. The major players in the fields of agriculture and nutrition have not yet sorted out the answers to the how question. What is very positive is that the challenge has been proclaimed, not least by this forum, and that we are beginning to try to meet it.

Jane Sherman, Nutrition Education Consultant, FAO, Rome

44. Florence Egal, Food Security and Nutrition expert, Italy

I have read with a lot of interest the different contributions, learnt a lot and had the pleasure to come across old friends. But I wonder if innovation in agriculture (instead of a food system approach) was not too narrow an entry point. We must move beyond the classical supply-driven value chain/commodity approach and revisit production systems from the demand side; re-localize development efforts, support family agriculture and aim for resilient food systems which make the best of existing resources (including indigenous knowledge).

Local government – and in an increasingly urbanized world, cities – should take the lead and engage in sustainable territorial planning in consultation with all relevant actors, aiming at food security and environmental sustainability in both rural and urban areas, while protecting and creating decent jobs and fulfilling human rights. Economics are important but there are only one dimension; health staff, sociologists, agronomists, environmentalists and economists must join forces to address complexity and learn together from existing practice.

Food-based nutrition education (in particular cooking demonstrations) can lead to changes in household food production. The promotion of sustainable diets constitutes the logical entry point and goal for sustainable food systems and a long-term solution to malnutrition.

45. Sonali Phate, M S Swaminathan Research Foundation, India

Dear Sir / Madam

Kindly find attached the case study for sharing on FSN Forum from M S Swaminathan research Foundation working in Vidharbha region specially in Wardha and Yawatmal districts under Mahila Kisan Sashtikaran Pariyojana.

Regards,

Sonali Phate

M S Swaminathan Research Foundation,
Wardha

Link:

<http://www.fao.org/fsnforum/sites/default/files/resources/Fulfilling%20Nutritional%20needs%20through%20kitchen%20garden.doc>

46. Alan Dangour, facilitator

Dear Colleagues,

As our consultation period draws to a close, we take this opportunity to thank you for your fantastic contributions to this important debate. We are delighted that we've engendered such a tremendous response and very grateful to you all for taking the time to share your thoughts and experiences.

There is clearly a lot of knowledge already in this field, and there are also many innovations in agriculture and the food system more broadly, which have been tested and proposed for further research. We are grateful for your willingness to share your ideas with us in such a collegiate manner. We will aim to draw together the general themes and specific ideas generated by the consultation in a single document in the next few weeks so please do keep an eye on the forum page.

Moving forward, the [Leveraging Agriculture for Nutrition in South Asia](#) (LANSA) programme plans to launch a Call for Research under its second Responsive Window in July 2015. We hope to attract research proposals seeking to conduct high quality formative and feasibility research on 'Innovations in Agriculture for Nutrition' in Afghanistan, Bangladesh, India and Pakistan. We shall use your ideas to shape the Call for Proposals.

We hope that the research funded by LANSA will generate sufficient evidence to support the future scale-up and formal testing of innovations to improve nutrition and food security in the Region. Please do consider this opportunity and share it with your colleagues when it is announced.

Finally, we thank you again for your support and contributions to this consultation. It has been an extremely rewarding and refreshing process.

With very best wishes,

Prof. M S Swaminathan

Dr. Alan Dangour

47.Naureen Bakhsh Chaudhry, Pakistan Poverty Alleviation Fund (PPAF), Pakistan

Pakistan Poverty Alleviation Fund (PPAF) is the lead apex institution for community-driven development in the country. As the sector developer and lead apex institution, Pakistan Poverty Alleviation Fund (PPAF) has been promoting value chain development since 2009 in partnership with The World Bank and International Fund for Agricultural Development (IFAD) under the Microfinance Innovation and Outreach Programme (MIOP) and the Programme for Increasing Sustainable Microfinance (PRISM). In order to promote low income households, PPAF along with its partner organizations provides strategic inputs and expertise that facilitate the growth of inclusive, niche and customized pro-poor value chain models for the marginalized and vulnerable. These value chains are aimed at institutional development, business development services, technical assistance, creating backward and forward linkages of communities, market access and increased gains for clients and communities. PPAF has implemented various pro-poor value chains related to poultry, dairy, livestock, agriculture, stitching, embroidery and enterprise.

Agriculture constitutes the largest sector of Pakistan's economy and contributes about 24 percent of Gross Domestic Product (GDP). There is dire need of providing small farmers with timely access to financial resources, provision of agri extension services and creation of linkages with various line departments, fertilizers, seed providers and food processing units to optimize their agri produce. The aim should be to emancipate small farmers from the clutches of "arthi" and increase farm productivity to improve their socio-economic status in life.

PPAF in lieu of its role as a sector developer has always aspired to transform the lives of poor farmers residing in rural communities across Pakistan, through a profusion of different agricultural initiatives. In order to lend its hand to the country's economy, PPAF, in collaboration with NRSP-Bank, designed a comprehensive multi-dimensional Agricultural Value Chain (AVC) for 10,000 wheat farmers in district Bahawalpur. Bahawalpur is located in Punjab province of Pakistan, and constitutes a large agricultural land and farming community. The economy of the district is essentially agrarian and wheat, cotton, rice, sugarcane, gram, pulses and dates are the major crops grown in the canal fed district.

This multi-dimensional agri-value chain was designed by PPAF with a vision to cover each and every aspect of crop life cycle, so as to reduce the dependence of the subsistence farmer on the middleman. The 10,000 farmers selected for the intervention were small farmers, having less than 5 acres of landholding. This multi-dimensional value chain consists of the following components:

- **Baseline Study:** A comprehensive baseline study was conducted by a third party consultant to inculcate necessary activities in the agri-value chain so that each and every aspect is covered in the initiative.
- **Financial Product:** Aimed to meet the needs and requirements of the farmers, NRSP-Bank offered larger loans of upto PKR 80,000, based on per acre agricultural input cost.
- **Social Mobilization:** Participant farmers of the value chain have been organized into Farmer Enterprise Groups (FEGs) through social mobilization, where 10,000 farmers have been organized into 864 FEGs. Moreover, an apex body of the farmers has been formed to enable the farmers to engage in collective bargaining and negotiation of improved rates for their output.
- **Capacity Building:** In order to overcome the lack of awareness and education about best farming practices, productivity experts have been hired to conduct trainings for the target farmers on crop management, farming best practices and financial literacy.
- **Improved Nutrition for farmers and communities:** Bahawalpur is one of the most deficient areas in Pakistan in terms of zinc presence in soil, hence zinc foliar spray has been deployed for 1 acre of land for each farmer with an aim to help fulfil the zinc deficiency of each of the 10,000 subsistence farmer households (1 x 7 family members). Partnership with Harvestplus, a public sector nutrition research institute, and a corporate entity Fauji Fertilizer Company (FFC) was formulated wherein FFC provided raw material for the zinc foliar spray at competitive prices and aided in provision of trainings to the Agri-Value Chain NRSP-Bank staff as well as Farmer Enterprise Groups-FEG leaders/ apex body heads, who further trained other farmers, about the Zinc Foliar Spray.
- **Linkages:** Backward and forward linkages have been created to facilitate on-farm technical assistance, soil testing and preparation, water testing, provision of quality seeds and fertilizers. In this regard various, public and private, institutions were engaged for provision of aforementioned agri inputs and advisory services. Forward linkages have also been created with government departments for timely uptake of harvested yield from farmers directly at government support price for wheat. Government provided bags and transportation cost (bardana) to the farmers. Moreover linkages were also created with FFC & Onfarm Water Management Department of Punjab for laser levelling and soil testing of the farmers' land, which has fostered decline in use of fertilizers, water conservation has been facilitated and there has also been a reduction in the use of diesel for tube wells.
- **Crop Yield Insurance:** In order to cover the risks of farmers, a comprehensive Crop Yield Insurance Product has been developed which provides insurance coverage in case of crop loss occurred due to natural calamities. Reference yield was calculated based on the crop yield data obtained from local markets, farmers knowledge and government department. Insurance coverage for 9,450 acres of 3,965 farmers has been completed. This initiative has aided to secure the assets of underserved marginalized farmers of District Bahawalpur against which claims amounting to PKR 0.72 Million have been distributed by the insurance companies to cover losses incurred by 14 farmers amid the adverse weather conditions. Further on, an additional 22,500 acres are to be insured as an upscale of this initiative for cotton crop. In this regard indices for deploying this mechanism are being designed in assistance from government departments, farmer knowledge and market firms.

- **Technology:** Debit cards are being designed for the farmers for which funds would be made available in a bank account in the farmer's name accessible through a bank card. Agreements between NRSP-MFB and supplier shops supplying fertilizer, seeds and pesticides would lead to transactions being completed between farmers and the supplier shop without the exchange of physical cash. The farmer would be able to withdraw cash (if required) for purchase of labor or hiring other services through agents of a branchless banking operator or from an ATM machine of a bank.
- **Environment Safeguards:** PPAF has facilitated collaboration with CABI – the first agriculture pertinent research institute of Pakistan – for deployment of Natural Enemy Farm Reservoir (NEFR). In the second phase of the value chain, women cotton pickers will be provided training to build their capacity to avoid risks and hazards associated with pesticides as well as pests. Based on the needs of the women farmers in the area, a women centric insurance product is being designed providing insurance coverage from diseases/animal bites which women cotton pickers are prone to.
- **Good Agricultural Practices (GAP):** In order to build capacity of NRSP-Bank AVC staff for effective and refined execution of the project, CABI has also been engaged for imparting a comprehensive ToT program. The GAP trainings will include integrated water management, integrated soil management, Habitat conservation, Fiber quality preservation and decent work promotion. This training program will be carried out in the upscale phase of the project, focusing on cotton crop.
- **SMS Service:** In order to build awareness and ensure that farmers remain up-to date about the latest best farming techniques, a SMS service is being initiated for the farmers participating this value chain. The service would facilitate the farmers in deploying best agri practices in a timely manner.
- **Warehouse Receipts:** In order reduce possible delays in uptake of the agri-value chain farmers' harvested yield, the world renowned warehouse receipts concept has also been introduced, whereby a limited number of farmers have been provided storage facility, so that they do not have to sell their crop at throwaway prices. Till date, one warehouse is operating through a specialized service delivery firm.

This value chain has played an imperative role in enhancing the farmers' incomes through increased access to financial services, enhanced technical capacity of the farmers enabling them to increase productivity through adoption of modern and latest farming tools & techniques. Results from implementation of the value chain indicate that crop yield of the farmers has increased by up-to 20%, Crop yield insurance has mitigated the risk for the farmers as well as for NRSP- Bank. Moreover, due to the larger loan sizes, NRSP-Bank's cost of delivery has also decreased. Direct links created with the government departments have enabled the farmers to gain maximum profits through sale on government support price, minimizing the dependence of the farmers on the middlemen (arthi). This value chain has resulted in a positive impact on the rural economy, improved nutrition, gender empowerment and fuelling a process of local as well as national agricultural growth. The value chain has also fostered adoption of productive farming patterns in the area, resulting in enhanced productivity and efficiency while bringing a positive impact on the social and economic status of the smallholder farmers.

48. Courtney Greene, International Fertilizer Development Center, United States of America

Good Farm Management Practices, including Fertilizer Deep Placement, in Bangladesh – Improving Nutrition and Gender Equity

The International Fertilizer Development Center has been active in Bangladesh for over 35 years – working with farmers to increase productivity, advocating for enabling policies and introducing good farm management practices and technologies such as fertilizer deep placement (FDP). FDP accomplishes what agriculture must do in a changing climate: lower pollution, increase efficiency, reduce costs and increase yields. Instead of simply broadcasting prilled urea into a rice paddy (the traditional practice), farmers place small fertilizer briquettes into the wet soil between rice plants. Rice yields increase by an average of 20 percent, farmers use one-third less fertilizer, and nutrient losses to air and water drop by half.

Based on this success, IFDC's focus now extends beyond rice production to fruit, vegetable and maize crops. Vegetable cultivation in Bangladesh heavily features women as producers. In 2013, IFDC partnered with the Walmart Foundation to bring best farm management practices, including FDP technology, to 40,000 Bangladeshi women farmers. The goal is to empower women to grow and market more nutritious, high-value vegetables and fruits. This crop diversification provides variety for primarily rice-based diets, which inherently lack balanced nutrients necessary for human health.

Income increases for women farmers utilizing FDP in vegetable crops have averaged U.S. \$202 per farm per season to date. Empowering women not only boosts family income but also promotes ground-level nutrition by increasing the amount of healthy food available for home consumption. The project also is developing a private sector, women-led supply system to ensure an adequate supply of FDP briquettes.

Namita, a project trainee from Jessore Sadar, says “The knowledge I gained from the training on FDP technology and nutrition has allowed me to farm vegetables in a new and effective way. I have transformed into a professional vegetable farmer. Now I can help my husband in his business and contribute to my family's income.”

Project results are still being collected. It is expected that women empowered through these activities will be positioned for greater involvement in family resource and business decisions, positively impacting family income, nutrition and child health and education.

49. Edye Kuyper, UC Davis World Food Center, United States of America

Reviews of existing evidence on the ability of food-based interventions to improve nutrition consistently find that nutrition education (or its absence) is related to the project success in increasing access to healthy, diverse foods. This is also bearing true in high-income countries, where evaluations of efforts to improve access to nutrient-dense foods in low-income neighborhoods are not resulting in the intended dietary improvements.

Yet innovation in the area of food and nutrition education is often an afterthought, and is typically underfunded. The nutrition community often bemoans a perceived inability to compete with the well-funded corporate advertising campaigns seeking to sell less healthy products. Education efforts also tend to be poorly conceived, inadequately tested among the target audience who may also receive insufficient exposure to the promotional messages.

One promising innovation is FAO's ENACT course now being implemented in 14 African countries. Participating undergraduates studying fields as diverse as medicine, agriculture, and nutrition are now equipped to effectively communicate and teach about food and nutrition.

In select African and Asian countries, Alive & Thrive has conducted well designed behavior change campaigns via diverse channels, including mass media as well as interpersonal counseling. This multifaceted approach is demonstrating positive results at scale.

The ability of well-designed food and nutrition education campaigns to deliver desired health and nutrition impacts depends on increased funding and research to these activities. The required investment should not be a deterrent, however: if marketing and promotion were not useful mechanisms for achieving increased consumption of specific foods, lucrative companies would not spend billions of dollars advertising their products.

50. Emily Lewis-Brown, Consultant, United Kingdom

Higher welfare farming usually produces animal products of higher nutritional value

Thank you for this opportunity to contribute to this important research area and discussion. I offer two case studies, one from Asia and one Africa, showing that low technology, often low cost interventions can improve the nutritional status of people and be robust in the face of environmental change. Improved animal welfare is an outcome of these farming systems, and can also act as an indicator of farming that is better for people and the planet.

China case study: dual purpose chickens (attachement 1, http://www.fao.org/fsnforum/sites/default/files/resources/china-chicken-case-study%20copy_0.pdf)

On this farm just outside Beijing, a slower-growing, dual purpose traditional breed of chicken is used to rear males chickens for meat and females are raised primarily for eggs and then used for meat at the end of their laying lives. The products receive premium prices at market due to their high quality. The farm is free range, offering higher welfare to the animals, which enjoy good health outcomes: mortality is low, and antibiotic use is low. It is also likely to be environmentally robust as the feeds are largely grown locally and the manure and crop residues are digested to produce energy. Water pollution is also low.

This model of farming could be applied elsewhere, bringing many benefits. In the UK, research shows that chicken and eggs from free-range and slow-growing breeds are of higher nutritional value than from intensive farming of fast-growing breeds. Meat from male chickens also has superior nutritional value. The research demonstrating this is found in attachment 3 and found online: <https://www.ciwf.org.uk/media/5234769/Nutritional-benefits-of-higher-welfare-animal-products-june-2012.pdf>

Research into the nutritional value of the meat from these end of lay hens and males; and the eggs from this farming system would be of value, to support roll-out of this farming style. The successes of this farming model can be used to secure good food and farming elsewhere. It can be used to resist industrial-scale intensive farming with fast growing breeds; wasteful practices; high grain use and associated vulnerability to feed price-shocks, heat and water stress; higher pollution and poorer outcomes for animals, farmers' health and livelihoods. Combining chicken farming with agro-forestry is an additional step that could bring multiple benefits and is worthy of field trials.

Ethiopia case study: water storage (attachment 2, <http://www.fao.org/fsnforum/sites/default/files/resources/ethiopia-case-study%20copy 0.pdf>)

In semi-arid areas of Africa, access to simple technology for storing water can dramatically improve the lives of people and farm animals. This study (2012) found that year-round access to water increased farm yields up to ten-fold, improved food security and nutrition, and farm animal welfare. It also reduced poverty in small-scale farming in the highlands of Ethiopia.

This study shows a mixed farming system where water harvesters have been used to lift farmers from requiring food assistance each year, to being fully independent, productive and self-reliant for food most years. Through saving water for irrigation of crops through the dry seasons, farmers have been able to secure crop productivity for their families and introduce livestock into their farming, adding manure for fuel and fertiliser; draught for ploughing and water carrying; as well as social and economic gains. The food security, nutrition and financial status of these small-scale family farmers have been advanced dramatically through this simple, low cost, easy to maintain technology. It may be adaptable to benefit other semi-arid areas, and areas where the summer melt waters from the Himalayas reduce as the glaciers reduce with global warming.

I hope you enjoy the materials attached and please do contact me for further information.

Best wishes,

Emily Lewis-Brown,

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on behalf of Compassion in World Farming: www.ciwf.org

51. Madeleine Smith, The SPRING Project - John Snow International- Research and Training Institute, USA

The USAID funded Strengthening Results, Partnerships, and Innovations in Nutrition Globally project staff had the opportunity to visit the USAID Feed the Future project: USAID | Yaajeende in Senegal, which is led by the National Cooperative Business Association CLUSA International (NCBA CLUSA), and focused on nutrition led agriculture. There are many successful innovations in this program, but one that stands out is the Community Based Solution Providers (CBSP) approach, which uses a network of community-based service providers and volunteers to sell and promote nutrition-sensitive products, services, and training. The CBSPs are selected by the communities where they live, and either provide or facilitate access to services and credit by working with larger input suppliers and financial institutions. The CBSPs buy in bulk, and are able to offer products in

smaller quantities, and facilitate group purchases and access to credit in order to reach more vulnerable households with limited assets and purchasing power.

Some examples of items and services sold include horticulture and cereal crop seeds, iodized salt, bio-fortified and enriched flours, fresh vegetables, and animal feed. Other services provided include providing or facilitating access to finance and business planning, traditional and mechanized ripping, and crop insurance. An initial evaluation of the CBSP approach shows that individual CBSP micro-enterprises are profitable, and there is growing demand for nutrition-sensitive agricultural products and services. CBSPs have formed regional networks and leadership structures, which will assume the management, leadership, and quality assurance roles, as well as ensure the sustainability and continued growth of the networks.

Please see these project links for additional information:

<https://www.spring-nutrition/technical-areas/ag-nut.org>

<http://ncba.coop>

<http://usaid.gov/news-information/videos/yaaajeende-community-based-solution-providers>

Thank you for the opportunity to contribute to this highly interesting discussion.

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