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Integrating nutrition into the curricula of agriculture education institutions: Strengthening human capacity to promote nutrition-sensitive agriculture

Collection of contributions received

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Topic note

In many countries, agricultural development has traditionally focused on raising productivity and maximizing production of cereals. For example, in Ethiopia it is evident from a 2015 report that 67.24% of the total cultivated area grows cereals, amounting to 61.5% of total production composed of cereal crops (CSA, 2014/15 Meher season agricultural sample survey for private holding farmers). The same survey results show that only 0.98% of total area of production is covered by vegetables, with only 1.55% total production as vegetable. This production system indicates a problem of dietary diversification where cereal crops are staple foods which constitute a major portion of the national diet. In effect, because a majority of the national food supply is cereal, it is difficult for people to access foods that are richer in protein and minerals, such as milk, meat, fish, eggs, beans, vegetables, and fruits, which are often more expensive than cereals.

Recently the term "nutrition sensitive agriculture" has emerged as a way to define agriculture investments made with the purpose of improving nutrition. The overall objective of nutrition-sensitive agriculture is to make the global food system better equipped to produce good nutritional outcomes. Increases in food production do not necessarily guarantee to improve diets or nutrition.

In addition to the production and consumption patterns found, a shortage of adequately trained agricultural workers providing nutrition services and support is thought to contribute to persisting high rates of malnutrition in Ethiopia (40.4% stunting; 25% underweight; 5% wasting, and 3% overweight/obesity, mini Ethiopian Demographic Health Survey 2014). The shortage of extension workers with nutrition knowledge and skills has been noted in other countries as well, including the most high-burden malnutrition countries of the world.

The lack of nutrition training of agricultural workers is acknowledged globally as a significant barrier to combating malnutrition through agriculture and food systems. Without social and behavioral changes, improved dietary diversity and consumption patterns, food storage, hygiene and preparation practices, the high prevalence of malnutrition may continue, even if incomes, production and productivity increase.

Based on the growing interest in identifying ways in which agriculture can contribute to improved nutrition outcomes, it is valid and timely to review the possible scope and role of agricultural training institutions in promoting nutrition-sensitive agriculture, that is making food systems better equipped to produce good nutritional outcomes.

Ethiopia is one example of a country that has set out to tackle under nutrition by making agriculture more nutrition sensitive and there may be other countries that are taking this direction.

The purpose of this on-line discussion is to share views and experiences of individuals, projects institutions and countries on how to integrate nutrition into the curriculum of agricultural training institutions, and how to strengthen pre-service education for agriculture students so as to develop a competent workforce that is capable of promoting nutrition-sensitive agriculture.

The leading questions for our discussion are:

- **What should be the role of agricultural colleges and higher education institutions to promote nutrition sensitive agriculture?**
- **What is meant by "integrating nutrition into the curriculum"? Does this mean nutrition knowledge alone or also include some competencies in promoting desirable food and dietary behaviors? In other words, what are the absolutely essential competencies of**

"nutrition" to include in the training of agricultural workers? Do the institutions see the relevance of including nutrition into the curriculum?

- **For what purpose? What is expected to result from this extra curriculum element? How do we expect graduates (i.e. agricultural workers) to use the new knowledge and skills in their daily work? What can they do to promote food and dietary diversification and better nutrition outcomes?**
- **Do you have experiences of integrating nutrition in to the curricula of agricultural higher institution? If yes, how will the curriculum change contribute to national nutrition goals or to nutrition objectives adopted by the governments? What are the opportunities, challenges, successes, lessons learnt?**

I thank you in advance for the time and the genuine thoughts that you contribute by responding to these questions. Your practical experience in integrating nutrition into the curricula of agricultural educational institutions is of great importance to facilitate the emergence of a competent workforce in the area of nutrition-sensitive agriculture.

Mebit Kebede Tariku,

B.Sc. in Plant science, M.Sc. Agriculture (specialized in Soil Science), Master of Public health. Jhpiego Ethiopia, ENGINE/USAID funded project, Pre-service education advisor for Nutrition

Contributions received

1. Noreen Mucha, Independent Consultant, Sr Nutrition Advisor, USA

Please find below the link to the following relevant paper on "**Strengthening Human Capacity to Scale Up Nutrition**" by Bread for the World Institute / Helen Keller International.

http://www.fao.org/fsnforum/sites/default/files/resources/strengthening-human-capacity-FINAL_June%202013.pdf

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

Agriculture is the main source of livelihood in India though the contribution of agriculture to national GDP is getting reduced to 15% by 2020. Sixty % of India's population now lives in rural areas where agriculture is the main stay. There is immense indigenous and traditional knowledge on agriculture-plants, soil, water, plant protection, uses and marketing. Agriculture is taught both formally and informally. Formal education starts at 10th class level in the form of occasional courses, diploma courses and polytechniques in agricultural engineering. At University level B.Sc. (Agriculture), B.Sc. (Horticulture), B.Sc (Home Science and Food science and Nutrition), B.Tch (Agri.Engineering), B.Sc (Agro-Forestry) and B.Sc (Food Processing) are offered with good employment potential. With realisation for the need for a nutritious diet, nutrition security has become a national policy issue. Self-sufficiency in nutritious food is promoted by encouraging nutrition gardens/kitchen gardens/backyard gardens/vertical farming, integrating poultry-fishery-horticulture in farming system has become a necessity. Women play a major role in nutrition security. A number of training courses are offered to even illiterate women by informal education. India as a sub-continent with 1200 million people, the scale of coverage has to be enlarged. English is read and spoken only by a minority. Books in local languages are needed. My recent edited book HORTICULTURE FOR NUTRITION SECURITY published by NIPA New Delhi covers a few of above aspects. In any case there is realization among policy makers that nutrition security is equally important to Food Security. India is the second country next to Brazil which passed the Food Security Act-2013 to make food as a right to its citizens.

3. Saibutcharao Mallampalli, Bharath Gomatha AgroResearch and Development Foundation, India

If we imagine the entire world is one ecosystem, Soil Health (soil microorganisms) plays an important role in supply of Food chain. Soil health depends on our Agricultural practices, Technologies we are using, utilization of Natural Resources etc. I believe Livestock is the only solution for integrated sustainable Agriculture. In India Crop-Livestock system is predominant and its very good system for Agriculture in the entire world. Unfortunately, India is moving far away from Crop-Livestock System. As per FAO, soil health is plant health and Human health and its continuation I say Livestock Health is Soil Health.

Education Institutes should work on People, Livestock and Environment relation with soil health. Depending on Agro climatic conditions they should work.

For Example, in India availability of land is big challenge, with limited land we have to produce food for human and livestock at the same time with population of livestock and human increasing. Here crop-livestock system will solve the problem. Produced grains are utilized by human and crop residues, Grain by products utilized by livestock. Here Education Institutions should start their role, they should develop dual purpose crops, synergetic cropping system, and drought resistant crops.

4. Lal Manavado, University of Oslo affiliate, Norway

Integration of Nutrition into Agricultural Education

The purpose of this note is to ascertain whether it is necessary to integrate nutrition into agricultural education, and if so, to explore how may one achieve that objective. I shall use a holistic approach, but it will be within the framework imposed by the logic of relevance to the two areas the current discussion specifies.

Let me begin by asking the question, how may one justify agricultural education? Is it because agricultural education enables those who plan and administer agricultural activities perform their work more effectively? Or is it because it enables those who actually engage in agriculture to produce more, and hence earn more?

If one should answer 'yes' to those two questions as one generally does, it inevitably entails that agricultural activities are undertaken for the sole purpose of earning a profit. Other things being equal, this in turn, entails that agricultural production is only governed by the demand for produce at local, regional or global levels.

This may look innocuous, and indeed in the opinion of many, praiseworthy. However, in real life where many a resounding theory is as tangible as a fata morgana, belief in it is directly responsible for malnutrition and/or inappropriate nutrition among the people.

In the 1980ies, increased peanut production for export in West Africa greatly diminished its availability to the local people, for whom it had been a major source of protein for generations. This led to wide-spread protein deficiency especially among children, which is well-documented. Likewise, in many Asian and South American countries, undue emphasis on cash crops rather than on the food crops and livestock has led to a similar result, or to the rising cost of wholesome food. Eg. Tea, coffee, cocoa, etc, are some of such crops.

I use the term 'wholesome food' advisedly. It may be true that growing cash-crops may enable a farmer to earn more, but the question is whether an appropriate diet would be available to one at an affordable cost when farmers will limit themselves to grow what will enable them to earn most?

Obviously, this is impossible. And if one wishes to eat appropriately, a considerable portion of a cash-crop grower's profits would have to be spent on food. Moreover, it has the same insidious impact on the eating habits of everybody in a given locality.

Now the dietary stage is set for the entrance of Iago! It proclaims in colourful photos, catchy tunes, and sonorous monosyllables that it is 'cool' and modern to consume some brand of industrial feed or drink just as the celebrity X or Y does. What's more, the stuff is comparatively cheap not only with reference to price, but also nutritive content, and taste.

Everywhere in the world, obesity and malnutrition has become a serious threat to public health, and human well-being. This is in part, due to current public ignorance of nutrition, and its failure to understand that one's intake of food ought to be commensurable with one's actual nutritional needs and never with current fashion.

I think now it becomes clear that unless agriculture of a community is guided by its actual nutritional needs, it would be impossible to avoid either malnutrition or its inappropriate counterpart. When this has been done, a community may employ its surplus agricultural capacity on suitable cash-crops, for it would be strange to give priority to the latter in order to import the former.

Thus, integration of nutrition into agriculture is fully justified, because it is the sole justifiable scientific frame of reference within which a community could engage in agriculture to its real benefit.

I shall next take up the question of integration. It is possible to distinguish between two aspects of nutrition one needs to integrate into agricultural education. Even though nutrition is one of our fundamental needs, what is justifiably constitutive of it and how it is satisfied, varies according to age, activity level, and climatic conditions.

For instance, growing children have a greater need for proteins and some minerals than an average grown-up. Those who dwell in colder climes may require more carbohydrates and fats than those who live in tropics. A hard-working lumber-jack in a Canadian forest needs many more Kilo Joules a day than say, a politician.

Meanwhile, agriculture has been with us for several millennia, and the agricultural communities have developed the art with reference to their peculiar climatic and geographic conditions so that they may meet their nutritional needs as well as possible. After many generations, the food culture of a community begins to instantiate how its members may best satisfy their nutritional needs.

Unfortunately, this very important aspect of a community's food culture is often neglected by nutritionists and in agricultural education. I can quote some instances where communities gave up some parts of their food culture for invalid reasons, and their substitution by foreign eating habits necessitated growing inappropriate crops and/or raising inappropriate live stock. Not only were those more very expensive to produce, but were also sometimes the cause of obesity. Eg. Supplanting rice with wheat, depreciation of yams, taro and similar root crops, introduction of sheep and cattle as a source of protein to Andean hill farms.

Therefore, I think agricultural education ought to be revised so that it does emphasise the importance of the traditional crops and livestock of a given area, and strive to improve and enhance them. Of course, this does not rule out introduction of new crops or even livestock, but that must be done with a great deal of caution.

It is crucial that we change the current basic tenet of agricultural education, viz. enabling those who are engaged in it to make the largest possible gain, into more reasonable one. That is, agricultural education should be concerned with enabling those who are engaged in it to make a reasonable gain by producing appropriate foods required to adequately meet the real nutritional needs of a community.

Improvement of crops and livestock through research etc., is one of the important means of ensuring that one may make a reasonable gain by engaging in agriculture.

Sound eating and drinking habits are not givens, and they have to be acquired by learning. Their soundness depends on whether those habits are adequate to meet one's nutritional needs. Now, the producers of food and drink are only a convenient sub-set of consumers of those items.

Hence, nutrition should be an integral component of school education for all, and at a more comprehensive level in agricultural education, for it provides the sole justifiable frame of reference that could guide agriculture as an endeavour that benefits all.

Best wishes!

Lal Manavado.

5. Ghady Chedrawi, FAO, Italy

Hello everyone,

I am glad to share with you a personal story. I have a nutritional background and I have always been interested in food security, particularly how we, as individuals, can contribute to achieve a world free of hunger. After working for seven years in the private food sector in Lebanon, I decided to join a Master's degree called "Management of Urban Food Security" at La Salle Beauvais, a specialized university in France focusing on agriculture, nutrition, and health. The Master especially targets young students from developed countries with the aim to instil a wider understanding of food security problems and provide practical tools and mechanisms that would allow students to go back to their country and contribute to achieving a positive social, economic, and political change, but more important, to give them the know-how to achieve sustainable and nutrition sensitive agriculture.

Integrating nutrition into the curricula of agriculture education institutions is a necessity and it goes a long way. Why?

We can answer with another question: who will be the farmers of the future? We will! Everyone will be. A nutrition-sensitive agriculture concerns every one of us, whether you are an agronomist, a nutritionist, a politician, a teacher or an engineer, agriculture and nutrition affect every aspect of your life. There is no agriculture without nutrition and no nutrition without agriculture. It is time that every farmer knows what crops they should cultivate for a healthy balanced diet, what crops can contribute to maintain nutritious soil sustainably, what crops can have a positive impact on the environment and help climate change mitigation and adaptation, how to avoid post-harvest loss, how agricultural products processing is an added value, how to stock products, how to access markets, how markets work, etc. The list is long. But imagine a world where farmers perfectly know the nutritional value of their products, how to engage their communities and get organized to optimize outcomes, and how to communicate with the public sector, civil society, and the private sector.

This master's degree does not make me an agronomist. I am still a nutritionist but the curricula that rightly addresses nutrition and agriculture education has changed the way I see nutrition. Recently, I asked a colleague in my class what he thought of the Master's degree. He said: When I go back to Niger, I will know exactly what crops I should recommend the farmers to grow in order to fight the drought and have a nutritious healthy lifestyle.

Personally, I never regret leaving everything behind, including a paid job, to pursue this master's degree. I strongly believe in the value of integrating nutrition into the curricula of agriculture education. There is no doubt for me that nutrition-sensitive agriculture education should become part not just of specialized agriculture institutions but even to some extent in primary and secondary schools. In order to promote awareness and increase interest in nutrition-sensitive agriculture, schools should start to organize visits for their young students to farms, agro-industries, food supply chains, and to their own school cafeterias to show them how agriculture and nutrition are combined, and why this combination is essential. Such initiatives would encourage college students to pursue agriculture studies at the undergraduate and graduate levels, and enrich the agricultural sector.

Thank you all,

Ghady

6. Michelle DeFreese, Innovative Agricultural Research Initiative (iAGRI), Tanzania

Role of agricultural colleges and higher education institutions to promote nutrition sensitive agriculture.

Agricultural colleges play an important role in promoting nutrition-sensitive agriculture through several mechanisms. Institutions of higher education provide a key entry point where nutrition-sensitive agriculture can be incorporated into curricula and into the training of agronomists and agricultural extension agents. Agricultural colleges are critical to not only building capacity but also designing programs that incorporate nutrition interventions tailored to goals and outcomes. These institutions are able to support nutrition-sensitive approaches through the training of agricultural extension agents and instilling competencies in both nutrition and agronomy. Agricultural colleges are also critical institutions whereby nutrition-sensitive agricultural approaches can be integrated into multiple programs and disciplines and facilitate collaborative, cross-disciplinary research and projects.

Universities have the capacity to support innovative nutrition-sensitive agriculture through robust evaluations of the efficacy of these programs in supporting household nutrition aims and policies. Institutions of higher education are also capable of promoting nutrition-sensitive agriculture through policy-relevant research, dissemination of results, and rigorous impact evaluations.

Universities are a key factor in the continuation of knowledge acquisition - both technical and theoretical - enabling nutrition-sensitive agriculture to be incorporated into existing extension systems and agricultural policies. Agricultural colleges are central to the training and capacity building of practitioners and academics including agronomists, nutritionists, and economists creating a cadre of experts adept at linking nutrition aims to agricultural practices. University graduates pursuing education in agricultural extension are able to close the gap between agronomists and nutritionists. Universities are able to produce the next generation of experts with the skills and knowledge to design, implement, and monitor projects that incorporate nutrition-sensitive approaches and perspectives.

In Tanzania, a number of projects are underway and involve universities as critical stakeholders in achieving nutrition-sensitive agriculture programs. At the Innovative Agricultural Research Initiative (iAGRI), a USAID funded partnership of American, Tanzanian, and Africa-wide institutions, emphasis is placed on strengthening the training, collaborative research, and extension capacities of Sokoine University of Agriculture (SUA) and the Tanzanian National Agricultural Research System. By investing in human capacity in the agricultural sciences, the project aims to improve Tanzania's ability to produce the leaders, researchers, and applied scientists it needs to achieve sustainable food security and reduce poverty.

Through investment in higher education in agricultural science and technology, the human capital needed to implement, support, and rigorously monitor and evaluate nutrition-sensitive agriculture can be achieved. With strengthened human capacity in these areas, agricultural colleges are able to integrate nutrition into the curriculum of agriculture extension teams and more effectively link agriculture and nutrition goals.

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

Dear Sirs,

This is just a general comment. In my opinion it is very important to introduce a formal and structured nutrition program in the agriculture curricula. Apart from the logical advantages it could avoid important biases. These occur in some medical pre-graduate medical studies: Pediatric nutrition (first year of life); Endocrinological nutrition (diabetes, obesity); Cardiovascular nutrition (hyper LDL cholesterolemia); Gastroenterological nutrition (intestinal malabsorption), etc. The problem is that real bases and guidance about correct nutrition is missing for the moment and there seems to be no firm possibilities of including this in the medical studies.

As only unsafe food causes 2 million people to die per year (WHO) a general approach, in this case at food production level is more than welcome.

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

8. Suresh Babu, IFPRI, USA

Dear FSN Forum,

I thought this Brief form the World Bank could be useful for the current discussion. This is based on the recent research in 3 states in India.

Thanks,

Suresh Babu

Fostering Agriculture-Nutrition links. Recommendations for Agriculture Extension Curriculum Reforms in India
http://www.fao.org/fsnforum/sites/default/files/resources/Babu%20et%20al%20-%202015.pdf

9. Lisa Kitinoja, The Postharvest Education Foundation, USA

Postharvest losses and food waste reduction has become a global issue, not only because food loss affects food security and income of smallholder farmers, but also because losses of food are a loss of nutrition for growers and consumers. Food loss can be due to quality changes and lower nutritional status, for example when the loss of vitamins occurs during handling without any visual appearance changes. Food loss can be related to food safety issues, for example, due to attack by pests and pathogens that are associated with aflatoxins, anti-nutritive agents or dangerous human

pathogens. Agricultural education curricula should include topics on how to 1) protect foods from damage and deterioration after the harvest, 2) prevent physical loss, loss of quality and nutritional value, and 3) protect foods from contamination and pests during the postharvest period (handling, storage, processing, and marketing).

Dr. Lisa Kitinoja
The Postharvest Education Foundation (PEF)
USA

www.postharvest.org

10. Jane Sherman, FAO, Italy

I have found the discussion so far very interesting and welcome the opportunity to give the point of view of an educator who has some experience of curriculum development and work-related learning.

It seems self-evident that agricultural officers and extension workers should know how to grow a good diet and be able to help others to do so. The potential impact of such capacities in the field has been described and so have the difficulties of achieving it (e.g. by Fanzo et al. 2013). There are therefore moves to introduce nutrition into the pre-service curriculum of agricultural colleges and degree courses. This seems to me to raise some important preliminary questions about the conditions necessary for successful work-related learning in this field.

Question 1- Is it worth doing?

Curriculum space is often jealously guarded and the status of a new subject may have to be fought for. One danger is the offer often made to new entrants of "integration across the curriculum", i.e. distribution across existing core subjects. This generally means fragmentation, loss of coherence and importance, especially if the subject is not allowed its own staff, exams and assessments.

Evidence of nutrition impact in normative agricultural extension activities is thin, hence it may be important to be able to produce evidence, cases and models of successful action, a strong rationale and a promotional plan (even plans for future assessment of impact) when arguing for a proper place for nutrition in the agriculture curriculum.

The evidence is important also in the curriculum itself. If agricultural extension services (AES) are to carry advisory weight in their communities, staff and graduates need to believe in the value of action to promote good diet.

Question 2 -What kind of syllabus should it be?

Nutrition learning for agricultural officers must be an applied subject if it is to have any effect on dietary practices. The syllabus will certainly have a large knowledge component (topic-based), including understanding of the food environment and familiarity with the nutritional values of many foods. However, since "nutrition" in the work of the AES largely refers to educational activities such as enquiring, communicating, explaining, advising and demonstrating, the syllabus must also aim to build working competences (task-based) relating to behaviour change and maintenance.

Topic-based and task-based syllabuses have very different objectives, activities and assessments: for example, task-based learning requires considerable hands-on observation, practice and field application. Many experts and institutions do not recognize the difference: in nutrition, a common error is to assume that the syllabus (a) consists mainly of facts about nutrition, and (b) can therefore be delivered through a few extra lectures. This cannot produce an effective change agent! All

those involved will therefore need to agree what kind of syllabus is needed, and may need to consider including specialists in work-related learning and nutrition education/behaviour change in the curriculum development team.

Question 3- Who else is involved?

The team must ensure that all the players in the institutional environment are consulted and are active in support of the new initiative, for example, that

1. the MoA has adopted nutrition objectives in line with national nutrition aims and that the curriculum is in line with any national nutritional strategy.
2. AES services are prepared to collaborate in formative research into work practices, outlook and knowledge of extension practitioners
3. the institution has agreed to a curriculum review to incorporate nutrition *and* nutrition education objectives, and will allow time for field work
4. the institution and the AES agree to actions necessary to create a supportive service for nutrition-focused activities (e.g. training of supervisors, revision of TORs, adaptation of existing tasks)
5. the capacity is available to develop a curriculum which will be effective in helping to improve diets.

There are plenty of other questions, but these three already seem to magnify the scope of the curriculum exercise considerably. I would very much like to hear comments from participants in this forum, including institutions which are contemplating such a curriculum change.

Jane Sherman,

Nutrition education consultant,

FAO

11. Eileen Omosa, We Grow Ideas, Canada

Thank you for the timely topic.

Integrating nutrition into the curricular of agriculture education institutions

My contribution starts from the last question on experience from incorporating new ideas into training curricular. I draw my experience from working with natural resources management NGOs based in Kenya with activities in Eastern and Southern Africa - one of the projects was coordinated by FAO in the 1990s and early 2000s.

The activity focused on the introduction and incorporation of collaborative natural resources management into forestry training institutions (colleges and universities). The project resource consuming but the end result was worth the effort. The process involved analysing existing curricular of the training institutions, which revealed a mostly plantation forestry orientation with scientific management processes and management practices of forest guards to keep intruders – too far apart from collaborative forest management which involves stakeholders (local communities, government departments, training institutions, industry, etc.). We implemented community-based research to identify the reality on the ground. Then identified and involved trainers (lecturers) and decisions

makers (administration) from forestry training institutions in field visits and informational sessions on benefits of collaborative management. Once the individuals bought into the idea, we facilitated sessions for representatives from training institutions, the Ministry in charge of forestry and the private sector.

The question of resources required to make revisions to an educational curricular came up – financial, human, publications and more. We created and strengthened networks at local and international levels, especially for the sharing of case studies and available training materials. Luckily for us, the FAO Coordinated FTPP programme was global, therefore easier to strengthen networks, especially with projects and training institutions in countries of Asia where community and collaborative forestry had taken route. The financial part involved the establishment of collaborative programs with colleges and universities and mobilizing financial resources for project implementation. We relied on our networks for field visits (by trainers from colleges and universities, government, private sectors and forest adjacent communities) for the purpose of learning from others. The result was a revised Forest Act in support of collaborative forest management, which indirectly required training institutions to make revisions to their curriculum, which was a manageable task for the trainers and decision-makers had been exposed to information and case studies on successful collaborative natural resources management projects. The lesson learnt was that the integration of new ideas into existing curricular involves awareness creation, sensitization on benefits of collaboration, mobilization of resources (financial, human, case studies, how-to-manuals) and availability of supportive policy.

12. Hom Gartaula, Canadian Mennonite University, Canada

I have found the discussion interesting and would like to take this opportunity to say few words. The issue here is incorporating nutrition education into the curricula of agricultural education institutes and increasing capacity of agriculture extension workers to provide better services to the clients. This is indeed a great way to increase dietary diversity among consumers while improving biodiversity on farm, which combinely called 'nutrition sensitive agriculture'.

Incorporating nutrition education in the curricula of agricultural colleges and higher education institutes is important, but it would not be enough to increase dietary diversity and improve nutrition security among farming families. Like functional literacy, the policy makers should pay attention to increase food literacy of farming communities. Food literacy is the understanding nutritional information and acting on the knowledge in ways consistent with promoting nutritional goals and food wellbeing (Block et al., 2011).

Especially in the rural communities the community-based informal education and curriculum-based formal education are two intersecting knowledge spheres, which can become important components to increase food literacy. Our study shows a negative correlation between these two knowledge spheres, showing a potential to increase food literacy by integrating local knowledge on nutrition and agriculture (as we know this is the practice people have been practicing for generations) in the formal education system. Therefore, to increase food literacy and improve nutrition security, can we think of integrating and recognizing the knowledge of local people related to food in formal education system?

13. Mebit Kebede, Jhpiego Ethiopia, Ethiopia

Dear Members,

First of all I would like to appreciate all your genuine ideas, experiences and views forwarded for online discussion on the aforementioned topics.

I have tried to go through with all your ideas and I am very happy to see almost all of you are supporting the ideas of integrating nutrition in to the curricula of agricultural education institutions. I would like also to appreciate those of you who contributed supporting documents in the areas of nutrition agriculture linkage focusing on human resource development in the areas of nutrition sensitive agriculture.

I want to quote one of our colleagues' ideas that he/she used to mention the importance of integrating nutrition in the curricula of agriculture as "I think now it becomes clear that unless agriculture of a community is guided by its actual nutritional needs, it would be impossible to avoid either malnutrition or its inappropriate counterpart." I also strongly agree with this idea. This may answer questions of members who raise its worthiness to do so.

When we say integrating nutrition in the curricula of agriculture education we do not mean that all agricultural graduates will be nutritionist or agricultural professionals will not replace the role of nutritionist. We are saying that agricultural professionals should have basic nutrition knowledge so as to promote nutrition sensitive agriculture. We may not expect from agricultural professional to be competent with detail nutrition skills like those of nutritionist.

Let me share our experience of integrating nutrition in to the curricula of agricultural education. The most important activity that we have to do first is that identifying nutrition core competencies that is relevant for agricultural professional.

Nutrition core competencies we identified for agriculture professionals are listed below: All the listed core competencies are described with their attributes in terms of knowledge, skill and attitude competency domains.

1. Apply basic principles of human nutrition
2. Assist in a variety of agricultural food production and promote use of diversified/complementary foods
3. Promote safe handling of agricultural food products during storage, transportation and preservation
4. Promote nutrition through Behaviour Change Communication(BCC) and use of technology
5. Utilize multi-sectoral collaboration and linkage
6. Plan manage, monitor and evaluate agriculture-related nutrition interventions
7. Apply professionalism and ethics

The challenge we faced at the beginning was how to integrate those nutrition core competencies in to the existing curricula of agricultural education. As we all know curriculum revision requires a great deal with decision makers and it needs long period of time. To escape these long process, add-on approach i.e. integrating the identified nutrition core competencies within the existing potential curriculum of agriculture education was the first option that we followed. Throughout all these process, all the essential stakeholders like MOA, MOH, MOE and other stakeholders were consulted.

Is it possible to address those nutrition core competencies with add-on approach or with extra lecture hours? As it was raised by Jane Sherman [participant to the discussion], this is the most important point that should be answered. Of course, now the Ministry of Agriculture (MoA) endorsed nutrition to be one of Occupational Standard (OS) for mid-level agricultural graduates and we are also working with Ministry of Education (MoE) to do the same for university agricultural graduates.

Having said this much about our experiences, I would like to request members to share their experiences and thought with specific to each leading questions listed under the discussion topics.

Mebit Kebede

14. Alexandrina Sirbu, Romania

Dear all,

It is a nice idea and a lot of topics to be addressed. In many countries the nutrition goes to thorough knowledge as health science; but in the same time remains a part of food security. Promote the nutrition sensitive agriculture in agricultural HE institutions means to prepare a new class of policy makers and / or in-depth study of added value of the quality and range of agro-food goods in order to improve the awareness on diet and a better life style in terms of nutrition and wellbeing.

15. Eloundou Tsanga Germain Grégoire, Center for Communication and Sustainable Development for All (CECOSDA)

[Original in French]

Merci pour la pertinence de ce sujet

Intégrer la nutrition aux programmes d'études des établissements d'enseignement agricole

Un nouveau contexte de production agricole et alimentaire caractérise le monde actuel. Face au défi permanent de la sécurité alimentaire, de la qualité nutritionnelle et organoleptique des aliments, il est important de développer des outils et des méthodes académiques plus adaptés. Au Cameroun, comme dans la plupart des pays en développement l'une des priorités de la formation des travailleurs agricole porte sur les techniques d'accroissement de la production et de la productivité dans le but d'éradiquer la faim et la pauvreté du secteur rural. Cependant, selon les rapports d'activités de terrain menées par le Centre pour la Communication et le développement durable (CECOSDA), les techniques d'amélioration de la qualité doivent de plus en plus être enseignées.

Au Cameroun par exemple la diversité ethnique et culturelle contribue énormément à la diversification du régime alimentaire (On dénombre plus de 280 ethnies aux habitudes alimentaires variées). En général, le type d'aliment cultivé varie selon les localités et les habitudes alimentaires.

Les programmes scolaires agricoles locaux apportent la touche scientifique qui permet d'adapter les stratégies agricoles en fonction de la zone agro écologique du pays où se trouve le travailleur agricole.

Au vue de l'expérience du CECOSDA, je pense que le programme de formation agricole scolaire et universitaire est très important et doit être renforcé par l'introduction des modules de formation sur :

1. Les techniques d'optimisation de la qualité ressources agropastorales locales pour une meilleure santé des populations et une exploitation durable des sols. Méthodes d'exploitation des aliments locaux disponibles pour le développement de régimes alimentaires équilibrés adaptés aux réalités locales ;
2. Doter les apprenants des outils leur permettant de maîtriser les propriétés physiques, chimiques et fonctionnelles, notamment des micro-constituants des plantes alimentaires ;

Il est en réalité important que l'aspect nutrition soit de plus en plus intégrer dans les institutions de formation agricole afin que le volet nutrition ne soit inconnu par les travailleur de ce secteur. Intégrer la nutrition au programme au scolaire de formation agricole c'est intégrer une nouvelle compétence permettant par exemple aux apprenants de dresser des tables de valeur nutritionnelle des plantes cultivé d'une localité. A base de ces tables de valeur l'agriculteur pourra aussi élaborer des régimes alimentaires complets, riches et nutritifs pour les populations de sa zone agricole.

[English version]

Thank you for the pertinence of this topic.

Integrating nutrition into the curricula of agriculture education institutions.

Today´s world is characterized by a new context of agricultural and food production. Faced with the permanent challenge of food security, of the nutritional and organoleptic quality of food, it is important to develop the best adapted tools and academic methods. In Cameroon, as in most developing countries, one of the priorities for training agricultural workers concerns the techniques for increasing production and productivity with the objective of eradicating hunger and poverty in rural areas. However, according to the reports on activities in the field carried out by the *Centre pour la Communication et le Developpement Durable* (CECOSDA) [Centre for Communication and Sustainable Development for All], techniques for quality improvement should be taught more and more.

In Cameroon for example, the ethnic and cultural diversity contributes enormously to the diversification of the food diet (more than 280 ethnicities have been recorded, each with different dietary customs). In general, the type of food cultivated varies according to the location and eating habits.

The local agricultural teaching programs add a scientific touch which allows agricultural strategies to be adapted to the agro-ecological area of the country where the agricultural worker resides.

With regards to the experience of CECOSDA, I think that the school and university agricultural training program is very important and ought to be reinforced by the introduction of training modules on:

Techniques for optimizing the quality of local agro-pastoral resources for the improved health of the population and a sustainable use of the land. Methods of using the locally available food for the development of balanced food diets adapted to local conditions;

Providing students with the tools that will enable them to master the physical, chemical and functional properties, in particular the micro-components of food plants;

In reality it is important that the subject of nutrition is more and more integrated into agricultural training institutions so that the nutritional component is no longer unknown to the worker in the sector.

To include nutrition in the schools' agricultural training program is to add a new skill enabling the students to tabulate the nutritional value of cultivated plants in a particular location. On the basis of

these value tabulations the farmer could also produce comprehensive, rich and nutritious diets for the inhabitants of his agricultural zone.

16. Jane Sherman, FAO, Italy [second contribution]

I thought Dr Gartuala expressed very well the potential tension between the formal curriculum in the college setting and the farmers' knowledge and perceptions in the social and workday landscape:

Especially in the rural communities the community-based informal education and curriculum-based formal education are two intersecting knowledge spheres, which can become important components to increase food literacy. Our study shows a negative correlation between these two knowledge spheres....

Reconciling these two spheres seems to me to be an essential component of the college curriculum, enabling students to create bridges through dialogue and experience with the community, through which they learn as much as the community does. This constructivist approach, "starting where people are" can use an agricultural metaphor: before you plant, first know your soil and your microclimate!

Jane Sherman

Nutrition education consultant, FAO

17. Eileen Omosa, We Grow Ideas, Canada [second contribution]

Whenever I talk about food security and food choices in my mother tongue or national language, people have asked me “is food and nutrition a science or a cultural practice?”

Integrating nutrition into the curriculum would take the following into consideration:

1. Contents of teaching curricular be country or region-specific, in line with variations in climate, soils and ethno cultural food choices and practices. A country with varied climatic conditions will have a curricular content reflecting food advantages in the different climatic conditions, e.g. livestock products, marine foods, food crops, and the role of networks in the exchange of food items.

2. The curriculum to contain detailed information on all stages of the nutritional chain: food production, processing, storage, preparation, to consumption.

3. Where to deliver content of the curriculum? The information could be sourced from extensive research on practices around food and nutrition - what is food to different communities and individuals at various life-stages, when and how people acquire food and nutritional habits, is it through socialization, formal institutions, extension workers? Then can we define an approach with the greatest impact in terms of behaviour change to embrace nutrition sensitive agriculture. The process is to help avoid situations where the curricular is miles apart from practice; practice of households where decisions on food are made.

4. To what extent will changes in curricular have an influence on agricultural practices, especially in rural Africa where agriculture is mostly small-scale and family oriented? I imagine that the integration of nutrition into the curriculum of higher training institutions would be more

practical in societies with large-scale agricultural production, where the use of technological inputs demand reliance on college and university trained personnel. The approach more likely to succeed in rural Africa with family farms is incorporation of information on nutrition sensitive agriculture into curricular at all levels of informal and formal education.

5. What do we know about behavioural change? A suggested approach is awareness creation on interlinkages: good nutrition, costs at the household level in terms of ailments (diabetes, high blood pressures, heart diseases, some cancers) and money. People are more likely to buy into practices that help them avoid ill health and economic costs.
6. How relevant is the inclusion of nutrition-sensitive agriculture in the curricular of colleges and universities, especially in countries where extension services have been privatized? The emerging reality in most developing countries is that students graduating from agricultural colleges and universities are limited to working with large agricultural private farms; most of which are in agriculture as a business, where mono-cropping brings the most economic returns. In such situations, the trained personnel might not have a chance to convince the farm owners on the need to diversify crops for the benefit of people's nutrition! Which is the best approach to work with the private sector on nutrition sensitive agriculture?

18. Pitam Chandra, ICAR, India

There are tremendous changes in the life style, family structure, and work ethos. Nutrition is one thing that could help immensely the present and future generations on this planet to continue making their contributions to the society and environment. Thorough understanding of what our bodies need, dependence on place and type of job, quality and safety, and methods of preparation/storage must become an integral part of primary and secondary education for all. This education cannot be optional. Even practical should be included in the course contents.

19. Subhash Mehta, Devarao Shivaram Trust, India

Nutrition through agro ecology is safe, low cost and low risk and accessible to producer communities at little or no cost and thus agro ecology must be the back bone of curriculums in schools and colleges if we are to mitigate hunger, mal nutrition, poverty and climate change

ttp://www.globalresearch.ca/poisoned-food-poisoned-agriculture-getting-off-the-chemical-trea dmill/5485076

A peer-reviewed study published last year in the British Journal of Nutrition, a leading international journal of nutritional science, showed that organic crops and crop-based foods are between 18 to 69 percent higher in a number of key antioxidants such as polyphenolics than conventionally-grown crops. Numerous studies have linked antioxidants to a reduced risk of chronic diseases, including cardiovascular and neurodegenerative diseases and certain cancers. The research team concluded that a switch to eating organic fruit, vegetable and cereals – and food made from them – would provide additional antioxidants equivalent to eating between one and two extra portions of fruit and vegetables a day.

Moreover, significantly lower levels of a range of toxic heavy metals were found in organic crops. For instance, cadmium is one of only three metal contaminants, along with lead and mercury, for which the European Commission has set maximum permitted contamination levels in food. It was found to be almost 50 percent lower in organic crops. Nitrogen concentrations were also found to be significantly lower in organic crops. Concentrations of total nitrogen were 10 percent, nitrate 30 percent and nitrite 87 percent lower in organic compared to conventional crops. The study also found that pesticide residues were four times more likely to be found in conventional crops than organic ones.

The research was the biggest of its kind ever undertaken. The international team of experts led by Newcastle University in the UK analysed 343 studies into the compositional differences between organic and conventional crops.

The findings contradict those of a 2009 UK Food Standards Agency (FSA) commissioned study which found there were no substantial differences or significant nutritional benefits from organic food. The FSA commissioned study based its conclusions on only 46 publications covering crops, meat and dairy, while the Newcastle University-led meta-analysis is based on data from 343 peer-reviewed publications on composition difference between organic and conventional crops.

There has been for a long time serious concerns about the health impacts of eating food that has been contaminated with petro-chemical pesticides and fertilisers. Over the past 60 years, agriculture has changed more than it did during the previous 12,000. And much of that change has come about due to the so-called 'green revolution', which has entailed soaking crops with petrochemicals. Coinciding with these changes has been the onset and proliferation of numerous diseases and allergies.

The global agritech/agribusiness sector is in effect poisoning our food and the environment with its pesticides, herbicides, GMOs and various other chemical inputs. Journalist Arthur Nelson has written that as many as 31 pesticides could have been banned in the EU because of potential health risks, if a blocked EU paper on hormone-mimicking chemicals had been acted upon.

Christina Sarich recently reported that there are currently 34,000 pesticides registered for use in the US. She states that drinking water it is often contaminated by pesticides and more babies are being born with preventable birth defects due to pesticide exposure. Chemicals are so prevalently used that they show up in breast milk of mothers.

Illnesses are on the rise too, including asthma, autism and learning disabilities, birth defects and reproductive dysfunction, diabetes, Parkinson's and Alzheimer's diseases and several types of cancer. Sarich says that their connection to pesticide exposure becomes more evident with every new study conducted.

Important pollinating insects have been decimated by chemical herbicides and pesticides, which are also stripping the soil of nutrients. As a result, for example, there has been a 41.1 to 100 percent decrease in vitamin A in 6 foods: apple, banana, broccoli, onion, potato and tomato. Both onion and potato saw a 100 percent loss of vitamin A between 1951 and 1999.

In Punjab, India, pesticides have turned the state into a 'cancer epicentre', and Indian soils are being depleted as a result of the application of 'green revolution' ideology and chemical inputs. India is losing 5,334 million tonnes of soil every year due to soil erosion because of the indiscreet and excessive use of fertilisers, insecticides and pesticides. The Indian Council of Agricultural Research reports that soil is become deficient in nutrients and fertility.

We can carry on down the route of chemical-intensive, poisonous agriculture, with our health and the environment continuing to be sacrificed on the altar of corporate profit. Or we can shift to organic farming and investment in and reaffirmation of indigenous models of agriculture as advocated by the International Assessment of Agricultural Knowledge Science and Technology (IAASTD) report.

In this respect, botanist Stuart Newton's states:

"The answers to Indian agricultural productivity is not that of embracing the international, monopolistic, corporate-conglomerate promotion of chemically-dependent GM crops… India has to restore and nurture her depleted, abused soils and not harm them any further, with dubious chemical overload, which are endangering human and animal health." (p24).

Newton provides insight into the importance of soils and their mineral compositions and links their depletion to the 'green revolution'. In turn, these depleted soils cannot help but lead to mass malnourishment. This is quite revealing given that proponents of the 'green revolution' claim it helped reduced malnutrition. Newton favours a system of agroecology, a sound understanding of soil and the eradication of poisonous chemical inputs.

Over the past few years, there have been numerous high level reports from the UN and development agencies putting forward similar arguments and proposals in favour of small farmers and agroecology, but this has not been translated into real action on the ground where peasant farmers increasingly face marginalisation and oppression.

According to Vandana Shiva, for instance, the plundering of Indian agriculture by foreign corporations is resulting in a forced removal of farmers from the land and the destruction of traditional communities on a scale of which has not been witnessed anywhere before throughout history. On a global level, not least because peasant/smallholder farming is more productive than industrial farming and because it feeds most of the world, this is undermining the world's ability for feeding itself. It is also leaving to denutrification: not only in terms of specific items containing less nutrients than before, as described above, but because people are being forced to rely on a narrower range of foodstuffs and crops as monocropping replaces a biodiverse system of agriculture.

The increasingly globalised industrial food system is failing to feed the world but is also responsible for some of the planet's most pressing political, social and environmental crises - not least hunger and poverty. This system – not forgetting the capitalism that underpins it - and the corporations and institutions (IMF, World Bank, WTO) that fuel it must be confronted, as must the wholly inappropriate and unsustainable urban-centric model of 'development' being forced through at the behest of these corporations in places like India.

Organic farmer and activist Bhaskar Save describes how this urban-centric model has served to uproot indigenous agriculture in India with devastating effect:

"The actual reason for pushing the 'Green Revolution' was the much narrower goal of increasing marketable surplus of a few relatively less perishable cereals to fuel the urban-industrial expansion favoured by the government. The new, parasitical way of farming… benefited only the industrialists, traders and the powers-that-be. The farmers' costs rose massively and margins dipped. Combined with the eroding natural fertility of their land, they were left with little in their hands, if not mounting debts and dead soils… Self-reliant farming – with minimal or zero external inputs – was the way we actually farmed, very successfully, in the past. Barring periods of war and excessive colonial oppression, our farmers were largely self-sufficient, and even produced surpluses, though generally smaller quantities of many more items. These, particularly perishables, were tougher to supply urban markets. And so the nation's farmers were steered to grow chemically cultivated monocultures of a few cash-crops like wheat, rice, or sugar, rather than their traditional polycultures that needed no purchased inputs."

Even if proponents of the 'green revolution' choose to live in a fool's paradise by ignoring the ecologically and environmentally unsustainable nature of the system they promote and merely mouth platitudes about organic being less productive, they might like to look at the results Bhaskar Save achieved on his farm. They might also like to consider this analysis which questions the apparent successes claimed by advocates of the 'green revolution'. And they should certainly consider this report based on a 30-year study which concluded that organic yields match conventional yields and

outperform conventional in years of drought. That report also showed that organic agriculture builds rather than deplete soil organic matter, making it a more sustainable system.

But why let science get in the way of propaganda? These proponents have already paved the way for extending the the corporate control of agriculture and the 'green revolution' with their GMOs and further chemical inputs – all underpinned of course by endless deceptions and neoliberal ideology wrapped up as fake concern for the poor.

20. Vijay Yadava Tokala, Punjab Agricultural University, India

Following the rising health consciousness among urban population and increased necessity of creating awareness about balanced nutrition among large proportion of rural population of world, there exists great necessity of including nutrition related topics into curricula of not only agricultural education institutions but also into other basic sciences curricula. On the present day the issue of global food security has recently emerged as an important societal concern. Factors such as the prospect of necessity to feed an additional two billion people in the next two or three decades, the presence today of nearly 870 million people who are chronically hungry and malnourished, and the recent social unrest associated with food price increases; all have contributed to awakening of interest in the issues like sustainable agriculture, nutrition security and reduction of postharvest losses.

In several countries already nutrition is part of curriculum in agriculture and allied branches. In India some of the courses such as home science, food science and nutrition extensively deal with almost all possible related topics of nutrition in detail, while other allied courses have basic topics of nutrition in the curriculum. With the rising concern for postharvest losses alleviation there is need to add topics related to "**reduction of postharvest nutrient losses and food processing**" into curricula.

Including these topics in curricula would ensure considerable difference with work capacity of agricultural workers in enhancing nutritional security by enlightening farmers, rural population and others, towards ways to fulfill essential nutrient requirements of their families from the available food resources. Already several International organizations are working towards the cause to educate about nutritional security and ways to achieve it. Hence we can hope that maximum institutions would find it relevant to include these topics into the curriculum.

I would like to quote my personal experience while working as extension worker. During graduation (B.Sc. Horticulture) we were briefly taught with some of the topics related to food security, source of nutrients, nutrition requirements of average person, malnutrition disorders, role of horticulture in ensuring food and nutrition security. When I started working as Horticulture Extension Officer I had a chance to implement the topics learnt, and encouraged villagers growing kitchen gardens with different vegetables and some fruit plants which could contribute to compensate the nutrition requirement of family and also ensure food safety...

Hence I feel integrating nutrition related topics, also including concepts related to **reduction of postharvest nutrient losses and food processing into curricula of agriculture and allied courses** would show a considerable impact on work ability of agricultural workers (extension workers) to promote nutrition-sensitive agriculture and also to achieve food and nutrition security.

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Vijay Yadav Tokala
PhD (Fruit Science) Scholar (Punjab Agricultural University, India)

The Postharvest Education Foundation, USA (Trained as Postharvest Specialist)
e-mail: vijayyadav.t@hotmail.com

21. Federico Albarracin, UNJBG, Peru

[Spanish version]

Buenos días,

Como experiencia familiar no vasta la información que se le transmita al sector educación, tiene que haber una verdadera sensibilización a los que dirigen las labores agrícolas, en todos los ámbitos como por ejemplo desde el agricultor dueño de la parcela hasta políticos de las comunidades.

Es una buena iniciativa el mejorar estos aprendizajes pero también va de la mano con financiamiento para sus pruebas pilotos que comiencen hacer estas personas capacitadas y un buen asesoramiento en todo el proceso de las pruebas para que no haya deficiencia y no se pierda el interés de mejorar la agricultura.

[English version]

Good morning,

As a family experience, the information provided to the educational institutions does not suffice. Awareness must be truly raised among those involved in farming activities at all levels: from the farmers owning the land to the community political representatives.

Improving training is a good initiative but must go hand in hand with funding for pilot tests to be undertaken by skilled people and adequate advice throughout the whole testing process to avoid any deficiency and ensure that the interest in improving agriculture is preserved.

22. Mebit Kebede, Jhpiego Ethiopia, Ethiopia

Dear members,

During the course of our online discussion, I have seen that most critical issues have been raised to be considered during integration of nutrition within the curricula of agriculture education. From all discussion ideas, I understand that almost all participants agreed with the importance of integrating nutrition in to the curricula of agriculture education is paramount important. The issue mostly raised is the modality on how to integrate it. I would like also to acknowledge those of you who raised issues to be considered while integrating nutrition in to curricula of agriculture. Hope the facilitator will consider all issues accordingly. Some of the ideas forwarded with questions needs further clarification. I would like to forward my opinion on the following issues:

1. To what extent will changes in curricular have an influence on agricultural practices, especially in rural Africa where agriculture is mostly small-scale and family oriented? This issue is raised intentionally to reflect the idea of incorporation of nutrition sensitive agriculture in Africa is more effective if we integrate into curriculum at all levels of informal and formal education. Partially I agree with this idea. Partially because if we incorporate nutrition at all level, it will be more effective but this does not mean that agricultural graduates from higher institutions

equipped with nutrition competency will be more practical only in societies with large-scale agricultural production. How much agricultural graduates in Africa are employed for large scale agricultural production? As far as I know (from Ethiopian experience) almost all agricultural graduates are employed for government organizations to deliver extension services to the community with family farms. But the extension service provided by agriculture professional is focused only to improve agricultural production and productivity. Albeit improving productivity (increase availability) is one of the four pillars for food security, it does not give guarantee for nutrition security. That is why we are saying promotion of nutrition sensitive agriculture is crucial. Therefore, agricultural professional with basic nutrition knowledge working with the community (family farms) will be responsible to promote nutrition sensitive agriculture with other agricultural extension services. This can be effective like other agricultural extension system implemented in developing countries.

2. How relevant is the inclusion of nutrition-sensitive agriculture in the curricular of colleges and universities, especially in countries where extension services have been privatized? I would like to reflect my Idea on this issue by forwarding question: Do you mean that is there a country in which agricultural extension system is fully privatized? If yes, what is the national nutrition strategy of that country says? Whenever we are talking about integration of nutrition in to the curricula of agriculture education basically we should consider the nutrition strategy of the country. The other most important point we should consider is that when we proposed this issue as a discussion point this does not mean that we will have uniform nutrition competencies to be integrated in to the curricula of agriculture education all over the world.

In agriculture private farms, are we appreciating mono-cropping only from their economic returns? I recommend all members to read the attached document “Value chain for nutrition”

I also understand that in countries like India, there is experience of integrating nutrition in to curricula of agriculture. Those of you who do have such experiences, it will be good if you share your experience based on each leading questions before the closeout of the discussion.

Thank you,

Mebit

Value Chains for Nutrition

http://www.fao.org/fsnforum/sites/default/files/resources/Value-Chains-for-Nutrition.pdf

23. Marie-Claude Dop, Institut de Recherche pour le Développement, France

Thanks to Mebit for introducing this crucial issue and to the contributors for their ideas and experiences.

I am glad Mebit mentioned the issue of agricultural extension services. He writes "agricultural graduates are employed by government organisations to deliver extension services to the community..." and "agricultural professionals with basic nutrition knowledge working with the community (family farms) will be responsible to promote nutrition sensitive agriculture with other agricultural extension services".

I believe the FAO developed approach of "Farmer Field Schools" could used to promote nutrition sensitive agriculture in the farming community.

The schools were very successful in promoting "Integrated pest management" as shown by an independent evaluation (van den Berg, Wageningen University, 2004). There have been a few pilot experiences led by FAO introducing the promotion of dietary diversity for improved nutrition in FFS, but they have not been upscaled. Unfortunately FAO did not pursue integration of nutrition aspects in the FFS initiative.

I strongly believe the FFS approach woul be a valuable tool for promoting nutrition sensitive agriculture at the farming community level and I definitely think future agricultural professionals should be trained to become Farmer Field Schools facilitators for promoting nutrition sensitive argiculture.

For those interested, the approach is described in a manual (not applied to nutrition alas !) available on the FAO website.

Marie Claude Dop, nutrition researcher, IRD, France

24. Wajid Pirzada, SAFWCO Foundation, Pakistan

It is utmost important that curricula/syllabi at all level of education from primary through secondary and tertiary level (s) are sensitized to and harmonized with the need to address climate change(CC) through informed policy & action.

At the University level the CC related contents needs to be integrated in to both research & course work in a holistic manner. Be it studies related to environmental sciences, health & nutrition, agricultural & forestry, veterinary & life sciences, energy-related disciplines, economics & international trade, business, gender, conflict and strategic studies one finds relevance of CC in all these and disciplines beyond these.

When it comes to sub disciplines like epidemiological sciences, natural resource management & biodiversity, Clean Technology & Green Economics etc. more insightful contents are needed to inform these sub-disciplines.

Unfortunately, the body of empirical evidence around impact of CC on specific geographical locales is either lacking or is sketchy in nature. Lot more therefore, is needed in terms of investment in CC research for collective good. Research studies at graduate & postgraduate level can have dedicated CC related research programs. In this way a core human resource can be developed that can lead the change management under CC at global, regional & national level(s).

25. Johannes Kahl, Denmark

The focused questions can be described as, how can we transform the whole food system to be more sustainable by a combination of sustainable production and sustainable.

The Organic Food System Programme (OFSP), will actively contribute to solve the focused question by using the organic food system as a model and living laboratory. The Organic Food System Programme (OFSP) will bring a shift from focus on the agricultural production system, to focus on the whole food chain from primary production until the farm gate and further on to sustainable dietary patterns, thereby linking production and consumption.

The OFSP will bring together scientists, initiatives and stakeholders on international, national, regional and local levels building enabling environments facilitating the involvement and processes to work on

the central question how to make food systems more sustainable. One of the identified work areas is "Education and training" wherein tasks are f.e. organization of lectures, modules and courses for Universities on sustainable food systems, sustainable agriculture with focus on nutrition and diets as well as conduction of seminars in local regions for stakeholders and consumer organizations. OFSP partners represent agriculture as well as nutrition departments from Universities in Africa, America, Asia, Australia and Europe.

This results in a wide range of best practise examples of how to integrate nutrition into the curricula of agriculture education on international, national and regional level with focus on sustainable food systems.

Best regards,

Johannes Kahl

26. Lluis Serra-Majem, University of Las Palmas de Gran Canaria & International Mediterranean Diet Foundation, Spain

Bajo mi punto de vista es muy importante integrar los Campus Agricolas con los Campus de Nutrición e incluso de Salud Pública y Ciencias Medioambientales, y eventualmente también los de Tecnologías culinarias y gastronómicas, de modo que la docencia y la investigación universitaria tienda a integrar estas tres grandes areas de forma paulatina. Ello redundaría en un afianciamiento de la sostenibilidad alimentaria sustentada bajo los pilares de la salud pública, el desarrollo económico y rural, el impacto medioambiental y la cultura alimentaria. En el marco de los modelos alimentarios sostenibles sin duda esto supondría un elemento fundamental y en la Universitat Politécnica de Cataluña existen tímidas iniciativas en este aspecto, si bien el Campus de Ingenieria Agrícola de la UPC en Castelldefels todavía no ha establecido conexiones estables con el Campus de Alimentación de Torribera de la Universitat de Barcelona.

27. Georges Bazongo, Self Help Africa, Burkina Faso

Good point to discuss and learn.

The first is that when the Ministry f Agriculture publish the annual food security, the focus is only on cereal with some point on tubers while in the country, there some vegetable and animals productions as well as forest products.

For me it means that all the curricula of agriculture education focus more in cereals and tubers production. The impacts of this curricula in the field is so clear. In Burkina Faso and Togo where we operate also, it's common to see the Agriculture Extension Agents and the Ingenieur with limited knowledge on agriculture diversification and nutrition. So the agriculture colleges or institutions should review theirs curricula by including nutrition understanding in the common language, the crop diversification and the combination of different food to improve nutrition status, the strategy to promote nutrition sensitive agriculture in the field and according the agro ecological ou climatic zone. These curricula should clearly show the link between agriculture (crop, animal, forest, fish productions) and nutrition improvement.

For me the purpose is to change the mind-set or the social considerations of the communities around agriculture and nutrition and to show the close interdependence of nutrition to agriculture. To do that, the development workers need to have a basic knowledge and skills on the links between agriculture and nutrition and also the local behaviours on some food consumption like meats, eggs, forest products, etc..

In the projects we implemented in Burkina Faso, Ghana and Togo, the projects managers realised that the Agricultural Extension Agents are very weak on nutrition promotion while they lead the farmers training on agriculture in a projects with food security and nutrition. We due to link with Health Services to support with nutrition aspects but they are also weak in Agriculture so they don't know how to encourage farmers to produce diversified agriculture production and the aim to improve their nutrition. So we found that it's better to train the Technician on nutrition sensitive agriculture and now we have some good achievements in the field.

This example is to show if these agents have had the knowledge from colleges, it would improve their work in the field.

Many thanks

Georges

28. Edye Kuyper, UC Davis, Integrating Gender and Nutrition within Agricultural Extension Systems (INGENAES) project, USA

This conversation stems in large part from the "silo effect" that limits interaction among sectors concerned about the same population, in this case, rural agricultural communities. Intuitively, both agriculture and nutrition relate to food, yet our training institutions rarely provide instruction that covers the continuum from production to nourishment, leading trainees to "master" one aspect (e.g. soil fertility, postharvest handling, infant & young child feeding) without having a strong understanding of how their expertise relates to the entire food system. Agricultural colleges should increasingly aim to train graduates to understand the complexity of food systems, including health and ecological implications.

Given the current divide between nutrition and agriculture in most institutions of higher learning, one way to start to bridge the gap would be by integrating basic nutrition information into core agricultural classes. This would include both basic knowledge competencies, particularly related to food-based approaches to improving nutrition (food based dietary guidelines, dietary diversity). It would also be beneficial to include the "how"; in the context of training for agriculture extensionists, training in participatory facilitation methods would improve their ability to impact both nutrition and agriculture production behaviors. For trainees less likely to directly interact with farmers, the "how" may include a more in-depth overview of consumer demand in the context of market systems and the health and economic implications of healthy and less healthy dietary patterns.

I do not yet have direct experience doing this effectively, and have struggled within a US institution in my efforts to encourage agricultural training programs to include nutrition. As is often the case, specific donor funding for this purpose or policy requirements would help nudge institutions in this direction. Growing interest in transdisciplinary research and training allows institutions to "shine" when they adopt programs that address these complex issues, but I do not see a strong system of rewards either for institutions or academics who work in these spaces, as of yet. Journals, academic awards, and even institutional awards are still largely slanted toward expertise of a very narrow sort instead of systems approaches, although there are examples of where this is changing. I hope that through the INGENAES (Integrating Gender and Nutrition within Agriculture Extension Systems) project we will have the opportunity to test various approaches in several diverse contexts over the course of the next 2+ years.

29. Emile Houngbo, Agricultural University of Ketou (UAK), Benin

L'école pour promouvoir la nutrition en Afrique

Les maux ne cesseront pas pour l'Afrique tant que l'alimentation et la nutrition ne seront pas mises au devant des préoccupations des Etats africains. En tant que le continent qui connaît le plus fort taux de croissance démographique, quoi de plus normal que d'assurer la sécurité alimentaire et nutritionnelle et l'autosuffisance alimentaire de cette population ?

C'est la condition qui devrait permettre de transformer cette population galopante en force productive et donc en moteur de développement (cas de la Chine), plutôt que de la contraindre à se comporter comme une charge et un frein au développement. Or, tout prouve aujourd'hui que l'Afrique pèche par la faiblesse de ses politiques agricoles et économiques. L'Asie du Sud et l'Afrique subsaharienne comptent maintenant pour la plus forte proportion de sous-nutrition dans le monde (FAO et al., 2015). Cette forte proportion de personnes sous-alimentées dans le monde est d'un grand impact sur l'état des femmes et de leurs enfants. Car, la malnutrition maternelle et infantile perpétue la pauvreté de génération en génération (FAO, 2015). On rencontre ainsi en Afrique à la fois la faim due à l'insuffisance quantitative d'aliments et les maladies liées à la malnutrition telles que le kwashiorkor, le diabète, l'anémie, le marasme nutritionnel, le béribéri. L'Afrique souffre non seulement de ne pas avoir suffisamment à manger et mais aussi parce qu'elle se nourrit mal. La question qui se pose est donc comment faire pour mettre plus l'accent sur la nutrition.

A ce sujet, il faut reconnaître que la nutrition est une question de culture. Elle est de ce fait influencée par les habitudes alimentaires (culturelles) et le niveau de connaissance des personnes concernées. Ainsi, l'intégration de la nutrition aux programmes d'études des établissements d'enseignement agricole est opportune. Mais, il ne s'agit pas seulement des écoles d'agriculture, mais de toutes les écoles (primaires, secondaires et universitaires) car, la question de la nutrition s'adresse à tous les consommateurs d'aliments et donc à tout le monde. Il faut travailler à forger des habitudes alimentaires favorables à la bonne nutrition. Ceci passe évidemment par l'école à travers des curricula consensuels impliquant les communautés, à travers des activités coopératives de production des élèves et écoliers. Ce dernier aspect s'avère très important parce qu'il constitue une piste privilégiée pour faciliter les échanges d'expériences intergénérationnels, la répercussion des connaissances reçues à l'école sur les parents. C'est une option qui pourrait déjà conduire à de bonnes pratiques agricoles et à des choix raisonnés de spéculations susceptibles d'entretenir une bonne santé et de lutter contre la malnutrition ; des espèces de plantes utilisées dans le traitement du diabète par exemple telles que l'orgueil de chine (Caesalpinia pulcherrima), le gingembre (Zingiber officinale).

Références :

FAO, FIDA & PAM (2015) : L'état de l'insécurité alimentaire dans le monde 2015. Objectifs internationaux 2015 de réduction de la faim: des progrès inégaux. Rome, FAO, 66 p.

FAO (2015): The State of Food and Agriculture, Social protection and agriculture: breaking the cycle of rural poverty, Rome, FAO, 151 p.

30. Mohammad Jahangir, Bangladesh Agricultural University, Bangladesh

I feel like agriculture graduates have better scope to improve quality of food (cereal, fruits, vegetables) through improved supplementation of plant nutrients (e.g. micronutrients). This means better management of plant nutrients will increase the production as well as improve the nutritional status of the produces. For example, increasing micronutrient content of the produces (e.g. Zn, Fe etc) can improve human nutrition and prevent the occurrences of diseases. Knowledge on human nutrition and

problems caused by the lack of different nutrient elements will give insight into the supplementation of these nutrient elements in agricultural production system i.e. in the soil and crop management systems.

31. Forests for Food Security and Nutrition, FAO Forestry Department, Italy

Integrating nutrition into the curricula of agriculture education institutions is vital to achieve improved Food Security and Nutrition (FSN). By the same token, it would be equally important for a similar approach to be taken into consideration in the forestry sector in parallel. FSN should not only be integrated in agriculture education, but also in forestry education.

Forests cover one third of the earth's land surface. It is estimated that over 2.4 billion people worldwide depend on forest goods and services for the direct provision of food, wood fuel, building materials, medicines, employment and cash income.

In particular, fuelwood, income, and ecosystem services are essential contributions of forests to FSN. About one third of the world population use fuelwood for cooking their food, and 750 million people use wood to boil their water to make it safe for drinking. Forests generate income for local people through the sale of wood and non-wood products. Wild forest foods provide nutritious food supplements to millions of rural people. Wild animals and edible insects from forests are often the main source of protein. Forest foods are a regular part of rural diets and serve as safety nets in periods of food scarcity. They also provide essential ecosystem services that support sustainable agriculture by regulating water flows, stabilizing soils, maintaining soil fertility, regulating the climate, and providing habitat for wild pollinators and the predators of agricultural pests.

The understanding of the role of forests in FSN is often overlooked, including in the field of forestry education. It would be of paramount importance for the forestry students (future forestry workers) and extension workers to receive relevant trainings on FSN as part of their forestry education curricula.

Indeed, forests and their roles in FSN will remain vital as an integral part of our livelihoods for a long time. In light of the Sustainable Development Goals, we are now heading toward "sustainable" food security and nutrition. Sustainable forest management practices that reflect the important aspects of FSN will enable us to achieve both sustainable forestry and sustainable agriculture simultaneously.

Forestry workers with adequate knowledge on FSN issues will be able to further develop their capacity on improving forest management practices in line with their own FSN context. Such an approach could eventually lead to improved FSN of rural populations by unlocking forests' full potential without jeopardizing them.

Forestry colleges and higher education institutions should further include education components on the complex and rapidly changing dynamics between communities and forests. Concepts such as the "hidden hunger", the importance of the biodiversity for diversified diets, and multiple health and nutrition properties of edible forestry products should be studied in depth. This way, forests can have the future they deserve, just as much as we deserve to be in a place with sustainable food security and nutrition.

32. Mebit Kebede, Jhpiego Ethiopia, Ethiopia

Dear members,

Taking this opportunity, I would like to say thank you for sharing your experiences and thoughts for our on- line discussion on the current burning issue "Integrating nutrition into the curricula of agriculture education institutions: Strengthening human capacity to promote nutrition-sensitive

agriculture" as one of the nutrition sensitive intervention for the reduction of double burden of malnutrition in our globe.

In my opinion, the discussion was fruitful. The discussion forum brought about 31 professionals (agricultural university lecturers, project managers, consultants and researchers) from 17 countries around the world on one table to discuss and share their experience on how to integrate nutrition in to the curricula of agricultural education.

If I am not mistaken, all participants of the discussion agreed synonymously that integration of nutrition in to agriculture curriculum is a timely agenda and fully justifiable. This tells me that how much the issue we have been discussed for about two weeks is relevant and the UN agencies particularly FAO will have its homework to bring the issue to the attention of policy makers and politicians.

Though all participants agreed with the basic ideas, modalities or things to be considered on how to integrate nutrition in to curricula of agriculture education were forwarded as a concern. As a concluding remark of the discussion, I have tried to summarize ideas forwarded from participants based on leading questions as follows:

1. Role of Agriculture college: Agricultural colleges/higher institutions can play an important role in promoting nutrition-sensitive agriculture through several mechanisms:
    - Provide a key entry point where nutrition-sensitive agriculture can be incorporated into curricula agricultural education
    - Designing programs that incorporate nutrition interventions tailored to goals and outcomes to reduce prevalence of malnutrition
    - Support nutrition-sensitive interventions through the training of agricultural extension agents which they are currently serving the community
    - Agricultural colleges are also critical institutions whereby nutrition-sensitive agricultural approaches can be integrated into multiple programs and disciplines and facilitate collaborative, cross-disciplinary research and projects.
    - Agricultural colleges are also capable of promoting nutrition-sensitive agriculture through policy-relevant research, dissemination of results, and rigorous impact evaluations
    - Create enabling environment to the agriculture sector to design nutrition-sensitive agriculture strategy to be incorporated into existing agricultural policies and extension systems.
2. What is meant by "integrating nutrition into the curriculum"?
    - When we say "integration" it does not mean that we are focusing only on distribution of nutrition core competencies across existing core subjects rather we better work to bring nutrition as a separate course for agricultural graduates. But until condition allows to bring nutrition as a separate course for agricultural students, it is also advisable to start by stream lining nutrition core competencies across existing core subjects of the existing agricultural curriculum.
3. What are the absolutely essential competencies of "nutrition" to include in the training of agricultural workers?

- The anticipated nutrition syllabus for agriculture students is better to address knowledge, skill and attitude competency domains
- Its content should be designed with practical knowledge and hands-on training specifically suited to students so they know how to produce and access nutritious foods, improve eating behavior, enhance nutritional status and prevent chronic diseases with better nutrition and food consumption
- It should be developed through careful synchronization with the notion of meeting the nutritional knowledge gaps of agricultural college graduates in order to contribute to improve nutrition outcomes in the community
- Contents of teaching curricular be country or region-specific depending on the nation nutrition strategy
- The curriculum to contain detailed information on all stages of the nutritional chain: food production, processing, storage, preparation, to consumption.

4. What is expected to result from this extra curriculum element? Or how do we expect graduates (i.e. agricultural workers) to use the new knowledge and skills in their daily work?
   - Integrating nutrition core competencies with undergraduate agricultural programs will not only have the highest potential to promote nutrition-sensitive production at the community level, but also to increase the effort of the agriculture sector—which is imperative to contribute to the national nutrition agenda.
5. Other consideration
   - Relevant stakeholders should be consulted and be active participants during identification of nutrition core competencies as well integration of nutrition in to the curricula of agriculture education
   - Integration of nutrition in to the curricula of agriculture education should be in line with the national nutrition strategy
   - In the rural communities, the community-based informal education and curriculum-based formal education are two intersecting knowledge spheres, which can become important components to increase food literacy
   - It is also important that curricula/syllabi at all level of education from primary through secondary and tertiary level (s) should be sensitized with the lenses of nutrition.
   - Farmer Field Schools approach of FAO can be used to promote nutrition sensitive agriculture in the farming community

Hope we all will receive the final proceedings from the global forum on food security and nutrition team in the near future. We encourage you to keep checking the resource section of this discussion for any updates.

Many thanks,

Mebit Kebede

33. Pradip Kumar Nath, National Institute of Rural Development, India

Integrating Nutrition with Curricula of Agriculture

It is fact that in many Universities in India the curricula has already included the themes on Nutrition.

But it is not covered as intensively as is expected to be.

The broad coverage of the same (Coverage on Nutrition) in "Indian Economic problems" could not fulfil the requisite needs of future research in Agriculture Extension.

Only the utilitarian purpose information on minor millets, local available small millets and seasonal fruits are covered up. There is hardly any documentation of fruits, tuber, roots, leaves, flowers which have been in the food habits of specific group of people in specific region.

As an example use of mango kernel in the food habits in a large tracts of DANDAKARANYA by the tribal community. It is a beautiful example of mitigation of food shortage without any nutrition deficiency. All the new practices of food habits (dictated by market forces) introduced through the much talked about Public Distribution System (PDS) in India have truncated the existing food habits-some of which were really nutritious.

The extensive and large scale use of Jackfruit in Central high land (Odisha, Chhattishgarh, MP) and Chotnagpur area has been one of the finest practice of good nutrition habits of the local population.

The thousands of practices of food habits are yet to be documented and put in the curriculum of Agriculture University.

Again the moot question is NUTRITION is taught in HOME SCIENCE or Nutrition Institute and there is hardly any synergy or convergence between the two branches of knowledge.

Each department and its research works in silos and they have hardly any interdisciplinary or trans-disciplinary approach towards knowledge creation.

ICRISAT has also done pioneering research in different food items and its nutrition contribution but its dissemination of knowledge has been very limited and there is the big issue of lab to land transmission loss.

Pradip Kumar Nath

34. Hélène Delisle, University of Montreal, Canada

Thank you for giving the opportunity to discuss such an important issue. It is not new: back in the ‘80s, FAO was into integrating nutrition into agriculture training and several manuals were produced; I was involved in this work. What is new is the “name of the game”: agriculture should now be “nutrition-sensitive”, which is more or less the same. I do think there has been progress along those lines, but better integration of nutrition and agriculture requires renewed effort.

Indeed, food, nutrition, health and the environment cannot be dissociated and these links should be at the forefront of the training in all relevant disciplines.

There have been many interesting comments – I am late in commenting as I wanted first to read the discussion points. Several relevant recommendations have already been formulated, including in the World Bank Group paper in India by Babu et al. I will only remind a few and add my personal views.

1. The whole food system and its sustainability needs to be understood, considered and analyzed, whatever the level of training.

2. Agriculture also includes animal science, and nutrition, health and environmental concerns should go beyond production to also encompass post-harvest processes, processing and consumption. The concept of nutrition value chain is key to integrating nutrition into agriculture, in order to preserve or improve the nutritional quality of the foods all along the chain.
3. What specific nutrition competencies to be developed during training of agronomists, extension workers, field agents, etc., should be the starting point. The competencies at various levels should be complementary.
4. Once the specific competencies are identified, and this exercise has to be location-specific, then the training objectives, the curriculum content and the evaluation methods can be defined.
5. In order for agriculture training to become more nutrition sensitive, a higher awareness of the above-mentioned links is required among faculty and other stakeholders: advocacy is essential. Unless the decision-makers for agriculture training and agriculture programs are convinced, business will continue as usual.
6. Beyond curriculum content, the means of training may have to be renewed, using problem-solving approaches, field exercises, case studies, et., instead of the still too common classroom-type of teaching.
7. Agriculture people should be able to (this list is not exhaustive):
    - Appreciate the impact of the food system on the foods consumed and the nutrition and health of the population, while also considering its environmental impact;
    - Understand and improve the nutrition value chains;
    - Encourage the production, conservation and appropriate (limited) processing of local foods that have an interesting nutritional profile;
    - Assess using simple methods food security and diversity at community and household level;
    - Have minimum knowledge on the nutrition challenges in the community and on (local) food sources of major nutrients;
    - Be familiar with food and nutrition strategies of the country, as well as existing programs and tools;
    - Provide basic nutrition education to the producers;
    - Collaborate with nutrition, health and environment professionals.
8. In order to develop such competencies, we feel that a separate (albeit short) nutrition course would be needed, in addition to integrating nutrition concerns and aspects wherever it is possible and relevant in the curriculum;
9. It may be important to conduct a curriculum review at country or regional level, as was done in West Africa by Roger Sodjinou and colleagues, in order to identify the gaps and weaknesses;

10. Let us not forget that research is critical to improve food and nutrition security through agriculture. Transdisciplinary research has to be promoted in Agriculture Schools, Universities, or Faculties.

35. Nyla Coelho, Taleemnet, India

About three years ago Dr. Priti Joshi went about in a part of the most agricultural distressed area of India (Wardha, Maharashtra) encouraging women to take up and set up kitchen gardening. Not only that, she then went around the villages teaching women how to prepare nutritionally wholesome food items from the garden produce. The women who had all tested +ve for anaemia had in one growing season reversed the condition not only among themselves but also in their neighbours, friends and relatives. These were all rural women connected to agriculture either on their own farms or as farm labourers. So obviously, they had at some point come in contact with the agricultural department staff and extension service centres; were familiar with farming and had access to farm produce; and yet, were all found to be anaemic.

The reason for this narration is to make a point for the need to offer an agriculture education programme that does not look at the science of growing crops in isolation but rather exposes the student to all the areas connected and concerned with the science of growing food and its consumption. After all agricultural practices have now been proven without a doubt to have caused the highest environmental impact to the planet.

Although not directly relevant to higher education in agriculture the following link offers a glimpse into curricular ideas that can be adopted to begin this practice from the very early years of education i.e. from the school level upwards.

36. Rekia Belahsen, Choaib Doukkali UIniversity, Morocco

[French version]

Les curricula doivent comporter aussi des notions sur l'intérêt de la biodiversité et sa relation avec la nutrition. Il serait aussi important d'encourager et supporter les études sur la composition alimentaire et son croisement avec la biodiversité /la "nutrition sensitive agriculture".

R. Belahsen

[English version]

The curriculum must also include notions on the importance of biodiversity and its relationship to nutrition. It is also important to encourage and support studies on food composition and its relationship with biodiversity / the "sensitive nutrition agriculture".

R. Belahsen