[B a c k g r o u n d   A n a l y s i s]

Berlin, June 2016

The Training Material of the German Food Partnership

An assessment of the training material used in the 'Better Rice Initiative' (BRIA) and 'Competitive African Rice Initiative' (CARI) programmes

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Foreword

In 2012 the "German Food Partnership" (GFP), a strategic alliance with agricultural corporations such as Bayer CropScience, AGCO and BASF, was launched under the umbrella of the Federal Ministry for Economic Cooperation and Development (BMZ). GFP projects aimed to boost productivity and performance along agricultural value chains in a socially and environmentally sustainable way by facilitating access to production inputs and markets for both male and female farmers. The focus of the GFP has been on improving rice value chains in Asia and Africa.

The objective was to raise farm income and improve nutrition for local farmers, and here smallholders especially, as well as for consumers. All GFP projects were meant to ensure ecological sustainability, prevent water and soil pollution and enhance soil fertility. The sustainable management of natural resources was said to be promoted by all GFP projects, essentially via the application of sustainable agricultural practices.

One of the important principles was the freedom of choice principle. Farmers involved in GFP projects should have complete freedom of choice with regard to the selection of inputs for agricultural production, e. g. fertilizer, seedlings, etc. The participating companies were meant to advise farmers in a fair manner and do not give recommendations that are limited to the use of their own products. This included also the prohibition of product placement by any of the GFP companies.

Since the beginning the GFP NGOs expressed their concerns regarding the cooperation with agricultural corporations because of the one-sided promotion of input-based agricultural models, the targeting of better-off farmers and the lack of developmental value added meriting the use of development aid for these public-private partnerships (PPPs). The campaign "No development support for agricultural corporations" having been run throughout 2014 highlighted the inherent problems and risks associated with the cooperation of agricultural corporations.

In 2015 the GFP was phased out. Nevertheless two out of the three initiatives the 'Better Rice Initiative Asia (BRIA)' and the 'Competitive African Rice Initiative' (CARI) are continuing. Agrar Koordination and Oxfam decided to commission an in-depth analysis of the training materials of BRIA and CARI in order to get a better understanding of the agricultural model promoted and the implications for the sustainability of rice production within the initiatives.

We thank Martin Rokitzki, an independent expert in natural resource management and climate-resilient agriculture, for this valuable analysis.

Oxfam Germany
Agrar Koordination

1) Introduction and Rationale

The German Food Partnership (GFP) has been a strategic public-private partnership (PPP) that served as a cooperation platform of German private sector companies and the German Federal Ministry for Economic Cooperation and Development (BMZ) to promote food and nutrition security in developing and emerging countries. It expired in March 2015, although its rice projects - 'Better Rice Initiative Asia' (BRIA) and 'Competitive African Rice Initiative' (CARI) continue till the end of 2017.

BRIA is a PPP aiming at improving the rice value chain through training and education measures in Thailand, Indonesia, Philippines and Vietnam. Cooperation partners from the private sector side are among others Bayer CropScience, AGCO, BASF and Yara. The financial volume is about 10 Mio. €

whereof 30 per cent is financed by BMZ. The in-kind contributions of companies include for example studies, materials and own staff which is elaborating training materials and curricula.

CARI is a PPP aiming at enhancing the income of rice producers in Burkina Faso, Ghana, Nigeria and Tanzania through adding value to rice production and improving relations among market actors. Cooperation partners from the private sector side are among others Bayer CropScience, Syngenta and AGCO. The financial volume of CARI is 18,4 Mio. € whereof Gates Foundation is contributing 73 per cent and the BMZ 27 per cent. Further co-financing of private partners is mainly envisaged through a Matching Grant Fund.

The GFP as such aimed to boost productivity and performance along agricultural value chains in a socially and environmentally sustainable way by facilitating access to production inputs and markets for both male and female farmers. The goal was to increase smallholders' income and nutrition.

Civil society organizations have been very critical towards the GFP based on various aspects such as a lack of participation of beneficiaries and the agricultural model that the GFP conveys as well as its suitability for smallholder farmers and for hunger eradication. They had asked the BMZ in November 2013 to end the GFP.[1] An NGO alliance targeted the GFP also in their campaign "No development support for agricultural corporations" in 2014.

In order to assess the extent to which these concerns have materialized in the implementation of GFP projects, Oxfam Germany had requested information about the implementation. Although the BMZ promised "full transparency" in November 2013 the requested information was given with a delay of 12 months. Eventually, the GFP Coordination Office hosted by the "Deutsche Gesellschaft für Internationale Zusammenarbeit" (GIZ), on behalf of the BMZ, has provided training material and manuals used in the 'Better Rice Initiative Asia' (BRIA) and 'Competitive African Rice Initiative' (CARI) programmes.

Oxfam Germany and the Agrar Koordination have subsequently commissioned an assessment of the training material, which encompassed CARI modules for Nigeria and BRIA modules for the Philippines. This assessment was conducted by an independent expert[2] in December 2015.

2) Methodology

The GFP set out with a plethora of principles and approaches, which are laid out in the 'Guide to the German Food Partnership' (BMZ and GIZ 2014; later in this report referred to as the 'GFP Guide').[3] An analysis of Oxfam Germany indicates that the criteria set up in the GFP Guide do not reach far enough.[4] However, this assessment has scrutinized the operationalization of some of these principles and approaches in the form of the training material and manuals used and promoted in various countries where CARI and BRIA is implemented.
Furthermore, the assessment examines, to what extent knowledge and technological advances through agro-ecological practices (documented, for example, in Anderson et al. 2015; Greenpeace 2015a and 2015b; Hilbeck et al. 2015) have been included in the design of the trainings.

The assessment is based on the content of the training material, bearing in mind that more information about the background of the participants, the initial knowledge level of participants, composition of the training groups etc. would be additional relevant factors to assess the impact and effectiveness of the training provided.

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[1] http://forumue.de/wp-content/uploads/2015/05/pospap_gfp_v3.pdf.
[2] Martin Rokitzki, Independent Expert in Natural Resource Management and Climate-Resilient Agriculture; https://de.linkedin.com/in/martinrokitzki
[3] http://www.germanfoodpartnership.de/wp-content/uploads/2015/10/Guide_to_the_GFP_20140224.pdf.
[4] https://www.oxfam.de/system/files/wohin_steuert_die_gfp_-_oxfam_hintergrund.pdf.

The guiding questions for the assessment were the following:

- Freedom of choice - Does the training material offer a reasonable breadth of potential options to farmers including pros and cons of the respective options?
- Is the soil fertility management sufficiently considered? In particular, the benefits of organic fertilizer, manure, rotation, intercropping, composting, mulching, crop residues etc. Are pros and cons sufficiently explained?
- Is biological pest management sufficiently considered? Are implications on the environment, the climate and human health mentioned/ discussed? Are there pesticides referred to mentioned that are on the PAN International List of Highly Hazardous Pesticides (HHPs[5])[6]?
- Is the issue of agro-biodiversity sufficiently covered?
- Is there reference made to specific companies or products in an unreasonable manner? If yes, which ones?

3) Findings of the Assessment

3.1. Training Material of CARI – Nigeria Modules

The model of agriculture and rice production that is suggested in the CARI content is an input-based model that promotes conventional agriculture. It furthermore ignores any innovations in view of advances made through the System of Rice Intensification (SRI) and other similar more sustainable rice production technologies.
The application of agro-chemicals is being presented as the preferable and superior way of weeding, pest control and plant protection (see figure 1 and 2). While displaying different techniques of weeding (e.g. CARI 2015a, page 38), one of the training manuals states, for instance, that 'chemical weeding saves time and money' as opposed to alternative options. Contested ingredients such as glyphosate (see figure 1) are being recommended despite the concerns about their effects on human health and the environment.[7] Even though farmers are advised to only apply agro-chemicals when they see attacks and to use solely approved and recommended fungicides and insecticides, alternative biological pest management practices are not referred to.

The CARI material promotes pesticides that are listed in the PAN International List of HHPs such as Cyhalothrin, Cypermethrin and Glyphosate (see also Annex 1). Even a study (CARI and GIZ 2015) that was commissioned in February 2015 to define and systematically introduce Integrated Pest Management (IPM) practices in order to avoid the risk of indiscriminate increase in use of pesticides and fungicides, recommends the use of some of these ingredients (see table 19 in: CARI and GIZ 2015). In the said study, the promotion of pesticides and herbicides are based on a very limited view on cost-effectiveness completely ignoring economic, environmental and health-related externalities. As set forth in the GFP guide, the study promotes an approach to IPM that is based on threshold-levels. Such approach appears unnecessarily harmful and 'outdated' in view of the latest innovations and practices in rice production that prove that an increase in productivity that does not rely on pesticide application is possible. In view of a 'freedom of choice' for famers and the provision of information on pros and cons of options, there is, for instance, no reference made to pesticide- and high yielding (varieties-induced pest problems which are increasingly reported.

In addition, the business cases that are highlighted favor strongly agrochemical-based farming. Figure 3, for instance, compares two business cases presented in the CARI material. The example on the

[5] The FAO definition of a HHP includes pesticides linked with a high incidence of severe or irreversible adverse effects on human health or the environment
[6] http://www.pan-germany.org/download/PAN_HHP_List_150602_F.pdf.
[7] http://www.agrarkoordination.de/fileadmin/dateiupload/Roundup___Co/Roundup___Co_-_Unterschaetzte_Gefahren.pdf

left, which is based on the application of agro-chemicals, is compared with a business case that is completely refraining from using agro-chemicals. The former business case is being stated as the superior one that provides more profit to the individual farmer.

Moreover, the example uses a productivity definition that favors the industrial conventional agricultural model by looking at labor purely as a production factor assuming the costs of wage labor units. Agro-ecological approaches have shown the advantages of labor-intensive production systems also as a way to strengthen rural economy and to avoid massive exodus of rural areas. Moreover, social and externalities are not considered in this definition of productivity. In view of seed selection and management, CARI training material promotes, amongst others, inter-specific hybrid varieties such as the New Rice for Africa (NERICA). This is not an uncontested approach. While some glorify NERICA as a 'magical' variety significantly increasing yields, others have raised concerns. The main argument is that it wipes out the real basis for African food sovereignty - Africa's small farmers and their local seed systems (see chapter 4 for a more detailed discussion). By all means, the GFP guide's principle that 'smallholders and seed keepers are to be informed about the risks and potentials of hybrids' is insufficiently adhered to in the approach taken in the training material. Aspects of agro-biodiversity are neither considered nor promoted. SRI instead can contribute to the conservation of biodiversity by making local or traditional varieties more productive, profitable, and thus competitive with high-yielding varieties and hybrids.

8. Cleaning the land with herbicides

Sometimes my husband Yakubu cleans my field 2 weeks before preparing the main plot and shortly before I sow onto the nursery. This is done when the rains have just started.

We use the following herbicide because it makes work faster and easier:

Ingredient	Example of product	Dosage per 15l sprayer	Dosage per ha	Ltrs of Water/Ha	15 litre Knapsack loads/ha
Glyphosate	Veesate, Roundup, Wuta-Wuta, Touchdown etc.	157 ml (1 peak milk tin)	4 litres	400	26

Yakubu sprays the field on a sunny and not windy day. **Because Glyphosate can be injurious to our health, Yakubu strictly adheres to the safety rules in chapter 9. (Extension officer to recommend best options or alternative to Glyphosate when available).**

Figure 1: Example of CARI training material (Source: CARI 2015a, page 18)

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16. Buying Good Insecticides and Fungicides

Q_1: What can you infer from the picture?

A: *Aminat is buying insecticides and fungicides*

Q_2: What cautions should be observed in buying insecticides and fungicides?

A: Only when I see attacks , I buy approved and recommended insecticides and fungicides from authorized dealers.

Q_3: Mention some examples of insecticides and fungicides that are currently recommended.

A: Fungicide - Mancozeb 2kg/ha

Insecticide - Cymbush, Cyper-1, Karate, Deltaforce

(The extension agents try to understand other ones not included here and confirm or condemn if its ingredients are not recommended).

Figure 2: Example of CARI training material (Source: CARI 2015b, page 34)

39. Who does better business

That's me with my rice harvest. My rice farm measures 1 hectare. I use certified seed of improved rice variety and mineral fertilizer. I maintain my field well. For the first season, I buy inputs and services for **77,750 NGN**. The labour I use is worth **74,400 NGN**. **I sell 4,000 kg rice. My profit is 167,850 NGN** for the **first season.**

Aminat's field	Unit	Quantity	Price NGN	Total NGN
1. Money-out				
Inputs and services				
Seeds	kg	30 x	250 =	7,500
Insecticide	Liter	1 x	1,000 =	1,000
Herbicide	Liter	7 x	1,250 =	8,750
Fertilizer: NPK 15:15:15	50kg bag	4 x	5,500 =	22,000
Fertilizer: Urea	50kg bag	2 x	6,000 =	12,000
Bags	Bag	40 x	100 =	4,000
Tractor service	lumpsum	1 x	22,500 =	22,500
Cost of inputs & services	**NGN**			**77,750**
Labor				
Levelling & preparing patches	MD	12 x	800 =	9,600
Nursery operations & transplanting	MD	10 x	800 =	8,000
Fertilizing (NPK & urea)	MD	4 x	800 =	3,200
Gap filling	MD	2 x	800 =	1,600
Weeding (chemical)	MD	1 x	800 =	800
Spraying pesticides	MD	2 x	800 =	1,600
Chasing birds	MD	20 x	800 =	16,000
Harvesting & heaping	MD	20 x	800 =	16,000
Threshing & winnowing	MD	20 x	800 =	16,000
Storage	MD	2 x	800 =	1,600
Labour needs & cost	MD	**93 x**	**800 =**	**74,400**
Total cost (money-out)	**NGN**			**152,150**
2. Money-in				
Production X sales price	**kg**	**4,000x**	**80 =**	**320,000**
3. Loss or Profit				
Money-in minus Money-out	**NGN**			**167,850**

Here is my neighbour Memunat with her rice harvest. Her rice farm also measures 1 hectare. She does not use improved varieties, fertilizer or pesticides. She doesn't sow in lines and doesn't maintain her farm well. Memunat buys inputs for **5,900 NGN**. The labour she uses is worth **71,200 NGN**. **Memunat sells 1,500 kg rice. Her profit is 42,900 NGN.**

Memunat's field	Unit	Quantity	Price NGN	Total NGN
1. Money-out				
Inputs and services				
Seeds	kg	80 x	55 =	4,400
Insecticide	Liter	0 x	2,500 =	0
Herbicide	lumpsum	0 x	4,500 =	0
Fertilizer: NPK 15.15.15	50kg bag	0 x	4,500 =	0
Fertilizer: Urea	50kg bag	0 x	4,500 =	0
Bags	Bag	15 x	100 =	1,500
Tractor service	lumpsum	0 x	12,500 =	0
Cost of inputs & services	**NGN**			**5,900**
Labour				
Land preparation, levelling & preparing of patches	MD	30 x	800 =	24,000
Nursery operations & transplanting	MD	10 x	800 =	8,000
Fertilizing (NPK & urea)	MD	0 x	800 =	0
Gap filling	MD	2 x	800 =	1,600
Weeding (manual)	MD	10 x	800 =	8,000
Spraying pesticides	MD	0 x	800 =	0
Chasing birds	MD	20 x	800 =	16,000
Harvesting & heaping	MD	8 x	800 =	6,400
Threshing & winnowing	MD	8 x	800 =	6,400
Storage	MD	1 x	800 =	800
Labour needs & cost	**MD**	**89 x**	**800 =**	**71,200**
Total cost (money-out)	**NGN**			**77,100**
2. Money-in				
Production X sales price	**kg**	**1,500 x**	**80 =**	**120,000**
3. Loss or Profit				
Money-in minus Money-out	**NGN**			**42,900**

Figure 3: Example of CARI training material (source: CARI 2015a, page 51 and 52)

Sustainable land management to enhance and preserve soil fertility is key, but only touched upon in a superficial way within CARI. The potential of organic fertiliser is insufficiently recognised and the advances of SRI that focuses on soil biota, better aeration and avoidance of plot saturation are not explained at all. It was found that the application of compost instead of fertilizer together the other SRI techniques lead to additional yield increases (Uphoff 2015). CARI strongly focuses on nutrient management which relies on the application of urea and NPK fertiliser. SRI instead reduces the use of fertilizer, this can improve air, soil and water quality. Commonly only about one-third of the nitrogen applied in rice paddies is taken up by the rice plants; 60-70% of what is applied thus accumulates in the groundwater or is volatilized into the atmosphere. CARI recommends transplanting after 3-4 weeks. However, young seedlings, less than 15 days old, when managed with the other SRI practices have more capacity for growth and greater fertility. SRI plants can have up to 100 tillers or more, compared with the 5-10 or at most 20 tillers that rice plants have when grown from seedlings which are transplanted when 3 to 4 weeks old, or even older (Uphoff 2015).

Summary of Findings

Overall, the CARI content appears completely insufficient in view of the ‚freedom of choice' of smallholders promoted in the GFP guide. More drastically phrased, it does not provide a choice. It represents a one-sided presentation of technologies and options strongly influenced by an out-dated conventional external input-based rice production. Many slides provide unambiguous and rather instructional answers to the questions that are posed as part of the dialogues that lead the participants through the training content.

The CARI training material is clearly inacceptable concerning its direct and unambiguous promotion of agro-chemical inputs (fertilizer, herbicides, fungicides and pesticides) without any or insufficient consideration of alternatives (e.g. biological pest control) and potential economic (e.g. dependency), environmental and health implications. The use of pesticides listed in the PAN International List of HHPs (including glyphosate) and hybrid seeds (mainly NERICA) is explicitly recommended. For a large-scale programme that claims to be dedicated to environmental sustainability and promotes availability of safe and healthy food, this approach is intolerable.

3.2. Training Material of BRIA – Philippines Modules

The available BRIA training material is comprehensive for the Philippines and very limited for Indonesia. For Thailand, the material is only available in Thai, and hence not analyzed due to language constraints. The backbone of the material is a Trainer's Manual (TM) for the Philippines that frames 16 thematic modules covering a wide range of topics. The TM provides guidance on the structure of sessions, session plans, slide content and delivery techniques.
As compared to the CARI training material, the BRIA-Philippines modules are more comprehensive, more diverse and offer a wider range of options. While there is again a strong focus on input-based agriculture, the modules do mention some alternatives approaches (SRI, community seed banks etc.) although without providing sufficient information with regard to those.

While the BRIA guidance is not completely consistent throughout[8], the backbone is the PalayCheck system[9] which considers an integrated perspective on rice production but falls behind other practices that rely much less on fertilizers and pesticides, such as SRI. For instance, the PalayCheck system provides little direction about age of seedlings and spacing, which is important for the development of healthy roots, as well as the importance of organic matter to build up soil biota.

In terms of soil fertility management, good land preparation and the integration of crop residues is emphasized as key check 2 of the PalayCheck system. But little is mentioned about the significance of organic fertilizers (i.e. compost or other biomass) as an alternative to inorganic fertilizers. Furthermore, BRIA-Philippines module 7, has a strong bias towards the positive effects of and the need for inorganic fertilizers (see figure 4 and 5). It highlights synthetic fertilizer as the ultimate technique to manage soil fertility. In this module, reference is also made especially to Yara fertilizers and Yara's "Just-in-time" plant nutrition concept. However, in the training materials of BRIA it is clearly stated, that "it is common understanding and precondition of BMZ" that product placement is not allowed. Similar messages about the need for NPK fertilizer is given in module 5A 'morphology of the rice plant'.

The guidance on water management is focused on water-saving irrigation techniques such as alternate-wetting-and-drying (AWD) having been developed by IRRI as an alternative to SRI. AWD recognizes advances in rice production technologies that have proven that the soil does not need to be saturated throughout the entire growing and maturing period. Although this is saving water and reducing methane emissions, it is built into a conventional rice production model.

In addition, BRIA training material comprises a comprehensive module on climate change adaptation and mitigation and the relevance of these strategies in rice production. However, the module provides little practical advice. In the same module, information and communication technologies (ICTs) are highlighted as important tools for weather-smart farming. While the integration of weather information in the farmer's decision-making is an important requisite to better adapt to climate risks, the tools are often used to foster a precision farming-type of input promotion at the same time (see also slide 33, CSA module and the Rice Crop Manager). The importance of soil organic matter and soil biota for carbon sequestration is mentioned but could be much stronger. Likewise, the increased emission of NO_2 through inorganic fertilizer use is not referred to at all.

[8] potentially due to a diverse range of sources and authors of modules
[9] http://www.pinoyrice.com/palaycheck/

In module 10, BRIA-Philippines offers Bayer CropScience a platform to present the benefits of chemical crop protection products. While the slides refrain from directly promoting specific Bayer CropScience products, the quintessence is clear and unambiguous: 'pesticides are beneficial in helping protect crops and other products' and 'negative effects of pesticides are avoidable through proper usage and handling' (see slide 47, module 10).

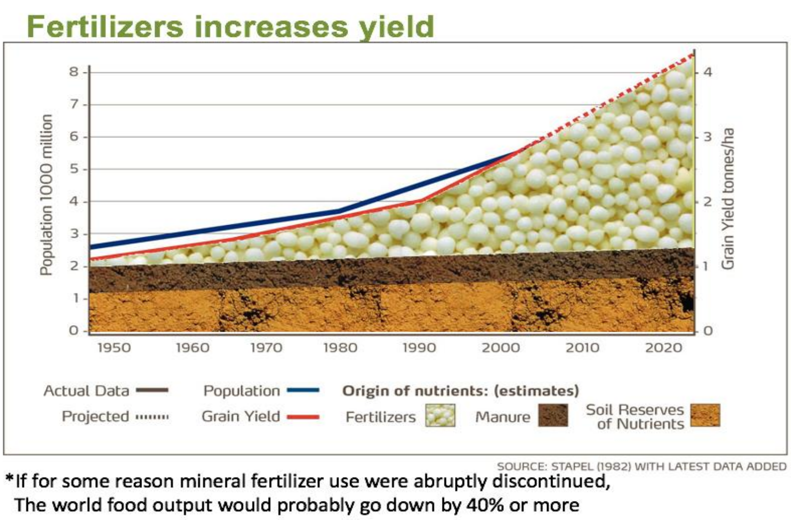

Figure 4: Example of BRIA training material (source: BRIA module 7, slide 5)

These recommendations unfortunately ignore findings of SRI application where no pesticides are needed or reduced to the minimum. Unfortunately, these findings are completely neglected and commercial interest of GFP partners seem to prevail. Also, insufficient space is given to biological pest management practices. Similar to CARI, BRIA recommends pesticides that are listed by PAN as Highly Hazardous Pesticides (e.g. Mancozeb, Carbendazim; see Module 'ToT major diseases').

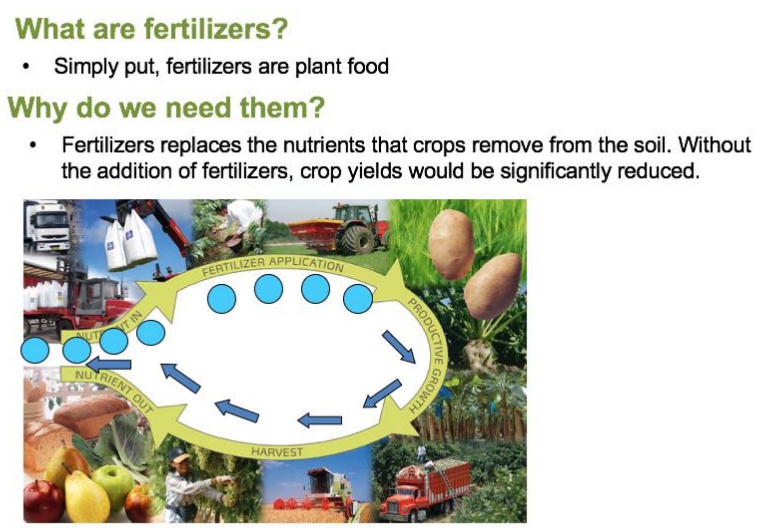

Figure 5: Example of BRIA training material (source: BRIA module 7, slide 4)

The GFP guide mentions that the 'GFP projects specifically focus on product-independent training for farmers' and that 'participating companies advise farmers in a fair manner and do not give recommendations that are limited to the use of their own products'. BRIA-Philippines training material is overall refraining from the direct promotion of pesticides products by GFP business partners, this is not the case when it comes to fertilizers (see figure 6 and 7).

In terms of seeds, BRIA (in module 4) promotes high-quality, certified seeds (both inbred and hybrid rice varieties[10]) that are not further specified. Again, like in CARI, no reference is made to the advantages of agro-biodiversity and traditional seed varieties, their pros and cons etc. Based on the presented training material, it is unclear whether these recommendations are used to explicitly exclude non-certified local seed varieties and their management systems.

Summary of Findings

Overall, the content of the BRIA training modules prioritizes external input-reliant technologies over sustainable approaches (e.g. biological pest control). While a few slides and sub-chapters of training modules make reference to agro-ecological approaches, the majority promotes an input-based agricultural model similarly to CARI. There are modules [11]that are in particular using the stage to recommend agro-chemicals such as fertilizers, pesticides, fungicides etc. Some of them produced or supplied by GFP partners and some of the pesticides are listed as HHPs (see Annex 1).

The rice production system that is promoted in the BRIA Philippines modules – the PalayCheck system – contains some aspects that use latest knowledge resource saving approaches (e.g. AWD) but falls short in areas of improved technologies that do not rely on external inputs but superior agronomic practices, for instance promoted by SRI. PalayCheck falls behind SRI in areas such as pest management (i.e. application of biological pest control, where applicable), nutrient management (i.e. application of organic instead of inorganic fertilizer; importance of soil biota) and good planting practices (i.e. age of seedlings at transplanting, spacing).

Figure 6: Example of BRIA training material (Source: BRIA module 7, slide 59)

[10] http://www.pinoyrice.com/rice-varieties/
[11] Module 7, 10, 'ToT major diseases'

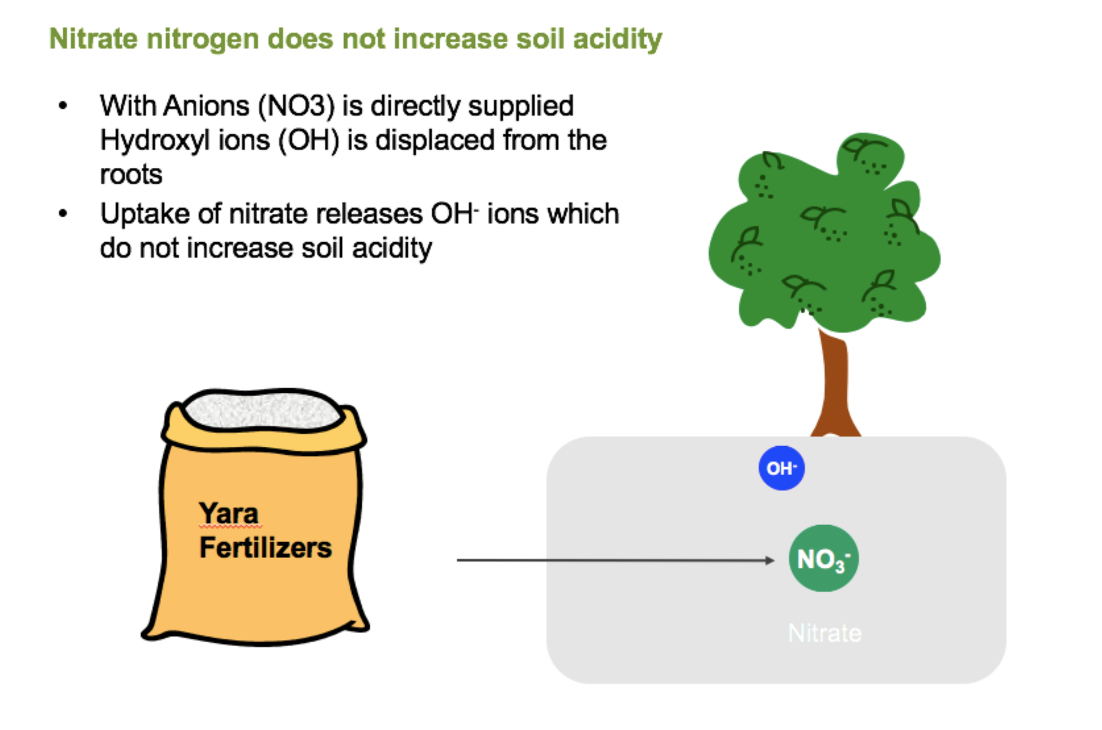

Figure 7: Example of BRIA training material (Source: BRIA module 7, slide 17)

4) Discussion of Findings and Recommendations

The assessment of the CARI and BRIA training material has brought to the forefront several deficiencies and shortcomings in view of the practices and technologies recommended. The following chapter focuses on some aspects that are under-represented or deserve more attention in future training material generally.

4.1. Climate resilience and better integration of adaptive capacity of agricultural systems

In view of current and future climate risks, agricultural production and marketing systems need to be prepared and building resilience to these risks more than the BRIA and CARI training material does. While potential risks are often very location and context-specific and blanket recommendations do not help, systems should be promoted that have inherently higher capacities to absorb weather shocks and the like (e.g. decreased erodibility through soil and water conservation technologies). Many agro-ecological approaches have shown that they are more resistant to weather shocks due to a long-term improvement of soil and crop properties[12]. Seed systems are another vital pillar of climate-resilient agro-systems. Local seed varieties have proven to be often better adapted to local climatic conditions than introduced hybrid varieties.[13]

[12] Complex, biodiverse systems appeal on grounds of ecological efficiency and aesthetics and possibly confer resilience to external shocks to agricultural systems; in: http://www.pnas.org/content/110/21/8345.full.

[13] Angepasste Landwirtschaft in Zeiten des Klimawandels http://www.agrarkoordination.de/fileadmin/dateiupload/PDF-Dateien/BA_Philippinen-Studie_download.pdf.

Building climate resilience can only be achieved through the application of profound, locally-specific knowledge of the ecologic conditions. This knowledge needs to be fostered, captured and disseminated and further developed through farmer-led research and experimentation[14]. Another aspect that should stronger highlighted in view of climate change is the value of agrobiodiversity (see figure 8).

How can agrobiodiversity help in the fight against climate change?

One of the main challenges that farmers have in the context of climate change is its unpredictability. Farmers can no longer rely on the timing of seasons and the availability of rainfall through the year. Using agrobiodiversity in the fight against climate change is about responding to variety with variety. Diversity can help farmers mitigate, adapt and ensure food and nutrition security, by providing them with more options to manage climatic risks, and strengthen the resilience of their farms and the surrounding ecosystems and landscapes. Examples for such options are:

- **At the genetic level:** Different crop varieties can be used to deal with climate-induced stress and unpredictability. Planting different varieties, including drought-tolerant varieties with different flowering times, can reduce the risk of a farmer losing all of a crop in sudden climatic events. Some local varieties are hardier and better able to cope with poor soil or little water. Farmers can use these varieties to profit from areas they would otherwise struggle to cultivate.
- **At the species level:** Different crops and livestock respond differently to environmental stresses such as heat, drought, frost and salinisation. Having different species on farm prevents farmers from losing everything – some species will deal with unpredictable shocks better than others. In general, mixed crop and crop-livestock systems provide opportunities for synergy and strengthen the resilience of a farm. Nitrogen-fixing legumes and trees not only keep soils fertile, but can act as windbreaks to mitigate strong winds and soil erosion from heavy rains. Livestock can be fed with biomass from crop parts that humans do not eat and, in return, provide fertilizer for crops in the form of manure, reducing the need for chemical inputs.
- **At the ecosystem and landscape level:** Diverse sources of food and smarter seasonal planting help communities cope with 'hungry' seasons. A landscape with many different land uses helps communities and their ecosystems deal with shocks. Forests store carbon, but also reduce soil erosion, runoff and landslides during storms. Managing water, land and soil at a larger scale with practices such as terracing or storage reservoirs can help buffer the impacts of climate stress.

Source: Bioversity International (2015)

Figure 8: Agrobiodiversity and climate change (Source: Bioversity International, 2015[15])

4.2 Nutrition-sensitive agriculture

The GFP claims to focus on nutrition security and to promote nutrition-sensitive food production, next to other objectives. The problems of malnutrition are known not to be resolved by merely an increase in agricultural productivity[16]. The BRIA and CARI training material, however, do not touch upon nutrition-sensitivity and the role of agriculture in nutrition at all. More attention needs to be given to nutrient rich traditional plants and diversified production in order to have an impact in view of nutrition security. There is increasing evidence of successful interventions[17], but scaling-up and other institutional changes need to take place.

[14] http://www.fao.org/giahs/giahs-home/en/.
[15] http://www.bioversityinternational.org/e-library/publications/detail/what-can-agricultural-biodiversity-do-in-the-fight-against-climate-change.
[16] http://www.ifpri.org/publication/reshaping-agriculture-nutrition-and-health
[17] http://www.actioncontrelafaim.org/sites/default/files/publications/fichiers/kenya_reconciling-agriculture-and-nutrition.pdf

4.3. Beyond the plot-level, landscape approaches are indispensable to manage natural resources sustainably

Environmental sustainability and the sustainable management of natural resources was mentioned as a principle of the GFP. Much of the BRIA and CARI guidance is focused at the plot- or farm-level though important flows of nutrients and water and the provision of other regulating ecosystem services can only be fully understood and sustainably managed at watershed or landscape level. Landscapes are the primary level at which the actions of individual households intersect those of others resource users. The control over and the right to access, use and manage natural resources becomes subject to social convention and negotiation, themselves framed by more formal rules set down by distant government agencies.

"Landscape approaches" have gained prominence in the search for solutions to reconcile conservation and development/ productivity tradeoffs. Agricultural landscapes are no longer just farmed entities: they are now recognized as providing multiple values and services to diverse interest groups. Management of such landscapes is increasingly being seen as an evolving outcome of ongoing negotiation, and frequent conflict, among these interest groups. The principles of the landscape approach provide a framework by which outcomes negotiated among stakeholders can be reached most effectively.[18]

5. Going further in the promotion of SRI and other agro-ecological practices

Particularly in the area of rice production, agro-ecological approaches have proven to be beneficial, both economically and environmentally. For instance, SRI has proven to reduce water requirements, increase land productivity, and promote less reliance on artificial fertilizers, pesticides, herbicides, and other agrochemicals, all while buffering against the effects of climate change and reducing greenhouse gases (GHG)(see figure 9)[19][20]. In many cases, even considerable savings in the amount of seeds required have been reported. These methods are indeed labor-intensive (for transplanting, harvesting and weeding), which shouldn't be seen as a disadvantage, in a world where rural areas desperately need employment opportunities.

Given the amount of positive evidence, it remains unclear why these scientific and empirical advances have not been reflected in the BRIA and CARI content. Though SRI is mentioned in the BRIA module on climate-smart agriculture, it clearly has not received the recognition it does deserve. Table 1 exemplifies the differences between the input-reliant practices promoted by CARI and the SRI.

[18] http://www.pnas.org/content/110/21/8349.full
[19] http://www.oxfamamerica.org/static/oa3/files/more-rice-for-people-more-water-for-the-planet-sri.pdf
[20] (http://foodtank.com/news/2014/01/five-ways-system-of-rice-intensification-sri-practices-and-ideas-can-help-f)

Table 1: Comparison of SRI and conventional rice production techniques promoted by CARI

Management Practice	SRI	CARI
Age of seedlings at transplanting	Transplant 8-12 day-old seedling raised from seedbed thinly layered with organic fertilizer	Transplant seedlings 3 weeks and not later than 4 weeks after sowing. Before, clean the land with Glyphosate and broadcast NPK fertilizer
Density & Spacing	Transplant 1 seedling per hill at 23cm x 25 cm in square pattern	puts 2 to 3 plants per hole and leave 20cm between
Weed Control	First rotary weeding start 10 DAT. Second rotary weeding 10 days after followed by selective hand weeding	First rotary: The best time is 2 to 3 weeks after transplanting. Second Rotary: The best time is 2 to 3 weeks after the first weeding
Water Management	Intermittent irrigation just to keep the soil moist. Allow soil surface to crack. During panicle initiation 2-3 cm water level is maintained and the field drained 10-15 days before the harvest.	Always leave a film of water of about 5-10 cm to suppress weeds. Drain slightly to about 5 cm when applying herbicide or urea. Between application flood again to 10-15 cm depth.
Nutrient Management	Applied 4 bags (50 kg/bag) organic fertilizer incorporated during final harrowing. 2 bags side dress & 2 bags top dress. Prior to initiation stage.	Applied 4 bags of 50 kg of NPK. Prior to initiation stage. Then first fertilization with urea 3 weeks after transplanting (50 kg/ha). Second fertilization with urea 7-8 weeks after transplanting (50kg/ha).
Pest Management	Adopted IPM during the growing period.	Best time to apply herbicides: 3 weeks after transplanting (rycester, orizopus, basagran).

Reported and Validated Benefits	Contribution to Resilience and Climate Change Adaptability
Higher yields per unit of land, labor and capital invested	Grain yields are increased on average by 20-50%, but often more. This not only generates more food, but releases some land and labor for other productive activities. Higher productivity per unit of land reduces pressure to expand cultivated area at the expense of other ecosystems.
Lightened workload for women	Women farmers widely report that SRI methods save them time and reduce the drudgery of rice cultivation, due to less time for nursery management and transplanting, ease of working with smaller seedlings, and less time laboring in standing water. It frees their time for activities of their choice (such as vegetable growing for profit or improved family diet) and enables other family members to seek non-farm employment, thereby diversifying household income.
Reduced requirements for irrigation water	With SRI, irrigation water use is generally reduced by 25-50%, as water is managed to maintain mostly aerobic soil conditions. Farmers can continue to cultivate rice where water is becoming scarcer or rains unpredictable, and can mitigate losses from late monsoons or less rainfall. Less water used at the head of canals means more water is available for farmers at the end. Water can be freed up for other crops and people, and for the maintenance of natural ecosystems.
Reduced seed rate	Since farmers need 80-90% fewer seeds for transplanting, they need much less space to sow the seed nurseries. Flooded nurseries are planted with a seed rate of 50-75 kg/ha whereas SRI nurseries are planted with a seed rate of only 5-7 kg/ha, leaving farmers more rice to use for food rather than planting. Smaller nurseries are easier to manage and require a lot less land.
Reduced reliance on chemical fertilizers, herbicides, and pesticides	The high and rising cost of fertilizer and other inputs is one of the main attractions for farmers to use SRI as it allows them to reduce chemical applications without loss of yield. Fewer chemicals around farmsteads has health benefits for people and their livestock. Reduced chemical loads and better soil and water quality has beneficial effects throughout the environment.
Resistance to lodging and storm damage (possibly also cold spells)	Climate change is contributing to more frequent and more severe storms, which cause rice plants to fall over or lodge. This can be devastating to farmers. A fallen crop is vulnerable to rotting and also more difficult to harvest. SRI practices produce stronger straw (tillers) and larger, deeper root systems that make rice plants less susceptible to being blown down or pushed over.
Increased resistance to pest damage	Climate change is expected to increase the prevalence and distribution of pest species as temperatures and rainfall patterns change. With SRI management, farmers observe less loss to pests and diseases even though they use fewer agrochemicals.
Increased drought tolerance	SRI rice plants exhibit stronger root systems that grow deeper into the soil profile. At greater depth they can access deeper reserves of soil moisture (and nutrients). This is particularly important given the increasing risk of rainfall variation during the growing season.
Shorter growing season	SRI crops can often be harvested 1-2 weeks, even sometimes 3 weeks earlier than the same variety conventionally grown. This has economic and environmental advantages. Farmers can use the same field for a short-season crop like a vegetable, or can plant a following crop such as wheat sooner to get higher yield. A shorter growing period reduces water needs and the crop's exposure to pests and storms that arrive late in the season.
Fewer seeds and faster time to planting give more flexibility	If a farmer's crop succumbs to adverse weather patterns, farmers can more easily find the seeds and time to replant the nursery and replant the crop since SRI requires only one-tenth of the seeds, and seedlings can be planted within 8-15 days of sowing, rather than 30-45. People who must travel after planting to find paid work can do so much sooner, and if they have to return to replant a failed crop, they only have to come home for a short time.
Increased production and marketing potential from traditional varieties keeps them viable	With SRI methods, farmers are able to achieve higher yields from their traditional varieties, most of which are better adapted genetically to a range of climate stresses. These local varieties often command a better price in the market. Rice biodiversity has plummeted since the 1960s; however, studies show many traditional varieties offer higher iron and protein content. Rehabilitation and conservation of landraces and local cultivars can give more genetic diversity for dealing with adverse growing conditions, maintaining robustness in the systems.
Improved farmer knowledge, experimentation and innovation	Good SRI extension promotes farmer initiative and evaluation. It encourages farmers to take more responsibility for adaptation and innovation, contributing to human resource development in rural areas and the prospect of farmers being able to identify and exploit other innovations as they emerge.
Diversified cropping systems	With higher yields per unit of paddy land, some farmers convert part of their land to growing more nutritional and more profitable crops such as fruits, vegetables, legumes and small livestock that diversify their diets and raise incomes. Reductions in chemical use make farming systems more compatible with fish, ducks and other non-crop components. More diversification of cropping systems helps to restore biodiversity and sequester carbon in the soil.

Figure 9: SRI improves farm household resilience and climate change adaptation (Africare, Oxfam America, WWF-ICRISAT Project, 2010)

4. Agro-biodiversity and local seed systems

As aforementioned, CARI promotes, among others, inter-specific NERICA varieties. There are differing records about the effects of the massive distribution of NERICA, especially for small farmers. There are experiences so far that indicate that NERICA is not fulfilling its promise and raise significant concerns about both its performance and its long-term effects. NERICA is being promoted in a "top-down" manner that jeopardizes the survival of local rice varieties and other traditional subsistence crops. Moreover, the spread of NERICA is associated with the explosion of private investment in African rice production, which threatens to displace Africa's small-farm rice systems with plantation-style rice production managed by big agribusiness. As such, NERICA is seen as a threat to local agro-biodiversity. The NERICA introduction should have used existing peasant seed systems as the point of departure. Instead, the development was purely steered by CGIAR experts in their laboratories. Moreover, the NERICA community-based seed system is regularly bypassing the actual work in the communities, with seeds being dispatched to farmers as part of government relief operations or distributed by NGOs. In many cases, seeds are simply produced through contract production arrangements between NGOs or government agencies and farmers' organizations. With some national NERICA programmes, seed production is almost entirely in the hands of a few seed companies or individuals with political connections and access to large areas of land. Some are concerned that the NERICA community-based seed system missed the chance to meaningfully integrate with existing local seed systems.

Instead of recommending hybrid varieties, local traditional seed systems should be strengthened by smarter policies and technologies to support community seedbanks, linking farmers to each other, and training them to produce better quality seed and use effective and cheaper seed conservation methods.

5. Participation of Farmer Organizations

As abovementioned, sustainable improvements in the smallholder sector can only be based on a sustained participation of farmers and their organizations (FOs). Though there is no strong indication that GFP implementation is explicitly discouraging farmer organizations from being political, however, a quote from the CARI stakeholder meeting in 2014 raises concerns. It says that 'farmer associations should primarily be business-oriented, rather than politically motivated; associations which have a business rationale will likely remain active regardless of the policy agenda of the current government'.

It needs to be re-emphasized that in order to establish sustainable food systems and related policies, FO's are indispensable and their voices are vital to create ownership and hence sustainability.

Annex 1: Examples of pesticides, fungicides, insecticides recommended in the training material

Product/ trade name	Ingredient	Supplier/ Producer	Remarks/ links
CARI			
Miral	Isazofos		http://www.chemicalbook.com/ChemicalProductProperty_EN_CB7474918.htm?CBNumber=CB7474918
Z-force Dithane-M45	Mancozeb	Adama (NZ)	http://www.adama.com/new-zealand/en/Images/Mancozeb_tcm42-46487.pdf
Basagran		BASF	http://www.betterturf.basf.us/products/basagran-t-o-herbicide.html
Cymbush		Syngenta	
Regent 50 Red SC		Wendell	http://wendell-trading.com/product/regent-50sc/
Bentazone	Basagran		
2,4 Amine salt – Propanil 360	Rycestar Orizoplus		
Veesate	Glyphosate		
Touchdown	Glyphosate		
Wuta-wuta	Glyphosate		
Round-Up	Glyphosate		
Cymbush Cyper-1	Deltamethrin		
Karate	Lambda-cyhalothrin		
Deltaforce	Cypermethrin		
BRIA			
	Carbendazim		In 'ToT major diesease' module
	Edifenphos		
	Mancozeb		
	Benomyl		
	Copper oxychloride		
	Triazoles		
	Strobilurins		
	Iprodione		
	Propiconazole		
	Azoxystrobin		
	Trifloxystrobin		
	Carbendazim		

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