



Bureau for Food Security Initial Environmental Examination (IEE)

Activity/Project Title: Feed the Future Partnering for Innovation (FTF-P4I)	
Contract/Award Number (if known): AID-OAA-A-12-0051/Sub-award PI-SMOG—Zambia Sub-award Title: MRI Seed-Syngenta Ltd.	
Geographic Location: Zambia	
Is this is an Amendment to an existing IEE? No Date & title of Original document: N/A ECD link:	
Funding: \$750,000	
Implementation Start/End: 1 December 2016 to August 31 2018	
Prepared By: Karen Menczer (Fintrac-P4I) BFS Office: Markets, Partnerships and Innovations	Date Prepared: 29 September 2016
Expiration Date (if any): 30 September 2018	EMMP Reporting dates: 1 January 2017; 1 January 2018
Recommended Threshold Determination: <input checked="" type="checkbox"/> Negative Determination <input checked="" type="checkbox"/> with conditions <input type="checkbox"/> Categorical Exclusion [include rationale per 216.2(c)]	<input type="checkbox"/> Deferral [include rationale per 216.3(a)(1)(iii)] <input type="checkbox"/> Exemption [include rationale per 216.2(b)] <input type="checkbox"/> Positive Determination [see 216.3(2)(iii)]
Environmental Mitigation and Monitoring Plan (EMMP): As required by this IEE, an EMMP will be developed by the Implementing Partner (IP) per the conditions described in this IEE. The EMMP will be completed before activities start. A periodic EMMP Report shall be prepared by the IP to describe how well the monitoring and mitigation measures are working, and if any modifications are necessary. Guidance on BFS EMMP development is available at the BFS Environmental Compliance Tracking site. (EMMP is attached to this IEE.)	
Gender Equality and Women's Empowerment Per USAID policy, this IEE will consider the proposed activity in the full light of gender equity and women's empowerment related to environmental impact, not as a separate component, but as a core activity element.	
Global Climate Change Per USAID and Presidential directives, this IEE will consider proposed activity impact on global climate change, and in as much as possible, promote climate-smart agriculture, planning, and related activities. As applicable, project implementation will be cognizant of adaptation, integration, mitigation, clean energy and sustainable landscapes.	
This Document: The purpose of the Initial Environmental Examination, in accordance with Title 22, Code of Federal Regulations, Part 216 (22CFR216), is to provide a preliminary review of the reasonably foreseeable effects on the environment of the described activity, and to recommend determinations and, as appropriate, conditions, for these activities. Upon final approval of this IEE, these recommended determinations are affirmed as 22 CFR 216 Threshold Decisions and Categorical Exclusions, and conditions become mandatory elements of implementation. This IEE is a critical element of a mandatory environmental review and compliance process meant to achieve environmentally sound activity design and implementation.	

IEE SUMMARY:

1. Project Context

Demand for horticulture commodities, especially for tomato, potato, and cabbage, has increased significantly in Zambia due to increased urbanization and steadily rising incomes. Smallholders in Zambia have an opportunity to produce vegetables to meet this growing demand. However, vegetable production requires care, especially during the early growth stage; poor germination rates are common. The purpose of this sub-award is to build a sustainable seedling distribution model by setting up nurseries to support the horticulture value chain, specifically tomato, potato, and cabbage; providing access to market information and linkages; training in good agricultural practices (GAPs) and business management; and introducing new technologies to help smallholders dramatically improve yields of horticulture crops.

2. Activity Description, Location, & Conditions

The specific activities to be supported by this sub-award are described in Section 2.1 of the IEE and are listed below in the Table in Section 5.

3. Potential Environmental Impacts

Potential environmental impacts of this activity are agricultural conversion, health and environmental impacts from pesticide use, and environmental impacts from improper use of chemical fertilizers.

4. Mitigation Conditions

The following mitigation measures are required as part of this sub-award:

Activity (1) Mitigation Measures

1) Syngenta shall submit a Safe Use Action Plan (SUAP) if pesticides to be provided as part of the starter kits are approved in the USAID/Zambia Pesticide Evaluation Report-Safer Use Action Plan, PERSUAP (see Annex A for list of approved and rejected pesticides) or an amended PERSUAP if pesticides are not already approved. The SUAP shall ensure that neonicotinoid pesticides are only recommended for seed treatments and not for field treatments.

2) Syngenta shall ensure that as part of starter kits, fertilizer is provided along with information on best practices, which can be adapted from the USAID AFR Bureau Fertilizer Fact Sheet (Annex B).

Activity (3) Mitigation Measures

3) Syngenta shall provide safe pesticide use training using the safe use practices in the USAID/Zambia PERSUAP, including:

- Use of integrated pest management (IPM) and use of pesticides as a last resort pest management measure;
- Use of appropriate personal protection equipment (PPE);
Information on neonicotinoid pesticides and their effects on bee populations;
- Other measures in the PERSUAP to protect human health and the environment; and

- Recommending only those pesticides (active ingredients) approved for use in the PERSUAP and listed in Annex A. Use of pesticides rejected by the PERSUAP, also listed in Annex A, shall be discouraged.

4) Syngenta’s training on use of fertilizer shall include best practices adapted from the USAID AFR Bureau Fertilizer Fact Sheet (Annex B).

Activity (4) Mitigation Measures

5) Prior to using and demonstrating pesticide use, Syngenta shall submit a SUAP if pesticides to be used and demonstrated are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list. As part of the SUAP, neonicotinoid pesticides may only be used for seed treatments and not for field treatments.

6) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.

Activity (5) Mitigation Measures

7) Syngenta shall ensure that YPR demonstration plots are located on sites that do not require conversion of natural ecosystems to create the plots.

8) Syngenta shall ensure that if pesticides are used and demonstrated at the demo plots, a SUAP if pesticides to be used and demonstrated are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list.

9) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.

5. Threshold Determinations

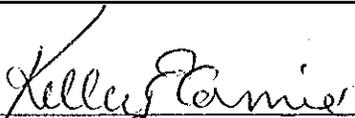
Activity	Recommended Determination
(1) Syngenta will establish 20 seedling production sites, owned and operated by entrepreneur YPRs, in 20 districts. Syngenta and the YPR will establish 8 x 15 meter nursery tunnels and Syngenta will procure equipment and supplies for the nurseries, including seedling trays, mesh tunnels, ground tarps, water pumps, and seedling starter kits, which include Syngenta tomato, potato, and cabbage seed, crop protection products, fertilizer, and growing medium for the seedlings.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(2) Syngenta will select 20 youth entrepreneurs capable and willing to grow the business.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)
(3) Syngenta will provide business and technical training to YPRs.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)

(4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host field days.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(6) Syngenta will offer vegetables in a "bag" concept for urban dwellers.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)
(7) Syngenta will mentor and link YPRs to key rural based sales outlets.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)

APPROVAL OF ENVIRONMENTAL ACTION RECOMMENDED:

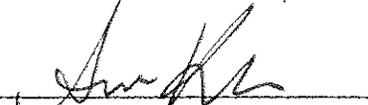
CLEARANCE:

Acting BFS/MPI Office Director:


Kelley Cormier

Date: 11/2/16

Agreement Officer Representative:


Aviva Kutnick

Date: 11/2/2016

CONCURRENCE:

BFS Bureau Environmental Officer:


William Thomas

Date: 11-2-2016

cc: USAID/Zambia Mission Environmental Officer

Filename/location: P:\BFS.MPI\FTF Partnering for Innovation\Component 2- Mission Buy-

Ins\Zambia\Zambia Syngenta

BFS Tracking #: BFS-16-9-007

BFS Initial Environmental Examination (IEE)

1. Project Context

Demand for horticulture commodities, especially for tomato, potato, and cabbage, has increased significantly in Zambia due to increased urbanization and steadily rising incomes. This has resulted in an increase in horticulture imports valued at over US\$400 million. Smallholders in Zambia have an opportunity to produce vegetables to meet this growing demand. However, vegetable production requires care, especially during the early growth stage; poor germination rates are common.

Syngenta, operating in Zambia through its wholly owned subsidiary, MRI Seed Ltd. is a leading horticulture hybrid seed producer and marketer. In addition to high quality hybrid seed, they offer crop protection products and irrigation equipment. Because of the low seed germination rates, smallholders tend to buy the lowest cost seeds to mitigate this risk. Instead, Syngenta is promoting tomato, potato, and cabbage seedlings, grown in a nursery, to create optimum conditions for germination and subsequent growth. These seedlings have a 90% success rate and much higher yields due to the quality of Syngenta's cabbage and tomato seed varieties.

2. Activity Description, Location, & Baseline

2.1. Activity Description

The purpose of this sub-award is to build a sustainable seedling distribution model by setting up seedling production and propagation facilities in the horticulture value chain, specifically tomato, potato, and cabbage; providing access to market information and linkages; training in good agricultural practices (GAPs) and business management; and introducing new technologies to help smallholders dramatically improve yields. By July 2018, Syngenta will have established 20 commercially viable young plant raiser (YPR) managed seedling nurseries, provided outreach demonstrations to 12,000 farmers through field days, and enabled \$500,000 in seedling sales to over 6,000 farmers.

The following activities will be implemented under this sub-award:

(1) Syngenta will establish 20 seedling production sites (nurseries), owned and operated by entrepreneur YPRs, in 20 districts. To establish these sites, Syngenta will procure the equipment and supplies for the nursery-as part of a starter kit-which will includes the following:

- Green-house tunnel (8 x 15 meters, this can be extended should the need arise: see picture below of a typical nursery tunnel, however this is approximately three times the size of those planned under this project)
- Plastic sheet flooring
- Tray tables & plastic trays
- Overhead water storage tank, solar pump, & accessories
- Knapsack sprayer & recommended personal protection equipment (PPE)
- Gardening pack (tools, including wheelbarrow, shovels, etc.)
- Drip kit pack, poles, anchors, steel wire, & accessories to create a demo plot for hybrid tomatoes, potato, and cabbage

- Signage for health & safety
- Storage shed (2 x 2 m, metal, lockable – to store equipment and pesticides)
- Hybrid seeds, pesticides, fertilizer (traditional & foliar), growing medium, plastic transport bags
- Samsung Tablet 3G (for technical reference guides, training guides, basic accounting software tools designed for rural agro-suppliers, communication tools, reporting tool to capture farmers attending training and field days, etc.).

Currently, the specific pesticides to be provided in the starter kits have not yet been identified.



Figure 1. Nursery tunnel

Sites will be located in areas with high market potential for vegetable products, with access to appropriate resources for seedling production, in underserved vegetable markets, and where Syngenta already has business operations, relationships, and markets for their maize and soybean.

(2) Syngenta will select 20 youth entrepreneurs capable and willing to grow the business. Syngenta will use existing networks to identify possible candidates and conduct in-depth interviews to determine technical skills and management and leadership capabilities.

(3) Syngenta will provide business and technical training to YPRs. To build YPRs business acumen, Syngenta will provide business management trainings on topics such as business planning and management, financial record keeping, profit and loss statements, and marketing. Technical trainings will include stewardship and safe handling of products, conservation agriculture, nursery management, greenhouse management, hybrid seed technology, crop protection programs, including disease management, scouting, and identification of diseases and pests. Technical training will include proper use of spray technologies and application measures so that YPRs can offer spraying services to horticulture clients.

(4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka. All YPR trainings will be held there.

(5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host at least three field days per year to demonstrate seedling technology and growing practices. Promotion and technical materials will be provided to all attendees.

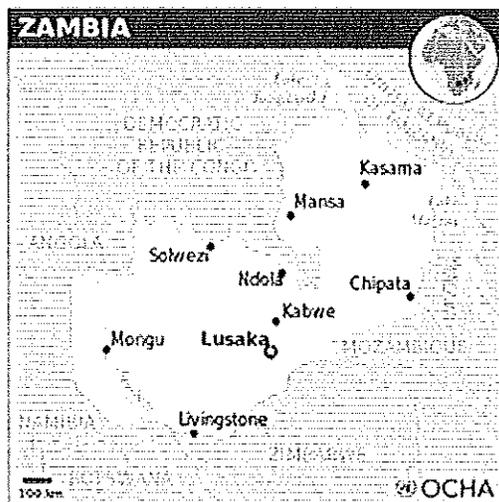
(6) Syngenta will offer vegetables in a “bag” concept for urban dwellers. This will be offered through YPRs to people living in low cost residential areas in cities and larger town. The vegetables in a “bag” concept allows vegetables to be grown in sacks using re-usable materials with no soil and requiring minimal water, thus making the product suitable for the urban/compound context. This would be another income-generating activity for the YPR, and would allow the YPR to cater to both rural and urban markets.

(7) Syngenta will mentor and link YPRs to key rural based sales outlets such as retail agro-dealer shops and community agro-dealers. Syngenta has relationships with public and private sector buyers and distributors of horticultural products, and they will leverage these existing distribution channels to ensure YPRs have the “last mile” market access to smallholder clients.

2.2. Location

Figure 1 shows Zambia’s location in south-central Africa. According to <http://www.nationsonline.org/oneworld/zambia.htm>, Zambia’s land area is 285,994 sq miles (740,724 sq km) and the total area of the country is 290,586 sq miles. The 2014 population was approximately 14,638,505. The annual population growth rate is 2.88%.

The capital city is Lusaka in the south-central part of Zambia. Zambia’s population is concentrated mainly around Lusaka and in the Copperbelt Province to the northwest, the core economic hubs of the country.



(Figure 1. Map of Zambia From: <https://en.wikipedia.org/wiki/Zambia>)

The following is from <https://en.wikipedia.org/wiki/Zambia>. Zambia is drained by two major river basins: the Zambezi/Kafue basin in the center, west, and south covering about three-quarters of the

country; and the Congo basin in the north covering about one-quarter of the country. A very small area in the northeast forms part of the internal drainage basin of Lake Rukwa in Tanzania.

In the Zambezi basin, there are a number of major rivers flowing wholly or partially through Zambia: the Kabompo, Lungwebungu, Kafue, Luangwa, and the Zambezi, which flows through the country in the west and then forms its southern border with Namibia, Botswana, and Zimbabwe. Two of the Zambezi's longest and largest tributaries, the Kafue and the Luangwa, flow mainly in Zambia. The Zambezi falls about 100 meters (328 ft) over the 1.6 km (0.99 mi) wide Victoria Falls, located in the southwest corner of the country, subsequently flowing into Lake Kariba.

According to the USAID/Zambia IEE for the Economic Development (EDEV) Portfolio (July 2015), data on deforestation rates are poor. The current annual deforestation rate is 250,000 to 300,000 ha/year (UN-REDD Programme Zambia, 2010). This is lower than previous estimates of 445,000 ha/year (Campbell et al., 2007) or 850,000 ha/year (FAO, 2005). Previous estimates had placed Zambia in fourth place globally, behind Brazil, Indonesia, and Sudan, for percentage rate of area deforested. Rapid population growth and rural-urban migration, combined with limited job opportunities, lead to over-exploitation of forest reserves and illegal off-take of wildlife and fish. In addition, most Zambians depend on either wood fuel or charcoal for their domestic energy supply. These trends explain why Zambia is threatened with a deforestation rate among the highest in Africa.

The USAID/Zambia Environmental Threats and Opportunities Assessment (March, 2011) states that there are 625 nationally recognized protected areas (PAs) in Zambia, covering approximately 309,052 sq km or about 41% of the country's territorial area. Included in this number are 480 forest reserves covering a total land area of about 7.2 million hectares.

The ETOA identified the following key threats to Zambia's environment:

- Unsustainable Agricultural Practices
- Climate Change
- Charcoal Production
- Illegal Off-takes
- Mining Operations and Expansion
- Poor Governance

The ETOA recommended the following to address the threats:

- Conservation Agriculture
- Public-Private Conservation Partnerships
- Integrated Land Use Planning
- High Efficiency Cook Stoves
- Monitoring, Reporting and Verification
- Urban Health and Environment Improvements

2.3. Project Baseline

This sub-award will work with youth entrepreneurs to develop nurseries in 20 districts across Zambia. The nursery sites have not yet been chosen.

3. Potential Environmental Impacts

The following are the potential environmental impacts of proposed activities under this sub-award to Syngenta:

(1) Syngenta will establish 20 nurseries, owned and operated by entrepreneur YPRs, in 20 districts. To establish these sites, Syngenta will procure equipment and supplies for the nursery-as part of a starter kit.

The 8 x 15 m nursery and 2 x 2 m shed will disturb a very small piece of land and environmental impacts, if any, would be exceedingly minor. Except for the pesticide application equipment, pesticides, and fertilizer, provision of equipment and supplies will have no adverse environmental impacts. Provision of pesticides and sprayers could have adverse impacts, including effects on human health and the environment. Although fertilizer will be used in the nursery on seedlings, if excess is disposed of in an environmentally sound manner, environmental impacts could result.

(2) Syngenta will select 20 youth entrepreneurs capable and willing to grow the business.

Selecting youth entrepreneurs to be YPRs will have no direct or indirect adverse environmental impacts.

(3) Syngenta will provide business and technical training to YPRs.

Provision of business training will have no direct or indirect adverse environmental impacts. The technical training provided to YPRs on pesticide use and spray equipment could indirectly affect the environment and human health. Training on fertilizer use can have indirect environmental impacts, as well. Other technical training, focused on good agronomy practices, will have no direct or indirect environmental impacts.

(4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka, where YPR trainings will be held.

If at the demonstration nursery Syngenta will use and demonstrate pesticide use, human health and environmental impacts could result. If fertilizer is used and demonstrated at the nursery, if excess is disposed of in an environmentally unsound manner, environmental impacts could result.

(5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host at least three field days per year to demonstrate seedling technology and growing practices.

If demonstration plots are located on sites that require conversion of natural ecosystems to create the plots, environmental impacts could result. In addition, if pesticides and fertilizers will be used at the demonstration plots, human health and environmental impacts could result.

(6) Syngenta will offer vegetables in a “bag” concept for urban dwellers.

This will result in no environmental impacts. This concept involves low water use and no soil (vegetables are grown in a sack).

(7) Syngenta will mentor and link YPRs to key rural based sales outlets such as retail agro-dealer shops and community agro-dealers.

Linking YPRs to markets will have no direct or indirect adverse environmental impacts.

4. Mitigation Conditions

Syngenta shall implement the following mitigation measures. With implementation of these measures, these activities will not have a significant effect on the environment.

Activity (1) Syngenta will establish 20 nurseries, owned and operated by entrepreneur YPRs, in 20 districts. To establish these sites, Syngenta will procure equipment and supplies for the nursery-as part of a starter kit.

Mitigation Measures

1) Syngenta shall submit a Safe Use Action Plan (SUAP) if pesticides to be provided as part of the starter kits are approved in the USAID/Zambia Pesticide Evaluation Report-Safer Use Action Plan, PERSUAP (see Annex A for list of approved and rejected pesticides) or an amended PERSUAP if pesticides are not already approved. The SUAP shall ensure that neonicotinoid pesticides are only recommended for seed treatments and not for field treatments.

2) Syngenta shall ensure that as part of starter kits, fertilizer is provided along with information on best practices, which can be adapted from the USAID AFR Bureau Fertilizer Fact Sheet (Annex B).

Activity (3) Syngenta will provide business and technical training to YPRs.

Mitigation Measures

3) Syngenta shall provide safe pesticide use training using the safe use practices in the USAID/Zambia PERSUAP, including:

- Use of integrated pest management (IPM) and use of pesticides as a last resort pest management measure;
- Use of appropriate personal protection equipment (PPE);
Information on neonicotinoid pesticides and their effects on bee populations;
- Other measures in the PERSUAP to protect human health and the environment; and

- Recommending only those pesticides (active ingredients) approved for use in the PERSUAP and listed in Annex A. Use of pesticides rejected by the PERSUAP, also listed in Annex A, shall be discouraged.

4) Syngenta’s training on use of fertilizer shall include best practices adapted from the USAID AFR Bureau Fertilizer Fact Sheet.

Activity (4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka, where YPR trainings will be held.

Mitigation Measures

5) Prior to using and demonstrating pesticide use, Syngenta shall submit a SUAP if pesticides to be used and demonstrated are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list. As part of the SUAP, neonicotinoid pesticides may only be used for seed treatments and not for field treatments.

6) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.

Activity (5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host field days to demonstrate seedling technology and growing practices.

Mitigation Measures

7) Syngenta shall ensure that YPR demonstration plots are located on sites that do not require conversion of natural ecosystems to create the plots.

8) Syngenta shall submit a SUAP if pesticides to be used and demonstrated at the demo plots are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list.

9) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.

5. Threshold Determinations

Recommended Threshold Determinations

In accordance with this analysis, the following determinations are recommended for this activity:

Activity	Recommended Determination
(1) Syngenta will establish 20 seedling production sites, owned and operated by entrepreneur YPRs, in 20 districts. Syngenta and the YPR will establish 8 x 15 meter nursery tunnels and Syngenta will procure equipment and supplies for the nurseries, including seedling trays, mesh tunnels, ground tarps, water pumps, and seedling starter	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)

kits, which include Syngenta tomato, potato, and cabbage seed, crop protection products, fertilizer, and growing medium for the seedlings.	
(2) Syngenta will select 20 youth entrepreneurs capable and willing to grow the business.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)
(3) Syngenta will provide business and technical training to YPRs.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host field days.	Negative Determination with conditions in accordance with 22 CFR 216.3(a)(2)(iii)
(6) Syngenta will offer vegetables in a "bag" concept for urban dwellers.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)
(7) Syngenta will mentor and link YPRs to key rural based sales outlets.	Negative Determination in accordance with 22 CFR 216.3(a)(2)(iii)

General Project Implementation and Monitoring Requirements

1. Integration and implementation of EMMP. Syngenta shall integrate the below EMMP into their project work plan, implement the EMMP, and report on its implementation as an element of their quarterly reporting.
2. Compliance with Host Country Requirements. Nothing in this IEE substitutes for or supersedes Syngenta's responsibility for compliance with all applicable Zambian laws and regulations. Syngenta must comply with Zambia's environmental regulations unless otherwise directed in writing by P4I.

6. Environmental Mitigation & Monitoring Plan

Syngenta's Project Manager is responsible for oversight of this EMMP. The Project Manager will collect monitoring data and will report to P4I quarterly, who will report to USAID in their quarterly reports. The quarterly report shall discuss status of mitigation measures, successes, and need for remedial action or other environmental compliance actions.

Syngenta EMMP

<i>Activity</i>	<i>Potential impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicators</i>	<i>Monitoring methods & frequency</i>

(1) Syngenta will establish 20 nurseries, owned and operated by entrepreneur YPRs, in 20 districts. To establish these sites, Syngenta will procure equipment and supplies for the nursery as part of a starter kit.	Provision of pesticides and sprayers could have adverse impacts, including effects on human health and the environment.	1) Syngenta shall submit a SUAP if pesticides to be provided as part of the starter kits are approved in the USAID/Zambia PERSUAP (see Annex A for list of approved and rejected pesticides) or an amended PERSUAP if pesticides are not already approved. The SUAP shall ensure that neonicotinoid pesticides are only recommended for seed treatments and not for field treatments.	SUAP or amended PERSUAP is submitted prior to providing pesticides	Monitor that SUAP or PERSUAP has been submitted and approved one time, when submitted
	Although fertilizer will be used in the nursery on seedlings, if excess is disposed of in an environmentally sound manner, environmental impacts could result.	2) Syngenta shall ensure that as part of starter kits, fertilizer is provided along with information on best practices, which can be adapted from the USAID AFR Bureau Fertilizer Fact Sheet (Annex B).	Best practices are included in starter kits	Monitor that starter kits include information on fertilizer best practices, one time before kits are provided
(3) Syngenta will provide business and technical training to YPRs.	Provision of technical training provided to YPRs on pesticide use and spray equipment could indirectly impact the environment and human health.	3) Syngenta shall provide safe pesticide use training using the safe use practices in the USAID/Zambia PERSUAP, including: <ul style="list-style-type: none"> • Use of integrated pest management (IPM) and use of pesticides as a last resort pest management measure; • Use of appropriate personal protection equipment (PPE); Information on neonicotinoid pesticides and their effects on bee populations; • Other measures in the PERSUAP to protect human health and the environment; and • Recommending only those pesticides (active ingredients) approved for use in the PERSUAP and listed in Annex A. Use of pesticides rejected by the PERSUAP, also listed in Annex A, shall be discouraged. 	Training includes these topics	Review training curricula annually to ensure these topics are included
	Training on fertilizer use can have indirect environmental impacts if applied or disposed of in an environmentally unsound manner.	4) Syngenta's training on use of fertilizer shall include best practices adapted from the USAID AFR Bureau Fertilizer Fact Sheet.	Training curricula includes fertilizer best practices	Monitor that curricula includes this, one time, when developed

(4) Syngenta will establish a demonstration nursery at their commercial farm outside of Lusaka, where YPR trainings will be held.	If at the demonstration nursery Syngenta will use and demonstrate pesticide use, human health and environmental impacts could result.	5) Prior to using and demonstrating pesticide use, Syngenta shall submit a SUAP if pesticides to be used and demonstrated are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list. As part of the SUAP, neonicotinoid pesticides may only be used for seed treatments and not for field treatments.	SUAP or amended PERSUAP submitted prior to using pesticides	Monitor that SUAP or PERSUAP has been submitted and approved one time, when submitted
	If fertilizer is used, if excess is disposed of in an environmentally unsound manner, environmental impacts could result.	6) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.	Demo plots include fertilizer best practice information as part of training-	Monitor at select sites when trainings are held
(5) Syngenta will coordinate with each YPR to set up a demonstration plot, where YPRs will host field days to demonstrate seedling technology and growing practices.	If demonstration plots are located on sites that require conversion of natural ecosystems to create the plots, environmental impacts could result.	7) Syngenta shall ensure that YPR demonstration plots are located on sites that do not require conversion of natural ecosystems to create the plots.	Demo plots are on already disturbed land	Check location of each of the 20 sites prior to creating demo plot
	If pesticides and fertilizers will be used at demonstration plots, human health and environmental impacts could result.	8) Syngenta shall submit a SUAP if pesticides to be used and demonstrated at the demo plots are on the list of approved pesticides in Annex A or an amended PERSUAP if pesticides are not on the approved list.	SUAP or amended PERSUAP submitted prior to using pesticides	Monitor that SUAP or PERSUAP has been submitted and approved one time, when submitted
		9) Syngenta shall use and demonstrate fertilizer use in conjunction with the best practices described in Annex B.	Demo plots use fertilizer best practices- provision of technical material at field days	Monitor at select site when demos/field days are held

Annex A: Pesticides Approved in the USAID/Zambia DO2 PERSUAP (PERSUAP expires 30 September 2018)

The following pesticides have been approved for use in USAID/Zambia DO 2 programs with the condition that mitigation measures described in the PERSUAP are implemented. Prior to providing support (providing pesticides in starter kits and using pesticides on demo plots), Syngenta must submit a Safer Use Action Plan (SUAP) to the COR (if pesticides are approved for use in the list below). If pesticides other than those listed below will be supported, P4I, in consultation with Syngenta, will submit an amended PERSUAP prior to providing such support.

Only the below-listed pesticides (active ingredients) are permitted for use/support and can only be used/supported with the mitigation measures described in the PERSUAP, including the development of a SUAP specific to this sub-award. For reference, AIs evaluated in the PERSUAP, but not approved, are also listed.

Allowed Fumigant AIs (with strict conditions)	
<ul style="list-style-type: none"> aluminum phosphide for stored grains (for use only by trained and certified applicators, not farmers; see Fumigation PEA) metam sodium for soil pests, diseases and weed seeds (for use only by trained and certified applicators, not farmers; see Fumigation PEA) 	
Allowed Miticide AIs registered by ZEMA	Miticide AIs registered by ZEMA and considered but Rejected for "Use" by USAID Projects
<ul style="list-style-type: none"> abamectin/avermectin (use only formulations below 1.9%) amitraz 	<ul style="list-style-type: none"> tetradifon (not EPA registered)
Allowed Insecticide AIs registered by ZEMA	Insecticide AIs registered by ZEMA and considered but Rejected for "Use" by USAID Projects
<ul style="list-style-type: none"> abamectin/avermectin (use only formulations below 1.9%) acetamiprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder) dichlorvos/DDVP (use only acute toxicity Class II and III products; not Class I) chlorpyrifos-ethyl (for uses except spraying for household pests, favor the use of granular formulations for soil pests) cyfluthrin (use only acute toxicity Class III products; not Class II) cypermethrin (registered USA for medical, veterinary and household use) deltamethrin dimethoate ethofenprox fenitrothion imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse) 	<ul style="list-style-type: none"> acrinathrin (not EPA registered) alpha-cypermethrin (not EPA registered) benthiocarb (not EPA registered) carbofuran (RUP, Class I) cartap hydrochloride (not EPA registered) chlorfenvinphos (not EPA registered) endosulfan (being phased out as banned under POPs Treaty) fenamiphos (not EPA registered) methamidophos (not EPA registered) monocrotophos (not EPA registered) profenofos (RUP) terbufos (RUP, Class I) triflumeron (not EPA registered)

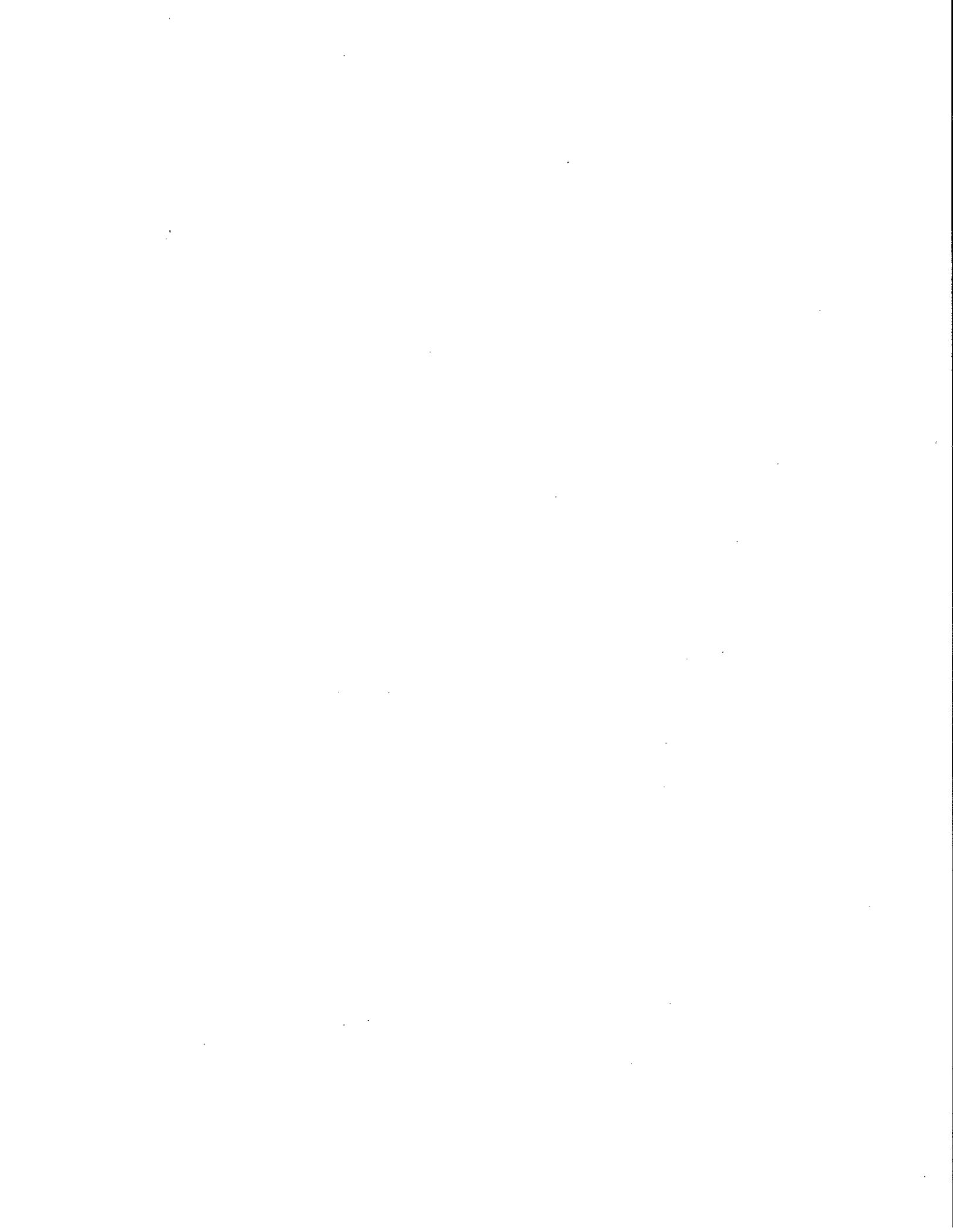
<ul style="list-style-type: none"> disorder) • lambda cyhalothrin (use only formulations 10% and below) • methomyl (use only acute toxicity Class II and III products; not Class I) • permethrin • pyrimiphos-methyl • propoxur 	
<p>Allowed (when registered) Insecticide AIs proposed for registration by ZEMA</p>	
<ul style="list-style-type: none"> • <i>Bacillus thuringiensis</i>-BT • <i>Beauveria bassiana</i> • cyromazine (for use only in areas without high water table and sandy soil) • fipronil (registered in USA for use against termites, ticks, mites, fleas, ants, roaches and mole crickets) • lufenuron • malathion/mercaptotion • pyrethrins (Marigold extract) • spinosad • thiamethoxam (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder) 	
<p>Allowed Fungicide AIs registered by ZEMA</p>	<p>Fungicide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects</p>
<ul style="list-style-type: none"> • boscalid (nicobifen) • carbendazim • chlorothalonil • copper ammonium complex (acetate, carbonate) • copper (cuprous) oxide • copper oxychloride • copper sulfate • difenoconazole • fenamidone • folpet • fosetyl aluminum • kresoxim-methyl • mancozeb/maneb-zinc • phosphorous acid • propamocarb HCl 	<ul style="list-style-type: none"> • benomyl/benlate (not EPA registered) • iprovalicarb (not EPA registered) • propineb (not EPA registered)

<ul style="list-style-type: none"> • propiconazole • sodium metabisulfite • tebuconazole • thiram • triadimefon 	
<p>Allowed (when registered) Fungicide AIs proposed for registration by ZEMA</p>	<p>Fungicide AIs proposed for registration by ZEMA, but Rejected for “Use” by USAID Projects</p>
<ul style="list-style-type: none"> • copper hydroxide • cymoxanil • famoxadone • metalaxyl • triadimenol • <i>Trichoderma species</i> • pyraclostrobin 	<ul style="list-style-type: none"> • alkyldimethylbenzyl ammonium chloride (not EPA registered) • dichlorophen (not EPA registered) • epoxiconazole (not EPA registered) • flusilazole (not EPA registered) • flutriafol (not EPA registered) • penconazole (not EPA registered)
<p>Allowed Herbicide AIs registered by ZEMA</p>	<p>Herbicide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects</p>
<ul style="list-style-type: none"> • 2 4 DB acid • 2 4 D isooctyl ester • ametryne • bentazon • bromoxynil • clethodim • clomazone • dacthal/DCPA (for use only in areas without high water table and sandy soil) • diuron (for use only in areas without high water table and sandy soil) • fluazifop-p-butyl • fomesafen (use only acute toxicity Class II and III products; not Class I) • glyphosate • hydramethylnon • imazethapyr • mepiquat chloride • metolachlor/S-metolochlor (for use only in areas without high water table and sandy soil) • metribuzin • metsulfuron-methyl • nicosulfuron • pendimethalin 	<ul style="list-style-type: none"> • acetochlor (RUP) • atrazine (RUP) • chlorimuron (ethyl) (not EPA registered) • paraquat (RUP) • propaquizafop (not EPA registered) • sulcotrione (not EPA registered)

<ul style="list-style-type: none"> • pyrothiobac-sodium • terbuthylazine 	
Allowed (when registered) Herbicide AIs proposed for registration by ZEMA	Herbicide AIs proposed for registration by ZEMA, but Rejected for “Use” by USAID Projects
<ul style="list-style-type: none"> • bentazon • diuron (use only in areas without high water table and sandy soil) • fluometuron • halosulfuron (methyl) • linuron • mesotrione • MCPA • nicosulfuron (methyl) • oxyfluorfen • prometryn • propachlor (continued use without PPE could increase cancer risk) • propanil • quizalofop-p-tefuryl • thiobencarb(e)/benthiocarb • trifluralin 	<ul style="list-style-type: none"> • cyanazine (not EPA registered)
Allowed Rodenticide AIs registered by ZEMA	Rodenticide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects
<ul style="list-style-type: none"> • bromadiolone • difethialone 	<ul style="list-style-type: none"> • coumatetralyl (not EPA registered)
Allowed (when registered) Rodenticide AI proposed for registration by ZEMA	
<ul style="list-style-type: none"> • zinc phosphide (only in concentrations of 2% and lower, which are EPA acute toxicity Class III) 	
Allowed Nematicide AIs registered by ZEMA	Nematicide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects
NONE	<ul style="list-style-type: none"> • fenamiphos (not EPA registered) • oxamyl (RUP, Class I) • terbufos (RUP, Class I)
Allowed (when registered) Nematicide AI proposed for registration by ZEMA	
<ul style="list-style-type: none"> • <i>Paecilomyces lilacinus</i> Strain 251 (attacks nematode eggs) 	

Allowed Molluscicide AIs registered by ZEMA	Molluscicide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects
NONE	NONE
Allowed Microbicide AI registered by ZEMA	Microbicide AI registered by ZEMA and considered but Rejected for “Use” by USAID Projects
<ul style="list-style-type: none"> • copper ammonium complex 	<ul style="list-style-type: none"> • alkyldimethylbenzyl ammonium chloride (not EPA registered)
Allowed Bird Repellant AI registered by ZEMA	
<ul style="list-style-type: none"> • methyl-anthranilate 	
Allowed (when registered) Nitrogen-Fixing Organism AIs proposed for registration by ZEMA	
<ul style="list-style-type: none"> • <i>Rhizobium leguminosarum</i> • <i>Bradyrhizobium japonica</i> 	
Allowed Wood Preservative Pesticide AIs registered by ZEMA	Wood Preservative Pesticide AIs registered by ZEMA and considered but Rejected for “Use” by USAID Projects
NONE	<ul style="list-style-type: none"> • chlorpyrifos-ethyl (no longer registered for this use by EPA)
Allowed (when registered) Wood Preservative Pesticide AI proposed for registration by ZEMA	Wood Preservative Pesticide AIs proposed for registration by ZEMA, but Rejected for “Use” by USAID Projects
<ul style="list-style-type: none"> • fipronil 	<ul style="list-style-type: none"> • creosote (RUP)
Seed Treatment Products	
Product Trade Name Active Ingredient	
<ul style="list-style-type: none"> • Medal SD <i>Imidacloprid</i>70% WDG 	<ul style="list-style-type: none"> •

Annex B. USAID/AFR Bureau Fertilizer Fact Sheet





USAID
FROM THE AMERICAN PEOPLE

Version: June 2004

Download this factsheet at:
www.encafafrica.org/docs.htm#specificagriculture

AFRICA BUREAU FERTILIZER FACTSHEET

Prepared by: Rob Clausen, Regional Environmental Advisor (REA), USAID West Africa Regional Program (WARP), Accra, Ghana & Walter Knusenberger, REA, USAID Regional Economic Development Services Office (REDSO), Nairobi, Kenya.

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are fundamental for sustainable agricultural and economic development.

2. FERTILIZERS AND USAID ENVIRONMENTAL PROCEDURES

Fertilizers are frequently lumped together with pesticides under the generic heading of “agro- or agrichemicals.” From an environmental compliance perspective (22 CFR 216), as well as from a field-level implementation point of view, this is inappropriate, because it implies that fertilizers require the same level of scrutiny reserved for pesticides. Whereas pesticides are subject to clearly defined environmental review procedures [22 CFR 216.3(b)(1)], and an approval process to promote safer use and integrated pest management, such procedures do not apply to fertilizers (procurement procedures do apply to quantity bulk purchase).

As with any technology, however, it is recommended that fertilizers be thoughtfully employed according to best practice, promoting integrated soil fertility management, within the context of the prevailing biophysical and socio-economic conditions, as well as the desired outcomes. This fact sheet was developed to assist in that regard.

I. BACKGROUND

Low soil fertility is a problem throughout most of Sub-Saharan Africa (SSA). Moreover, the drastic reduction in fallow periods and the almost continuous cropping without soil fertility restoration has depleted the nutrient base of most soils. By the mid-late 1990s, all SSA countries were demonstrating a negative annual nutrient balance¹.

Countries that have the highest nutrient loss rates are the ones where fertilizer use is low and soil erosion is high. These areas include the East African highlands and a number of countries in West Africa.

Low soil fertility is also a driving force behind the conversion of natural areas for agricultural extension. It is generally accepted that agricultural intensification is the only viable means to conserve key natural areas while increasing food security for the continents growing population and generating economic growth through improved agricultural productivity. Land degradation undermines the ability of countries to move in this direction, and the loss of soil nutrients is the most important contributing factor to the land degradation process. The use of inorganic fertilizers is a critical part of the strategy to stop land degradation, restore soil fertility and better manage the soil resources that

3. IMPORTANCE OF WATER MANAGEMENT TO NUTRIENT UPTAKE

Proper water management is important for maximizing crop use of nutrients. About 97% of crop nutrient uptake is from soil solution (water-soluble nutrients), which makes water by far the most important nutrient or fertilizer delivery medium. This also means that, for the most part, nutrient mobility is directly linked to water movement. In sandy soils, nutrients move more quickly through the root zone and soil profile than in other soil types, and excessive water application (or heavy rainfall) can lead to nutrient loss through leaching. Run-off is most serious on loamy-sands or sandy loams that often have a strong surface crust formation. In heavier soils (clays), if nutrients are not adequately incorporated into the soil, the chances for surface runoff in the event of heavy rains or over-irrigation are increased. Sound water management is especially important in rainfed conditions (common throughout SSA). Overall, good water management leads to a more efficient

use of fertilizers and increased nutrient uptake and vice versa.

4. GENERAL SOIL FERTILITY TRENDS IN AFRICA

- Farmers who have taken measures to conserve moisture or increase soil organic matter are more likely to use inorganic fertilizer. When farmers in some areas have capital, they often invest first in increasing moisture retention and/or increasing soil organic matter and secondly in inorganic fertilizer.
- Farmers increase their use of fertilizer when investing more money in fertilizer is seen to be the best available option.

This increase may result from changes in any of the following: fertilizer price, crop price, fertilizer availability, water availability, seed availability, knowledge about fertilizer use, or cropping pattern.

- In West Africa, integrated soil fertility management is progressively adopted. It concerns the combined use of soil amendments and inorganic fertilizer, leading in time to improved soil fertility and increased fertilizer use efficiency and profitability. The nutrient losses to the environment are decreasing.
- Given past and current use rates, USAID's fertilizer-related activities in Africa are unlikely to cause environmental problems.

5. FERTILIZER APPLICATION GUIDELINES

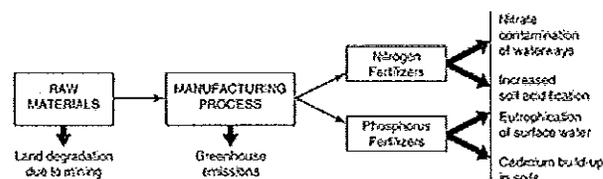
- Before applying fertilizers, obtain an assessment of soil conditions (fertility).
- Indiscriminate use of chemical fertilizers should be avoided.
- Different kinds of fertilizers are required in order to maintain a given level of soil fertility. This depends on site-specific factors, including the soil type, the nutrient requirement of the crop and the various sources of available nutrients. Nitrogen and Phosphorous are the most important nutrients lacking in SSA soils.
- Fertilizer application has to be considered in the context of the overall farming system. This includes the use of organic manure and residues, soil cultivation and crop rotation and water harvesting. Collectively, these factors influence the efficiency of nutrient use.
- When fertilizers are used, it is very important to apply the correct amount for the given situation. The challenge to the farmer is to match as closely as possible the input of nutrients to the nutrient uptake of the crop, thereby minimizing losses. Over fertilization is both costly (wasteful) and potentially harmful to the

environment. To apply the correct amount, the farmer has to define his production goal.

6. POTENTIAL NEGATIVE ENVIRONMENTAL EFFECTS OF FERTILIZERS

Excessive application of nutrients over time can cause pollution. Such losses may occur when nutrients run off the land caused by heavy rainfall, are leached through the soil, beyond the root zone, eventually reaching the groundwater, or escape into the atmosphere as volatile gases.

Aspects of environmental impact can be illustrated as follows:



(Taken from Incitec Fertilizers)

NITROGEN FERTILIZERS

Inorganic nitrogen fertilizers are readily converted by soil organisms to nitrate in the soil. The nitrogen in soil organic matter and organic fertilizers becomes available more slowly. Nitrates may be readily leached if not used by crops or other vegetation. Leaching is particularly likely in sandy soils following heavy rainfall. Leached nitrates may contaminate underground water. This is of concern if the water is to be used for human or livestock consumption, as high concentrations of nitrate may affect health.

Nitrogen fertilizers can also accelerate the natural process of soil acidification. Some fertilizers (e.g. anhydrous ammonia and urea) may initially raise the soil pH at the site of application but in the long term acidify the soils. This occurs when ammonium is converted to nitrate. Acid produced in the nitrification process is used if the nitrate is taken up by plants or soil organisms, but if the nitrate is leached beyond the root zone, acidification occurs. Soil acidification reduces the availability of the trace element molybdenum, fosters the development of aluminum, iron and manganese toxicity and increases nodulation failure in legumes. Lime may be required where acidity is a problem (obtained from naturally occurring calcium carbonate) or the use of acid tolerant plant species can be considered. An illustrative list of crops with acid tolerant varieties include: rice, cassava, mango, cashew, citrus, pineapple and cowpeas.

PHOSPHORUS FERTILIZERS

Excess amounts of phosphorus have been associated with algal blooms and the eutrophication of lakes and waterways. In most waters, phosphorus functions as a growth-limiting factor because it is usually present in very low concentrations. Algae only require small amounts of phosphorus to live. Excessive phosphorus over-stimulates the growth of algae, which could deplete the water of the

dissolved oxygen that is vital to other aquatic life. Phosphorus is relatively immobile in the soil, so conservation and cultural practices which reduce soil erosion can significantly reduce phosphorus inputs into water bodies and the water table.

Phosphorus fertilizers contain various impurities from the phosphate rock and acid used in manufacturing the fertilizer. Cadmium increases is the greatest concern as its compounds are toxic to human beings. Cadmium increases are most noticeable in certain crops e.g. potatoes and leafy vegetables (lettuce and spinach) and in the organs (kidneys and liver) of animals. Almost all phosphate fertilizers contain traces of cadmium, and the concentration of cadmium varies considerably from source to source. At this time, there are efforts underway in West Africa to develop viable processes to remove cadmium from phosphate rock. Exports of rock phosphate represent a vital source of revenue for a number of developing countries in Africa.

FERTILIZER EFFECTS ON SOIL BIOLOGY

Good soil consists of 93% mineral and 7% bio-organic substances. The bio-organic parts are humus (85%), roots (10%) and soil organisms (5%). Most of the soil organisms are decomposers (bacteria and fungi), which are responsible for nutrient retention in soil. In order for nutrients to become available they must be mineralized by the interaction of decomposers and organisms that feed on the decomposers (protozoa, nematodes, micorarthropods and earthworms). Plant growth is dependent on microbial nutrient immobilization. When the number of decomposers declines in soils, more nutrients are lost into the ground and surface water. Heavy treatments of chemical fertilizers can kill decomposers and other soil organisms, which will lead to a reduction in nutrient retention and possible surface and ground water contamination.

7. A SUMMARY OF BEST MANAGEMENT PRACTICES FOR SOIL FERTILITY AND HEALTH

- Practice Integrated Soil Fertility Management (ISFM) – the use of both organic and inorganic sources of nutrients rather than either alone;
- Use of legume cover crops (plus phosphorous) and green manures by fallow rotation or intercropping;
- Promote agroforestry practices – in addition to soil conservation and production benefits, agroforestry transfers/cycles nutrients from within the soil profile (deeper levels to surface);
- Use conservation tillage rather than deep plowing (although conservation tillage can be harmful for production systems in certain regions?);
- Use farm site manures and household wastes, with or without composting;

- Choose crops and associated plants that have high nutrient use efficiency.

6. ADDITIONAL READING

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ACKNOWLEDGMENT

This fact sheet was strengthened by a thoughtful technical review by Dr. Henk Bremen, Director of Africa Division, International Center for Soil Fertility and Agricultural Development (IFDC), Lome, Togo.

