CROP PROTECTION PROGRAMME

Improved access to appropriate farm inputs for integrated maize crop management by small-scale farmers in Kenya and Tanzania

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Executive Summary

Poor soil fertility, prevalence of the maize streak virus (MSV) and weeds all contribute to poor yields of maize in the Mount Kenya region. Use of appropriate farm inputs (fertilizers, disease-tolerant varieties and herbicides) is essential to increase yields. However, inputs are conventionally packaged in large bag sizes that are too expensive for most small farmers. In addition, blanket recommendations for fertilizer that date back a decade or more, can result in the current use of inappropriate nutrient applications to crops. The overall project purpose is to increase yields and livelihoods of small farmers through the development and implementation of innovative methodologies to introduce small farmers to appropriate farm inputs and crop management. An independent impact assessment conducted in Embu and Kirinyaga districts found increases in food security amongst farmers who had adopted the use of MSV-tolerant maize varieties and improved fertilizers promoted by FIPS-Africa in the preceding project. A subsequent survey of 100 farmers by FIPS-Africa showed that the number of food secure families increased from 30 to 80%.The extra quantity of maize produced per farmer was on average 5.65 bags x 90 kg bags equivalent to KSh 6780. A total of 1012 demonstrations of MSV-tolerant varieties, and optimum fertilizer and weed management were conducted during this period. In addition, in co-operation with Western Seed Co. (WSC) and Monsanto, 15000 x 150g mini-packs of MSV-tolerant varieties (WH502, WH403, WS202, DK8031) were distributed to farmers in the target districts. FIPS-Africa developed the 60 seed pack of maize to help farmers experiment with smaller quantities of seeds, and also developed the *Participatory Roadside Demonstration*. Other methods were developed including the 30 seed mini-pack of KB-9 bean seed, Food Security Input Package, and Village Approach. KARI continued to promote conservation tillage through Farmer Field Schools. FIPS-Africa, with co-operation of Monsanto, developed a new method for promotion of herbicides. Approximately 3,000 farmers were visited and glyphosate (*Roundup Max*) herbicide demonstrated on a small 5m x 10m plot. A survey of 118 farmers found that 70% of farmers returned to their stockist to purchase commercial 100g sachets of the herbicide. As a result of FIPS-Africa's promotions, quantity of MSV-tolerant maize varieties sold through stockists in Nyeri district increased from 1.84 tonnes in 2004 to 39.62 tonnes in 2005. Also, sales of *Mavuno* fertilizers increased more than 10 times from 43.5 in 2004 to 473.5 tonnes in 2005. In Meru district, sales of *Mavuno* fertilizers also greatly increased from 55 tonnes in 2004 to 425.5 tonnes in 2005. A survey of 73 farmers in Nyeri district who had received a mini-pack of a variety from WSC, and had subsequently purchased WSC varieties showed that on average they produced an extra 5.2 x 90 kg bags of maize with a value of KSh 6224. The number of farmers who attained the food security target of at least 5 bags / season increased from 32% before FIPS-Africa's intervention to 73% in the 2005 long rains season.

In Tanzania, lack of access to the appropriate farm inputs, especially fertilizer, limits productivity of small farmers. A survey in the S. Highlands showed that stockists invariably repackaged inputs into smaller pack sizes. FIPS-Africa worked with Minjingu Mines and Fertilizer Co.(MMFC) to develop a new fertilizer (*Minjingu Mazao)*, and with Kibo Seed Co., distributors of *Mavuno* fertilizers, to develop a new promotion package whereby a 2g packet of vegetable seed was given to farmers for free when purchasing a 1 kg pack of Mavuno fertilizer. FIPS-Africa worked with other CPP projects to promote their project outputs. Demonstrations of *Minjingu Mazao* on beans were established with CIAT in the N. Highlands (R7955) and on disease-tolerant maize varieties with ARI Uyole in the S. Highlands (R8220). The new fertilizer increased yields of beans by a factor of 2-3, and MMFC has agreed to make available 20T of the new fertilizer in small packs to meet the demand from farmers in the 2006 long rains season.

Background

This proposal is based on needs arising from FIPS-Africa's project to improve small farmers' access to appropriate farm inputs for integrated maize crop management over the last 18 months in Embu and Kirinyaga districts (R8219). The main objective is to improve the food security of small-scale farmers through improving their access to, and rapid dissemination of technology to improve crop production (appropriate fertilizers, lime) and crop protection (MSV-tolerant maize varieties, herbicides).

Research has shown that poor soil fertility, high weed infestation, and Maize Streak Virus (MSV) seriously depress yields of maize. Technology to address these constraints is available, but not accessible to small-scale farmers. Working in co-operation with the private sector, FIPS-Africa staff promote small packets of improved fertilizer (1 kg), and improved MSV-tolerant maize varieties through local stockists. Having experimented with these small packets, small farmers return to the stockists to purchase larger quantities of these inputs to improve their food security.

Key to the success of the project has been close co-operation with the private sector. Co-operators include:

a. Athi River Mining (ARM) which has developed two improved fertilizers (Mavuno planting; *Mavuno* topdressing) packaged in 1 kg bags, and distributed them to stockists at project sites for FIPS-Africa´s promotions. ARM has also provided FIPS Africa with funds to employ 3 staff members to extend the range of the project´s activities to other districts (Nairobi, Kiambu, Thika, Murang'a, Nyeri and Meru districts);

b. Western Seed Co. (WSC) which has provided FIPS Africa with 30,000 small packets (150g) of seed free-of-charge for its promotions. Varieties are MSV-tolerant (WH505, WH403, WS202) and have been performing outstandingly in FIPS Africa´s demonstration plots.

c. Pannar (PAN 67), Freshco (KH 500-21A), Monsanto (DK 8071, DK 8051, DK 8031), and Seedco have also donated MSV-tolerant varieties to FIPS-Africa free-of-charge for demonstrations.

A promotion concept was developed in which a mini-pack of 150g seed of a MSV-tolerant variety was given to farmers when purchasing 1 kg of new *Mavuno* fertilizer. A total of 60,000 seed mini-packs of improved varieties and 60,000 x 1 kg packs of *Mavuno* were promoted through a network of 43 stockists, reaching about 20,000 farmers. Subsequent visits to farmers who purchased the promotional package are showing exceptional crop performance in areas with adequate rainfall, and improved performance over conventional cropping practices in drought-affected areas. As a result, demand for the *Mavuno* fertilizers, and MSV-tolerant varieties (WH505, WH403, WS202) from *WSC* is rapidly increasing. Bt the end of the last project (March 31st 2005), FIPS-Africa had catalysed the supply of over 100 tonnes of *Mavuno* fertilizer. Consumption would have been much higher as farmers' demands frequently exceeded ARM´s capacity to supply. Consequently, ARM invested US$6 million to increase its production from 3,000 T to 50,000 T fertilizer/year. In addition, FIPS-Africa had also catalysed the supply of 6.5T of WSC's MSV-tolerant maize varieties.

Further work is proposed in Embu/Kirinyaga districts to further refine FIPS Africa's promotion methodology. This will involve the development of a food security input package, and a strategy for the dissemination of glyphosate (Roundup) herbicide in small sachets. It is also proposed to extend promotions of MSV-tolerant varieties and improved fertilizers into neighbouring districts (Meru and Nyeri) which has already started in a pilot phase with funding from ARM.

In addition, due to requests from CPP projects and seed and fertilizer companies in Tanzania, FIPS Africa proposes to extend its promotion methodology to assist the dissemination of disease-tolerant maize varieties in projects (R 8220) and pest-tolerant bean varieties (R7955) in project target areas in N. and S. Highlands of Tanzania. Co-operation with R7955 project will also enable FIPS Africa to assist farmers to experiment with mini-packs of beans varieties in Kenya.

Finally, despite the large numbers of small packets distributed, and uptake of technologies by farmers as indicated by sales of inputs in Embu/Kirinyaga districts, there is need for an impact assessment to determine the impact of different promotion methods on adoption, and the effect of the project on farmers' yields and livelihoods. This will help FIPS-Africa and CPP to fine tune their dissemination strategies for future programme activities and documentation of the success stories will help CPP to seek funds to continue programme activities.

Project Purpose

The overall project purpose is to increase yields of small farmers through the development and implementation of methodologies to introduce small farmers to the appropriate farm inputs. Inputs included fertilizers to increase crop productivity, MSV-tolerant maize varieties to reduce the effects of disease incidence, and herbicides to protect crops from the effects of weeds. Methodologies included dissemination through Farmer Field Schools (FFS), demonstrations, and promotions using small packs of inputs provided by the private sector.

Research Activities and Outputs

Activity 1.1: Develop questionnaire and conduct impact assessment.

External consultants were hired by NRI, and an Impact Assessment was conducted amongst farmers in Embu and Kirinyaga districts between August 29th and September 7th. A report entitled "Participatory Impact Assessment of improved access to appropriate farm inputs by small farmers in Eastern and Central Kenya" is available as one of the outputs of this project.

As the study was unable to determine the impact of different dissemination pathways on adoption of inputs, and increases in yield, a further study was conducted in the month of December 2005 by FIPS-Africa field workers in Kirinyaga district to determine the effect of the 150g mini-packs of hybrid seed provided by Western Seed Co on adoption of new maize varieties.

One hundred farmers who received a 150g mini-pack of a Western Seed Co. variety were interviewed. Results of the survey are presented in Table 1. Farmers recalled that before advice from FIPS-Africa they would harvest on average 3.82 x 90 kg bags/0.81 acre (equivalent to 5.36 bags/acre). After trying out the mini-pack, 98% reported that they had subsequently purchased Western Seed varieties. In the 2005 long rainy season, mean yield of farmers had increased to 9.44 bags/0.69 acre (equivalent to 16.1 bags/acre). Extra quantity of maize produced per farmer was 5.65 bags equivalent to KSh 6780.

In terms of food security, only 30% of farmers produced 5 bags or more before the receipt of the mini-pack. After receipt of the mini-pack, 80% of those farmers produced 5 bags or more of maize on their farms. Assuming families on average need to produce 5 bags per season for food security, it can be concluded that through FIPS-Africa's interventions, the number of food secure families increased from 30 to 80%.

Interestingly, farmers reduced their acreage under maize from 0.81 to 0.69 acres. Benefits are therefore likely to be underestimated as farmers could have benefited from growing higher value crops on the land taken out of maize production.

Table 1: Results of farmer survey in Kirinyaga district.

Name	Village	Variety	Yield (bags)	Land area (acres)	Variety	Yield (bags)	Land area (acres)	Change in yield (bags)	Value of change in yield (KSh)
James Maina	Mururi	H512	2	0.25	WH403	4	0.25	2	2400
Mary Nduke	Kianjiri	H512	3	0.5	WH404	7	0.5	4	4800
Johnah Muriuki	Mururi	Saved	1	0.5	WH403	4.5	0.5	3.5	4200
Geoffrey Muriuki	Mukandu-ini	H512/H513	3	1	WS202	6.5	1	3.5	4200
Phylis Wanjiku	Mukandu-ini	Local	8	1	DK8031	4	0.25	-4	-4800
Lucy Wanjiru	Gitumbi	H513	1	1	WH403	4	0.25	3	3600
Salome Wangeci	Gitumbi	H513	10	2	WH403	14	2	4	4800
Teresiah Wangithi	Gitumbi	Local	3	1.5	WH403	6	0.25	3	3600
Jamleck Muthike	Gitumbi	H513	10	1	WH505	14	1	4	4800
Nancy Munithi	Kagongw'e	Phb3253	4	0.25	WH403	5	0.25	1	1200
Catherine Karani	Giacai	Local	10	1.5	WH505/ WH403	30	1.5	20	24000
Ruth Wambui	Gitumbi	CG 4141	5	0.25	WH403	6	0.25	1	1200
Kelvin Kinyua	Gitumbi	Local	0.17	0.25	WH403	4.5	0.25	4.3	5208
David Muriithi	Gitumbi	CG 4141	4	0.25	WH403	6	0.25	2	2400
Rose Peter	Gitumbi	H513	0.66	0.75	WH403	6	0.75	5.34	6408
Felister Wakuthi	Gitumbi	CG 4141	14	1	WH403	17.5	1	3.5	4200
Murage Thuo	Mukandu-ini	H513	7	2	WH403 /WH505	10	2	3	3600
Jenifer Karingi	Kagongwe	H513	0.66	1	WH403	14	0.75	13.3	16008
John M. Mbote	Mukandu-ini	Saved	1.5	1	WH505/ WH403	4	0.25	2.5	3000
Jamleck Ngirigacha	Gitumbi	Saved	1	0.5	WH403	9	0.5	8	9600
Josiah Gicheru	Mukandu-ini	Saved	2	7	WH505	5	0.5	3	3600
Jacob Mithamo	Gitumbi	Saved	4	0.5	WH403	6	0.5	2	2400
Ann Karuana	Gitumbi	Pioneer 3253	6	1	WH403	16	1	10	12000
Geoffrey Kangangi	Kiamukuyu	Recycled	0.89	0.25	WH403	3.5	0.25	2.6	3144
Irene Kirimunge	Kiamwaki	Recycled	1	0.25	WH505	4	0.25	3	3600
Mrs Kanyotu	Kinyakiiru	H513	5	3	WH505	8	0.5	3	3600
Mrs Mwangi	Kahiro	Recycled	0.78	0.25	WH505	4	0.25	7.2	8676
Tabitha Munyi	Rwambiti	CG 4141	7	1	WH403	9	1	2	2400
Mrs Kariuki	Kiangoma	H513	6	1	WH505	11	1	5	6000
Mrs Muriithi	Riakiania	H614	2	.25	WH505	5	.25	3	3600
Peter Wanjohi	Mutarabo	Recycled	4	2	WH505	9	2	5	6000
Ben Mwangi	Kairungu	H614	2	.25	WH505	4	.25	2	2400
Karanja Chomba	Riakiania	H614	4	.25	WH505	5	.25	4	4800
John Thuo	Kahiro	H513	4	.5	WH505	9	.5	5	6000
Eliud Ngara	Mutinu	Recycled	3	1	WH505	5	0.25	2	2400
Gerald Wanjohi	Thumaita	Phb3253	5	.5	WH505	7	.5	2	2400
Samuel Githinji	Kiamiciri	H513	1	.25	WH403	3	.25	2	2400
Beatrice Warutue	Kiamiciri	Saved	0.5	.25	WH403	4	.25	3.5	4200
Samuel Kirera	Kiamiciri	H513	1	.25	WH505	5	.25	4	4800
Sospeter Murimi	Kiania	H513	1	.25	WH403	4	.25	3	3600
Regina N. Gicheru	Kiania	H614	5	.75	WH505	12	2	7	8400
Mercy Wangeci	Kamutuguti	CG 4141	26	1	WH403	32	2	6	7200
Sophia Karonjo	Kamutuguti	H513	2	1	WH403	16	1	14	16800
Irene Njeri	Githima	Recycled	6	1	WH403	6	0.25	0	0
Rose B. Muriithi	Kamutuguti	Recycled	0.44	.75	WH403	4	.75	3.6	4272
Elizabeth Kathoni M.	Gitwe	Recycled	6	3	WH403	12	1	6	7200
James Murimi	Githima	Recycled	7	2	WH403	12	2	5	6000
Florence Wanjiru	Gitumbi	Local	2	.5	WH403	10	.5	8	9600
Caroline Wawira	Gitumbi	Local	4	.5	WH403	15	.5	11	13200
Catherine Wakuthii	Gitumbi	H513	2	.125	WH403	10	0.25	8	9600

Mercy Wanjiku	Giacai	Pioneer 3253	5	.5	WH403	18	1	13	15600
Rose Nyawira	Gitumbi	H513	2.5	.5	WH403	12	.5	9.5	11400
Mary Wainoi	Giacai	H511	4	.75	WH403/ WH505	12	.75	8	9600
Lucy Njagi	Kamutuguti	Recycled	2.5	.75	WH403	10	.75	7.5	9000
Beatrice Itugu	Kamutuguti	Saved	3	1.5	WH403/ WH505	13	2	10	12000
Eliud Mwangi	Gitumbi	H513	4	.5	WH403	8	.5	4	4800
Ruben Muriuki	Kamutuguti	Saved	1.5	1.5	WH403	8	0.75	6.5	7800
Anthony Karani	Nguraini	Recycled	1.5	.25	WH505	7	.25	5.5	6600
Jeniffer Karingi J.	Kianjogu	Recycled	1	.25	WH403	5	.25	4	4800
David Muriuki	Gitumbi	Saved	4	1	WH403	10	1	6	7200
Cecilia Wanjiku N.	Gitumbi	H513	3	.5	WH505	7	.5	4	4800
Jephitha Muchiri	Ndaba	Recycled	3	.75	WH505	5	.75	2	2400
Francis Macharia	Mung'ang'a	CG 4141	8	.75	WH403	11	.75	3	3600
Pastor Murimi	Thumaita	H513	5	1	WH505	12	1	7	8400
Samwel Mbiri	Kandongu	H513	1.5	.5	WH403	5	.5	3.5	4200
Charles Gikunju	Gitoini	Recycled	0.5	.25	WH505	5	.25	4.5	5400
Joseph Ikuri	Muthatura	Recycled	2	.5	WH505	10	.5	8	9600
Githiga Minai	Kianjugu	Saved	2	.5	WS909	5	.5	3	3600
James Nyoike	Gathaka	H513	9	1	WH403	18	1	9	10800
Lawrence Mugo	Kiandai	PAN5243	45	.25	WH403	6	.25	2	2400
Mrs Njogu	Kangaru	H513	2	.5	WH505	7	.5	5	6000
Simon Gatimu	Kariua	Recycled	1	.25	WS202	4	.25	3	3600
John Ndege	Kiamuthambi	H513	10	1	WH403	15	1	5	6000
Gathumbi Kamau	Gacharu	Recycled	0.5	.125	WS909	3.5	.125	3	3600
John Mwaniki	Kianjugu	Recycled	4	1	WH505	11	1	7	8400
John Karatu	Karia	H513	8	1.5	WH403	14	1.5	6	7200
Patrick Wachira	Thumaita	Pioneer 3253	1	.25	DK8031 /WH505	12	0.5	11	13200
Jane Muthoni	Kamondo	H512	7	1	WH505	11	0.5	4	4800
Alice Muchiri	Karia	GL 4141	7	.75	WH403	15	.75	8	9600
Philis Wanjira	Karia	HB513	1	.25	WH403	5.5	.25	4.5	5400
Agnes Wainoi	Karia	H513	4	.5	WH403	5	0.25	1	1200
Esther Gathu	Gathaka	Recycled	1	.25	WH403	3.5	.25	2.5	3000
Patrick Muthike	Kiathigirai	Recycled	2	.5	WH505	10	.5	8	9600
Juliah Wangari	Kamondo	Local	0.5	.25	WH403	5	.25	4.5	5400
Francis Njuki	Karia	Local	1	.25	WH403	6	.25	5	6000
Jane Wambui	Karia	Recycled	3	1	WS202	33	2	30	36000
Michael Karunguru	Thumaita west	PAN67	6	1.5	WH403	10	1.5	4	4800
Samson Ngayo	Githumbu	PAN67	4	1	WH505	12	1	8	9600
Andrew Cubi	Thumaita	Pioneer 30G97	15	3	WH505	6	0.25	-9	-10800
Stanley Maina	Thumaita	H513	11	2	WH403	34	2	23	27600
Stanley Wainaina	Thumaita	H513	3	1.75	WH403 WH505 WS202	42.5	1.75	39.5	47400
Sicily Muthike	Kamiciri	Saved	0.66	.25	WH504	2	.25	1.34	1608
Philisila Njoki Mbiti	Kiamiciri	Recycled	1	.25	WH403	4	.25	3	3600
Beatrice Wanjiru	Kiamiciri	Saved	5	2	WH403	8	0.25	3	3600
Julius Kithaka	Kiamiciri	Saved	3	2	WH403	8	1	5	6000
Henry Gitogu	Kiamiciri	H614	2	.5	WH403	6	0.5	4	4800
James Gachoki	Kiamiciri	H513	1	.25	WH403	4	.25	3	3600
Margaret Nduki	Kiamiciri	H513	3	1	WH403	20	1	17	20400
Mburia	Kiamiciri	Local	0.66	.5	WH505	5	.5	4.3	5208
David Muthike	Kiamiciri	Local	0.5	.25	WH505	3	.25	2.5	3000
Mean			3.82	0.81		9.44	0.69	5.65	6781

Activity 2.1 Test application methods of glyphosate mini-packs amongst farmer groups.

Application methods for application of glyphosate herbicide were tested in co-operation with a KARI-managed Farmer Field School in Embu. It was decided to

adopt the use of a pump action pressurisable 1 litre hand sprayer which is locally available on the Kenya market at a cost of approximately KSh 300. Recommended rate of *Roundup max*/litre is 10g. Therefore FIPS-Africa developed a method to promote 10g *Roundup max* herbicide using a 1 litre hand sprayer.

Photo: Farmer in Embu district testing out different herbicide applicators

Activity 2.2: Promotion of glyphosate mini-packs through stockists and farmer groups.

Photo: Application of glyphosate in a 1 litre pressurisable hand sprayer.

In the course of the project, FIPS-Africa developed a new method to promote herbicides amongst small farmers in Central Province, in co-operation with Monsanto. The method involved extension workers visiting farmers and spraying a new granular formula of glyphosate (*Roundup Max*) on small plots of weeds (5 m x 10 m). A total of 3026 farms were visited in Central Province between May and December 2005, and farmers trained on how to use *Roundup Max*. Most spot sprayings were in Embu district (850), Kirinyaga district (679), Nyeri (550), and Meru (542). Sprayings were also extended into neighbouring Maragwa (142), Thika (109), Kiambu (109), and Murang'a (45) districts. Despite the fact that FIPS-Africa workers charged farmers KSh20 each for the service, demand was overwhelming.

After 3 months, FIPS-Africa revisited 118 farmers to determine the extent to which farmers had adopted the herbicide.

Table 2: Summary of results of survey to determine the effect of FIPS-Africa's promotion campaign on the adoption of *Roundup Max* herbicide.

District	M	F	Mean farm size (acre)	New herbicide users (%)	Farmers purchasing commercial sachets (%)	Mean quantity purchased (g)	Crops to which Roundup max applied
Kirinyaga	9	11	3.1	55	65	161	Horticulture/maize
Embu 1	13	7	3	55	75	166	Coffee/maize
Embu 2	18	2	4.6	65	80	193	Maize/coffee
Nyeri	14	6	19.5	45	100	1055	Coffee/napier
Meru S	15	5	3.8	10	90	144	Bananas/coffee
Meru N	16	2	3.2	22	61	155	Maize/tea

Results of the survey are summarised in table 2. Twenty of the 118 farmers interviewed were in each of Kirinyaga, Nyeri, Meru South, and Meru North districts. Embu district was split up into two, and 20 farmers interviewed in each half. Farms were on average small, approximately 3 acres, with the exception of Nyeri district where mean farm size was about 20 acres. Most farmers interviewed were male.

Of the farmers interviewed, approximately 40% had never used herbicides before. Farmers were more familiar with herbicides in Meru S. and Meru N. districts. Those who had used herbicides had primarily used *Roundup* (liquid), *Wipeout* (both glyphosate) and *gramoxone*.

Results showed that approximately 80% of farmers returned to their stockists to purchase larger quantities of *Roundup Max*. Most farmers elected to buy 1 or 2 x 100g sachets, with the exception of Nyeri district where farms were much larger and farmers purchased on average 10 sachets each.

Crops to which farmers applied *Roundup Max* to were very diverse and depended on the priority crop in each district. In general, *Roundup Max* was applied to maize and coffee. In Meru South, farmers also applied *Roundup Max* to control weeds in their banana plantations, and in Kirinyaga district, farmers applied *Max* before planting tomatoes and french beans.

It can be concluded that the promotion method was very successful in catalysing adoption of *Roundup Max* by small-scale farmers. A further study is required to determine the use of *Roundup Max* by these farmers over time. Also, as most respondents were male, a study is required to determine the adoption of *Roundup Max* by both male and female farmers.

The method could be considered to be the first step in dissemination of conservation tillage. In a future project phase, farmers need to be revisited, and shown how they can plant maize and other crops just by digging holes within the sprayed plot. This will save farmers time, and will improve crop performance through improved soil fertility and water availability.

Through this co-operation with Monsanto, FIPS-Africa was given the opportunity to distribute the commercial 100g sachets of *Roundup Max* through its network of co-

operating stockists in Central Province to make them locally-available for purchase. Under this agreement, a total of 3920 x 100 g sachets were sold. Another distributor, Murphy Chemicals, was also able to distribute approximately 10,000 sachets.

Activity 3.1: Establish network of farm input stockists in Meru and Nyeri districts and train in MSV-tolerant varieties and use of appropriate fertilizers.
A network of 50 stockists was established in Meru and Nyeri districts and stockists trained on MSV-tolerant varieties, and the use of appropriate fertilizers. Two stockists actively participated in promotions by taking part in FIPS-Africa's field days.

Photo: Boston Agrovet in Karatina participated in FIPS-Africa's promotions by attending field days.

Activity 3.2: Promotion of use of appropriate farm inputs in markets, and amongst farmer groups.
FIPS-Africa continued to develop methodology to assist small farmers gain access to the appropriate farm inputs in a sustainable way as quickly as possible. FIPS-Africa's mini-pack concept was extended to include early-maturing beans and collards for nutrition and income generation, respectively.

Katumani bean (KB-9) dissemination method
The Katumani Bean (KB9), developed by KARI, is a drought- and heat-tolerant bean suitable for areas with a short growing season. Depending on temperature, it may mature in only 60 days. It is therefore suitable for areas with low and unreliable rainfall, and because it is early-maturing it is useful for food security.

FIPS-Africa experimented by giving farmers the bean in small 30 seed packs. Farmers tested the bean against their local varieties and found that it matured much faster than their conventionally-used varieties, and was also very high-yielding. They were so impressed with the bean that they stored the seed for planting the next season. In this way, farmers could bulk up to 10 kg seed within 2 seasons.

Photo: Farmer in Kiamiciri Village, Kirinyaga district showing the KAT B-9 variety (left) compared to local variety (right).

Because of the farmers' interest in trying out the bean, a total of 13000 x 30 seed mini-packs of the drought-tolerant KAT B-9 bean variety were distributed to farmers in the target districts. Seeds were distributed during farmer field days, and within FIPS-Africa's Village approach. Also, those farmers purchasing the "Food Security Input Package" received 1 kg beans.

The KB-9 variety became so popular that those farmers purchasing the "Food Security Input Package" sold part of their harvest to neighbouring farmers at KSh 100/kg. This compares to the local variety which costs only KSh 35/kg.

Village Approach

A new promotion concept, named the "Village Approach" was developed to enhance adoption in a focal area. 300 farmers in Kiamiciri village in Kirinyaga district purchased a 1 kg pack of *Mavuno* fertilizer, and received a small pack of MSV-tolerant maize seed, a 30 seed pack of KAT B-9 beans, and a 2 g pack of collards. Of these 300 farmers, 100 went to their stockist to purchase a 2 kg pack of MSV-tolerant maize seed. The village approach was also started in Embu and Nyeri districts with two villages per district.

A major field day was held in Kirinyaga district on July 15th to which donors, private sector co-operators, and Ministry of Agriculture co-operators were invited to see FIPS-Africa's methodology in action, and impact of the project at the farmer level in Kiamiciri Village. Over 1000 farmers attended the demonstrations at Mutito Secondary School. A video of the field day was prepared by NRI, and has been sent to donors, policy makers, and Ministry of Agriculture Officials.

Photo: A farmer from Kiamiciri village in Kirinyaga district showing her 1 acre plot of maize (WH403).

Photo: Farmer in Nyeri district Village Approach showing harvest of collards from a 2g mini-pack of seed given free when purchasing 1 kg of Mavuno fertilizer.

Dissemination of MSV-tolerant varieties

A total of 1012 demonstrations of MSV-tolerant varieties, and optimum fertilizer and weed management were conducted during this period. In addition, 15000 x 150g mini-packs of MSV-tolerant varieties (WH502, WH403, WS202, DK8031) were distributed to farmers in the target districts. FIPS-Africa developed the 60 seed pack of maize to help farmers experiment with smaller quantities of inputs, and with this developed the *Participatory Roadside Demonstration*.

Food Security Input Package

Demonstrations included the "Food Security Input Package". Many small farmers grow maize extensively with poor management over a large area (4000-10000 m2), which yields very little. Through the "Food Security Package", FIPS-Africa aims to show farmers that, by concentrating their efforts and resources in a small area (500 m2), they can harvest as much if not more than on their larger plots. In this way, farmers can save time, labour, and money, and produce enough food for a family of 5

for a six month period. Having learnt from the small plot, they can scale up production methods to produce more maize and beans for the market.

The package, which costs KSh 860, includes high-yielding early-maturing and disease-tolerant varieties, and appropriate management practices to ensure that farmers obtain a good yield in seasons with below average rainfall.

In 2005, over 100 food security packages were purchased by farmers. Yields were measured on 8 farms in Embu district in the 2005 long rainy season. Data are presented in table 3. On average, farmers were able to harvest 2.56 bags of maize and 26 kg beans from their 500m2 plot. This is equivalent to 21 bags of Maize and 215 kg beans/acre. Considering that these farmers normally harvest only 6 bags/acre, then farmers could harvest approximately the same from concentrating their resources into 0.25 acre of maize. Clearly, these results show that in order to reach the 5 bag/family target for food security per season, then the food security package needs to be enlarged from 0.13 acres to 0.25 acres.

Table 3: Yields from farmers adopting "food security input package" in Embu district (long rains 2005).

Farmer	Village	Maize Yield /plot (bags)	Beans Yield/ plot (kg)	Maize Yield (Bags/ acre)	Beans yield (kg/acre)
Nephat Karanja	Ithatha	3	21	24.5	170
Joseph Nthiga	Kiaragana	3	27	24.5	220
Magdalene Muranciri	Nguruka	2	32	16.3	261
Dewitt Njeru Simon	Kiringa	2.75	28	22.4	228
James Nyamburo	Kyandundu	2.5	30	20.4	245
Pius Ndigwa	Kyandundu	3	30	24.5	245
Bernard Nyaga	Ndumari	2	16	16.3	131
Joseck Kanyikiri	Ndumari	2.25	27	18.4	220
	Mean	2.56	26.4	20.9	215

Participatory Roadside Demonstration

FIPS-Africa developed a very small package of inputs designed to teach farmers how to grow good maize with an improved MSV-tolerant variety. The package consists of a 60 seed pack of maize, 150g of planting fertilizer, and 150 g of topdressing fertilizer, and is designed for a small plot of 6 m x 2.5 m. The plot is placed along the road (6 m road frontage) to attract the interest of passers-by. At the time the demo is laid out, the farmer is asked to call 10 of her neighbouring farmers who receive instructions on how to plant correctly. In the 2005 long rainy season, over 800 farmers conducted the Roadside demo, and approximately 10,000 neighbouring farmers received training during the mini-field days. At the mini-field days, farmers are given a 60 seed pack of maize to take back to their farms Because plots are so small, up to 10 demos can be laid out in a day by one person. The method therefore has the potential to reach many thousands of farmers in a season.

Photo: Neighbouring farmers receiving instructions on how to grow maize by a roadside demonstration in Kirinyaga district.

Photo: Farmers receiving a 60 seed pack of MSV-tolerant variety (DK8031) adjacent to a Participatory Roadside demo in Kagio town, Kirinyaga district.

Particpatory Conservation Tillage:: KARI-managed Farmer Field Schools

In this project, KARI continued to evaluate and promote conservation tillage (CT) technologies through the establishment of Farmers Field Schools in both Embu and Kirinyaga districts. Members of Farmer Field Schools were trained on a weekly basis around CT demonstrations, and field days were held at all sites. Approximately 1000 farmers were trained, and those successfully completing the training were awarded with a graduation certificate.

Activity 4.1: Conduct market surveys to determine appropriate sized seed and fertilizer packages for promotions in Tanzania

In co-operation with co-operators from the DfID Crop Post Harvest Protection Programme, at ARI Uyole, FIPS-Africa participated in a survey of stockists in the S. Highlands from 19th -25th October. Approximately 4 stockists were interviewed in each of the major market towns of Iringa, Makambako, Njombe, Mbarali, Chimala, Vwawa, and Mlowo.

Results are summarised in Table 4. Frequency of repackaging all categories of farm inputs by stockists into smaller bag sizes was found to be high indicating the need for the private sector to make inputs available into smaller more affordable packages. For example, minimum fertilizer package size was 50 kg, but farmers were demanding fertilizers in packages for as little as 0.5 kg. This study did not show the frequency with which small farmers demanded inputs in smaller pack sizes, and a further study of farmers are required to determine the optimum bag size of different inputs in terms of affordability.

Table 4: Results of stockist survey in S. Highlands of Tanzania.

Product type	Product	Pack size	Pack price (TSh)	Repack size	Repack price
Fertilizer	DAP	50 kg	14500 - 26500	(0.5) – 1 kg	(350) - 500-600
	Urea	50 kg	13340 - 23500	(0.5) – 1kg	(250) - 500-600
	TSP	50 kg	16000 - 19000	(0.5) – 1kg	(300) - 500-600
	CAN	50 kg	17000 - 19500	(0.5) – 1kg	(250) - 500-600
Maize seed	TMV1/TMV2	2 kg	1900	0.5 kg	500
	CG4141	2 kg	4200	0.5 kg	1100
Vegetable seed	Tomato	100 g	10000	5 g	400
	Chinese cabbage	100 g	4500	5 g	200
Herbicides	Roundup	1000 ml	9000	100 ml	1200
	Gramoxone	1000 ml	7000	100 ml	900
Insecticides	Dursban	1000 ml	9500 - 11000	100 ml	1500
	Karate	1000 ml	14000	50 ml	500
	Thionex	1000 ml	8700	100 ml	1000
	Sumithion	1000 ml	10000	1 ml	20
	Furadan	1 kg	4500	spoonful	300
Grain storage	Actellic 50 EC	1000 ml	22000-26300	100 ml	2630-3000

Activity 4.2: New fertilizer products and range of seeds commercialised by private sector.

FIPS-Africa worked with the Minjingu Mines and Fertiliser Ltd. (MMF), based in Arusha, Tanzania, to develop new improved fertilizers for the benefit of small-scale farmers in the region. The Minjingu mine contains about 10 million tonnes of sedimentary rock phosphate (30% P2O5). However, phosphate from the rock, following application to soil, becomes available very slowly, and is ineffective for fast-growing annual crops such as maize and beans. The possibility exists to develop a more effective fertilizer by blending with other fertilizers to supply N, soluble P, K, and S.

MMF agreed to develop a new fertilizer called *Minjingu Mazao*, containing 7%N, 30%P2O5, 9%K2O and 5%S. Because it also contains 16%CaO, it is suitable for acid soils. FIPS-Africa has started to test the fertilizer amongst small farmers in

Arumeru district in Tanzania, and in Kisii and Embu districts in Kenya, and it is performing well in comparison to other fertilizers.

The fertilizer is currently in a powder form which farmers find difficult to apply. MMFC therefore agreed to invest in a granulator at its mine, and package in small 1 kg bags to enable farmers to try it out in an affordable way. Because it contains 40% *Minjingu* rock phosphate, it will be substantially less expensive than imported fertilizers, and is expected to bring benefits from improved soil fertility and crop production to hundreds of thousands of small-scale farmers in the region.

The *Minjingu Mazao* fertilizer will not be commercially-available until February 2006. Already stockists have requested for 10 tonnes of the product for sale.

FIPS-Africa had less success in encouraging private sector to commercialise seeds in small quantities. Alpha Seed Co. agreed in principle to package its indigenous vegetable seeds and tomato varieties in small packages. Companies were more willing to package seeds in small quantities for promotions. Monsanto, and East African Seed Co. agreed to give FIPS-Africa small packets of maize seed (100-200g) for promotions and Kibo Seed Co. packaged its collard seeds into 2g packs for promotion of *Mavuno* fertilizers.

Activity 4.3 Develop and test protocols for learning plots with farmer groups and extension workers

Photo: Mr Anup Modha, Director of Minjingu Mines and Fertiliser Ltd. at a fertilizer / maize variety demo in Arumeru district.

In N. Tanzania, planting fertilizer is not recommended, because it is generally regarded that soils are not deficient in Phosphorus. As a result, few farmers apply planting fertilizer. However, these recommendations have been in place for many years, and it is considered that soil P deficiency is increasing. Therefore, protocols were designed to compare either Mavuno or *Minjingu Mazao* planting fertilizer against the farmer control plot without planting fertilizers. These treatments were superimposed upon 6 commercially-available maize varieties (DK 8051, Longe 6, SC513, H513, PAN6549, and farmers' saved seed. All plots were topdressed with either urea according to farmer or *Mavuno* top. By the time the project started, most farmers had already planted. However, it was possible to lay 30 of these demonstrations with 2 farmer groups in Arumeru district.

Photo: Staff of Kibo Seed Co, distributors of *Mavuno* fertilizers in Tanzania, by FIPS-Africa demo during Field Day in August 2005.

Of these demonstrations, 4 were harvested and results were analysed. There was little difference between varieties. Planting fertilizer increased yields by 15% (see figure 1).

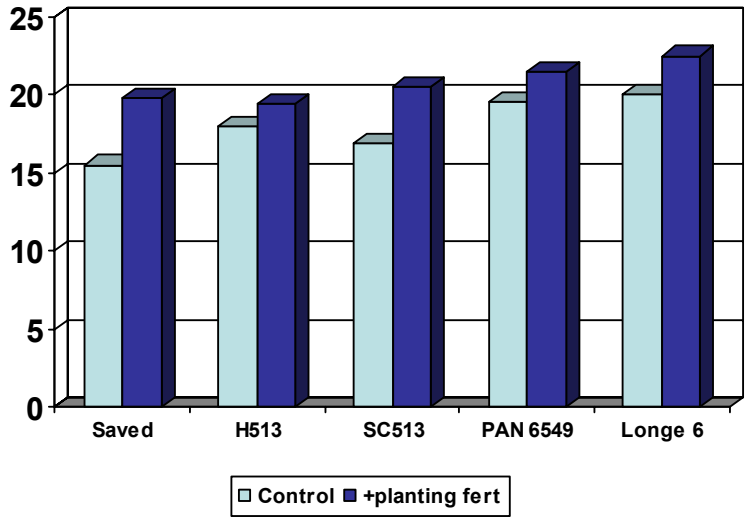

Figure 1: Mean yields (kg/plot) from 4 Maize variety/planting fertilizer demos in Arumeru district (long rains 2005).

Demonstrations of *Minjingu Mazao* fertilizer on beans (co-operation with CIAT; R7955)

In the short rainy season, FIPS-Africa entered into co-operation with Dr Eli Minja of CIAT, another CPP project leader. 1 kg packs of *Minjingu Mazao* fertilizer were

provided for farmer experimentation on small plots (5m x10 m) of beans.

Photo: Demonstration showing the effect of *Minjingu Mazao* fertilizer on beans in Arumeru district.

In Moshi district, 214 farmers experimented with the *Minjingu Mazao* fertilizer on bush and climbing beans. Although the short rains were erratic, *Minjingu Mazao* was found to increase bean grain yield by 1.5 - 2 times.

In Arumeru district, 50 farmers experimented with *Minjingu Mazao* on beans. The new fertilizer increased bean yields by 200-300% under irrigation. In Tarime district, *Minjingu Mazao* was demonstrated with 7 farmers and at 1 farmer training centre. Although rainfall was erratic, *Minjingu Mazao* increased the yields of released varieties by a factor of between 2 and 2.5.

One farmer field day each was held in Moshi and Tarime while 2 were held on different dates and sites in Arumeru district. Farmers were impressed by the performance of the beans and they have asked for the fertilizer to be availed in the shops in Moshi and Arumeru in the next season.

These findings are important. P deficiency appears to be limiting the productivity of beans, and more research is required to determine the economic benefits of applying planting fertilizer to beans.

Photo: Farmers admiring the effect of *Minjingu Mazao* fertilizer on beans at a Field Day at Mukumira, Arumeru district on 11/01/2006. 68 farmers attended the field day.

Fertilizer type demos (Co-operation with ARI – Uyole (R 8220))

Finally, FIPS-Africa entered into co-operation with ARI Uyole, and the Ministry of Agriculture and provided inputs for on-farm demonstrations in the S. Highlands for the 2006-2007 growing season. Materials were provided for 10 demonstrations in Njombe district, 5 demos in Mlowo, 10 demos in Iringa, 10 in Mbozi and 5 in Mbeya districts. The aim was to compare no planting fertilizer, DAP, *Minjingu*, *Minjingu Mazao*, and *Mavuno* planting fertilizers on 1 variety of maize, namely UH615. This was beyond the scope of this particular project, but considering that P was not a major factor limiting maize production in the N. Highlands, and extreme P deficiency is extreme in the South, it was regarded that this would be the best place to test out the efficacy of *Minjingu Mazao* fertilizer against other commercially-available fertilizers.

Activity 4.4 Establish network of farm input stockists in CPP project areas in N. Tanzania, train in improved, pest- and disease-tolerant varieties and use of appropriate fertilizers and promote farm inputs.

A network of 10 stockists has been developed in N.Tanzania. New fertilizers, MSV-tolerant varieties, and vegetable seeds were promoted through stockists in co-operation with Kibo Seed Co. and Monsanto. 1000 promotion packs of maize seed (DK8031, DK8051, DK8071) and 2000 promotion packs of collards vegetable seeds have been promoted. Kibo Seed Co agreed to start a collards promotion campaign, in which any farmer purchasing 1 kg *Mavuno* fertilizer would receive a 2g sachet of collards free-of-charge.

Photo: Farmers purchasing the Kibo seed Co. promotion pack (1 kg *Mavuno* fertilizer + 2 g collard seed) outside a stockist in Tengeru, Arumeru district.

Contribution of Outputs to developmental impact

Farmer surveys in the independent Participatory Impact Assessment, and subsequently by FIPS-Africa staff in Embu and Kirinyaga districts have shown that farmers who have participated in FIPS-Africa's promotion campaigns have adopted the use of improved maize varieties, and increased their food security. The FIPS-Africa study showed that the number of farmers producing 5 bags of maize or more per season had increased from 30% to 80%. Mean yield increase per farmer was 5 .65 x 90 kg bags equivalent to KSh 6781, assuming the current price of a 90 kg bag of maize = KSh 1200.

In Nyeri and Meru districts, FIPS-Africa's promotion methodology, designed to raise demand for the appropriate farm inputs, amongst as many small farmers as quickly as possible, was very successful as can be seen by the massive increase in sales of *Mavuno* fertilizers, and Western Seed Co. varieties within the districts.

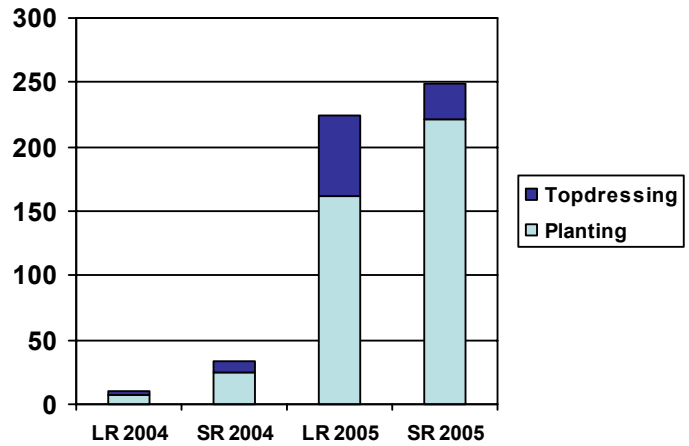

Figure 2: Sales of Mavuno fertilizers (tonnes) through stockists in Nyeri district between 2004-2005.

FIPS-Africa promoters linked with private sector suppliers to communicate orders of inputs to this network. In 2005, there was a massive increase in the quantity of *Mavuno* fertilizers supplied to stockists in Nyeri district. Sales increased more than 10 times from 43.5 in 2004 to 473.5 tonnes in 2005 (see figure 2).

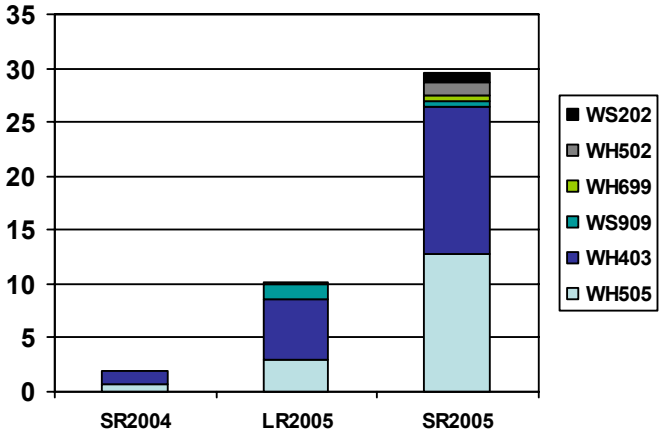

Figure 3: Quantities (Tonnes) of Western Seed Co. varieties supplied to stockists in Nyeri district in the 2004 short rainy season (SR2004), the 2005 long rains season (LR2005), and the 2005 short rains season (SR2005).

Sales of Western Seed Co. varieties also increased from 1.84 tonnes in 2004 to 39.62 tonnes in 2005 (see figure 3).

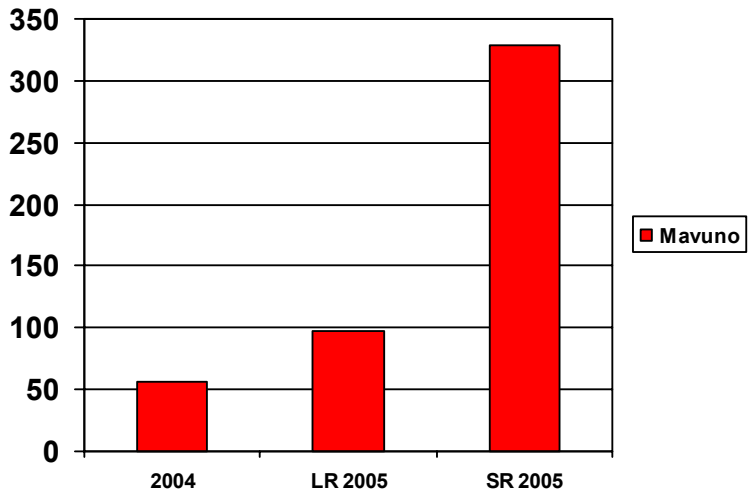

Figure 4: Sales of *Mavuno* fertilizers (tonnes) through stockists in Meru S., Meru C., and Meru N. districts between 2004-2005.

Sales of *Mavuno* fertilizers also greatly increased in Meru district from 55 tonnes in 2004 to 425.5 tonnes in 2005 (see figure 4).

The question remains how many farmers have benefited from FIPS-Africa's project, and by how much they have benefited.

A survey was conducted of 73 farmers in Nyeri district who had received a 150g mini-pack of a Western Seed Co. variety. Farmers were contacted at random and interviewed concerning the varieties used before and after receipt of the mini-packs, and also yield levels. 97% of farmers said that they had used Western Seed Co.

varieties in the 2005 long rainy season. Before receiving instruction from FIPS-Africa, farmers said that they had on average produced 3.89 bags/0.86 acres (5.71 bags / acre). After receipt of mini-pack and instruction on improved maize crop management, yields increased on average to 9.07 bags/0.77 acres (14.4 bags / acre). Extra yield produced/farmer was on average 5.2 bags equivalent to KSh 6224. Interestingly, whilst maize yields increased by a factor of 2.33, mean land area under maize cultivation declined by 10% presumably as farmers realised they could produce enough for their needs from a smaller land area.

Most importantly the number of farmers who attained the food security target of at least 5 bags / season increased from 32% before FIPS-Africa's intervention to 73% in the 2005 long rains season.

Table 5: Summary of yields of farmers in Nyeri district before and after instruction from FIPS-Africa.

		Before Mini-pack			After Mini-pack				
Name	Village	Variety	Yield (bags)	Land area (acre)	Variety	Yield (bags)	Land area (acre)	Change in yield (bags)	Value of change in yield (KSh)
Eunice Wambui	Igana	H614	2.5	0.25	WH403	3	0.25	0.5	600
Elias W. Titus	Kalundu	H614	3	0.5	WH403	9	0.5	6	7200
Margaret Wanja	Kalundu	Pannar	8	1	WH505	16	1	8	9600
Beatrice Kariuki	Kalundu	H513	3	0.5	WH403	14	0.5	11	13200
Wangari Migwi	Kalundu	Saved	0.5	0.25	WH505	3.5	0.25	3	3600
Maina Kihembe	Kalundu	H614	1.5	0.25	WH505	3	0.25	1.5	1800
Mwangi Kabue	Mihute	H614	3.3	1.5	WH403	4.5	0.25	1.2	1440
Margaret Wamuyu	Kiawangi	H511	4	1	WH403	16	1	12	14400
Ibrahim Muriithi	Ruthagati	H513	1.3	0.25	WH403	4.3	0.25	3	3600
Richard Muya	Ruthagati	H627	1.4	5	WH505 WH403	0	0	-1.4	-1680
Maina Muriuki	Ruthagati	H614	2.5	2	WH403	8.5	2	6	7200
Dorcas Gachaba	Kiawangi	Saved	1	1	WH403	3	0.25	2	2400
Joseph Ndegwa	Ngai-ini	H513	8	1	WH403	19	1	11	13200
Mary Wambui M.	Genchania	H513/H614	4.5	0.75	WH403	11.25	0.75	6.75	8100
Eunice Wachira	Ruthagati	H511/H512	4	1.25	WH403	14.4	1.25	10.4	12480
Nick Muchiri N.	Ruthagati	H614	3	0.5	WH403	8	0.5	5	6000
Nickson Kamau	Ruthagati	H513	1.25	0.25	WH403	4.5	0.25	3.3	3960
Regine N.Wanjohi	Kirerema	Saved	3	1	WS202	10	1	7	8400
Charity Muriuki	Giitero	H513	5	0.5	WH403	10	0.5	5	6000
Nelson Manji	Ichamara	DK8031	10	1	WH505	15	1	5	6000
Teresiah W. Irugu	Ichamara	H513	4	0.5	WH403	7.5	0.5	3.5	4200
Simon Thuo	Ithanji	Pannar	10	1	WH505	15	1	5	6000
James Ngure	Kihoro	H614	4	0.5	WH505	6.5	0.5	2.5	3000
Mwangi Kiuma	Ichamara	Pannar	5	1	WH505	8	1	3	3600
Newton Kimani	Ichamara	H614/H513	2.5	0.5	WH505	7.5	0.5	5	6000
David Kariuki	Ichamara	DK8031	4	0.5	WH403	8	0.5	4	4800
George Gathongo	Marua	H513	1.25	0.25	WH505	2	0.25	0.75	900
Ruira Kagumba	Muruguru	H513	8	1	WH505	15	1	7	8400
Partrick Nguru	Marua	Pannar	4.5	0.75	WH505	9	0.75	4.5	5400
Kabugi Gatuna	Marua	H513	6	1	WH403	15	1	9	10800
Joyce Marani	Marua	H614	3.75	0.75	WH403	11.25	0.75	7.5	9000
Elizabeth Kanyago	Marua	Saved	0.5	0.25	WH505	3.75	3.75	3.25	3900
Lucy Maina	Maringaini	Saved	1.25	0.25	WH403	2.5	2.5	1.2	1500
Mary Waithaka	Marua	H614	3.5	0.5	WH403	7.5	0.5	4	4800
Peter Mugambi	Muruguni	H614	3	0.5	WH505	6	0.5	3	3600
Nyokabi	Muruguni	H513	1.5	0.25	WH505	3	0.25	1.5	1800

Mwangi									
Leonard Irungu	Muruguni	H614	6.4	1.25	WH505	12.8	1.25	6.4	7680
Robert Rukwaro	Mweiga	H614	2.5	2	WH505	9	2	6.5	7800
Jane Wanja K.	Mweiga	H614	2	0.5	WH505	5	0.5	3	3600
Margaret Wangui	Mweiga	H512	5	1	WH505	15	1	10	12000
John Gakuu	Mweiga	Pannar	6	1	WH505	13	1	7	8400
Peter Ndegwa	Amboni	Pioneer	2.5	0.5	WH505	7.5	0.5	5	6000
Benson Mahana	Amboni	H614	6	1	WH505	4	0.25	-2	-2400
Clidomis Wanja	Amboni	H513	3	2	WH505	7.5	0.5	4.5	5400
Leah Wairimu	Njengi	Saved	2	2	WH505	7.5	0.5	5.5	6600
Joseph Ndung'u	Kimattu	DK8031	1.5	2	WS202	6	1	4.5	5400
Gladys Wairimu	Watuka	Pioneer	5	1	WH403	10	1	5	6000
Nancy Murigwi	Watuka	Saved	0.5	0.25	WH403	4	0.25	3.5	4200
Mary Muthoni	Watuka	Saved	5	1	WH403	5	0.5	0	0
Beatrice Nyokabi	Gitero	H614	10	1	WH403	20	1	10	12000
Joseph Kinyua	Gitero	H614	6	0.75	WH505	13.5	0.75	7.5	9000
Evans	Gitero	H614	4	0.5	WH505	8	0.5	4	4800
Mama Tree	Karura	H614	6	0.75	WH505 WH403	15	0.75	9	10800
Richard Mwaniki	Karura	H627	3	0.5	WH505	9	0.5	6	7200
Mark M. Giteru	Gichiche	H614	3	0.5	WH505	8	0.5	5	6000
Esther Wairimu	Gichiche	H513	1.5	0.25	WH505	9	0.5	7.5	9000
Justus Kamaru	Gichiche	H614	1	0.25	WH505	3.5	0.25	2.5	3000
Waweru Isaac K	Gitundu	H627	4	0.25	WH505	4.5	0.25	0.5	600
Harry Kiambati	Gitundu	H614	1.25	0.25	WH699	4.5	0.25	3.3	3900
Mary Gitonga	Gitundu	H614	4.5	0.75	WH505	12	0.75	7.5	9000
Pauline Ewangeci	Gitundu	Saved	1	0.25	H614	3	0.25	2	2400
Mrs Kimotho	Kiandai	H513	1.6	5	WH403	3.6	5	2	2400
Mr. Kanyoni	Gitero	H513	2.5	0.5	WH403	10.5	0.75	8	9600
Cecilia Henery	Gitero	H513	2.5	0.5	DK8031	6	0.5	3.5	4200
Mrs Ngumo	Ihwagi	none	0	0	WH403	3	0.25	3	3600
Mercy Wangui	Gikumbo	H614	1.5	0.25	WH403	9	0.5	7.5	9000
Samuel Maina	Gikumbo	H513	10	1	WH505	20	1	10	12000
Josephine Wandia	Gikumbo	H614	6	0.75	WH505	18	1	12	14400
Richard Kinyua	Gikumbo	H513	5	1	WH403	20	1	15	18000
Gladys Nyawira	Gikumbo	H614	5	0.5	WH403	10	0.5	5	6000
Purity Nyaguthii	Karura	H627	12	1	WH699	20	1	8	9600
Mary Ngima	Karura	H614	7.5	0.75	WH505	13.5	0.75	6	7200
Leah Wanjiru	Karura	H513	4	0.5	WH505	8	0.5	4	4800
Mean			3.89	0.86		9.07	0.77	5.19	6224

The quantity of Western Seed Co. varieties purchased by these 73 farmers was on average 6.2 kg/farmer. Considering that 39.62 T of Western Seed varieties was sold in Nyeri district in 2005, then assuming mean quantity purchased/farmer was 6.2 kg, then 6390 farmers would have benefited from purchasing Western Seed varieties. Assuming that each farmer produced on average 5.2 more bags of maize, then 33,228 more bags of maize would have been produced with a value of KSh 39.9 million (approx. GBP 306,720).

These benefits accruing to farmers from the project are an underestimate as they do not account for the thousands more farmers who have received instruction from FIPS-Africa on improved maize management, and may have benefited from improved management of their existing varieties. It should also be noted that much of the *Mavuno* fertilizer sold in the district was applied to crops other than maize such as coffee, passion-fruit, and vegetables.

Two notable success stories of farmers benefiting from the use of *Mavuno* fertilizers on other crops are documented below:

1. Dickson Kamau is a small-scale farmer in Nyeri district. He has 250 coffee bushes. After attending a FIPS-Africa field day in his village, he decided to buy 25 kg *Mavuno* planting fertilizer which he applied to his coffee in October 2004. He applied 25 kg *Mavuno* topdressing fertilizer in March 2005.

He normally harvests 60 kg coffee per day using 17-17-17 and CAN fertilizers. With *Mavuno* he is harvesting 180 kg/day! As he harvests 3 times a week, over a six week period, he estimates that use of the *Mavuno* fertilizer will earn him an extra US$576! Dickson also doubled the yields of his potatoes by using *Mavuno*.

Photo: Dickson Kamau (right) by one of his coffee bushes, fertilized with *Mavuno*, together with the proprietor of Boston Agrovet (Karatina Town)

2. Richard Karumba is a small-scale farmer in Nyeri district. He has 3000 vines of passion-fruit grown on 2 acres. He first encountered FIPS-Africa staff outside Boston Agrovet in Karatina Town. They told him about *Mavuno* fertilizers and he agreed to visit another farmer who was succeeding with *Mavuno* on his passion-fruit. He was convinced. In 2004, he started to use *Mavuno* fertilizers and he has not looked back.

He used to use 17-17-17 and CAN fertilizers. He would harvest about 750,000 fruits/year, but fruits were small and he would fill a carton with 60 fruits and sell them for the local market at KSh 70/carton. This meant that he would produce 12,500 cartons generating income of KSh 875,000.

Through using *Mavuno* fertilizers he found out that he could get larger fruits of export quality. He increased the number of fruits harvested by only 500, but because the fruits were larger, he would fill a carton with only 48 fruits which meant he could fill an extra 3,125 cartons. Because quality was higher, he earned KSh 120 / carton. As a result, through the use of *Mavuno* fertilizers he generated income of KSh 1,876,200!

Therefore by changing from 17-17-17 and CAN fertilizers to *Mavuno* basal and *Mavuno* top fertilizers, at no extra cost, Richard found that he could earn an extra KSh 1 million/year from his 2 acres. This is equivalent to US$ 14,285 or US$ 7,142 / acre!

Photo: Richard Karumba (centre) together with FIPS-Africa staff Eliud Kinyua (left) and Stephen Waweru (right) exhibiting the day's passion-fruit harvest.

Benefits accruing to farmers in Meru district are more difficult to estimate as only 7 T of Western Seed varieties were sold in the districts in 2005. This is because Western Seed Co. did not have the capacity to deliver effectively to the district. However, the number of farmers benefiting from supply of 425 T to the district in 2005 is estimated to be approximately 10,000.

A few of many success stories of farmers benefiting from the project in Meru district are documented below:

1. Mrs. Jennifer Kanake, Athiru Runjini sub-location, Ndoleli division
The farmer has a 60 acre farm. Before advice from FIPS-Africa, she used to plant H511, H513 and local seeds. She used to harvest an average of 8-10 bags / acre. She had noticed a problem of MSV but was not aware of the disease. She used to use a spacing of 90 x 30cm and planted 3 seeds per hole without use of fertilizer.

FIPS-Africa held a field day at the farmer's farm and with other another 10 farmers decided to adopt the technology. She adopted MSV-tolerant varieties (WH403 and DK8031), and planted one seed/station at a spacing of 75X25cm, and started to use *Mavuno* fertilizer on a 6 acre piece of land. As a result, she increased her yields to 22 bags / acre. She has now expanded the acreage under the variety to 20 acres. She has a boarding school, and she has enough maize to feed her 100 pupils. Before, she used to buy maize for her school. Now she does not need to buy maize.

2. Joseph Mionki: Amwamba sub-location; Igembe S. W. division
The farmer has a 0.5 acre plot. In November 2004, the farmer attended one of FIPS-Africa's field days around a maize variety demonstration. Before receiving advice from FIPS-Africa, he used to plant 2kg of H614 seed. There was a major problem of MSV and 60% of the crop did not cob and was used to feed his only dairy cow. He used to buy 4 bags of maize to feed his family. After the field day, the farmer purchased 2 kg of seed of a MSV-tolerant variety i.e. WH403. He used the recommended spacing (75 x 25 cm), and used *Mavuno* fertilizer (10 kg per 0.25 acre). He harvested 5 bags and he is able to feed the family with the improved yields. So far he has saved Ksh 6,000 and has used the money to pay fees for his son at the university.

3. Sebastian Bundi, Amwamba sub-location; Igembe division
Sebastian Bundi has a 0.5 acre plot of land and used to plant 2kg of H614 seed which was prone to MSV disease. He used to harvest about 2 bags. A field day was held around a maize variety demonstration and the farmer adopted the WH403 variety using *Mavuno* fertilizer and recommended spacing and fertilizer application methods. He is expecting to harvest 6 bags. He has now saved KSh 4,500 by not buying maize and has bought a dairy cow with the savings.

The same farmer used to plant 3,000 stems of kales. He was using DAP and top dressed with CAN. It took 1.5 months before he could harvest. He used to harvest 4 bags x 10 kg of leaves after every 14 days. After adopting both planting and topdressing *Mavuno* fertilizers, the farmer has noted the current crop in the field took only 4 weeks for the first harvest. He is now harvesting 7 bags at an interval of 8 days. He used to harvest his kales for 3 months but the current crop is now in its sixth month!

4. Wanja Mworia, Ruiri location, Tigania West division
The farmer has a 20 acre farm. She used to plant local varieties on 5 acres and used to harvest 50 bags. After a maize variety demonstration was laid on her farm, and after receiving advice at the field day, the farmer then adopted DK8031 and WH505 varieties and *Mavuno* planting and topdressing fertilizers. The farmer also adopted good management practices e.g. correct spacing – 75 cm x 25 cm, and clean and timely weeding. The farmer doubled her yields to 100 bags from the same 5 acre plot. As a result, the farmer has been able to pay school fees for her two daughters.

FIPS-Africa's close co-operation with stockists in this project is one of the main reasons for the massive increase in sales of *Mavuno* and Western Seed varieties in the year. In Nyeri district, stockists accompanied FIPS-Africa to numerous farmer field days so they could witness the benefit of the products in demonstrations, and so could advise customers at their shop accordingly. Also, farmers at the field days knew where they could go to purchase the inputs. Also, the involvement of stockists means that the development realised in this project is sustainable. Stockists purchase inputs directly from the Input Supply Companies, and independently of FIPS-Africa.

In comparison to seeds and fertilizers, promotion of herbicides is more difficult because of the need for more intensive training in terms of application and health and safety aspects. In this project, FIPS-Africa chose to develop a more intensive Training and Visit methodology. Even though farmers contributed towards the cost of the visit, demand for FIPS-Africa's service was very high with over 3,000 on-farm spot sprayings conducted. The involvement of Monsanto in the provision of more affordable small 100g commercial sachets of *Roundup Max* is expected to enhance the adoption of herbicides by small farmers, and ensure that results of research are put into action by small farmers.

A case study of Mrs. Mary Wangechi of Kariguini Division in Maragwa district is provided here. In May 2005, she attended a FIPS-Africa Field Day on proper use of farm inputs, where she learnt about the use of *Roundup Max* for control of couch grass. In this area nobody wanted to hear about the use of chemicals because in the year 2000, a farmer working at Delmonte Estate applied some chemical acquired from the estate on his farm and for a period of one and a half year, nothing germinated on his farm, not even crops. This caused a great fear to the villagers because a rumour that he had used *Roundup* had been spread around. However several farmers paid for the FIPS-Africa *Roundup Max* spot spraying service. Feedback from the farmers was positive. One of them was Mrs. Mary Wangechi who

had after trying all methods to control Kikuyu and couch grass unsuccessfully. It normally takes her two full days dig an area of 13 by 8 feet, but now she was able to prepare the same area of land in less than 3 minutes using *Roundup Max*. She was very excited after 2 weeks when she observed the positive effect of *Roundup Max.* This prompted her to visit Kilimo Agrovet in Maragua where she purchased 5 x 100g sachets of *Roundup Max* for use on her entire farm.

Photo: Mrs Wangechi showing the plot where she used the 10g mini-pack of *Roundup Max* to control couch grass.

Further work is required to document the benefits of improved weed control at the farmer level in terms of savings in labour, and improved crop productivity. Also in a further project phase, the spot spraying should be investigated as the first step in the dissemination of reduced tillage methodology.

With respect to Conservation Tillage (CT), the project has had some notable successes of adoption within KARI's Farmer Field Schools, and through FIPS-Africa's Farmer Field Days. Mr. Kimani of Maragua Township attended a FIPS-Africa field day in Feb 2004, in which farmers were taught various topics on proper use of farm inputs which included CT. The first demonstration site suffered a lot of water stress but a farmer who had never harvested a bag of maize harvested 1.5 bags from his 0.25 acre plot. This was a big challenge to Mr. Kimani and he decided to adopt the technology. He bought *Roundup Max* and *Lasso atrazine* from Blue n Spot Agrovet and started with 0.5 acres. It was so successful, from then to date he has never tilled his land because it's all under CT. Before he adopted CT his land was unproductive and he normally harvested less than 1 x 90 kg bag. He never used fertilizer and always planted saved seeds by selecting the big cobs from his harvest. The first time he used CT, together with *Mavuno* fertilizer and WH403, he harvested 10 x 90 kg bags of maize which amazed him. He sold 5 bags each at KSh 1000 in his local Maragua market and from then he harvested his maize grain and makes not less than KSh 20,000 from the same land that produced very little before. Due to his strategic position of his land and his ability to quickly adopt new technology, all seed companies approach him to have their demonstrations done by him, but his preference is for WH403 and *Mavuno* fertilizer.

Despite the obvious benefits of CT in saving of labour, the number of stories where farmers have adopted are limited. More work need to be done to promote CT, and the 10g *Roundup Max* mini-pack may provide the ideal entry point for this.

Photo: Esther Kamau, FIPS-Africa Field worker, shows Mr Kimani's crop of maize.

The development of new methodology in this project phase, in particular the 30 seed bean pack, and 60 seed maize pack, has great potential to assist development projects to rapidly disseminate improved germplasm to as many farmers as quickly as possible. The impact of FIPS-Africa's method on adoption of the Katumani Bean and its effect on food security needs to be conducted in a future project phase.

This project enabled FIPS-Africa to explore the potential of its methodology to promote the outputs of fellow CPP co-operators in Tanzania. Interest amongst potential private sector co-operators was impressive, particularly from Minjingu Mines and Kibo Seed Co. In the co-operation with Dr Eli Minja of CIAT (CPP project No. 7955), the new improved *Minjingu Mazao* fertilizer was shown to have a big effect on increasing the productivity of beans in the N. Highlands in numerous on-farm trials, and although granulation facilities have yet to be installed, Minjingu Mines has agreed to manufacture 20 tonnes of the product in advance of the 2006 long rainy season to make the product available for sale amongst CIAT-co-operating farmers. The stockist survey conducted in the S. Highlands in which it was shown that stockists regularly repackage fertilizers down to 0.5-1 kg quantities according to the demands of small farmers will lend weight to the argument for Minjingu Mines to package its fertilizer in 1 kg bags for promotion purposes. Because P deficiency is greater in the S. Highlands, FIPS-Africa has started to co-operate with ARI Uyole (CPP project no. R 8220) in order to demonstrate the effect of improved fertilizers (e.g. *Minjingu Mazao*, *Mavuno*) with the improved disease-resistant UH615 variety. 40 demonstrations have been established in December 2005 in co-operation with the Ministry of Agriculture, and need to be followed up in a future project phase.

Biometricians Signature

I confirm that the biometric issues have been adequately addressed in the Final Technical Report:

Signature:
Name (typed):
Position:
Date: