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Maize Intensification in Mozambique: Demonstrating to Farmers the Benefits of Better Land and Crop Management

Goujard, O.[(1)]*, M. van den Berg*[(2)]*, P. Heffer*[(3)]*, and S. Zingore*[(4)]*.*

Farmers from the association "7 de Abril - Zembe" in front of their demonstration field. Photo by O. Goujard.

Introduction

Mozambique is a developing country which, until the beginning of the 90s, suffered greatly from a protracted civil war. Eighty to ninety percent of its population is involved in agriculture; most of the farmers are subsistence smallholders cultivating less than three hectares. The most important cultivated crops are maize, cassava and legumes, the main staple foods. Productivity remains very low with an average maize yield of less of than 1.0 metric ton per hectare (mt ha^{-1}) cultivated. Agro-input markets are particularly undeveloped and the majority of smallholder farmers are not well connected to the output market and value chain. Fertilizer use in sub-Saharan Africa (SSA) is very low; on average, 8.0 kilograms per hectare (kg ha^{-1}), or less than 10 percent of the world average. For Mozambique specifically, fertilizer use is, on average, around 6 kg ha^{-1}.

The Maize Intensification in Mozambique project (MIM) began in September 2008 and is being implemented by the International Fertilizer Development Centre (IFDC). The MIM project is funded and receives technical support from the International Fertilizer Industries Association (IFA), the International Plant Nutrition Institute (IPNI), and the International Potash Institute (IPI). The project was initiated in response to the Abuja Declaration on Fertilizer for an African Green Revolution that commits governments in SSA to increase fertilizer use to an average of 50 kg ha^{-1}.

At the Africa Fertilizer Summit (Abuja, Nigeria, 13 June 2006, see link), delegates agreed that fertilizer is crucial for achieving an African Green Revolution in the face of a rapidly rising population and declining soil fertility. In response to the Abuja Declaration, the New Partnership for Africa's Development (NEPAD) has declared that the vision of economic development in Africa must be based on raising and sustaining higher rates of economic growth (seven percent per year). To realize this vision, African Heads of States and Governments adopted the Comprehensive Africa Agricultural Development Program (CAADP), which calls for six percent annual growth in agricultural production, as a framework for the restoration of agricultural growth, food security and rural development in Africa.

Project goal

The project aims to demonstrate how farmers can intensify rain-fed maize production.

Project objectives

1) To increase maize yields and nutritional value of the crop through increased and balanced use of fertilizer and improved seed varieties.

2) To increase the income and improve livelihoods of smallholder farmers in rural areas through improved purchasing power and enhanced access to input and output markets.

The project is implementing a complete value chain approach to achieve the goals of increasing maize productivity and profitability covering the following activities:

- **Increasing farmer adoption of improved maize seed varieties.** In Mozambique, traditional (i.e. farmer-saved seed) open pollinated varieties of maize, which have low productivity potential and low response to fertilizer application, are

(1) IPI Coordinator for sub-Saharan Africa, olivier.goujard@kalifrance.com.

(2) IFDC former COP, Mozambique

(3) IFA, Director Agriculture, PHEFFER@fertilizer.org

(4) IPNI, Regional Director Africa, SZingore@ipni.net

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used extensively. The project aims to demonstrate how farmers can improve their maize yield through the use of improved seed such as Sussuma, Matuba, and hybrids such as PAN67.

- **Increasing the adoption of use of fertilizer.** Increasing fertilizer use from the current 6 kg ha^{-1} is required to increase maize yields in a sustainable manner. The project aims to demonstrate how farmers can improve their yield through increasing the use of appropriate fertilizers, conservation agriculture, use of sound agronomic practices and other inputs (e.g. seeds). The project is also facilitating the market linkage between farmers and input suppliers to ensure they have easy and timely access to fertilizer and improved seed varieties.
- **Facilitating the market linkage between farmers and agricultural commodities buyers.** By achieving this, farmers will have access to viable maize markets, allowing them to sell their produce at profitable prices and improve their capacity to purchase inputs.

Expected outputs and impact

1) About 250 smallholder farmers (five clusters of 50 smallholder farmers) to benefit directly from increased yields and incomes in the project's areas. In addition, wider dissemination of market-oriented agricultural intensification technologies to at least 5,000 smallholder farmers will be facilitated through field days and extension material.

2) Maize yield to increase by 50 percent above the baseline yield in each project area.

3) Fifty agro-dealers to be trained in input and output marketing with each agro-dealer being able to increase the supply of inputs and technology transfer to 500 farmers, enabling increased production for 25,000 farmers.

Map of Mozambique with a focus on the Beira corridor, central Mozambique (marked by the circle). Source: http://www.nationsonline.org/oneworld/map/mozambique_map.htm.

4) Producer groups to be established and linked with input and output markets.

5) Incomes of the 250 farmers participating directly in the project area to increase by 20 percent above baseline incomes in the project area.

6) Establishment and dissemination of improved fertilizer recommendations utilizing soil testing and Nutrient Management Support System (NuMaSS) for maize production in each of the project implementation zones.

7) A soil fertility management plan (Integrated Soil Fertility Management; Site Specific Nutrient Management; ISFM/SSNM) and Integrated Pest Management (IPM) plan for maize-based cropping systems (monoculture, mixed cropping, intercropping, and crop rotation with maize) to be prepared for project areas at the beginning of each cropping season.

Project sites

The MIM project is being implemented in productive clusters in Sofala, Manica and Tete provinces within the Beira Corridor (see map).

In 2008, five sites involving different farmers' associations were chosen for demonstration trials, which were then

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Table 1. Sites, co-operators and farmers at the MIM project.

Province	District	Farmer association	Project participants		
			Men	Women	Total
Sofala	Gorongosa	Nhauranga Farming	17	9	26
		Tendeni Pabodzi	10	8	18
	Nhamatanda	Fambizanai	8	8	16
		Luta Contra Pobreza	5	7	12
Manica	Gondola	7 de Abril - Zembe	29	1	30
		16 de Junho – Bengo	7	9	16
	Sussundenga	Matchipissa	1	0	1
		Muvé	10	4	14
	Manica	Chinhamancungo	11	4	15
		Cufuma Ichungo	4	2	6
	Báruè	Vila Miti	1	0	1
Tete	Angónia	Teguira ne Manja	10	13	23
	Macanga	Tithandizane	14	11	25
		Muenze	16	4	20
	Moatize	Chiande	22	8	30
Total 3	9	15	165	88	253

Table 2. MIM demonstration protocol and factors in 2008, 2009 and 2010.

		Year		
		2008	2009	2010
Demo trial number		5	10	15
Plot size (ha)		1	1	1
Seeds	Farmer-saved seeds	+	+	+
	OPV seeds	+	-	-
	Hybrid seeds	+	+	+
Fertilizers (kg ha^{-1})	NPK: 12-24-12 +6S (basal)	300	50-100	50-100
	NPK: 12-24-12 +0S (basal)	300	-	-
	Urea (topdressing)	150	50-100	50-100
Tillage	Conventional (Conv.)	+	+	+
	Conservation (Cons. + herbicide)	-	+	+

Table 3. MIM trial treatments in 2009-2010.

Treatment No.	Seeds		Fertilizer type		Fertilizer dose	
	Farmer-saved seed	Hybrid (PAN67)	Basal N-P-K-S 12-24-12-6(S)	Top dressing urea	Basal N-P-K-S	Top dressing urea
					----------*kg ha^{-1}*----------	
T_1	+		-	-	0	0
T_2	+		+	+	6-12-6-3	23
T_3	+		+	+	12-24-12-6	46
T_4		+	-	-	0	0
T_5		+	+	+	6-12-6-3	23
T_6		+	+	+	12-24-12-6	46

increased to 10 sites in 2009 and 15 sites in 2010 (Table 1 and 2). The MIM project is working directly with 253 smallholder farmers of which 35 percent are women.

Demonstration protocol

Demonstrations to show the potential for maize intensification were started in 2008, targeting the use of seed varieties and fertilizer rates that easily match local growing conditions, farmers' production objectives and their capacity to invest in seed and fertilizer. Table 2 summarises the changes in studied factors during the three years of the project as the project narrowed down on best management practices. The Open Pollinated Variety (OPV) that was initially part of the demonstrations was discontinued after the first year, as results confirmed their poor performance. It was also decided to keep only the basal fertilizer that gave the greatest yield increases (NPK+S) but with reduced fertilizer application rate from 300 to 100 kg ha^{-1} (2 bags) and 50 kg ha^{-1} (1 bag) to use rates that are more affordable to farmers. Likewise the urea dose was reduced from 150 to 100 kg ha^{-1}. Cons. tillage (with application of the herbicide glyphosate before planting) was included to compare with Conv. tillage (manual or animal traction), each site being divided into two parts.

Table 3 presents the current demonstration design agreed by the project partners, this protocol being duplicated at each site with one part in conservation tillage and one part in conventional tillage.

Each demonstration field was the same size of 1.3 ha (130 m x 102 m). The field was divided into two equal parts; with one part cultivated using conventional tillage and the other with conservation tillage. Each of the two plots was further divided into six plots of 0.1 ha (50 m x 20 m) corresponding to six treatments. All plots were separated by a 2 m buffer zone. Demonstrations were implemented at the beginning of the rainy season (November) with land preparation and sowing being done in December; maize maturity and harvest occurs from April to June, depending on local weather conditions during the growing season.

Planting

The maize hybrid seed selected for testing was PAN67, the most commonly grown hybrid maize variety in Mozambique. Despite the availability of

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T_1 plot: Farmer-saved seeds without fertilizer. Photo by O. Goujard.

T_6 plot: Hybrid variety + 100 kg ha^{-1} fertilizer. Photo by O. Goujard.

more productive improved maize varieties, it is estimated that at least 95 percent of maize planted in Mozambique is farmer-saved seed. It is reported that less than one percent of maize planted is with hybrid seed and approximately four percent is with certified/commercial seed of open-pollinated varieties (OPVs).

Planting is done manually using a hand hoe (*Enxada*). Due to low germination rate, three maize seeds were placed in each planting hole of farmer-saved seeds and only two for the hybrid variety. Seedlings were then thinned to one plant per hill two weeks after plant emergence; this thinning was not done in the farmer-saved seed control plot since this is local farmers' practice. The planting density was 50,000 plants ha^{-1} for PAN67 and between 55,000 to 90,000 plants ha^{-1} for farmer-saved seeds.

Fertilization

The NPK basal fertilizer being used was 12-24-12 +6S which is manufactured (bulk-blended) and distributed locally. Basal fertilizer was applied at planting and placed 5 cm deep and 5 cm from the seed hole and covered with soil. The top dressing (urea 46%) was applied when maize vegetative growth stage was at knee height.

Analysis of soil samples from each demonstration site was carried out in 2010 to check whether fertilization was adequate in relation to soil nutrient contents. Results are shown in Table 4.

Weed and pest control

Weed competition is a key issue for maize cultivation in Mozambique reducing yields by 25 to 85 percent. Manual weeding is performed approximately three times during the period of major competition (i.e. during the first 10 to 40 days after emergence of the seedlings and when the weeds compete with maize for water, nutrients, and space). Weed control was performed on all plots, including the control plots, even though farmers typically do only limited weeding.

Insect pest pressure is also very high in Mozambique and can lead to severe crop and grain damage, not only during the cropping phase but also during grain storage. Maize stalk borer and termites are the main pests which damage maize

Table 4. MIM soil sample analysis from October 2010 performed by Omnia (RSA).

Province	District	Association	Clay	Silt	Sand	pH (KCl)	CEC	P	K	Ca	Mg
			----------%----------				*cmol$_c$ kg^{-1}*	---------*mg kg^{-1}*---------			
Sofala	Gorongosa	Nhauranga	10	8	82	4.6	2.2	3	133	256	62
		Tendene Pabhozi	6	9	85	4.4	4.7	69	150	593	138
	Nhamatanda	Fambidzai	12	23	65	4.8	10.2	11	211	1,280	387
		Luta c/ Pobreza	20	34	46	4.9	16.2	10	159	2,250	519
Manica	Gondola	16 de Junho	12	11	77	4.3	2.9	4	85	340	87
	Zembe	7 Abril	12	19	69	4.4	2.7	5	164	294	59
	Manica	Chinhamacungo	10	10	80	4.2	1.7	20	84	143	24
		Ifuma Ichungo	14	12	74	4.6	4.4	2	112	489	196
	Sussundenga	Muve	12	9	79	5.2	6.6	3	163	975	141
		Matchipisse	N/S	N/S	N/S	4.5	2.7	5	114	319	74
	Catandica	Viramite	10	1	89	5.7	7.1	56	111	1,140	125
Tete	Macanga	Titandizane	16	11	73	4.3	3.0	22	114	320	92
		Muenze	8	12	80	4.5	1.6	30	79	167	35
	Angonia	Umodzi	8	16	76	4.8	11.0	4	158	1,300	481
		Tiguirane Ne Manja	16	11	73	4.6	4.9	1	188	595	165
	Zobue	Antechito Achiambe	4	13	83	5.2	3.6	35	92	538	77

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Table 5. MIM trial sites rainfall verified in 2010 (mm).

Province	District (trial site)	Rainfall (mm/month)						Total
		January	February	March	April	May	June	
Manica	Barue	204	496	138	162	0	0	1,001
	Gondola	32	294	78	13	5.5	6	429
	Manica	79	334	139	96	7	0	655
	Sussundenga	17	172	168	145	10	0	513
Sofala	Gorongosa	155	125	145	204	148	12	789
	Nhamatanda	52	30	66	27	19	6	200
Tete	Angónia	112	249	98	24	0	0	483
	Macanga	32	386	159	98	7	6	689
	Moatize	----------------------No data------------------------						
	Tsangano	----------------------No data------------------------						

Table 6. Effect of soil tillage on maize yields in 2010 (average of 8 sites).

Treatment	Average Cons.	Average Conv.	Cons. over Conv.
			%
T_1	1.11	1.18	-5.43
T_2	1.55	1.71	-9.08
T_3	2.1	2.28	-8.16
T_4	1.67	2.05	-18.54
T_5	2.69	2.98	-9.79
T_6	3.11	3.34	-7.14
Average	2.04	2.26	-9.68

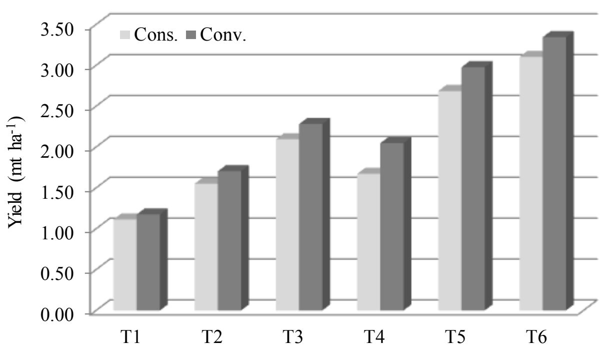

Fig 1. MIM overall average of maize yield in 2010.

plants; adequate chemical control was conducted when required on each trial site.

Trial results

This paper summarizes only one year of results of the 2009-2010 season, since the 2008-2009 protocol was different and the 2010-2011 season results have not yet been officially published by IFDC.

Due to severe drought, especially during the maize flowering growth stage, two sites out of ten could not be harvested: Nhamatanda (Sofala Province) and Gondola (Manica Province). In general, yield levels were lower than in the previous year because rainfall distribution was very erratic in early 2010 as illustrated in Table 5.

The yield data of the eight harvested sites is shown in Fig. 1. In a year with erratic weather conditions, yield data ranged from 1.1 mt ha^{-1} to 3.3 mt ha^{-1}. The control plot illustrating farmer practice in both tillage systems yielded approximately 1.1 mt ha^{-1}, similar to the yield obtained for rainfed maize in Mozambique (less than 1 mt ha^{-1}).

Influence of soil tillage

In almost all the eight harvested sites, the yields obtained with conservation tillage were lower than those with conventional tillage (Table 6). This effect of conservation tillage in the first year is possibly associated with immobilization of soil nitrogen due to addition of maize residues and sub-optimal weed control. Past research has shown that it can take at least three years for the benefits of conservation to be seen.

Influence of using improved seeds

On average, PAN67 reached only 40 percent of its yield potential (8.0 to 9.0 mt ha^{-1}). This yield gap can be explained by poor rainfall distribution, as well as poor soil fertility conditions in farmers' fields. However, conventional tillage showed higher yields in almost all treatments when compared with farmer-saved seeds grown under similar conditions (Table 7). On average amongst the demo trials, PAN67 had a 65 percent higher yield compared with farmer-saved seeds.

Influence of applying fertilizer

The influence of fertilizer application on yield can be observed by comparing the results of the average yield per treatment (Table 8). The application of basal fertilizer 12-24-12 +6S (+ urea as top dressing) boosted yield in all treatments at the two tested doses: 50 kg and 100 kg ha^{-1}. Throughout the trial locations yield increases were obtained which were very variable: in some places there were only limited yield increases (+10 percent) whereas in other sites (e.g. Sofala district), up to +200 percent yield increases were found. The application of one fertilizer bag per hectare (50 kg ha^{-1}) led to a 44 percent yield increase (+540 kg maize ha^{-1}) over local farmer practice (farmer-saved seeds with conventional tillage and no fertilizer applied). Yields were

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almost doubled (+94.2 percent) with application of two fertilizer bags (100 kg ha^{-1}). A similar trend was observed for the conservation tillage + farmer-saved seeds and hybrid variety + Cons. or Conv. From the data obtained soil tillage and seed quality does not seem to have any positive or negative cross effect with fertilization.

Table 7. Influence of seed source and nutrients in the two tillage systems on maize yields in 2010.

Fertilizer treatment	Tillage	Average yield: Farmer-saved seeds	Average yield: Hybrid variety (PAN67)	Change in yield
		--------------*mt ha^{-1}*--------------		*%*
Unfertilized	Cons.	1.22	1.55	+36
	Conv.	1.21	1.92	+61
50 kg NPK + 50 kg urea	Cons.	1.67	2.75	+68
	Conv.	1.75	3.04	+73
100 kg NPK + 100 kg urea	Cons.	2.15	3.18	+51
	Conv.	2.35	3.44	+47
Average		1.73	2.65	+65

Table 8. Influence of fertilizer application on maize in the two tillage systems on yields in 2010.

	Tillage	Control (no fertilizers)	50 kg NPK + 50 kg urea		100 kg NPK + 100 kg urea		
	1	2	3	4	5	6	7
		mt ha^{-1}	*mt ha^{-1}*	*Col. 3 minus Col. 2*	*mt ha^{-1}*	*Col. 5 minus Col. 2*	*Col. 5 minus Col. 3*
				%		----------*%*----------	
Farmer-saved seeds	Cons.	1.22	1.67	+36.9	2.15	+76.2	+28.7
	Conv.	1.21	1.75	+44.6	2.35	+94.2	+34.3
Hybrid variety	Cons.	1.55	2.75	+77.4	3.18	+105.2	+15.6
	Conv.	1.92	3.04	+58.3	3.44	+79.2	+13.2
Average		1.48	2.30	+56.1	2.78	+88.5	+20.7

Economic analysis

Gross revenue

Farmers who grow maize in Mozambique usually obtain a yield of approximately 1.0 mt ha^{-1}. The value of this production varies from place to place and also varies according to the time of year. Grain buyers typically pay the least for maize during the harvest season when quantities are most plentiful. Prices increase with time after harvest. A value of six Meticais/kg (6 MTs kg^{-1}) was reported during the time following harvest in 2010. With an exchange rate of 37.2 MTs/USD (August 2010; 25 MTs per USD during the last season), the equivalent price that could be obtained by the farmers was USD 161.29 mt^{-1} of maize grain. Gross revenue obtained in the different treatments is described in Table 9.

Input costs

Costs of agro-inputs vary greatly from year to year. One example regards fertilizer: from the 2008-2009 season to the 2009-2010 season, there was a decrease of 60 percent for the basal fertilizer (12-24-12 +6S) and 30 percent decrease for the top dressing fertilizer (urea 46 percent). The fluctuation of US

Table 9. Economic analysis of the various treatments.

Treatment		Tillage	Average yield	Gross revenue[(1)]	Input cost: Maize seed	Input cost: NPK 12-24-12 +6S	Input cost: Urea 46%	Input cost: Herbicide glyphosate	Gross input	Gross margin	Gross margin
			kg grain ha^{-1}	----------------------------	-------------	-------------	*MTs ha^{-1}*	-------------	-------------	-------------	*US$ ha^{-1}*
T_1	Farmers seed with no fertilizer	Cons.	1,114	6,683	363	0	0	2,210	2,573	4,110	110
		Conv.	1,175	7,050	363	0	0	0	363	6,687	180
T_2	Farmers seed with 50 kg NPKS + 50 kg urea	Cons.	1,551	9,308	363	840	1,530	2,210	4,943	4,365	117
		Conv.	1,704	10,223	363	840	1,530	0	2,733	7,490	201
T_3	Farmers seed with 100 kg NPKS + 100 kg urea	Cons.	2,094	12,563	363	1,680	3,060	2,210	7,313	5,250	141
		Conv.	2,281	13,688	363	1,680	3,060	0	5,103	8,585	230
T_4	Hybrid seed with no fertilizer	Cons.	1,671	10,028	1,625	0	0	2,210	3,835	6,193	166
		Conv.	2,047	12,285	1,625	0	0	0	1,625	10,660	287
T_5	Hybrid seed with 50 kg NPKS + 50 kg urea	Cons.	2,685	16,110	1,625	840	1,530	2,210	6,205	9,905	266
		Conv.	2,976	17,858	1,625	840	1,530	0	3,995	13,863	373
T_6	Hybrid seed with 100 kg NPKS + 100 kg urea	Cons.	3,102	18,615	1,625	1,680	3,060	2,210	8,575	10,040	270
		Conv.	3,344	20,063	1,625	1,680	3,060	0	6,365	13,698	368

[(1)]1 kg of maize = 6 MTs

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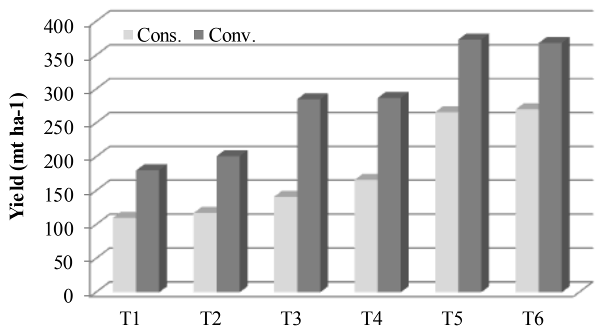

Fig 2. Gross margins approach from MIM treatments in 2010 (US$/ha).

Dollar/Meticais exchange rate can also create important variations from one year to the next. Table 9 describes all input costs per treatment within the MIM protocol.

Gross margin

Gross margin calculation is obtained by deducting cultivation cost from gross revenue; here only input costs are considered as a variable factor within overall costs.

The cost of labour for managing the multi-treatment demonstration plots are not representative of the costs that would normally be incurred by smallholder farmers who would typically cultivate one hectare of maize and utilize family labor to the greatest extent possible. Hand labor by family members has low cost implications, as opportunity costs are low. However, fertilizer application, herbicide application, weeding and other cultivation features have different labour requirements with regard to the treatments done according to the protocol. Furthermore, tillage can be done mechanically, by means of animal traction or manually by hand.

Gross margin calculation within MIM project site conditions is described in Table 9. The reference treatment (T_1 with Conv.) which represents current farmer practice in Mozambique gives a benefit of 6,687 MTs ha^{-1} which is worth around USD 180 ha^{-1}, depending on the rate of conversion. Data is also presented as a chart (Fig. 2) so that gross margin increase according to input used can be readily seen. The highest gross margin is obtained in conventional tillage (Conv.) with the two treatments, hybrid seeds + fertilizer: USD 373 per ha cultivated for the 50 kg fertilizer dose (T_5) and USD 368 for 100 kg fertilizer dose (T_6). Here, the yield effect of adding fertilizer versus unfertilized T_4 is outstanding but there is no dose effect expressed.

With reference to conservative tillage (Cons.), the dose effect between 50 kg (T_2) and 100 kg fertilizer (T_3) is much more significant.

Field days and resulting communications

During the cropping season (February to April), farmer field days were organized at some of the demonstration trial sites. The objective of these days is to invite farmers (members of a farmers' associations) to let them experience first-hand the benefits of implementing better farming practices using improved agro-inputs, such as fertilizers or improved seeds.

The other key objective of these days is to establish linkages between farmers and input/output markets.

In 2011, three sites (out of 15) were chosen for such field days; on average 180 to 200 smallholder farmers participated in each visit. Furthermore, in each of the demonstration sites, results are communicated to all the farmers belonging to the farmers' associations which are partners of the MIM project. As a result, at least 3,200 smallholder farmers were involved directly or indirectly with MIM demonstration trials and could benefit from it by learning or getting in touch with the market.

Recommendations for future activities

For forthcoming seasons, the MIM project intends to increase the number of demonstration plots from 15 to 30 in order to increase the rate of dissemination of agricultural intensification technologies. In each district it is proposed to establish three demonstration plots in such a way that each demonstration field can be considered for analytical purposes as one replication. It is also proposed that for each agro-climatic zone (The Institute of Agricultural Research of Mozambique; IIAM Classification), fertilizer rates should be based on official rates recommended by IIAM, taking into account the results of laboratory soil analysis as follows:

- T_1: Farmer-saved seed without fertilizer application.
- T_2: Farmer-saved seed with 50% of recommended fertilizer rate.
- T_3: Farmer-saved seed with 100% of recommended fertilizer rate.
- T_4: Hybrid (PAN 67) without fertilizer application.
- T_5: Hybrid (PAN 67) with 50% of recommended fertilizer rate.
- T_6: Hybrid (PAN 67) with 100% of recommended fertilizer rate.

Treatments 1 to 6 will be applied under both conventional and conservation tillage.

In addition, three full trials with replication will be established in cooperation with IIAM in order to identify the response to single nutrients (N, P and K).

Other activities to be undertaken by the MIM project will be:

- Training of agro-dealers on agriculture technology packages and agribusiness.

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- Training of extension agents and association members on agriculture technology packages.
- Acquisition of inputs for next cropping season.
- Selection of new associations and new demonstration fields sites (dependent on approval of proposal of increased number of demonstration sites from 15 to 30).
- Strengthening the linkage with IIAM to exchange experiences.
- Facilitation of market linkages between farmers and input suppliers and agriculture commodities buyers (value and supply chain).

Farmers association meeting. Photo by O. Goujard.

Conclusion and recommendations

The purpose of the MIM project has been to improve Mozambican smallholder farmers' livelihoods by intensifying maize production through the use of quality seeds and fertilizers, as well as by improved land management.

The preliminary results obtained from the 2009-2010 season from eight demonstration trials clearly show a significant yield increase (up to 200 percent) due to the use of NPKS fertilizer and use of a hybrid maize seed variety. Despite the fact that these improved agro-inputs are costly for local smallholder farmers, economic analysis showed a high benefit from their use.

Technology transfer is often a key issue in sub-Saharan Africa and it is a key component of the MIM project. Education for smallholder farmers starts with demonstrations, but farmer visits by extension agents, and knowledge dissemination is required as follow up. The network created within the farmer clusters aims to optimize exchange of expertise and techniques.

The other focus of the MIM project is the transition from subsistence farming to commercial maize production and marketing. The project aims to link farmers to the value and supply chain by initiating contacts during field days with agro-input suppliers and maize purchasers. The other organizations involved (extension services, farmers associations, development organizations such as IFDC, AGRA) are working together to create a dynamic environment which strengthens the whole maize value and supply chain in the target areas and other areas in Mozambique. ■

The paper "Maize Intensification in Mozambique: Demonstrating to Farmers the Benefits of Better Land and Crop Management" appears also at:

Regional Activities/sub-Saharan Africa