

Relationships between market linkages, input purchases and technology utilization in Babati District - Tanzania

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Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

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Background

Smallholder farmers use various strategies including the creation of farmers' organizations to improve their access to inputs, financial services, and markets. The main role of these organizations is to support their members by providing services that include:

- Input supply
- Storage facilities
- Collective marketing opportunities
- Credit access
- Equipment and agricultural advisory services

These services enable smallholders to adopt good agricultural practices that increase productivity, reduce risk, and improve food security, income, and livelihood.

The Selian Agricultural Research institute (SARI) and CIAT have been testing and promoting sustainable intensified agricultural technologies including value chain activities in collaboration with the Africa RISING program for the last six years. One of the collaborative activities is the linking of farmers through their organizations to input and output markets to enhance access to inputs, utilization of good agricultural technologies, and access to output market.

In November 2017, a team of researchers from SARI conducted interviews with leaders of 32 farmers' organizations to characterize them according to input purchases and use, extent of market linkage, and profitability from the use of the inputs.

Objectives

Specific objectives were to:

- Assess input access/purchases by members of farmers' organizations.
- Identify marketing points for agricultural produce.
- Assess the level of profitability for agricultural produce.

Methodology

The team conducted interviews with the leaders of 32 farmers' organizations/groups which were formed and/or strengthened by Africa RISING in collaboration with other partners such as AGRA Soil Health Program using a structured questionnaire to collect information on input access, output marketing, and profitability. Only two out of the 32 purposively sampled groups were coming from the upland zone where they intercrop maize with common bean. The remaining 30 groups were from lowland-medium zones where maize–pigeon pea intercropping is a common system in the district. The data were analyzed using SPSS package.

Results and discussions

The 32 farmers' organizations interviewed had a total of 2,027 members. Of these, 1,043 were females (Table 1).

Table 1: Number of farmers from farmers' organizations.

Zone category	Number of males	Number of females	Total number of farmers
Low-midland	908	979	1,887
Highland	76	64	140
Total	984	1,043	2,027

The following sections show crop production, input purchases, marketing of produce, and profitability obtained from marketing.

Crop production

The common crops grown by members of the farmers' organizations/groups interviewed were maize, common bean, and pigeon pea as shown in Table 2.

Table 2: Main crops cultivated by members of the farmers' organizations/groups.

Crop	Responses on the cultivated crop		
	Number of farmers' organizations that grow the crop	Number of farmers' organizations that do not grow the crop	Total
Maize	32 (100%)	0	32
Common bean	27 (84.4%)	5 (15.6)	32
Pigeon pea	30 (93.8%)	2 (6.3%)	32

The main crops grown by members of the organizations are maize, pigeon pea, and common bean. Some of the farmers in the low-midlands also grow common bean, especially during the short rains, but the crop is not as important as pigeon pea. Likewise, a few farmers in the uplands grow pigeon pea although the crop is not important to them. The pigeon pea grown in the uplands was introduced to the farmers by Africa RISING in the 2012/13 season.

Use of various inputs for crop production

Maize varieties

The main maize varieties grown by members of the organizations/groups and the numbers of organizations growing the specific maize varieties are shown in Table 3.

Table 3: Number of farmers' organizations/groups growing maize varieties in various proportions.

Maize varieties	Number of organizations/groups growing maize varieties in various proportions		
	None of the members grow the variety	1–50% of members grow the variety	Above 50% of members grow the variety
SeedCo	1 (3.1%)	4 (12.5%)	27 (84.4%)
Pannar	22 (68.8%)	8 (25%)	2 (6.3%)
Meru	7 (21.9%)	23 (71.9%)	2 (6.3%)
DK	8 (25%)	24 (75%)	0
Pioneer	24 (75%)	8 (25%)	0
Local	30 (93.8%)	2 (6.3%)	0
Hybrid	31 (96.9%)	1 (3.1%)	0
H628	31 (96.9%)	1 (3.1%)	0
HC712	31 (96.9%)	1 (3.1%)	0
STUKA	24 (75%)	8 (25%)	0
Kitale H632	31 (96.9%)	1 (3.1%)	0

The study revealed that farmers are aware of improved maize varieties and can have access to them through agro-dealers and their organizations.

Use of improved maize varieties is common among farmers. SeedCo varieties and especially Seed Co 627 are the common varieties used by the majority of farmers' organizations/groups and in big quantities, followed by DK and Meru. Other maize varieties are used in small amounts by members and hence need to be promoted.

Use of common bean varieties

The main common bean varieties grown by members of farmers' organizations and numbers of groups growing the specific varieties are shown in Table 4.

Table 4: Number of farmers' organizations/groups growing common bean varieties in various proportions.

Common bean varieties	Number of groups growing the common bean varieties in various proportions		
	None of the members grow the variety	1–50% of members grow the variety	Above 50% of members grow the variety
Lyamungo	15 (60%)	8 (32%)	2 (8%)
JESICA	1 (4%)	14 (56%)	10 (40%)
Gololi	19 (76%)	6 (24%)	0
Uyolenjano	10 (40%)	13 (52%)	2 (8%)
Nyeusi	24 (96%)	1 (4%)	0

Although common bean is among the crops regularly grown by farmers' organizations, the majority of members grow it on small pieces of land during the short rains and as a sole crop. Acreage has decreased in recent years owing to drought, pests and diseases, and a shift to other drought tolerant crops such as pigeon pea and sesame. The common bean variety is JESICA.

Use of pigeon pea varieties

The main pigeon pea varieties grown by members and numbers of farmers' organizations growing the specific pigeon pea varieties are shown in Table 5.

Table 5: Number of farmers' organizations/groups growing pigeon pea varieties in various proportions.

Pigeon pea varieties	Number of farmers' organizations growing the pigeon pea varieties in various proportions		
	None of the members grow the variety	1–50% of members grow the variety	Above 50% of members use the variety
Mali	1 (3.3%)	3 (10%)	26 (86.7%)
Kiboko	12 (40%)	17 (56.7%)	1 (3.3%)
Bangili	26 (86.7%)	4 (13.3%)	0
Nyekundu	29 (96.7%)	1 (3.3%)	0
Nyeusi	29 (96.7%)	1 (3.3%)	0

The improved pigeon pea varieties commonly grown by the farmers are Mali and Kiboko. Mali is the most common variety grown by most of the farmers' organizations/groups. About 86.7% of the farmers (more than 50% of the members) planted the variety. Mali variety can be grown/performs well on all kinds of soils in the district, whereas Kiboko performs best in black soils only. Furthermore, Mali was officially released in 2002 whereas Kiboko was released in 2014 though it had been tested in some parts of the district since 1999. Hence there had been a big dissemination/promotion of Mali compared to Kiboko. The other varieties/lines were the unimproved landraces, which were grown by farmers before the introduction of improved varieties, hence most the farmers did not grow them after adopting the new germplasm.

Use of fertilizers

The main fertilizers used by members of farmers' organizations and numbers of farmers' organizations using the specific fertilizers are shown in Table 6.

Table 6: Number of farmers' organizations using fertilizers in various proportions.

Fertilizer	Number of farmers' organizations/groups using the fertilizers in various proportions		
	None of the members use the fertilizer	1–50% of members use the fertilizer	Above 50% of members use the fertilizer
DAP for planting	10 (31.3%)	18 (56.3%)	4 (12.5%)
Minjingu Mazao for planting	17 (53.1%)	15 (46.9%)	0
Minjingu Nafaka Plus for planting	21 (65.6%)	11 (34.4%)	0
Urea for top-dressing	4 (12.5%)	26 (81.3%)	2 (6.3%)
Minjingu Top-dressing for top-dressing	24 (75%)	8 (25%)	0

SA for top-dressing	26 (81.3%)	6 (18.8%)	0
Farmyard manure	31 (96.9%)	1 (3.1)	0

Use of mineral fertilizers for cereal-legume cropping in the district has been introduced by Africa RISING and AGRA Soil Health Programs in the last six years. Despite their initial wrong notion that fertilizers destroy soils farmers have started changing their opinion owing to the increased yields and incomes they are getting from the use of fertilizers particularly at planting. Based upon the results, most farmers purchase and use Urea for top dressing, followed by DAP and Minjingu Mazao for planting. Urea has been used by farmers for more than two decades and hence they are quite familiar with its benefits. Minjingu Nafaka Plus and Minjingu Top-dressing are new blended fertilizers produced by Minjingu Mining and Fertilizer Co. and hence their use is not very common although farmers already know their benefits. The use of farmyard manure which was considered in the past to be the most important source of fertilizer is negligible these days due to the inadequate amounts available at the homesteads.

Sale of produce in various markets

Table 7 shows the main points used by farmers for selling crop produce.

Table 7: Main marketing points by members of farmers' organizations.

Crop	Responses of farmers' organizations on selling points		
	Yes	No	Total
Farm-gate	32 (100%)	0	32
Middlemen	23 (71.9%)	9 (28.1%)	32
Local market	22 (68.8%)	10 (31.3%)	32
Outside the region	4 (12.5%)	28 (87.5%)	32

The majority of members sell their produce at home or at the farms through middlemen. They also sell to local markets within the ward or district. Very few farmers sell their produce to markets outside the region, and this fact indicates the need for them to be linked to those profitable markets.

Yield and profitability of crops

Means of yields were obtained from the farmers who used DAP, Minjingu Mazao, Urea, Minjingu Nafaka Plus, and Minjingu Top-dressing.

The yields of maize and pigeon pea in t/ha from the farmers' fertilized and non-fertilized fields in the lowland and midlands are shown in Table 8.

Table 8: Mean maize and pigeon pea grain yield (t/ha) for low-medium zones in Babati District.

Groups under	Maize yield (t/ha) with fertilizer use	Maize yield (t/ha) without fertilizer use	Pigeon pea yield (t/ha) with fertilizer use	Pigeon pea yield (t/ha) without fertilizer use
Low - medium lands	3.9	1.3	1.5	0.3

Maize yields from fertilized plots in low-medium land zones were about three times more than the yields from plots without fertilizer. Pigeon pea yields from fertilized plots were about five times more than yields from plots without fertilizer, indicating that use of the fertilizer input increased yields of both crops.

The farmers expected to sell their pigeon pea through collective action to traders who export the crop to India. However, India banned imports from other countries in 2017 owing to surplus production in the season. This caused a "crash" in the expected price, resulting in farmers getting an average price of TZH 300/kg at the selling time as opposed to an average of about TZH 1000/kg.

Tables 9 and 10 show profitability using two different pigeon pea prices for the maize-pigeon pea cropping system in the low-medium zones.

Table 9: Partial budget at TZS 400/kg of maize and TZS 1000/ kg of pigeon pea.

Treatments	Gross income (TZS/ha)	Production costs (TZS/ha)	Profit (TZS/ha)
With fertilizer	3,160,000	1,581,750	1,578,250
Without fertilizer	875,000	822,750	52,250

Table 10: Partial budget at TZS. 400/kg of maize and TZS. 300/kg of pigeon pea.

Treatments	Gross income (TZS/ha)	Production costs (TZS/ha)	Profit (TZS/ha)
With fertilizer	2,180,000.00	1,581,750.00	598,250.00
Without fertilizer	665,000.00	822,750.00	(157,750.00)

*Exchange rate: 1 USD = 2,220 TZS

Use of fertilizers increased profitability regardless of price. The profit obtained from the plots treated with fertilizers when the pigeon pea price was TZS 1000/ kg was about thirty (30) times more than when they didn't apply fertilizers, with a benefit: cost ratio of 2. When the price of pigeon pea declined to TZS 300/kg the production costs were about TZS 157,750 more than the income indicating a loss, and the benefit: cost ratio was 0.80. Farmers are therefore advised to use fertilizers, and search for profitable markets outside the traditional Indian market to obtain a good price when the Indian market does not import legumes as it did this season. Towards the end of the year the price of pigeon pea increased to about TZS

500–560/kg but most of the farmers had disposed of the grain before the price increase to avoid spoilage.

Table 11: Mean maize and common bean grain yields (t/ha) for uplands in Babati District.

Groups under Uplands	Maize yield (t/ha) with fertilizer use	Maize yield (t/ha) (without fertilizer use)	Common bean yield (t/ha) in the fertilized plots	Common bean yield (t/ha) in the plots without fertilizer use
Uplands	5.2	1.4	0.5	0.4

Maize yields from fertilized plots in the upland zones were about four times more than maize yields from plots without fertilizer. There was no significant increase in the yield of common bean because farmers do not use fertilizer in common bean production though the yields from the fertilized maize plots had slightly more yields. The partial budget is presented in Table 12.

Table 12: Partial budget at TZS 400/ kg of maize and TZS 1500/kg of common bean.

Treatments	Gross income (TZS/ha)	Production costs (TZS/ha)	Profit (TZS/ha)
With fertilizer use	3,860,000	1,561,788	2,298,213
Without fertilizer use	1,025,000	852,750	172,250

The profit obtained from plots treated with fertilizers was about 13 times more than the profitability obtained from plots without fertilizer due to the big difference in maize yields. The benefit: cost ratio for the fertilized plots was 2.5 and 1.2 for the non-fertilized plots.

Conclusion and recommendations

There has been increased awareness/briefing about use of inputs such as mineral fertilizers and improved seeds due to linkages between inputs suppliers and farmers' organizations/groups facilitated by Africa RISING and AGRA Soil Health Programs. Farmers have realized very big increases in yields and profitability when they used improved inputs compared to yields after non-use. Output markets are limited to the farm-gate/middlemen, and the local markets within their villages/wards and to a very small extent to district markets. Access to external markets is minimal, resulting in denying the farmers profitable markets for their produce. India is the traditional global market for pigeon pea, which is however controlled by big traders who can deliver large volumes of the required quality at the right time.

The pigeon pea price "crash" this season due to surplus production in India reduced the farmers' profitability to about 38% for those who used fertilizers. Those who didn't use fertilizers could not recover their costs of production when the price was reduced to TZS. 300/kg. The profitability for the maize-common bean intercropping using fertilizers was about 13 times higher than when the farmers didn't use fertilizers as a result of the big difference in maize yield.

Dependence on only one market in India coupled with the ban on importation of pigeon pea this season has provided a lesson and challenge for all actors in the value chain including the farmers. There is a need to invest in promoting local use of pigeon pea so that farmers can be linked to non-traditional markets (e.g., schools and other institutions) for sustainable marketing and attractive prices. Future efforts will include training in value chain development including increased productivity, utilization, and processing of pigeon pea, marketing through collective action, and agricultural financing.