Annex 11

Initial observation: Intercropping Maize and Orange-fleshed sweetpotato at Bvumbwe Research Station in the 2010/2011 rainy season*

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Introduction

In the agriculture sector, crop diversification is now at the core of Malawi's agriculture policy. The Government of Malawi (GoM) recognizes the need to invest in agriculture and nutrition. The government is seeking potential synergies by improving links between the nutrition and agriculture sectors to achieve the goals of having food and nutrition security in the country. Maize is the most important food crop, followed by cassava, sweetpotato and sorghum (MoAFS of Malawi, 2008). However, sweetpotato is currently one of the most widely grown crops. It is becoming a major food source and increasingly contributing to the food basket in Malawi. This crop is also a source of cash and employment to many farmers. The Ministry of Agriculture and Food Security indicated sweetpotato production estimates of 2.7 million MT in 2009 (Chipungu, 2010) and is the third most important crop after maize and cassava in terms of total production.

In the 2010/2011 rainy season, an initial demo trial of Intercropping maize and sweetpotato was conducted at Bvumbwe Research Station. Our objective was to find out the best combination between maize and sweetpotato which were intercropped. In this demo trial, we could not include the sole cropping of maize and sweetpotato due to having a technical problem. Thus, the efficiency of intercropping between maize and sweetpotato cannot be calculated. However, we had some good results to be reported. We also calculated the estimate gross margin analysis that we included in this report.

Methodology

Two orange-fleshed sweetpotato (OFSP) varieties were chosen for the trial. These were Zondeni and a promising variety LU06/0428. We investigated 2 main factors, harvest and types of intercropping. There were 3 different harvest periods of OFSP varieties and 4 different types of intercropping.

Zondeni was harvested at 5, 6 and 7 months after planting (MAP) and LU06/0248 only at 5 MAP because we did not have enough planting material for this new variety. One maize cultivar, SC627, was selected. This maize cultivar was harvested at once for all treatments; and it was at 4 MAP. All crops were planted in ridges (rows). The planting distance for both crops was 30 cm within plants and 90 cm between ridges. The land was prepared by a tractor. Each plot had 22 ridges of 6.6 m long. Guard rows were made surrounding the plots. Thus, for observation purposes, we took only 20 ridges with 20 plants per ridge. Fertilizers were applied only for maize. A randomized block design with 3 replicates was applied. The rainfall was not recorded but noted. For some days, we did not receive rains so it interrupted the planting dates during conducting this trial.

Four types of intercropping were practiced: 1) Treatment 1: 2 ridges OFSP and 1 ridge maize; 2) Treatment 2: 1 ridge OFSP and 1 ridge maize; 3) Treatment 3: 1 ridge OFSP and 2 ridges maize; and 4) Treatment 4: planted in the same row (intra-cropping), 1 maize plant and 3 OFSP plants.

For Zondeni harvested at 5 MAP, we planted both maize and Zondeni on 30th December 2010. A basal dressing for maize was done on 10th January 2011. The compound fertilizers of 23:21:0+4S and Urea (46%N) were used at the ratio of 2:1. The top dressing with Urea (46%N) was on 2nd February 2011.

For Zondeni harvested at 6 MAP, we planted both maize and Zondeni on 6th January 2011. A basal dressing for maize was done on 10th January 2011. The compound fertilizers of 23:21:0+4S and Urea (46%N) were used at the ratio of 2:1. The top dressing with Urea (46%N) was on 2nd February 2011.

For Zondeni harvested at 7 MAP, we planted maize and Zondeni on 11th January 2011. A basal dressing for maize was done on 2nd February 2011. The fertilizers were 23:21:0+4S and Urea (46%N) at the ratio of 2:1. The top dressing with Urea (46%N) was on 8th March 2011.

For the OFSP promising variety LU06/0248 harvested at 5 MAP, we planted both maize and OFSP on 19th January 2011. A basal dressing for maize was done on 2nd February 2011. The compound fertilizers of 23:21:0+4S and Urea (46%N) were used at the ratio of 2:1. The top dressing with Urea (46%N) was on 8th March 2011.

Farmers, government extension staff and NGO implementing partners from 5 districts of Dedza, Zomba, Phalombe, Mulanje, and Chikhwawa have been invited in two Open Days held at Bvumbwe Research Station on 9th May and 22nd August 2011. We wanted to share opinions between these invited guests, CIP and DARS scientists. The participants went around the field, observed the crops and discussed with the researchers any matters which were arisen during the observation. At the end, a simple questionnaire was given to each participant and their opinions are reported in this paper.

Data Collection and Analysis

Both crops were observed on pest and disease incident by researchers. Data at harvests were also collected and analyzed using the Genstat (2005). In this report, we only focused on yield data. The average yield from each plot of each treatment was calculated. Yield was converted into metric ton per hectare (t/ha). A gross margin analysis for maize and sweetpotato was also calculated.

Results and Discussion

Pest and Disease incidence

No serious diseases and pests were noticed from the trial. The only problem was the thieves. The plots near the roadside were heavily disturbed by the thieves. Maize at the plots where sweetpotato was harvested at 7 MAP was stolen. Too many data were missing so we cannot consider the data to be included in the statistical analysis.

Questionnaire

Seventy people participated in the open day of 9th May and 71 people on 22nd August 2011. From the first Open day held on 9th May 2011, we collected opinions of 52 participants from the 5 districts. The number of men and women who participated was equal. The results were compiled and summarized in Table 1.

Table 1. Treatments, participants and ranking given during the open day held on 9th May 2011. The OFSP variety planted was Zondeni.

Treatment Number	Description	Participants	Rank
1	2 ridges Zondeni and 1 ridge maize	13	2
2	1 ridge Zondeni and 1 ridge maize	12	3
3	1 ridges Zondeni and 2 ridges maize	24	1
4	same row (Intra planting) 1 maize plant and 3 Zondeni plants	3	4
Total		52	

Reasons for choosing Treatment 3 as Ranking 1

- High maize yield (Staple food) and some sweetpotato roots shall be harvested and used to improve nutrition at household level.
- Maize can be stored longer than Sweetpotato.
- Suitable for farmers with Limited Landing hold size.
- Ideal technology for climatic change, when rains are erratic or even stops while maize is not yet matured, a farmer can benefit from Sweetpotato.
- Both Sweetpotato and Maize are doing well in this treatment.
- The treatment has a moderate soil cover thereby reducing soil erosion as well as retaining available soil moisture.
- There will be equal produce of maize and Sweetpotato.
- Good stand for both Maize and Sweetpotato, because of land scarcity, farmers opted for maize as their staple food.
- Maize is mainly grown for food, sweetpotato roots will be sold and a farmer will get cash.
- Maximum Plant population for Maize (Staple food) at least some sweetpotato to top up on food.
- We can realize high yields on Maize, during harvesting period; we can not damage Sweetpotato plants. Since each crop is on a separate ridge.
- It seems the yield of Maize will be the highest if we can compared to all the treatments.
- Due to Land scarcity in some Districts of Southern Malawi, 75% of land should be covered by maize for food.

Reasons for choosing Treatment 1 as Ranking 2

- More yield for Zondeni, Zondeni is being promoted at this treatment.
- More yield for Zondeni evidenced by cracking of ridges.
- More Sweetpotato will be harvested (Two crops will be harvested at the same piece of land)

- Both Sweetpotato and Maize are doing well.
- This will give potential production for each crop
- It is profitable, there is a need to practice in our respective areas will assistance from extension Staff.

Reasons for choosing Treatment 2 as ranking 3

- Balanced utilization of land is achieved
- Both Sweetpotato and Maize are doing well.
- Both Crops will give equal yield (50% of each on one piece of Land).
- A Farmer can have both Maize and Sweetpotato.
- Profitable to both Crops (Maize and Sweetpotato)
- Due to limited Land holding size in Malawi, we can harvest both Maize and Sweetpotato on one piece of Land.
- Both Crops are doing well because they are exposed to sunlight, air , space. In addition, the Crop spacing is good.

Reasons for choosing Treatment 4 as Ranking 4

- More Sweetpotato will be harvested and if we can add some maize that will be harvested, we can sell and have more money.
- There is adequate space for Sweetpotato and there if possibility that it can do better.

The questionnaire collected from the second open day is not shown in this paper. The participants observed only the performance of OFSP Zondeni harvested at 7 MAP because maize has already been harvested. The participants had a good impression on the size of the storage root. The good performance of the storage roots is an indication of having a good yield.

Maize Yield

Table 2 shows the statistical analysis of the yield of maize at two blocks where the OFSP would be harvested at 5 and 6 MAP.

Table 2 indicates that there is a highly significant difference among the treatments for the weight of unshelled maize, shelled maize after drying, and weight of stalks with cobs. Treatment 2 is better compared to Treatments 3 and 4. There is no different between Treatment 1 and Treatment 3 (LSD at 5%).

No significance was recognized between Block 1 and Block 2 for weight unshelled maize and shelled after drying. There is a high significance on the weight stalks with cobs between the two blocks. This difference might be due to the soil fertility and not because of the sweetpotato (Table 2).

Table 2. Maize Data, harvested 4 MAP

	Wt unshelled maize (t/ha)	Wt shelled after drying (t/ha)	Wt Stalk with cob (t/ha)
Treatment			
T1: 2 rows sp vs 1 row maize	6.72	5.05	15.65

T2: 1 row sp vs 1 row maize	7.08	5.30	15.97
T3: 1 row sp vs 2 rows maize	6.03	4.633	13.43
T4: Intra 3 sp plts and 1 maize plt	4.98	4.067	10.83
P-value	**	**	**
LSD	0.797	0.5919	2.368
Block			
B1: field with sp harvested at 5 MAP	6.21	4.717	15.32
B2: field with sp harvested at 6 MAP	6.20	4.808	12.62
P-value	ns	ns	**
LSD	-	-	1.675
Grand mean	6.20	4.762	13.97
cv (%)	10.4	10.0	13.7

Notes: **: highly significant at p-value<0.01 with LSD 5%; *: significant at p-value<0.05 with LSD 5%; in the brackets: p-value<0.1 with LSD 10%; and ns = non-significant.

OFSP Zondeni Yield

Table 3 shows detailed information on number of marketable roots per plot, weight of storage roots in metric ton per hectare and the total yield of Zondeni in metric ton per hectare. A non-significant difference was found in the 4 treatments for the number of marketable roots and the total number of roots (data not shown). The significant difference is met with the treatments on the 3 harvest periods. The interaction between treatments and harvests was significantly found in the marketable and total yield. A significant correlation between weight of marketable roots and total yield (R > 0.25) has also noted. This is an indication that the total yield was determined by the size of roots and not by the number of roots (Table 3).

Table 3. OFSP Zondeni data harvested at 5, 6 and 7 MAP

	Number of marketable roots per plot	Wt marketable roots (t/ha)	Total Yield storage roots (t/ha)
Treatment			
T1: 2 rows sp vs 1 row maize	315	28.8	33.7
T2: 1 row sp vs 1 row maize	383	21.2	24.3
T3: 1 row sp vs 2 rows maize	318	19.5	22.2
T4: Intra 3 sp plts and 1 maize plt	276	26.5	29.1
P-value	ns	*	**
LSD	-	6.63	6.47
Environment (Harvest)			
H1: 5 MAP	277	10.8	12.5
H2: 6 MAP	401	15.9	18.7
H3: 7 MAP	292	45.2	50.7
P-value	(*)	**	**

LSD	(90.8)	5.74	5.60
Interaction			
T1 x H1	271	11.2	13.1
T1 x H2	336	15.1	18.2
T1 x H3	338	60.0	69.7
T2 x H1	336	11.3	12.8
T2 x H2	510	15.7	18.4
T2 x H3	304	36.5	41.6
T3 x H1	250	9.3	10.9
T3 x H2	421	16.2	18.9
T3 x H3	283	32.9	36.7
T4 x H1	251	11.4	13.2
T4 x H2	336	16.8	19.3
T4 x H3	241	51.4	54.7
P-value	ns	*	**
LSD	-	11.48	11.20
Grand mean	323	24.0	27.3
cv (%)	40.1	28.3	24.2

Notes: **: highly significant at p-value<0.01 with LSD 5%; *: significant at p-value<0.05 with LSD 5%; in the brackets: p-value<0.1 with LSD 10%; and ns = non-significant.

Gross Margin Analysis

Table 4 gives detailed information about the gross margin analysis of intercropped maize with sweetpotato. It can be seen that the profit is strongly due to the sweetpotato production. A high profit could be significantly generated from the Treatment 1 and Treatment 4 (Tables 3 and 4).

Table 4. Gross Margin Analysis for intercropping maize and OFSP Zondeni per ha (in Malawian Kwacha)

	Treatment 1	**Treatment 2**	**Treatment 3**	**Treatment 4**
A. Income				
Maize Yield (Shelled after drying) (t/ha)	5.1	5.3	4.6	4.1
Zondeni marketable yield (t/ha)	28.8	21.2	19.5	26.5
Sale of Maize (Mk 35/kg)	178,500	185,500	161,000	143,500
Sale of OFSP (Mk 100/kg)	2,880,000	2,120,000	1,950,000	2,650,000
Total Income	**3,058,500**	**2,305,500**	**2,111,000**	**2,793,500**
B. Expenditure				
Maize seed	17,974	17,974	17,974	17,974
OFSP vine cuttings	19,136	19,136	19,136	19,136
Labor (land preparation, planting, weeding, fertilizer application)	324,074	324,074	324,074	324,074
Fertilizer for maize only	16,802	17,352	16,684	17,352

Total Expenditure	**377,986**	**378,536**	**378,706**	**378,536**
Profit	**2,680,514**	**1,926,964**	**1,732,294**	**2,414,964**

OFSP Promising Variety LU06/248 versus Zondeni

Table 5 shows detailed information about the promising OFSP variety LU06/0248 and Zondeni. It is likely that LU06/0248 performed better than Zondeni ($p<0.01$). However, both varieties performed better at Treatments 1, 2 and 3 ($p\leq0.1$).

Table 5. LU06/0248 versus Zondeni

	Wt marketable roots (t/ha)	Total Yield storage roots (t/ha)
Varieties		
LU06/0248	16.46	17.78
Zondeni	10.80	12.52
P-value	**	**
LSD	2.798	2.978
Treatment		
T1: 2 rows sp vs 1 row maize	13.15	14.78
T2: 1 row sp vs 1 row maize	14.75	16.17
T3: 1 row sp vs 2 rows maize	14.55	16.13
T4: Intra 3 sp plts and 1 maize plt	12.07	13.52
P-value	ns	ns
LSD	-	-
Interaction		
LU06/0248 x T1	15.10	16.43
LU06/0248 x T2	18.17	19.50
LU06/0248 x T3	19.83	21.33
LU06/0248 x T4	12.73	13.87
Zondeni x T1	11.20	13.13
Zondeni x T2	11.33	12.83
Zondeni x T3	9.27	10.93
Zondeni x T4	11.40	13.17
P-value	(*)	(*)
LSD	4.595	4.891
Grand mean	13.63	15.15
cv (%)	23.4	22.4

Notes: **: highly significant at p-value<0.01 with LSD 5%; *: significant at p-value<0.05 with LSD 5%; in the brackets: p-value≤0.1 with LSD 10%; and ns = non-significant.

Concluding Remarks

Crop diversification can be encouraged by applying the intercropping between maize and sweetpotato. This intercropping practice significantly gives opportunities for farmers to generate income, increase the nutrition and secure the food at their household level.

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