NRSP PROJECT R8115

Improvement of Soil Fertility Management Practices in Rainwater Harvesting Systems

ANNEX B5

MONITORING AND EVALUATION OF ADOPTION OF INNOVATIONS AND CHANGES WITH REFERENCE TO THE BASELINE DATA

Soil Water Management Research Group

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Summary

A monitoring and Evaluation (M +E) survey was conducted for Project R8115 to gauge the changes brought by developing and promoting improved strategies for integrated soil and plant nutrient management in the Semi arid areas of Maswa and WPLL. Project R8115 target villages were isulilo, Njiapanda and Bukangilija in Maswa district and tae, Mwembe and Makanya in WPLL. The monitoring and evaluation data and information was collected using a questionnaire. The information collected/ gathered addressed three main aspects, namely the use of soil fertility amendments, use of the various information transaction mechanisms and channels in the dissemination of information on integrated soil fertility and nutrient management and the extent of the use of various rainwater harvesting systems in the target areas in crop production. The questionnaire was administered to a total of 304 farmers in the two project sites taking into account the wealth status of the farmers, gender balance and age groups. The farmers were randomly picked based on the aforementationed three criteria.

The M and E was under taken two years from the date of inception of the Project. The M and E data was then compared to the baseline data collected prior to the inception of the project on the same issues. Result from the compiled and analysed M and E data showed that the number of farmers using various soil fertility amendments increased within the two year period (2002 & 2004) and this was due to the increase in the awareness by farmers on the various aspects of integrated soil fertility and nutrient management on soil productivity, hence improved crop yields. The erratic nature of the rainfall amounts and distribution, drastically affected the quantities of rainwater harvested. Inadequate availability of organic soil amendment and the very high prices of the inorganic soil amendment limited the extent of adoption of the improved soil fertility management technologies. It was further noted that the best information transaction channels for integrated soil fertility and plant nutrient management strategies included farmer-to-farmer, demonstrations trials and farm visits.

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1.0 INTRODUCTION

Monitoring and Evaluation (M&E) involves keeping track of adoption of changes and innovations taking place as a result of an intervention. The SWMRG conducted an M & E of data and information for Project R8115 so as to gauge the changes brought by/ in developing and promoting improved strategies for integrated soil and plant nutrient management which benefit the poor farmers in Maswa and WPLL practicing rainwater harvesting. In this particular case, M&E was a two-stage process. Stage one involved a baseline survey in the project areas, which was undertaken during the inception stage of Project R8115. The information gathered formed a database against which the first stage of M&E was undertaken (2004). The information collected both during the baseline survey and at M&E first update (two years later) was on three aspects namely; *use of soil fertility amendments, use of alternative sources of integrated nutrient management (INM) information and the use of rainwater harvesting (RWH)* systems Changes with regard to soil fertility management in RWH systems were measured against the baseline data (2002) by comparing it with the second stage survey (2004). The baseline (Annex B5) and second survey data are presented in tabular forms.

2.0 METHODOLOGY

The methodology adopted during the data collection during the first M + E process was the same as that used during the baseline survey (Annex 5). Three villages on the same toposequence both on the Ndala river catchment in Maswa district (Isulilo, Njiapanda and Bukangilija,) and on the Makanya river catchment, in Western Pare Lowlands (WPLL) Same district (Tae, Mwembe and Makanya) were chosen to represent the upper, middle and bottom areas of the catchments, respectively. Primary data were collected through a questionnaire survey. (Appendix 1). The questionnaire was administered to a total of 304 farmers, that is 100 farmers on the Makanya River catchment and 204 farmers on the Ndala river catchment, based on gender, age group and weather status/category as shown in Appendix II to XI. The data/information collected was compared to the baseline survey data (Annex B5) and the changes were compiled and analyzed using SPSS/PC+ computer package version 9. The magnitude of changes were expressed in percentages. Statistical analysis were not undertaken, as the number of monitoring and evaluation surveys was limited (only one was undertaken) due to the lifespan of the Project.

3.0 RESULTS AND DISCUSSION

The compiled data collected using the questionnaire survey (appendix 1) were as presented in Table 1 to Table 3 and Appendices II to X1. The changes, either increase or decrease are given in %. The % changes were not statistically analyzed because the monitoring and evaluation survey was conducted a only once (2004). If the M + E was conducted more than twice, then, statistical analysis and evaluation of the changes could have been appropriate, meaningful and viable. The life spam of the project did not give room for more than two M + E surveys to be conducted.

3.1 The Extent of Use of Organic and Inorganic Soil Amendments

3.1.1 Lower slopes: Bukangilija in Maswa and Makanya in WPLL

The extent of use of organic and inorganic soil amendments in crop production for the period 2002 to 2004 in the lower slope positions in Maswa and the WPLL is shown in Table 1. The number of farmers using FYM increased by 24 % in Bukangilija and by 6 % in Makanya. The opposite was true for the number of farmers using compost that is an increase of 5 % in Bukangilija against 32 % in Makanya. The increase in the use of organic soil amendments is

attributed to the participatory training workshops and seminars between the Soil-Water Management Research Group (SWMRG), farmers and other stakeholders on the importance and usefulness of organic soil amendments in enhancing and sustaining soil fertility and productivity.

The relatively higher increase in the number of farmers using compost manure in Makanya is attributed to the training given to the farmers in the preparation of compost using local materials and leftovers from the households and farmyard manure from kraals close to the households' premises. Similar training was not conducted in Maswa, because the Lake Zone Research Institute Ukiriguru, had earlier undertaken a similar training. The increase in the use of compost across gender, age groups and wealth categories varied from 28% to 38%.

Table 1. Extent of use (%) of organic and inorganic soil amendments in the study villages in Maswa and WPLL

Soil amendments	**Baseline (2002)**	**After 2 yrs (2004)**	**Change**		**Baseline (2002)**	**After 2 yrs (2004)**	**Change**
	Maswa				**WPLL**		
Lower slope	***Bukangilija***				***Makanya***		
FYM	9	33	+24		12	18	+6
Compost	0	5	+5		5	37	+32
Inorganic fertilizer	0	0	0		2	15	+13
None	91	62	-29		81	30	-51
Total	100	100			100	100	
Mid slope	***Njia Panda***				***Mwembe***		
FYM	27	37	+10		47	22	-25
Compost	0	14	+14		47	33	-14
Inorganic fertilizer	0	0	0		3	34	+31
None	73	50	-23		3	11	+8
Total	100	100			100	100	
Upper slope	***Isulilo***				***Tae***		
FYM	73	42	-31		58	28	-30
Compost	0	14	+14		27	32	+5
Inorganic fertilizer	0	2	+2		15	24	+9
None	27	42	+15		0	16	+16
Total	100	100			100	100	

The use of inorganic fertilizers at Bukangilija remained unchanged at zero. However, the number of farmers using this soil amendment (inorganic soil amendment, that is mineral, fertilizers) in Makanya increased by 13 %. In both villages the number of farmers not using either organic or inorganic soil amendments decreased, with Makanya village showing the highest decrease of 51 % compared to 29 % for Bukangilija. The increase in the use of inorganic fertilizers in Makanya is attributed to the increase in the number of farmers producing high value crops like tomatoes and cabbage.

The non-use of inorganic fertilizers in Bukangilija is attributed to unfavorable fertilizer: crop price ratios given the poor market infrastructure (poor roads to major markets) and limited opportunities for the production of high value crops like in Makanya. Given the fact that the quantities of both FYM and compost available at Bukangilija are not enough, combined use of

organic soil amendments and inorganic fertilizers should be encouraged to optimize agricultural production at reasonable and economic nutrient: crop price ratios.

During the administration of the questionnaire on M & E, it was noted that the youth significantly contributed to the increased use of soil amendments because this is the group involved in the cultivation of high value crops (Appendix II). Further, this is the group with the ability to look for markets for their produce.

3.1.2 Mid slopes: Njiapanda in Maswa and Mwembe in WPLL

The percentage changes in the number of farmers using organic and inorganic soil amendments in the mid-slope positions in Maswa and the WPLL during the period 2002 to 2004 is summarized in Table 1. In Njiapanda in Maswa the number of farmers using farmyard and compost manure increased by 10 % and 14 %, respectively. On the contrary the number of farmers using farmyard manure and compost in Mwembe (WPLL) decreased substantially (by 25 % and 14 % respectively). Whereas there were no farmers using inorganic fertilizers in Njiapanda during that period, there was a drastic increase in the number of farmers using inorganic fertilizers in Mwembe (by 31 %). The number of farmers not using either inorganic or organic soil amendments decreased by 23 % in Njiapanda while it increased by 8 % in Mwembe. The increase in the use of organic soil amendments in Njiapanda is attributed to the availability of the materials in the village and the intervention by the SWMRG who raised the farmer's awareness on the importance of organic nutrient resources in crop production. On the other hand the decrease in the number of farmers using FYM and compost in Mwembe could be due to limited supply of these nutrient resources.

The observation that farmers at Njiapanda village are not using inorganic fertilizers is attributed to the high prices of the fertilizers. Again, farmers should be sensitized to use inorganic fertilizers as the available/production of the organic soil amendments is far short of the amounts required for significant increase in crop yields. Further the nutrient contents in the organic amendments are low hence large quantities need to be applied thus compounding the shortage. Meanwhile the increase in the use of inorganic fertilizers is attributed to the cultivation of high value crops leading to profitable use of these fertilizers. The increase in the use of inorganic fertilizers in crop production could be attributed to intensification of the agricultural production systems and the production of high priced crops resulting into profitable use of inorganic fertilizers in terms of revenue accruing from the sale of the produce. The increase in the number of farmers not using any soil amendments in Mwembe is attributed to the increase in the number of farmers in the poor category group because of inadequate land for cultivation.

3.1.3 Upper slopes: Isulilo in Maswa and Tae in WPLL

The percentage changes in the number of farmers using organic and inorganic soil amendments in the upper slope positions in Maswa and the WPLL during 2002 to 2004 is presented in Table 1. The number of farmers using FYM decreased by about 30 % in both Isulilo (Maswa) and Tae (WPLL) while the use of compost increased by 14 % in Isulilo and 5 % in Tae. Meanwhile, the use of inorganic fertilizers increased by 2 % in Isulilio and by 9 % in Tae and farmers who did not use any amendments increased by about 15 % in both sites.

The decrease in the use of FYM in Isulilo is attributed to unfavorable weather conditions during the 2002/2003 cropping season that discouraged farmers from using FYM in the 2003/2004 cropping season. The increase in the use of inorganic fertilizers is attributed to intervention by researchers from the SWMRG, other research institutes and fertilizers stockists. The increase in the use of compost in Isulilo is attributed to increased acreage in the households' vegetable gardens and cultivation of off-season vegetable crops that fetch high prices in the market. Further, the proximity of Isulilo village to Maswa Township facilitated the purchase and transportation of the fertilizers to the farmers' fields.

The increase in the number of farmers using compost and inorganic fertilizers in Tae is mostly attributed to the production of off-season vegetable crops using harvested rainwater stored in *Ndivas* (micro-dams). Meanwhile, the decrease in the use of FYM in the same village is attributed to the decrease in the livestock population due to the decrease in the land available for grazing and cultivation of pastures. The increase in the number of farmers not using organic or inorganic fertilizers in Tae is due to some farmers not being able to acquire and purchase the fertilizers because of their very low income. Scarcity of land for cultivation in Tae village has contributed to the increasing onfarm unemployment.

3.2 Extent of Use of Alternative Sources of Information for Integrated Nutrient Management (INM) in Crop Production

3.2.1 Lower slopes: Bukangilija in Maswa and Makanya in WPLL

The percentage changes in the number of farmers using alternative sources of information on INM in the lower slope positions in Maswa and the WPLL is shown in Table 2. The baseline survey showed that family members, institutions, radio, agricultural shows and newspapers had no role at all in the communication of INM knowledge to farmers at Bukangilija village (Maswa). This is attributed to lack of awareness and limited understanding by farmers on INM information contained/obtained from such sources. After two years of the project a positive contribution of the radio (11 %), institutions (11 %), newspapers (3 %), researchers (2 %) and family members (29 %) was observed. This is due to the seminars and workshops conducted by SWMRG, research institutions, local government institutions and NGOs on the importance of the above sources and disseminators of INM information.

The decrease in the contribution by farmer to farmer (by 43 %) and extension staff (by 3 %) as alternative sources of information on INM in Bukangilija is due to farmers awareness and comprehension of the other sources of information conceived during the participatory workshops, seminars, training, field visits and on farm demonstrations on INM. Meanwhile the non-contribution of agricultural shows as an alternative source and dissemination of information on INM in Bukangilija was due to the fact that such activities are difficult to organize because of the logistics involved particularly in the mobilization of funds and other inputs needed.

In Makanya the decrease in the number of farmers obtaining information from farmer-to-farmer groups and agricultural shows (both by 7 %) could be due to farmers relying and using information from the other alternative sources as mentioned above. On the other hand the use of institutions, researchers, extension staff and family members as sources of information on INM increased by 7, 19, 22 and 26 percent, respectively during 2002 - 2004. This is attributed to the intervention by the institutions in question, SWMRG inclusive. The interventions were through seminars, workshops and provision of reading materials/references in the form of booklets, manuals, leaflets and posters. Meanwhile, the use of radio as source and disseminator of information for INM is not applicable in Makanya village (Table 2) probably due to such programs being aired at times when the farmers are involved in other activities hence not available to listen to such programs. Further, inadequate and inappropriate radio programs on INM could be one of the factors contributing to the observed trend.

3.2.2 Mid slopes: Njia Panda in Maswa and Mwembe in WPLL

The percentage change in the number of farmers using alternative sources of information on INM in the mid-slope positions in Maswa and the WPLL is summarized in Table 2. At Njia Panda (Maswa) there was an increase in the use of institutions (11 %), researchers, (4 %) extension staff (17 %) and family members (26 %) as alternative sources of information on INM. However, the contribution of farmer-to-farmer, radio, agricultural shows and newspapers as

alternative sources and disseminators of information decreased by 48, 4, 3 and 4 percent respectively as compared to the baseline. The negative changes could be attributed to increased prices of newspapers and agricultural shows and poor communication between farmers. The positive changes were due to effective participation of institutions, researchers, extension staff and family members in providing information on various aspects on INM. The changes in Njia Panda conform to the heterogeneity of the farming community at the village in terms of wealth status, gender, age groups and distribution of common pool resources (CPR). An in depth study is required to establish the causes of the above changes.

In Mwembe (WPLL) the number of farmers depending on radio, newspapers, institutions, researchers, and extension staff as sources and disseminator of information increased by 7, 7, 12 and 27 percent respectively. The increase is attributed to SWMRG, institutions, radio and extension staff who provided farmers with relevant information on INM. The decrease in the number of farmers relying on farm to farm tours and agricultural shows for information on INM reflect the individual farmers comprehension of the various sources of information on INM and the agricultural shows being too expensive and time consuming to conduct.

Table 2. Extent of use (%) of alternative sources of information for INM in the study villages in Maswa and WPLL

Source of information	**Baseline (2002)**	**After 2 yrs (2004)**	**Change**		**Baseline (2002)**	**After 2 yrs (2004)**	**Change**
	Maswa				**WPLL**		
Lower slope	***Bukangilija***				***Makanya***		
Farmer to farmer	66	23	-43		29	22	-7
Radio	0	11	+11		0	0	0
Agricultural Show	0	0	0		7	0	-7
Institutions	0	11	+11		2	9	7
Newspapers	0	3	+3		-	-	-
Researchers	5	7	+2		2	21	+19
Extension staff	30	17	-3		0	22	+22
Family Member	0	29	+29		-	26	+26
None	-	-	-		60	-	-
Total	100	100			100	100	
Mid slope	***Njia Panda***				***Mwembe***		
Farmer to farmer	80	32	-48		47	6	-41
Radio	6	2	-4		0	5	+5
Agricultural Show	3	0	-3		6	0	-6
Institutions	0	11	+11		22	29	7
Newspapers	6	2	-4		0	7	+7
Researchers	0	4	+4		14	26	+12
Extension staff	6	23	+17		0	27	+27
Family Member	-	26	+26		1	-	-
None	-	-	-		11	-	-
Total	100	100			100	100	
Upper slope	***Isulilo***				***Tae***		
Farmer to farmer	39	38	-1		4	8	+4
Radio	5	4	-1		4	3	-1
Agricultural Show	0	4	+4		0	0	0

Institutions	3	13	+10		4	18	+14
Newspapers	0	1	+1		-	-	-
Researchers	0	2	+2		0	18	+18
Extension staff	49	20	-29		80	36	-44
Family Member	-	23	+23		0	17	+17
None	-	-	-		60	0	-
Total	100	100			100	100	

3.2.3 Upper slopes: Isulilo in Maswa and Tae in WPLL

The changes in the number of farmers using alternative sources of information for INM in crop production in the upper slope positions in Maswa and the WPLL during 2002 - 2004 is summarized in Table 2. In Isulilo, agricultural shows, institutions, newspapers and researchers contributed positively as sources and disseminators of information for INM. In contrast farmer-to-farmer, radio and extension staff contributions as sources and disseminators of information on INM decreased by 1%, 1% and 11%, respectively during the period 2002 to 2004. The decrease in the effectiveness of the above alternative sources of information is due to intervention by SWMRG and other relevant institutions in providing appropriate and correct information on INM, through workshops and seminars.

In Tae (WPLL) The number of farmers relying on farmer-to-farmer tours and institution, researchers and family members as alternative sources and disseminator of information for INM increased by 4, 14, 18 and 17 percent during the period 2002 to 2004. The increase is due to increasing role of researchers and institutions in providing information on INM. The reduced roles of radio (by 1 %) and extension staff (by 44 %) as sources of information on INM is a result of the ever increasing role of the farmer to farmer tours, institutions and researchers as reliable sources of information on INM (Table 2). It could further be assumed that the role of extension staff as providers of information on INM has drastically diminished because of their inability to pay frequent visits to farmers due to lack of transport. Further, the ratio of extension staff: farmers is extremely wide making it impossible for them to visit and advise the farmers at the appropriate times.

3.3 Extent of Use of Rainwater Harvesting (RWH) Systems in Maswa

3.3.1 Lower slopes: Bukangilija

The extent of use of different rainwater harvesting systems was assessed in Maswa only and the information is summarized in Table 3. The percentage number of farmers using harvested rainwater by directing water into bunded fields and ridged and tie ridged fields increased by 14 and 19 percent respectively while those channeling water into their fields and capitalizing on increased water percolation and retention by deep tillage decreased by 7 percent (Table 3). After SWMRG intervention all the farmers in Bukangilija village are practicing RWH in one-way or the other (using different methods or techniques of directing the harvested rainwater into their fields). The increase in the number of farmers using harvested rainwater by bunded basins and ridges and tie ridges is attributed to the observed use efficiency of the harvested rainwater. On the other hand the decrease in the number of farmers channeling harvested rainwater into their fields and those practicing deep tillage could be due to the costs involved in the construction and maintenance of the channels and the expensive and unavailability of the tools and machinery needed in deep tillage, respectively.

The observation that all the farmers at Bukangilija village are harvesting rainwater for agricultural activities indicates the importance of rainwater harvesting in semi-arid areas. The changes observed at Bukangilija village are due to the training, awareness raising and sensitization of farmers by the SWMRG and other institutions on the importance of RWH and the consequent increase in crop production. Farmers have therefore, comprehended that, by

capitalizing on harvested rainwater, agricultural productivity could be enhanced and sustained in semi arid areas where soil water is the major constraint to agricultural production.

3.3.2 Mid slopes: Njiapanda

The extent of use of different water harvesting systems at Njiapanda village is presented in Table 3. The number of farmers benefiting from harvested rainwater by channeling it into their fields, confining the water into bunded fields and construction of ridges and tie ridges increased by 4, 3 and 1 percent respectively. On the other hand, the number of farmers practicing deep tillage as a way of maximizing storage of the harvested water within the soils decreased 5 %. Further, all the farmers at Njiapanda village use harvested rainwater in crop production. The increase in the number of farmers using harvested rainwater by various techniques indicates increased awareness by farmers on the importance of conserving water. The decrease in the number of farmers practicing deep tillage as a way of increasing the use efficiency of the harvested water was due to unavailability and unaffordable high prices of the tools and machinery that are used in deep tillage. The above changes are attributed to the intervention by the SWMRG and other institutions on the use of harvested rainwater and the appropriate and affordable methods/techniques of directing and storing the harvested water in the crop fields.

Table 3. Extent of use (%) of RWH systems in Maswa

RWH system	**Baseline (2002)**	**After 2 yrs (2004)**	**Change**
Lower slope	***Bukangilija***		
No RWH	18	0	-18
Channeling water	13	6	-7
Store and Channel water	0	0	0
Bunded basis	14	28	+14
Ridges and tie ridges	18	37	+19
Deep tillage	37	30	-7
Total	100	100	
Mid slope	***Njia Panda***		
No RWH	3	0	-3
Channeling water	0	4	+4
Store and Channel water	0	0	0
Bunded basis	27	30	+3
Ridges and tie ridges	34	35	+1
Deep tillage	36	31	-5
Total	100	100	
Upper slope	***Isulilo***		
No RWH	9	0	-9
Channeling water	1	2	+1
Store and Channel water	3	0	-3
Bunded basins	9	24	+15
Ridges and tie ridges	56	44	-12
Deep tillage	22	30	+8
Total	100	100	

3.3.3. Upper slopes: Isulilo

The extent of the use of different water harvesting systems at Isulilo village is presented in Table 3. All the farmers at Isulilo village are practicing rainwater harvesting for crop production. The

number of farmers channeling rainwater into their fields, directing the water into bunded fields and increasing the soils water storage capacity through deep tillage increased by 1, 15 and 8 percent. This is attributed to the intervention of the SWMRG and other institutions as well as the low cost and labour involved in the construction of the structures. The number of farmers storing and later channeling water into the fields and those constructing ridges and tie ridges as a way of confining more water in the fields decreased by 3 and 12 percent. This is attributed to the high costs and labour involved in the construction of the storage structures and channels, ridges and tie ridges.

At Isulilo village the number of farmers using the technique of utilizing the harvested rainwater through deep tillage increased while in the other two villages (Bukangilija and Njiapanda) the number decreased. This is attributed to the proximity of the village to Maswa township and presence of well to do farmers (civil servants and business people) in the village who can afford the tools and machinery needed for deep tillage.

4.0 Conclusion

The number of farmers using various soil amendments in crop production has increased considerably and this was due to the increased awareness and adoption of rainwater harvesting practices. Further, production of vegetable crops both for home consumption and for sale outside the target areas, has promoted the use of organic and inorganic soil amendments and wide adoption of RWH practices. The above achievements are due to the interventions by SWMRG researchers, research institutions and NGOs through exchange of ideas, information and technologies with farmers and extension staff through participatory workshops, seminars and training.

APPENDIXES

Appendix 1: Appendix I. Dodoso Kuu kwa Wakulima

A: HABARI ZA MSINGI

1. Jinsia ya mdodoswa Me (…..) Ke (…..)

2. Jina lake……

3. Kijiji ……..Kitongoji anachoishi…….

1 2 3

4. Kundi la kipato…….

5. Umri wake ……..(miaka)

6. Kiwango cha elimu

Sijasoma	Elimu ya watu wazima	Elimu ya msingi	Elimu ya kidato cha 4	Elimu ya kidato cha 6	Nyingine (zitaje

B: MIKAKATI UNAYOTUMIA SASA KATIKA URUTUBISHAJI UDONGO NA UVUNAJI MAJI YA MVUA

7. Orodhesha mashamba yako, ukubwa wa kila shamba na umiliki.

Jina la shamba	Ukubwa (eka)	Mahali Lilipo	Mazao yanayolimwa	Mfumo wa uvunaji maji	Matumizi ya Mbolea			
					Samadi	Mboji	Kiwandani	Hatumii

Mahali shamba lilipo: 1 =Bondeni 2 =Katikati 3 =Sehemu ya juu;
Mifumo ya uvunaj: 1=Sivuni 2 =Maji yanaelekezwa 3 =Yanahifadhiwa na kuelekezwa
4 = Majaruba 5=. Matuta au tie ridges 6= Kutifua ardhi
Mazao yanayolimwa: 1= Pamba 2= Mahindi 3= Mtama 4 = Mpunga 5= Mihogo
6 Karanga 7= Kunde 8 = Njugu mawe 9 =Choroko 10= Maharage 11= Viazi vitamu

8. Mikakati ya kurutubisha udongo

Mikakati unayotumia kurutubisha udongo	***Umepata wapi elimu hiyo?**	**Mahali gani pengine unapoweza kupata elimu hiyo?**

Mahali unapoweza kupata elimu ya kurutubisha udongo.

1 =Mkulima mwenzako 2 =Redio 3 =Maonyesho ya kilimo 4 =Taasisi
5 =Magazeti 6 =Watafiti 7 = Bwana shamba 8= Kurithi

Appendix 2: The extent of use of organic and Inorganic Soil Amendments Along the Ndala River Catchment, Maswa District

Appendix 2 a: Percentage e Use of Organic Soil Amendment and Inorganic Fertilizers in Bukangilija Village.

Organic soil amendment/inorganic fertilizers	Gender (n=88)		Age Group (n=88)		Wealth category (n=88)			Overall
	Male	Female	Young	Old	Rich	Average	Poor	
	(n=78)	(n=10)	(n=35)	(n=53)	(n=11	(n=42)	(n=3)	(n=)
Farm yard manure	34	29	29	35	39	37	25	33
Compost	3	14	2	6	0	8	2	5
inorganic	0	0	0	0	0	0	0	0
None	63	57	69	59	61	55	73	62
Total	100	100	100	100	100	100	100	100

Appendix 2b: Percentage Use of Organic Soil Amendment and Inorganic Fertilizers in Isulilo Village.

Organic soil Amendment/inorganic fertilizers	Gender _n=55		Age Group (n=55		Wealth category n=55			Overall
	Male n=36	Female n=19	Young n=24	Old n=31	Rich n=2	Average n=25	Poor n=28	n=
Farm yard manure	41	42	38	43	50	45	36	42
Compost	16	8	9	16	25	19	5	14
Inorganic	2	4	3	2	0	2	3	2
None	41	46	50	39	25	34	56	42
Total	100	100	100	100	100	100	100	100

Appendix 2c : Percentage Use of Organic Soil Amendment and Inorganic Fertilizers in Njiapanda Village.

Organic soil amendment/inorganic fertilizers	Gender (n=6l)		Age Group (n=61)		Wealth category (n=61)			Overall
	Male (n=37)	Female (n=24)	Young (n=33)	Old (n=28)	Rich (n=11)	Average (n=37)	Poor (n=13)	(n=)
Farm yard manure	35	39	36	39	35	39	33	37
Compost	10	15	14	10	26	7	13	14
Inorganic	0	0	0	0	0	0	0	0
None	55	46	50	51	39	54	54	50
Total	100	100	100	100	100	100	100	100

Appendix 3: The Current Strategies Used by Farmers in Soil and Plant Nutrient Management Along the Ndala river Catchments Maswa District

Appendix 3a: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%) in Bukangilija village

INM strategies	Gender n=88)		Age Group n=88)		Wealth category (n=88)			Overall
	Male (n=78)	Female (n=10)	Young (n=35)	Old (n=53)	Rich (n=11)	Average (n=42)	Poor (n=35)	(n=)
Farm yard manure	34	25	35	33	35	40	25	32
Crop residues	34	50	39	34	24	33	42	37
Composite	5	8	4	6	0	10	2	5
Fallowing	18	8	11	20	29	12	19	17
Inorganic fertilizer	4	0	9	0	0	5	2	3
Intercropping	3	0	2	2	6	0	4	2
Crop rotation	2	9	0	5	6	0	6	4
Total	100	100	100	100	100	100	100	100

Appendix 3b: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%) in Isulilo village.

INM strategies	Gender (n=55)		Age Group (n=55)		Wealth category (n=55)			Overall
	Male (n=39)	Female (n=19)	Young (n=24	Old (n=31)	Rich (n=2)	Average (n=25)	Poor (n=28)	(n=)
Farm yard manure	45	46	44	47	67	49	42	49
Crop residues	30	32	39	26	0	23	40	27
Composite	16	4	6	15	33	19	4	14
Fallowing	0	0	0	0	0	0	0	0
Inorganic fertilizer	8	18	11	12	0	9	14	10
Intercropping	1	0	0	0	0	0	0	0
Crop rotation	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

Appendix 3c: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%). in Njiapanda village.

INM strategies	Gender (n=61)		Age Group (n=61)		Wealth category (n=61)			Overall
	Male (n=37)	Female (n=24)	Young (n=33)	Old (n=28)	Rich (n=11)	Average (n=3)	Poor (n=13)	(n=)
Farm yard manure	32	43	36	36	38	40	24	36
Crop residues	38	36	34	41	38	35	43	38
Composite	6	12	10	7	19	6	5	9
Fallowing	9	5	10	5	5	6	14	8
Inorganic fertilizer	5	2	5	2	0	3	10	4
Intercropping	8	2	5	7	0	8	4	5
Crop rotation	2	0	0	2	0	2	0	1
Total	100	100	100	100	100	100	100	100

Appendix 4: Use of alternative sources of information on INM along the Ndala River Catchment Maswa District

Appendix 4a: Extent of the Use (%) of Alternative Sources of Information for INM in Bukangilija Village

Sources of Information	Gender n=88)		Age Group n=88)		Wealth category n=88			Overall (n=)
	Male (n=78)	Female (n=10)	Young (n=35)	Old (n=53)	Rich (n=11)	Average (n=42)	Poor (n=35)	
Neighboring farmer	28	7	34	20	18	25	29	23
Radio	7	36	9	4	9	5	6	11
Agric show	0	0	0	0	0	0	0	0
Institutes	11	7	9	12	18	8	12	11
Newspaper	5	14	0	0	0	0	0	3
Researchers	0	0	6	12	9	10	9	7
Extension staff	22	0	23	16	18	25	12	17
Inheritance	27	36	20	36	27	28	32	29
Total	100	100	100	100	100	100	100	100

Appendix 4b: Extent of the Use (%) of Alternative Sources of Information for INM in Isulilo village.

Sources of Information	Gender n=55		Age Group n=55		Wealth category n=55			Overall
	Male (n=39)	Female (n=19)	Young (n=24)	Old (n=31)	Rich (n=2) (n=25	Average (n=25)	Poor n=28	(n=)
Neighboring farmer	40	46	35	28	33	31	50	38
Radio	4	8	6	6	0	0	6	4
Agric show	0	0	0	0	0	0	0	0
Institutes	13	17	16	14	17	17	11	13
Newspaper	2	4	0	0	0	0	0	1
Researchers	0	0	3	3	6	6	0	2
Extension staff	19	17	19	19	33	25	8	20
Inheritance	21	8	19	31	33	22	25	23
Total	100	100	100	100	100	100	100	100

Appendix 4c: Extent of the Use (%) of Alternative Sources of Information for INM in Njiapanda village

Sources of Information	Gender (n=61)		Age Group (n=61)		Wealth category (n=61)			Overall
	Male (n=37)	Female (n=24	Young (n=33)	Old (n=28)	Rich (n=11)	Average (n=37)	Poor (n=13	(n=)
Neighboring farmer	28	44	35	26	37	37	18	32
Radio	2	3	2	2	5	0	0	2
Agric show	0	0	0	0	0	0	0	0
Institutes	6	11	14	15	5	6	18	11
Newspaper	2	3	0	2	5	0	0	2
Researchers	0	0	8	4	5	8	6	4
Extension staff	32	17	18	26	26	27	12	23
Inheritance	30	22	22	24	16	22	47	26
Total	100	100	100	100	100	100	100	100

Appendix 5: Extent of the use RWH systems along the Ndala River catchment Maswa District

Appendix 5a: Extent of the Use (%) of RWH stems in Bukangilija Village

RWH systems	Gender (n=88)		Age Group (n=88)		Wealth category (n=88)			Overall (n=)
	Male (n=78)	Female (n=10)	Young (n=35)	Old (n=53)	Rich (n=11)	Average (n=42)	Poor (n=35)	
No RWH	0	0	0	0	0	0	0	0
Channeling water	7	5	6	7	3	11	2	6
Store & channel water	0	0	0	0	0	0	0	0
Bunded basins (EBBs)	27	27	27	28	30	23	32	28
Ridges & tie ridges	36	41	37	36	33	37	37	37
Tillage	30	27	30	29	34	29	29	30
Total	100	100	100	100	100	100	100	100

Appendix 5b: Extent of the Use (%) of RWH stems in Isulilo village.

RWH systems	Gender (n55=)		Age Group (n=55)		Wealth category (n=55)			Overall
	Male (n=39)	Female (n=19	Young (n=24)	Old (n=31)	Rich (n=2)	Average (n=25)	Poor (n=28)	(n=)
No RWH	0	0	0	0	0	0	0	0
Channeling water	1	3	2	2	0	4	0	2
Store & channel water	0	0	0	0	0	0	0	0
Bunded basins (EBBs)	22	26	21	25	25	25	21	24
Ridges & tie ridges	42	46	42	44	50	42	45	44
Tillage	35	25	35	29	25	30	34	30
Total	100	100	100	100	100	100	100	100

Appendix 5c: Extent of the Use (%) of Extent of the Use (%) of RWH systems in Njiapanda village

RWH systems	Gender (n=61)		Age Group (n=61)		Wealth category (n=61)			Overall
	Male (n=37)	Female (n=24)	Young (n=33)	Old (n=28)	Rich (n=11)	Average (n=37)	Poor (n=13)	(n=)
No RWH	0	0	0	0	0	0	0	0
Channeling water	3	5	2	5	3	4	4	4
Store &channel water	0	0	0	0	0	0	0	0
Bunded basins (EBBs)	32	29	33	29	30	33	26	30
Ridges & tie ridges	37	33	36	34	37	35	35	35
Tillage	28	33	29	32	30	28	35	31
Total	100	100	100	100	100	100	100	100

Appendix 6: Use of INM strategies under various RWH Techniques Along the Ndala River Catchment – Maswa District

Appendix 6a: Extent of the Use (%) of RWH systems by INM strategies in Bukan ilija Village (n=67)

INM strategies	RWH s stems					
	No RWH	Channeling water	Store & channel water	Bunded basins EBBs	Ridges & tie ridges	Tillage
Farm yard manure	0	37	0	35	34	33
Crop residues	0	26	0	37	33	36
Composite	0	4	0	2	6	5
Fallowing	0	22	0	17	18	16
Inorganic fertilizer	0	11	0	0	3	2
Intercrop ing	0	0	0	4	3	4
Crop rotation	0	0	0	5	3	4
Total	0	100	0	100	100	100

Appendix 6b: Extent of the Use % of RWH systems INM strategies in Isulilo village (n=77).

INM strategies	RWH s stems					
	No RWH	Channeling water	Store & channel water	Bunded basins EBBs	Ridges & tie ridges	Tillage
Farm yard manure	0	40	0	40	48	43
Crop residues	0	0	0	40	29	33
Composite	0	20	0	10	13	15
Fallowing	0	0	0	0	0	0
Inorganic fertilizer	0	40	0	10	10	9
Intercroppin	0	0	0	0	0	0
Crop rotation	0	0	0	0	0	0
Total	0	100	0	100	100	100

Appendix 6c: Extent of the Use (%) of RWH systems by INM strategies in Njiapanda village (n=90)

INM strategies	RWH s stems					
	No RWH	Channeling water	Store & channel water	Bunded basins EBBs	Ridges & tie ridges	Tillage
Farm yard manure	0	50	37	37	350	
Crop residues	0	8	39	36	400	
Composite	0	0	9	9	80	
Fallowing	0	8	8	7	70	
Inorganic fertilizer	0	17	1	4	40	
Intercropping	0	17	5	6	50	
Crop rotation	0	0	1	1	10	
Total	0	100	100	100	100	0

Appendix 7: Extent (%) of Use of Organic Soil Amendments and Inorganic fertilizers along the Makanya

Appendix 7a: Percentage Use of Organic Soil Amendment and Inorganic Fertilizers in Makanya Village.

Organic soil amendment/inorganic fertilizers	Gender (n=50)		Age Group (n=50)		Wealth category (n=50)			Overall
	Male (n=25)	Female (n=25)	Young (n=27)	Old (n=23)	Rich (n=16)	Average (n=20)	Poor (n=14)	(n=50)
Farm yard manure	14	22	20	16	27	16	10	18
Compost	37	37	36	38	32	37	42	37
Inorganic	14	15	15	14	17	14	13	15
None	35	26	29	32	24	33	35	30
Total	100	100	100	100	100	100	100	100

Appendix 7b: Percentage Use of Organic Soil Amendment and Inorganic Fertilizers in Mwembe Village.

Organic soil amendment/inorganic fertilizers	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=15)	Female (n=10)	Young (n=6)	Old (n=16)	Rich (n=2)	Average (n=14)	Poor (n=9)	(n=25)
Farm yard manure	21	25	25	22	23	27	12	22
Compost	36	36	31	37	22	35	36	33
Inorganic	36	36	38	35	22	35	36	34
None	7	3	6	6	33	3	16	11
Total	100	100	100	100	100	100	100	100

Appendix 7c: Percentage Use of Organic Soil Amendment and Inorganic Fertilizers in Tae Village.

Organic soil amendment/inorganic Fertilizers	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=16)	Female (n=9)	Young (n=10)	Old (n=15)	Rich (n=2)	~ Average (n=20)	Poor (n=3)	(n=25)
Farm yard manure	30	32	29	32	25	33	17	28
Compost	30	32	33	29	25	29	50	32
Inorganic	26	23	25	24	25	25	17	24
None	14	13	13	15	25	13	16	16
Total	100	100	100	100	100	100	100	100

Appendix 8 The Current Strategies Used by Farmers in Soil and Plant Nutrient Management along the Makanya river Catchment WPLL

Appendix 8a: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%) in Makanya village.

INM strategies		Gender (n=50)	Age (n=50)	Group		Wealth category		Overall
	Male (n=25)	Female (n=25)	Young (n=27)	Old (n=23)	Rich (n=16)	Average (n=20)	Poor (n=14)	(n=50)
Farm yard manure	20	26	25	21	31	21	14	23
Crop residues	49	39	43	46	38	46	50	44
Composite	22	18	20	21	17	25	18	20
Fallowing	0	0	0	0	0	0	0	0
Inorganic fertilizer	0	5	2	2	7	0	0	2
Intercropping	0	0	0	0	0	0	0	0
Crop rotation	9	12	10	10	7	8	18	11
Mulching	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

Appendix 8b: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%) in Mwembe village.

INM strategies	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=15)	Female (n=10)	Young (n=6)	Old (n=19)	Rich (n=2)	Average (n=14)	Poor (n=9)	(n=25)
Farm yard manure	17	23	22	19	17	24	13	20
Crop residues	2	3	0	4	0	2	4	2
Composite	34	32	33	33	33	31	38	33
Fallowing	2	0	0	2	0	2	0	1
Inorganic fertilizer	0	0	0	0	0	0	0	0
Intercropping	20	19	22	19	17	17	25	20
Crop rotation 17	17	19	12	20	33	17	16	19
Mulching	8	4	11	3	0	7	4	5
Total	100	100	100	100	100	100	100	100

Appendix 8c: Current Strategies of Soil and Plant Nutrient Management Employed in Different Farmer's Field (%) in Tae village.

INM strategies	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n16=)	Female (n=9)	Young (n=10)	Old (n=15)	Rich (n=2)	Average (n=20)	Poor (n=3)	(n=25)
Farm yard manure	5	44	39	41	50	40	34	36
Crop residues	32	19	17	22	0	20	33	20
Composite	50	25	33	28	50	29	33	35
Fallowing	0	0	0	0	0	0	0	0
Inorganic fertilizer	13	12	11	9	0	11	0	9
Intercropping	0	0	0	0	0	0	0	0
Crop rotation	0	0	0	0	0	0	0	0
Mulching	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

Appendix 9: The percentage Use of Alternative Sources of Information on INM Along the Makanya River Catchment WPLL

Appendix 9a: Extent of the Use (%) of Alternative Sources of Information for INM in Makanya Village

Sources of Information	Gender (n=50)		Age Group (n=50)		Wealth category			Overall ; (n=50)
	Male (n=25)	Female (n=25)	Young (n=27)	Old (n=23)	Rich (n=16)	Average (n=20)	Poor (n=14)	
Neighbouring farmer	23	22	22	22	18	26	23	22
Radio	0	0	0	0	0	0	0	0
Agric show	0	0	0	0	0	0	0	0
Institutes	5	13	10	7	9	9	9	9
Newspaper	0	0	0	0	0	0	0	0
Researchers	22	20	22	20	25	20	17	21
Extension staff	22	22	20	24	26	20	20	22
Inheritance	28	23	25	26	22	25	31	26
Tv	0	0	0	0	0	0	0	0
Cinema	0	0	1	2	0	0	0	0
Total	100	100	100	100	100	100	100	100

Appendix 9b: Extent of the Use (%) of Alternative Sources of Information for INM in Mwembe village.

Sources of Information	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=15)	Female (n=10)	Young (n=6)	Old (n=19)	Rich (n=2)	Average (n=14)	Poor (n=9)	(n=25)
Neighbouring farmer	3	8	0	7	13	4	6	6
Radio	7	3	5	5	0	6	6	5
Agric show	0	0	0	0	0	0	0	0
Institutes	26	28	29	26	29	26	27	27
News paper	0	0	0	0	0	0	0	0
Researchers	25	25	29	25	29	24	25	26
Extension staff	26	28	29	26	29	26	27	27
Inheritance	0	3	0	1	0	0	3	1
Tv	10	3	5	8	0	10	3	6
Cinema	3	2	3	2	0	4	3	2
Total	100	100	100	100	100	100	100	100

Appendix 9c: Extent of the Use (%) of Alternative Sources of Information for INM in Tae village

Sources of Information	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=16)	Female (n=9)	Young (n=10)	Old (n=15)	Rich (n=2)	Average (n=20)	Poor (n=3)	(n=25)
Neighbouring farmer	5	17	13	8	0	11	0	8
Radio	5	8	0	5	0	4	0	3
Agric show	0	0	0	0	0	0	0	0
Institutes	18	13	13	18	33	15	17	18
Newspaper	0	0	0	0	0	0	0	0
Researchers	20	8	17	16	34	15	17	18
Extension staff	35	33	33	37	33	34	50	36
Inheritance	18	21	24	16	0	21	16	17
Tv	0	0	0	0	0	0	0	0
Cinema	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

Appendix 10: The extent of the use RWH systems Along the Makanya River Catchment - WPLL

Appendix 10a: Extent of the Use (%) of RWH systems in Makanya Village

RWH systems	Gender (n=50)		Age Group (n=50)		Wealth category (n=50)			Overall (n=50)
	Male (n=25)	Female (n=25)	Young (n=27)	Old (n=23)	Rich (n=16)	Average (n20=)	Poor (n=14)	
No RWH	0	0	0	0	0	0	0	0
Channeling water	93	89	93	92	89	91	100	92
Store & channel water	0	11	0	8	11	0	0	5
Bunded basins (EBBs)	0	0	0	0	0	0	0	0
Ridges & tie ridges	0	0	0	0	0	0	0	0
Tillage	7	0	7	0	0	9	0	3
Total	100	100	100	100	100	100	100	100

Appendix 10b: Extent of the Use (%) of RWH systems in Mwembe village.

RWH systems	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=15)	Female (n=10)	Young (n=6)	Old (n=19)	Rich (n=2)	Average (n=14)	Poor (n=9)	(n=25)
No RWH	0	0	0	0	0	0	0	0
Channeling water	41	37	38	40	34	40	39	38
Store & channel water	24	23	19	25	33	23	22	24
Bunded basins (EBBs)	0	0	0	0	0	0	0	0
Ridges & tie ridges	0	7	13	0	0	0	9	5
Tillage	35	33	30	35	33	37	30	33
Total	100	100	100	100	100	100	100	100

Appendix 10c: Extent of the Use (%) of Extent of the Use (%) of RWH systems in Tae village

RWH systems	Gender (n=25)		Age Group (n=25)		Wealth category (n=25)			Overall
	Male (n=16)	Female (n=9)	Young (n=10)	Old (n=15)	Rich (n=2)	Average (n=20)	Poor (n=3)	(n=25)
No RWH	0	0	0	0	0	0	0	0
Channeling water	42	40	32	44	22	38	18	34
Store & channel water	3	5	21	0	56	9	24	17
Bunded basins (EBBs)	0	0	0	0	0	0	0	0
Ridges & tie ridges	13	20	15	15	11	16	46	19
Tillage	42	35	32	41	11	37	12	30
Total	100	100	100	100	100	100	100	100

Appendix 11: The Use of RWH Systems by INM strategies Along the Makanya river Catchment WPLL

Appendix 11a: Extent of the Use (%) of RWH systems by INM strategies in Makanya Village (n=50)

INM	RWH systems					
	No RWH	Channeling water	Store & channel	Bunded basins (EBBs)	Ridges & tie ridges	Tillage
Farm yard manure	0	23	16	0	20	34
Crop residues	0	39	36	0	20	33
Composite	0	21	36	0	20	0
Fallowing	0	3	0	0	0	0
Inorganic fertilizer	0	3	2	0	20	0
Intercropping	0	1	0	0	20	33
Crop rotation	0	10	10	0	0	0
Mulching	0	0	0	0	0	0
Total	0	100	100	0	100	100

Appendix 11b: Extent of the Use (%) of RWH systems by INM strategies in Mwembe village (n=25).

INM strategies	**RWH systems**					
	No RWH	**Channeling water**	**Store & channel water**	**Bunded basins (EBBs)**	**Ridges & tie ridges**	**Tillage**
Farm yard manure	0	13	13	0	20	14
Crop residues	0	24	24	0	20	24
Composite	0	23	24	0	20	23
Fallowing	0	1	0	0	0	1
Inorganic fertilizer	0	1	1	0	20	0
Intercropping	0	22	22	0	20	24
Crop rotation	0	12	12	0	0	14
Mulching	0	4	4	0	0	0
Total	0	100	100	0	100	100

Appendix 11c: Extent of the Use (%) of RWH systems by INM strategies in Tae village (n=25)

INM strategies	**RWH systems**					
	No RWH	Channeling water	Store & channel water	Bunded basins (EBBs)	Ridges & tie ridges	Tillage
Farm yard manure	0	22	18	0	23	23
Crop residues	0	28	23	0	21	24
Composite	0	17	24	0	16	15
Fallowing	0	0	0	0	0	0
Inorganic fertilizer	0	12	11	0	23	11
Intercropping	0	21	18	0	17	27
Crop rotation	0	0	6	0	0	0
Mulching	0	0	0	0	0	0
Total	0	100	100	0	100	100