AgWater Solutions Project
Case Study

Agricultural Water Management Technology Adoption in Zambia: Findings of a Household Survey

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July 2011

Acknowledgment
The authors and project partners wish to thank the Bill & Melinda Gates Foundation for the generous grant that made this project possible.

The AWM Project
The AgWater Solutions project was implemented in five countries in Africa and two states in India between 2008 and 2012. The objective of the project was to identify investment options and opportunities in agricultural water management with the greatest potential to improve incomes and food security for poor farmers, and to develop tools and recommendations for stakeholders in the sector including policymakers, investors, NGOs and small-scale farmers.

The leading implementing institutions were the International Water Management Institute (IWMI), the Stockholm Environment Institute (SEI), the Food and Agriculture Organization of the United Nations (FAO), the International Food Policy Research Institute (IFPRI), International Development Enterprises (iDE) and CH2MHill.

For more information on the project or detailed reports please visit the project website http://awm-solutions.iwmi.org/home-page.aspx.

Disclaimers

This report is based on research funded by the Bill & Melinda Gates Foundation. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the project, its partners or the Bill & Melinda Gates Foundation.

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1. Introduction

This report presents the results of a household survey on Agricultural Water Management Technology Adoption in Zambia. The household survey is one of the case studies conducted as part of the Zambian component of the Agricultural Water Management Solutions project, carried out by the International Water Management Institute in collaboration with the Food and Agricultural Organization, International Development Enterprise, International Food Policy Research Institute, Stockholm Environmental Institute, and CH2MHill (www.awm-solutions.iwmi.org).

The survey examined rainy season cropping and dry season irrigation in 2009/2010. The site and sample selection were based on an Inventory of Agricultural Water Management Technologies for the same project. This inventory captured the range of important Agricultural Water Management (AWM) Technologies throughout Zambia, including buckets, *dambos*, river diversions, treadle pumps and motor pumps, conservation agriculture, and public irrigation schemes.

To ensure sufficient frequencies of river diversions, treadle and motor pumps, conservation agriculture, and public irrigation schemes, districts were selected where experts expected the highest concentrations. Accordingly, the selection included Mpika (river diversions), Chibombo (treadle and motor pumps), Monze (conservation agriculture) and Sinazongwe (public irrigation scheme). In these districts all households in adjacent area were interviewed, so adopters and non- or dis-adopters were interviewed (Table 1.1, Figure 1.2).

Out of the total 1,935 households interviewed, surveyors randomly selected 60 households in each of the 4 districts for a total of 240 households[1]. In the 191 Male Headed Households, 182 respondents were Male Household Heads (MHHs), while in 9 cases the respondent was the wife. For the 49 Female Headed Households (FHHs), all 49 respondents were household heads (Figure 1.1). The field work for this analysis was conducted by the Farming Systems Association of Zambia (FASAZ).

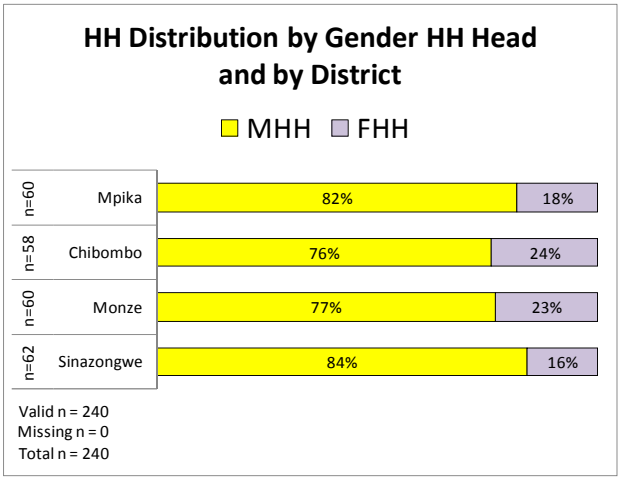


Figure 1.1: Household distribution by gender of household head and district.

[1] See Annex 2: Sample Data.

There were 240 households in the sample, of which 191 (80%) were MHHs and 49 (20%) FHHs (Table 1.1). Among the FHHs, 43 (18%) are *de jure* (i.e. not married) and 6 (2%) *de facto* married, but the husband is not in the household head.

Table 1.1: Sample data.

Districts	Adopters		Dis-adopters		Non-adopters		Total	
	No.	%	No.	%	No.	%	No.	%
Mpika	42	70	9	15	9	15	60	100
Chibombo	41	71	9	16	8	14	58	100
Monze	40	67	16	27	4	7	60	100
Sinazongwe	39	63	18	29	5	8	62	100
Total	162		52		26		240	

Between 60% and 70% of the sample were households currently using one or more forms of AWM technology (adopters), while the remainder are not currently using any form of AWM technology (Figure 1.2). Among the latter are those who have never used an AWM technology (8-15% non-adopters) and those that have used AWM technology before (15-29% dis-adopters).

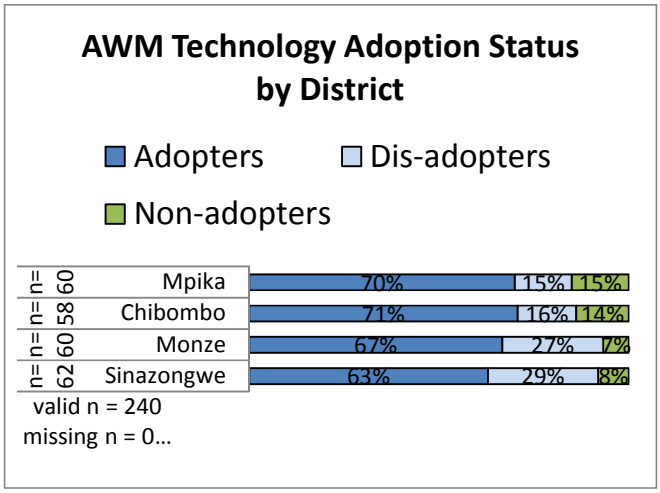


Figure 1.2: AWM technology adoption status by district.

Between the 4 districts the adoption rates are not much different (Table 1.2 and Figure1.3), but there are relatively more dis-adopters in Monze and Sinazongwe (27-29%) than in the other two districts (15-16%).

Table 1.2: Adopters, non- and dis-adoptors by gender of household head.

Districts	Adopters		Dis-adopters		Non-adopters		Total	
	No.	%	No.	%	No.	%	No.	%
MHH	135	71	41	21	15	8	191	100
FHH	27	55	11	22	11	22	49	100
Total	162		52		26		240	

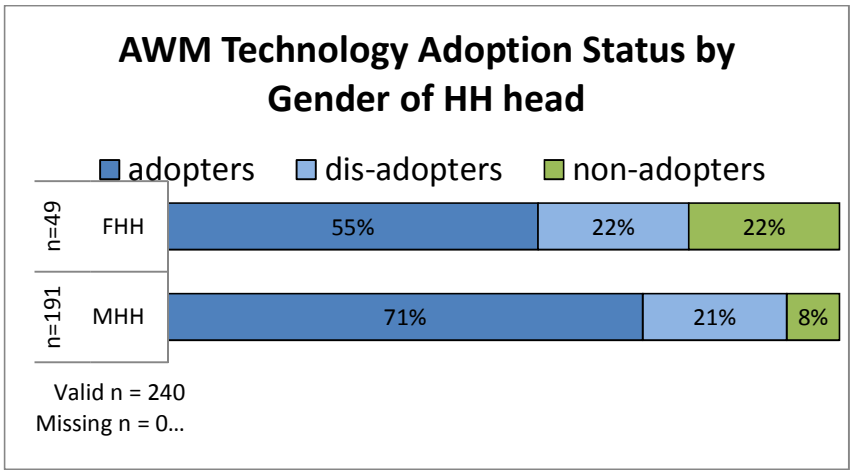


Figure 1.3: AWM technology adoption status by gender of household head.

FHHs have a lower adoption rate (55%) than MHHs (71%). More FHHs are non-adopters (22%) than MHHs (8%). There is not much difference between the MHHs and FHHs as far as dis-adoption is concerned. In the 4 districts the farmers are using different technologies (Figure 1.4). Where the bucket is the predominant technology in most districts, the next most important technology is different for each of the districts[2]. The more advanced AWM technologies are most commonly used in Mpika (50% of the adopters use river diversions) and Chibombo (29% of adopters use motor pumps), followed by Sinazongwe (18% of adopters use the irrigation scheme) and Monze (13% of adopters use conservation agriculture).

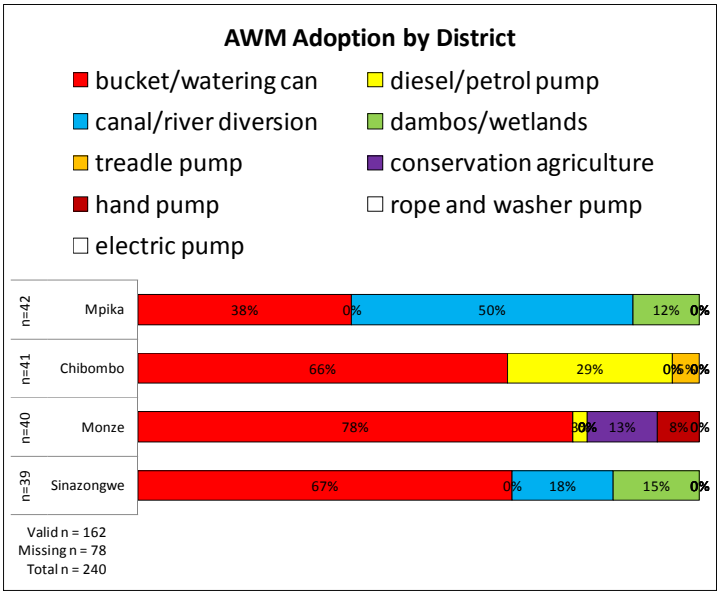


Figure 1.4: AWM adoption by district.

Buckets are used by all small-scale farmers in the survey area (and in fact all over Zambia). In this report, 'bucket' refers to any type of container that can be used for carrying water (Photo 1). In this

2 Note: Neither electric pumps or rope and washer pumps were not found in any of the 4 districts and are therefore not included in this report.

case the water is collected from a perennial stretch of the Maramba River. Farmers like buckets because they are cheap, they have low or no maintenance costs, they are easy to handle and always readily available for irrigation. Buckets are also commonly used for various household chores like collecting water from a pump or well for drinking and other uses. Livestock can be watered with a bucket. They can be easily lent and borrowed. There are no disadvantages in using a bucket. Other water lifting devices farmers know and would like to use are motor pumps and treadle pumps.

Photo 1: Left: A woman using buckets to irrigate her rape field in Kasiya village near Livingstone, Southern Province, Zambia. Credit: AWS. Right: A perennial part of the river which is used for domestic chores like laundry and bucket irrigation by women

Dambos and wetlands are mainly found in Mpika and Sinazongwe and were analysed together with the more dominant technologies in those districts. *Dambos* and wetland fields are individually owned and managed and no payments are made for water.

Mpika: River diversions (Photo 2) are the most important AWM Technology, even more important than buckets.

Photo 2. A typical river diversion in Mpika District.

The majority of river diversions are owned by groups of water users, of which the head of the household is a member. The HH head pays for water and for maintenance and he/she also provides labour for maintenance. The wife in a MHH also provides some labour. Some river diversions are

privately owned. Farmers like this technology because they can irrigate more land and more plots. The technology is also easy to use.
Most households said that water from a river diversion is used for irrigation and for domestic uses including drinking water.

Chibombo: This district was chosen because of the predominance of motorised pumps, mainly small 5hp portable petrol pumps. Chibombo is approximately 20 km north of Lusaka. The Great North Road to Kabwe runs through Chibombo.

Photo 3 shows a motor pump being tested on a farm in the Katuba area. Water is pumped from an unprotected shallow well, which provides water throughout the dry season. These wells may need some deepening as the water table drops in the dry season.

Photo 3: Testing a small motor pump to draw water from a nearby well. Photo: AWS.

Pumps are generally owned by individuals. Pumps were provided to some groups by a Danida-supported WWF project. Since then, some group members have bought their own pumps. Farmers say that individual ownership means the pump is available when they want it for the household. Pump owners find it easy to acquire this technology and the majority say that they have no reason to prefer a different technology. They find the pump easy to operate, they have enough household labour for irrigation with a pump, and they can irrigate more land than before. Only a few farmers said that high fuel cost is a disadvantage. Half the farmers use the pumped water for drinking, cooking and other domestic uses. None of the farmers have rented out their pumps.

Only two treadle pumps were found in the survey area (5%). In the remainder of this report, treadle pumps are grouped under 'other technologies'.

Monze: This district was chosen because of the predominance of conservation agriculture which has been introduced over the past ten years. The most common conservation farming practices observed were: crop rotation, mulching with organic residues, zero tillage and water harvesting (e.g. potholes and bunds; (Photo 4). Hand-pumps are also quite common because they were installed some 25 years ago when farm plots where allocated to farmers in Kayuni Settlement on an ex-Kayuni State Farm.

Photo 4: Potholing is a common conservation agriculture technique. Photo: AWS.

Sinazongwe: This district was chosen because there is a public irrigation scheme on the shores of Lake Kariba. The scheme comprises a constructed lake established when the Kariba Dam was built in the 1950s. The Valley Tongas used to have gardens on the banks of the Zambezi before the valley was flooded.

Photo 5: Doing the luandry. Irrigation schemes like this one in Sinazongwe are often used for muliple purposes.

Most users see the scheme as owned and managed by groups of water users comprised of heads of households. They pay for water and contribute labour for maintenance, comparable to the river diversion schemes in Mpika. Farmers like this scheme because it is easy to use and gives more access to land for irrigation and wives and relatives can use the scheme. Water is also used for non-irrigation purposes such as laundry (Photo 5), although there are no specific facilities like a washing slab. The irrigation scheme in Sinazongwe is a *de facto* multiple use system.[3] AWM technologies used by gender of household head are displayed in Figure 1.5.

[3] van Koppen, B. *et al*., (2009). Climbing the water ladder, multiple use water services for poverty reduction. IRC and International Water Management Institute, Colombo, Sri Lanka.

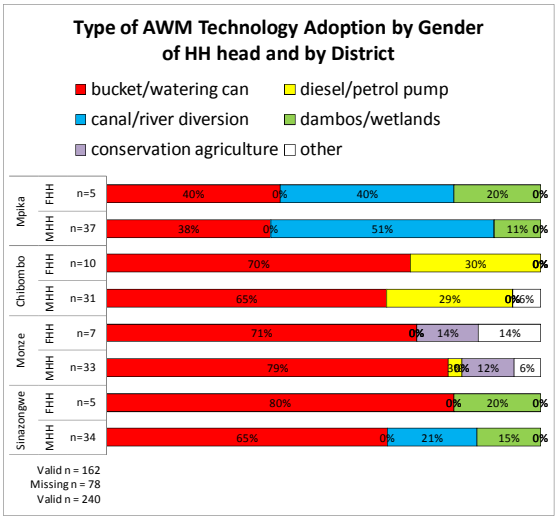


Figure 1.5: Type of AWM technology adoption by gender of household head and district.

- Farmers in all districts use buckets as the main AWM technology except for Mpika, where river diversions are used by 51% of the adopting MHHs. Only 39% of MHHs use buckets. For FHHs in Mpika, buckets and river diversions are of equal importance. FHHs use *dambos* more frequently and river diversions less frequently than MHHs.
- In Chibombo, motorised pumps are the most important after buckets, equally used by MHHs and FHHs[4].
- In Monze, conservation agriculture is the dominant technology after buckets and are equally used by FHHs and MHHs.
- In Sinazongwe, the irrigation scheme is used by 21% of the MHHs and by none of the FHHs. *Dambos* are used by FHHs (20%) and MHHs (15%).

2. Household Wealth by Gender of Household Head and Adoption Status

Asset ownership by gender of household head (Figure 2.1)

All MHHs (n=191) and FHHs (n=49) were asked about the ownership of the following assets:

1. Housing: 1. improved dwelling, 2. improved toilet, 3. electricity
2. Farming equipment: 4. oxcart, 5. plough, 6. hoe, 7. axe
3. Livestock: 8. bulls, 9. cows, 10. oxen, 11. poultry
4. Other equipment: 12. mobile phone, 13. bicycle, 14. sewing machine, 15. TV, 16. satellite dish

Male household heads own more assets than female household heads. Female household heads own more assets than spouses. The most common assets are hoes and axes, while the least common asset is improved housing.

[4] In the Inventory, motor pump adoption rates are lower for FHHs (15%) than MHHs (31%). The difference between the Inventory and household survey is explained by a slight divergence from fully proportionate sampling.

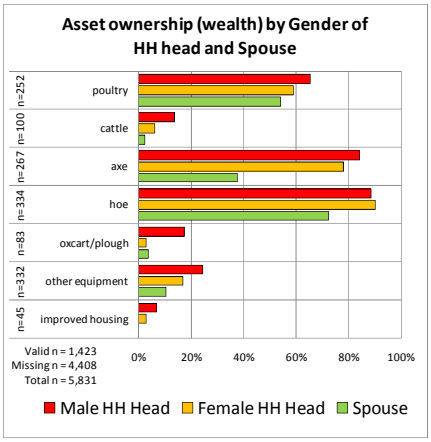


Figure 2.1: Asset ownership by gender of household head and spouse.

Seasonal food availability

The respondents were asked to name the month when the food crop they harvested last season ran out during the current season (Table 2.1).

Table 2.1: Month food crop harvested last season ran out this season.

All figures are %	MHH	FHH	*De jure* FHH	*De facto* FHH
	N=191	N=49	N=43	N=6
Did not run out	20	16	16	17
January	8	6	7	0
February	8	0	0	0
March	7	6	7	0
April	6	8	9	0
May	4	4	2	17
June	7	10	12	0
July	6	6	5	17
August	9	8	7	17
September	6	12	14	0
October	5	8	9	0
November	4	8	7	17
December	7	4	5	0
Destroyed	2	2	0	17

There is no clear pattern that differentiates the 4 household categories. One would expect food shortages the few months before the harvest (January, February, March) but the results do not bear this out. The sample households did not belong to the poorest families because most have two or three meals per day. In Zambia it is generally considered that the poorest households have only one meal per day. Food stress would show a clear seasonal shortage pattern the few months before harvesting, which is not the case here.

Frequency of nutritious (protein-rich) meals by household head

The respondents were asked how many times they had eaten fish or meat in the last week (Figure 2.2). Almost half the FHHs had not eaten a nutritious meal in the last week, while this only applied to one quarter of the MHHs.

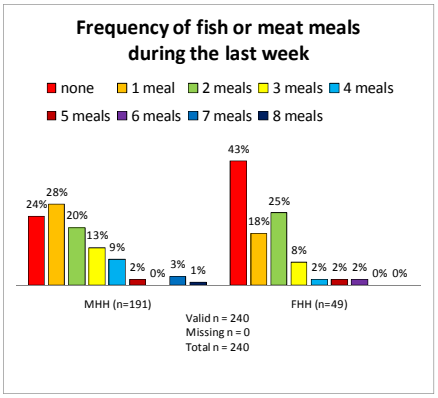


Figure 2.2: Frequency of fish or meat meals during the last week.

Asset ownership by adopters and non- and dis-adopters

All adopters (n=162) and non- and dis-adopters (n=78) were asked about the ownership of the following assets (Figure 2.3):

1. Housing: improved dwelling, improved toilet, electricity
2. Farming equipment: oxcart, plough, hoe, axe
3. Livestock: bulls, cows, oxen, poultry
4. Other equipment: mobile phone, bicycle, sewing machine, TV, satellite dish

Household heads and spouses of adopter households have a slightly higher asset ownership status than household heads and spouses of non- and dis-adopter households.

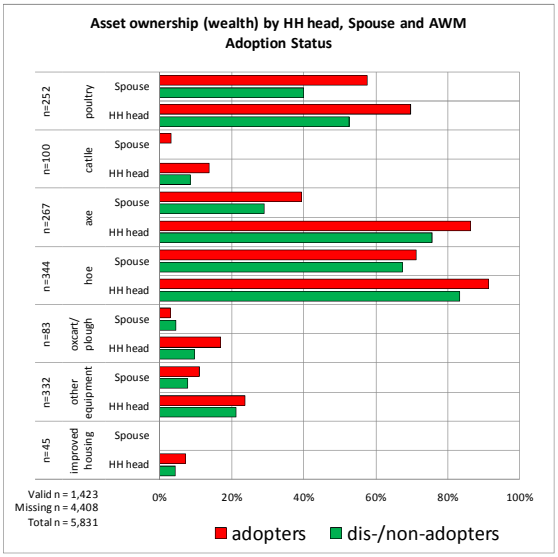


Figure 2.3: Asset ownership by household head, spouse and AWM adoption status.

2.5: Highest education level for adopters and non- and dis-adopters

There is little difference between adopters and non- and dis-adopters in terms of education level (Table 2.2).

Table 2.2: Education level for adopters and non- and dis-adopters.

Highest education level	Non- and dis-adopters N=418	Adopters N=1018
	%	%
None	33	31
Primary	49	44
Junior	13	17
Senior	3	6
College/university	1	0

3. Time spent on farm work by gender of household head and by adoption status

The total number of respondents for this analysis was 240 households with an average household size of 6.04 = 1,450 household members (Table 3.1). More MHH members do not work on the farm (42%) compared to FHH members (33%). FHHs have a smaller household size from which to draw labour (Table 3.2).

Table 3.1: Survey sample data.

	Mean
MHH	6.37
FHH	4.73
All HHs	6.04

Table 3.2: Percentage of household members working hours per day.

Hours	MHH		FHH		Total N
	N	%	N	%	
Zero	507	42	75	33	582
1-4	438	36	106	46	544
4-6	179	15	33	14	212
>6	87	7	16	0	103
Total	1211		230		1441

In Figures 3.1 and 3.2, household members are numbered from 1 to 14, where 1 is always the household head (male or female) and 14 is the youngest, often a grandchild. Number 2 is the wife in a MHH, if applicable. Then follow other members of the family (children and father, mother, brother and sister of head, etc.).

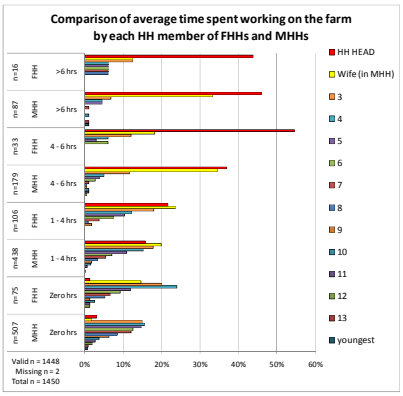
The following trends can be seen:

- Only a few household heads do not work at all. Work is done most frequently by the household head and the person immediately following the household head (e.g. wife in MHH).
- For longer working hours, the responsibility shifts from the household as a whole to the household head and the wife in a MHH, where more household heads take up the heavier workloads.
- In MHHs, wives do an equal amount of work as their husbands, up to workloads of 6 hours. When the workload goes beyond 6 hours, more often household heads do the work.

- In FHHs, the household head is assisted by the second person in that household but for longer working hours the responsibility shifts to the household head with less help from the second person.

Comparison of average times spent working on the farm by each household member of male and female headed households

Figure 3.1: Comparison of average times spent working on the farm by each household member of male and female headed households.



The total number of survey respondents for this analysis was 240 households with an average household size of 6.04 (Table 3.3) or 1,450 household members.

Table 3.3: Survey data.

	Mean
Non- and dis-adopters	5.40
Adopters	6.35
All HHs	6.04

Slightly more non- and dis-adopter household members do not work on the farm at all (45%) compared to adopter household members (39%). More adopter household members (41%) work 1-4 hours more than members of the non- and dis-adopter households (30%). The following trends can be seen from Table 3.4 and Figure 3.2. Overall, more adopter household members are involved in farm work than non- and dis-adopter household members, and more household heads work longer hours than the second adult in the household (e.g. the wife in a MHH).

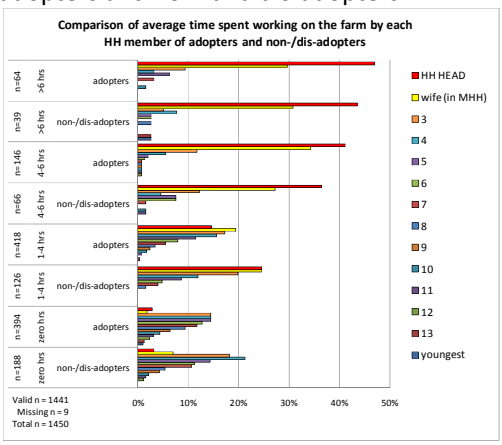
1. For workloads of 1-4 hours, the adopters spread the load out over more family members than the non- and dis-adopters. Adopter households have a larger average household size (6.35) to depend on for work than the non- and dis-adopter households (5.40).
2. For heavier workloads the responsibility shifts from the household as a whole to the household head and wife in a MHH, where more household heads take on a heavier workload.
3. There is a slight trend that more adults in adopter households take on the heavier workloads than in the non- and dis-adopter households.

Table 3.4: Hours worked by household members of adopter and non- and dis-adopter households.

Hours	Adopters		Non-/Dis-adopters		Total N
	%	N	%	N	
Zero	39	394	45	188	582
1-4	41	418	30	126	544
4-6	14	146	16	66	212
>6	6	64	9	39	103
Total		1022		419	1441

Comparison of average times spent working on the farm by household members of adopters and non- and dis-adopters.

Figure 3.2: Comparison of average times spent working on the farm by household members of adopters and non- and dis-adopters.



4. Water Management

Natural water sources for buckets and motorised pumps

Ground water is the most common natural water source. Shallow ground water can be reached by digging an unprotected shallow well. This is common in Chibombo (Katuba area). Motor pumps have an average maximum suction head of 8 meters (Table 4.1).

Table 4.1: Natural water sources.

	Perennial river/stream	Seasonal river/stream	Pond/lake	Groundwater	*Dambo*
Bucket takes water from	11	5	4	68	12
	11%	5%	4%	68%	12%
Motor pump takes water from	3	0	2	10	0
	20%	0	13%	67%	0

Water reliablity and availability

Lake and spring water seem to be the most reliable sources, followed by perennial streams and groundwater. Less reliable groundwater sources are *dambos* and seasonal streams (Table 4.2).

Table 4.2: Reliability and quality of water sources.

Question about reliability	Water source				
	Lake/spring	Perennial stream	Ground water	*Dambo*	Seasonal stream
Water is available in October	93%	89%	86%	79%	67%
Number of yes answers/number of respondents	13/14	31/35	72/84	15/19	4/6
Water quality is no problem	100%	91%	96%	95%	100%
Number of yes answers/number of respondents	14/14	32/35	80/83	19/20	6/6

5. Differences between Owners of Irrigated and Rainfed Plots

This section deals with the owners, by gender, of irrigated and rainfed plots. General characteristics are displayed in Table 5.1.

Table 5.1: Overview of adopters and non- and dis-adopters for all plots.

	Adopters	Non- and dis-adopters	Total
Irrigated Plot Owners			
Husband	158		158
Wife	21		21
Male HH Head	3		3
Female HH Head	22		22
Irrigated sub-total	204		204
Rain-fed Plot Owners			
Husband	193	67	260
Wife	27	21	48
Male HH Head	4	5	9
Female HH Head	25	18	43
Rainfed sub-total	249	111	360
Total	453	111	564

Data were collected for the three main irrigated plots (numbered 1, 2, 3) and the three main rainfed plots (4, 5, 6). The frequencies in Table 5.2 were used as the n values in Figure 5.1. Table 5.2 shows that adopters as well as non- and dis-adopters are owners of rainfed plots.

Table 5.2: Plot ownership frequencies by gender of household head.

Plot	Description	Husband	Wife	Single Male HH head	Single Female HH head	Total
1	Irrigated	109	15	2	20	146
2	Irrigated	38	5	1	2	46
3	Irrigated	11	1	0	0	12
	Sub-total irrigated plots	158	21	3	22	204
4	Rainfed	144	13	6	37	200
5	Rainfed	74	30	2	0	106
6	Rainfed	42	5	1	6	54
	Sub-total rainfed plots	260	48	9	43	360
	Total	418	69	12	65	564

Income from harvest sold per gendered plot owner category

Figure 5.1 shows the main differences in average annual income from harvests (*not* the value of total harvest) between owners of irrigated and rainfed plots:

- Husbands have a higher income than wives from both irrigated and rainfed plots.
- Wives earn more income from irrigated plots than single women (FHH heads).
- Single women earn more income from rainfed plots than wives.

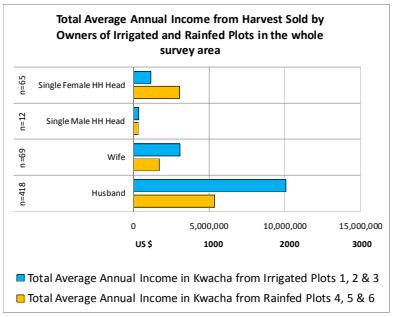


Figure 5.1: Total average annual income from harvests sold by owners of irrigated and rainfed plots.

The frequencies in Table 5.3 were used as the n values in Figures 5.2, 5.3 and 5.4).

Table 5.3: Plot ownership frequencies by district.

Plot	Description	Mpika	Chibombo	Monze	Sinazongwe	Total
1	Irrigated	36	41	35	34	146
2	Irrigated	20	16	3	7	46
3	Irrigated	2	6	1	3	12
	Sub-total irrigated plots	58	63	39	44	204
4	Rainfed	56	54	52	38	200
5	Rainfed	44	24	29	9	106
6	Rainfed	25	10	16	3	54
	Sub-total rainfed plots	125	88	97	50	360
	Total	183	151	136	94	564

Income from harvest sold per district

Figure 5.2 shows the main similarities and differences in average annual income between the districts.

- Chibombo, where motor pumps are the most common AWM technology after buckets, has a higher income from irrigated than from rainfed plots.
- Chibombo has by far the highest income from irrigated as well as rainfed plots compared to the other three districts, possibly because of its proximity to the Lusaka market (about 20 km).
- In Chibombo (motor pumps) and Sinazongwe (irrigation scheme and dambos near Lake Kariba) the income from irrigated plots is higher than the income from rainfed plots. Sinazongwe has hardly any income from rainfed plots.
- In Mpika (river diversions) the income from rainfed crops is higher than from irrigated plots.
- In Monze (conservation agriculture), the income from rainfed plots is higher than from irrigated plots, which are 78% irrigated by buckets and 13% cultivated under conservation agriculture.

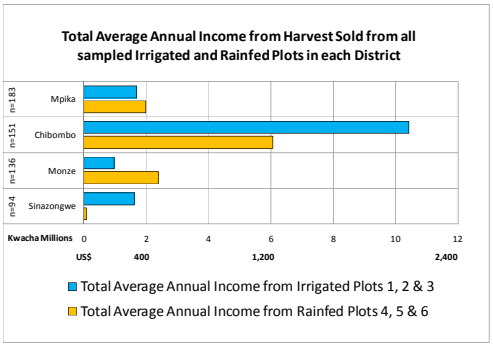


Figure 5.2: Total average annual income from harvest sold from all sampled irrigated and rainfed plots.

Figures 5.3 shows average annual incomes from harvests sold in more detail.

- In Chibombo, FHH heads earn far more income from rainfed plots than wives, while in the other three districts wives earn more from rainfed plots than female household heads.
- Husbands earn more than wives from irrigated plots, while wives earn more from irrigated plots than female household heads.

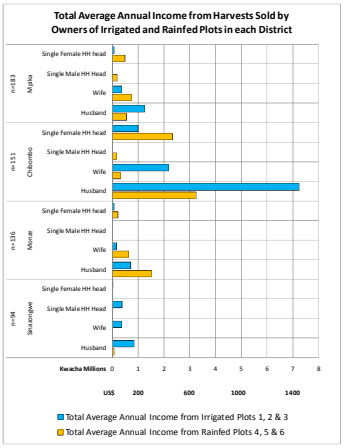


Figure 5.3: Total average annual income from harvests sold by owners of irrigated and rainfed plots in each district.

Figure 5.4 shows distinct patterns for average annual income by gendered plot ownership[5]. For the three districts with a good number of owners of irrigated and rainfed plots (Mpika, Chibombo and Monze):

- Husbands have, on average, a minimum of 3 irrigated plots and 3 rainfed plots.
- Compared to husbands, wives have fewer plots, on average only 1 or 2 irrigated plots and 1 to 3 rainfed plots. Wives in Mpika have up to 5 plots, while in Chibombo and Monze up to 3 plots.
- Compared to husbands and wives, female household heads have fewer plots (1 or 2 irrigated plots and 1 to 2 rainfed plots).
- In Sinazongwe, the husband has up to 2 irrigated plots while the others have only 1 irrigated plot.

[5] Where a plot does not show in the Figure it means there is no income from sales from that plot.

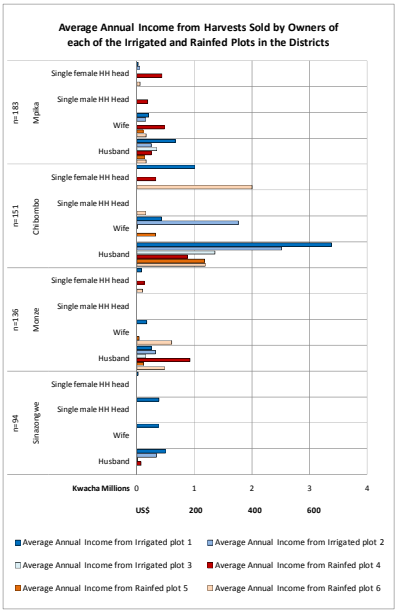


Figure 5.4: Average annual income from harvests sold by owners of each of the irrigated and rainfed plots.

6. Irrigated and Rainfed Plot Size and Yield[6]

The total hectares of rainfed plots is larger than the total hectares of irrigated plots (Figure 6.1). Husbands have more hectares for both rainfed and irrigated plots compared to wives and other owner categories.

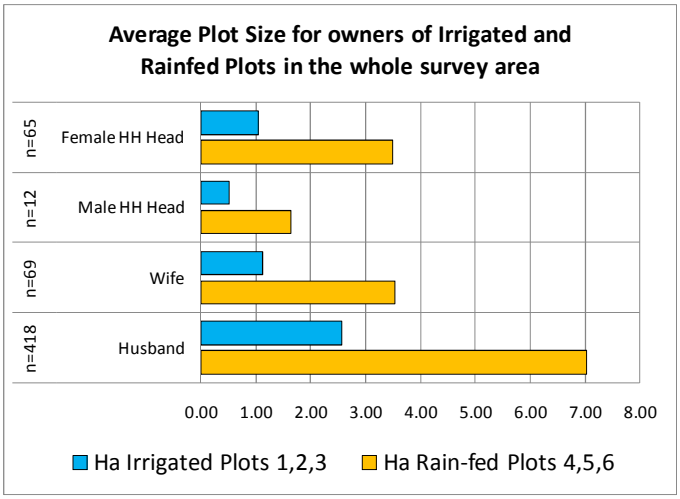


Figure 6.1: Average plot size for owners of irrigated and rainfed plots in the survey area.

For all owner categories, the yields per hectare from harvest sales are higher for irrigated plots than for rainfed plots (Figure 6.2). Irrigation is for cash crops, while harvests from rainfed plots are mostly consumed as staple foods.

[6] See Chapter 9 "Adopter and non- and dis-adopter plot owners", Figures 9.10. and 9.11 for plot size and yields specified for adopters and non- and dis-adopters.

- Husbands have higher yields in both irrigated and rainfed plots than their wives.
- Female household heads have slightly higher yields on their rainfed fields than other owner categories and their yields on rainfed and irrigated fields are almost the same. For other owner categories, the yields for irrigated plots are much higher than yields for rainfed plots.

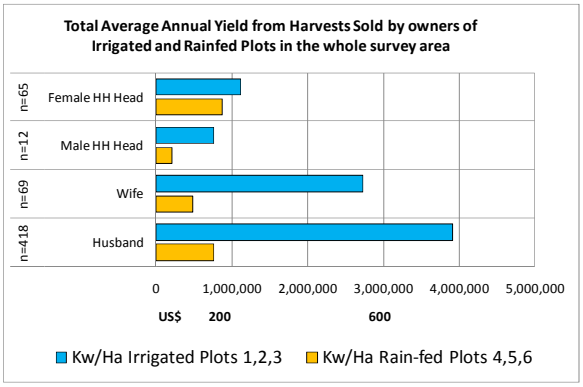


Figure 6.2: Total average annual yields from harvests sold by owners of irrigated and rainfed plots.

In all districts, the average rainfed plot sizes are much larger than irrigated plot sizes (Figure 6.3).

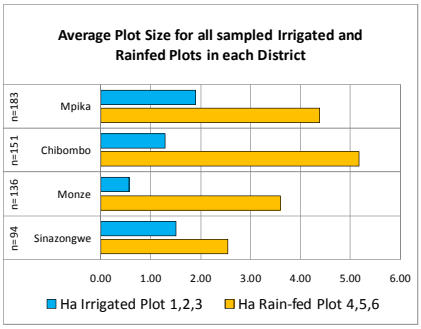


Figure 6.3: Average plot size for all sampled irrigated and rainfed plots.

- Yields from harvests sold are higher in irrigated fields than in rainfed fields (Figure 6.4).
- Chibombo has a much higher yield from irrigated plots than other districts.
- Chibombo also has a higher yield from rainfed farming compared to the other districts.

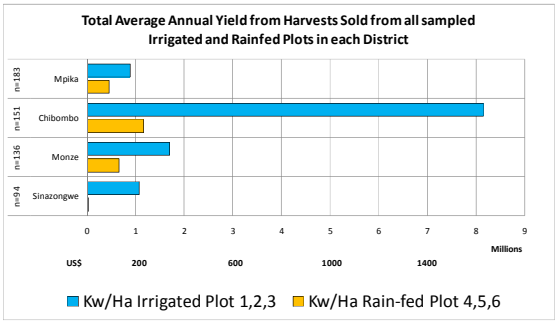


Figure 6.4: Total average annual yields from irrigated and rainfed plots in each district.

In all districts, husbands' irrigated plots are larger than their wives' plots and other owner category plots. Husbands' rainfed plots are usually larger than those of other owners, except for Mpika where the husbands' and wives' rainfed plots are approximately the same size (Figure 6.5).

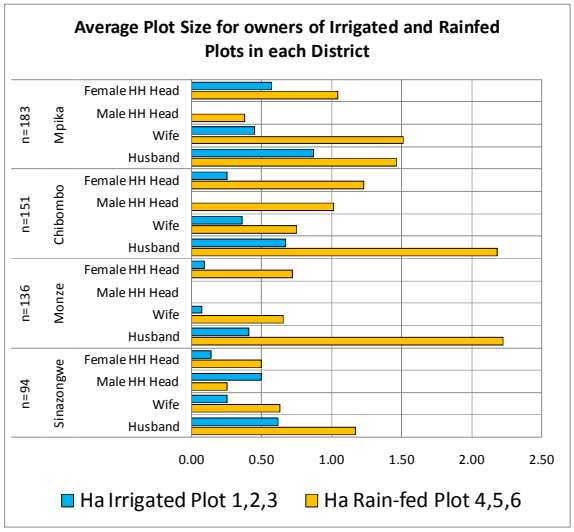


Figure 6.5: Average plot size for owners of irrigated and rainfed plots.

Chibombo has the highest yields from harvests from irrigated plots by all owner categories (except MHHs which have a low frequency (Figure 6.6). In all districts for all owner categories, the yield from harvests sold from irrigated plots is considerably higher than from rainfed plots.

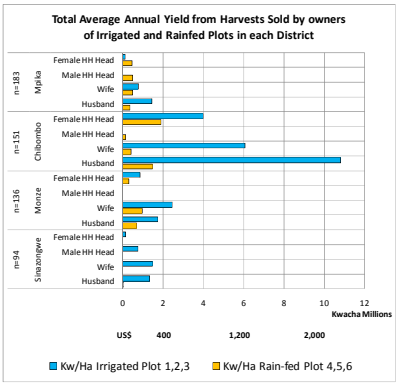


Figure 6.6: Total average annual yields from harvests sold by owners of irrigated and rainfed plots.

There is little difference between the plot sizes of the 3 irrigated plots, which are mostly between 0.1 and 0.3 ha. Irrigated plot sizes are limited because of water availability and type of technology (mostly buckets). Size of rainfed plots differ considerably. Plot 4 is much larger (about 1 ha) than plots 5 and 6 (around 0.5 ha). Plot 4 could be the main staple food crop or the main cash crop, while the other smaller rainfed plots could be vegetables and other crops (Figure 6.7).

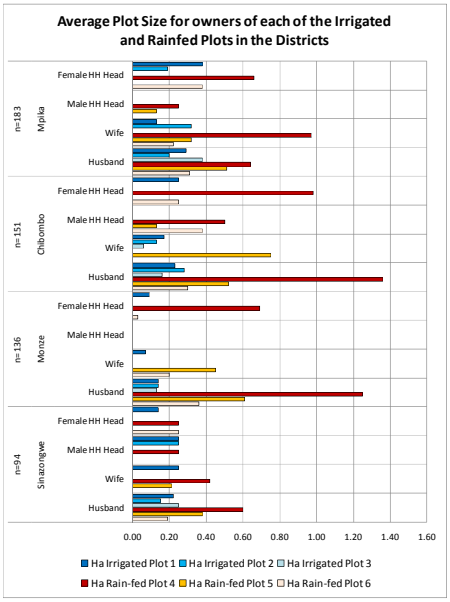


Figure 6.7: Average irrigated and rainfed plot size.

Yields from smaller rainfed plot 6 are usually higher than from the larger rainfed plot 4. It may be that the smaller rainfed plots are used for rainy season vegetables grown for sale (Figure 6.8).

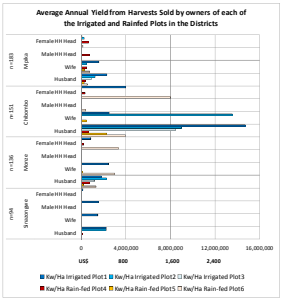


Figure 6.8: Average annual yield from harvests sold by owners of irrigated and rainfed plots.

7. Net Yield from Irrigated and Rainfed Plots

Deducting cost of inputs[7] from harvest sales income gives net income from sales. The net yield is calculated as the net income per hectare. The net yield from all the irrigated plots is greater than zero, while the net yield from rainfed plots is marginally greater than zero or less than zero, in which case sales from rainfed plots are not sufficient to cover costs. One possible explanation is that rainfed plots are mainly used to grow food crops for household consumption, although vegetables for sale are also grown on rainfed plots (Figure 7.1).

[7] Cost of Inputs as defined in the Questionnaire was erroneously recorded as Cost of Seeds in the SPSS files.

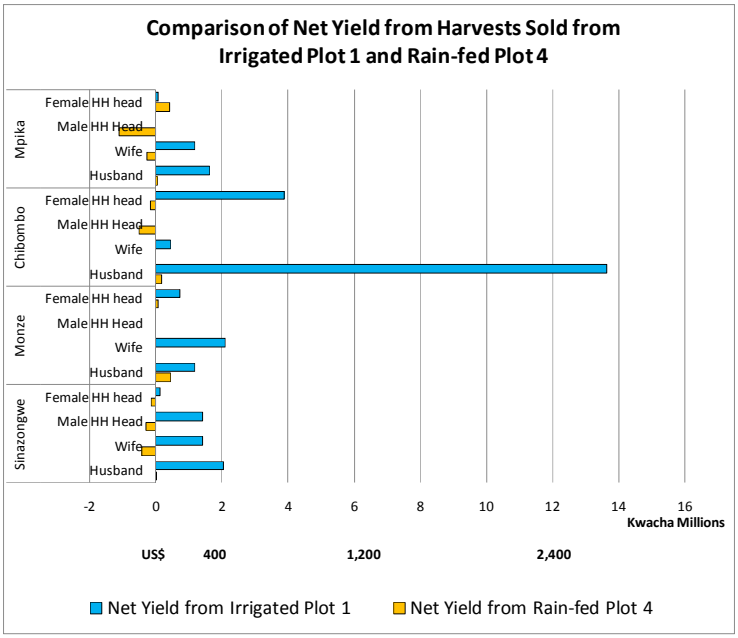


Figure 7.1: Comparison of net yields from harvest sold from irrigated plot 1 and rainfed plot 4.

8. Characteristics of owners of irrigated plots (adopters) only

The relationship between ownership of irrigated plots and control over money from sales of produce of the plots shows the following trends. In most cases the owner decides. In a minority of cases the wife decides (24%) instead of the husband-owner, the husband decides (15%) instead of the wife-owner, or somebody else (7%) decides instead of the female household head owner.

- When female household heads are owners, in 93% of the cases they control the money.
- When wives are owners, in 69% of the cases they control the money.
- When husbands are owners, in 57% of the cases they control the money.

Figure 8.1 shows that more female household heads have control over money than decision making power over consumption or sale of produce (93% as compared to 80%) and the same is the case for wives (69% as compared to 60%). Fewer husbands have control over money than decision making power over sale or consumption (57% as compared to 68%).

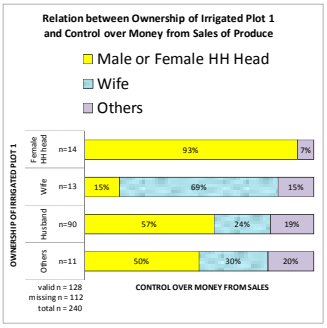


Figure 8.1: Ownership of irrigated plot 1 and control over money from sales for produce.

Nature of land acquisition and encouragement to invest

In Zambia land can be acquired through:

- Customary procedures through the headman/chief or through a relative.
- Modern legal procedures, such as renting (within customary tenure), getting title deeds or getting access through being member of a cooperative.

The nature of land acquisition determines the level of confidence farmers have in investing in land in the long term. Farmers appear to have more confidence in customary than in modern forms of land ownership. As can be seen in Figure 8.2.

- A majority of farmers acquired land through customary procedures, either recently or in the past. The frequency for customary procedures is 126 cases, while the frequency for modern procedures is only 23.
- Approximately 12% of farmers who acquired land through customary procedures are discouraged to invest in the long term (possibly due to land disputes) while almost half (44%) who acquired land through various modern procedures where lacking confidence in long-term investment.

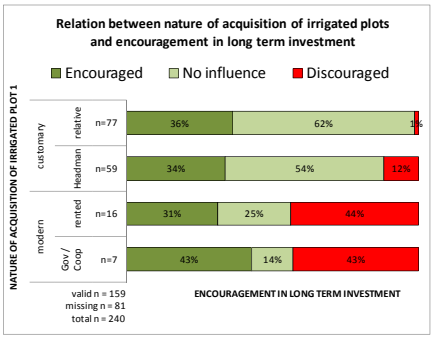


Figure 8.2: Nature of acquisition of irrigated plots and encouragement in long-term investment.

Nature of land acquisition and encouragement to invest and gender of irrigated plot owner

The general confidence of farmers in customary land ownership shows equally among the gender categories of irrigated plot owners: husbands, wives, and female household heads. Only a few owners are discouraged (5% of female household heads and 7% of husbands) (Figure 8.3).

For modern forms of land ownership:

- There were no female household heads in the sample who acquired land through modern procedures.
- There were more wives (67%) than husbands (42%) who were discouraged by modern forms of land ownership.

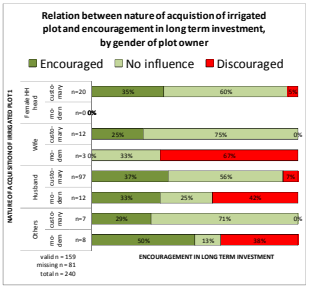


Figure 8.3: Nature of acquisition of irrigated plot and encouragement in long-term investment and gender of plot owner.

9. Comparison of Adopter and Non- and Dis-adopter Plot Owners

Gendered plot ownership and decision making is characterized in terms of decision making over the choice to consume produce or sell it (Figure 9.1). In general, the owner decides; the female household head more than the husband, and the husband more than the wife. Wife-owners have a stronger say in their rainfed plots and wives of husband-owned plots have more say in the irrigated plots. It seems that irrigation strengthens the decision making power of wives.

- When female household heads are owners, in more than 80% of the cases they decide. They may be adopter owners of irrigated or rainfed plots, or non- or dis-adopter owners of rainfed plots. Their control over their rainfed plots is strongest in terms of deciding whether the produce will be consumed or sold.
- When wives are owners, there is always a proportion whose husbands decide, but when they are adopter owners, a higher proportion of wives have decision making power (50-60%) than when they are non- or dis-adopter owners (43%). Wives who are adopter owners of irrigated plots more often have decision making power (60%) than wives who are adopter owners of rainfed plots (50%).
- When husbands are owners, their wives decide in at most 13% of the cases, but their decision making power is much more frequent (70%) than that of wife-owners (40-60%).

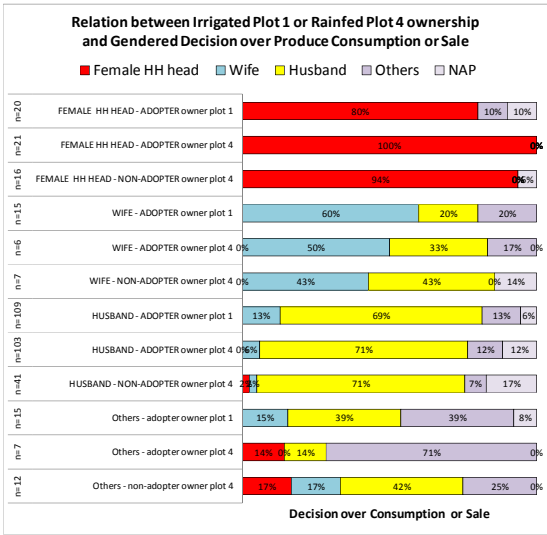


Figure 9.1: Irrigated plot 1 or rainfed plot 4 ownership and gendered decision making over produce consumption or sale

Technology adoption, gendered plot ownership and farm operations

In this section, the most common farm operations are cross-tabulated with AWM technology adoption status of the household[8] and with the gendered ownership of irrigated plot 1 and rainfed plot 4. Table 9.1 shows the data for these analyses.

Table 9.1: Survey data.

Adoption status (Total N=240)	N
Dambos/wetland	11
Canal/river diversion	28
Diesel/petrol pump	13
Bucket/watering can	101
4 other AWM technologies	9
Non-and dis-adopters	78

Owners of Rainfed Plot 4[9]	N
Husband	144
Wife	13
Female HH head	37
Others	19
Not applicable	27
Total N	240

Owners of Irrigated Plot 1	N
Husband	109
Wife	15
Female HH head	30
Others	15
Not applicable	81
Total N	240

[8] Additional Figures in Annex 1.

In Figures 9.2 to 9.11), the Valid n and Total N values are presented for each of the adopter categories or each of the plot owner categories as ratios in the form: Valid n:Total N (n:N).

Example: Hoeing by *dambo*s/wetland adopters has an n ratio occurrence of 10:11 which means that 10 of the 11 adopters do hoeing, while ploughing by *dambo*s/wetland adopters has an n:N ratio of 3:11 which means that only 3 of the 11 adopters do ploughing. The n:N ratio is an indication of the relative importance of a farm operation. The higher the Valid n, the more common the operation. In this example, it would mean that hoeing is much more common than ploughing and that farm mechanisation in the sample households is not common.

A broad analysis (Table 9.2) shows the general patterns of labour provision by gender. For most labour intensive farm operations, labour contributions are equally made by men and women, although sowing is mostly done by women.

- The more strenuous and skilled jobs, like ploughing, and the more technical jobs like disease and pest control are mainly done by men. Supervision of paid labour is mostly done by men.
- At times children provide labour, but only in a few cases. When children provide labour they are mostly helping their mothers in the field.

Table 9.2: Overview of labour provision by gender.

Farm operator category	Provision of labor	
	Male	Female
Land preparation		
Hoeing	+	+
Ploughing	+	
Cultivation		
Sowing		+
Irrigation	+	+
Weeding	+	+
Disease and pest control	+	
Supervising paid labor	+	
Harvesting	+	+

The following questions framed the interpretation of Figures 9.2 to 9.11:

- What is the most characteristic labour profile?
- In the n:N ratio: how important is the operation, i.e. what is the relative number of respondents who perform that operation?
- Is there any difference between adopters and non- and dis-adopters? Is there any difference between technologies?
- Is there any difference between irrigated plot 1 and rainfed plot 4?
- Is there any difference between the gendered plot owners of irrigated plot 1?
- Is there any difference between the gendered plot owners of rainfed plot 4?

Hoeing (Figure 9.2.1 and 9.2.2)

- Labour for hoeing is mainly shared between men and women, but with a slight bias towards women.
- n:N ratio: The majority of respondents are involved in hoeing their fields; a common practice.
- There is no difference between adopters and non- and dis-adopters or between technologies and between the irrigated and rainfed plots.
- There is a difference between the gendered owners of irrigated plot 1. A female household head said she gets relatively more assistance from men.
- There is no difference between the gendered owners of rainfed plot 4.

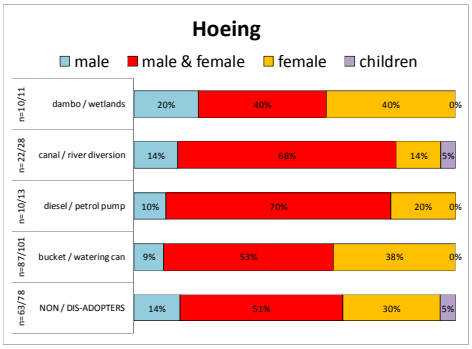


Figure 9.2.1: Hoeing (water source/AWM technology).

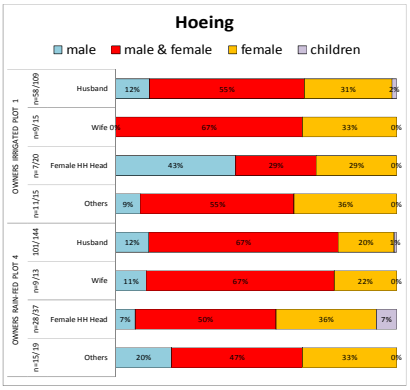


Figure 9.2.2: Hoeing (gender).

Ploughing (Figure 9.3.1 and 9.3.2)

- Labour for ploughing is mainly provided by men and to a lesser degree by both men and women together. Ploughing is hardly ever done by women only (3 cases).
- n:N ratio: The minority of respondents are involved in ploughing, but ploughing is much more common in rainfed fields than in irrigated fields as irrigated fields are often small enough to be worked by hoe.
- Among non- and dis-adopters, ploughing is done mainly by men, while among adopters there is more variation, but n:N values are low. There is a strong similarity in the labour pattern of bucket watering among adopters and the non- and dis-adopters, possibly indicating that the users of the most common AWM technology work in the same way on their irrigated fields as on their rainfed fields. Bucket users do not need any specific irrigation skills or large investments. The pattern is similar for other farm operations below (sowing, disease and pest control, supervising paid labour and harvesting).
- On his plot, the husband gets help from women in 40% of the cases, while on the wife's plot all the ploughing is done by men.

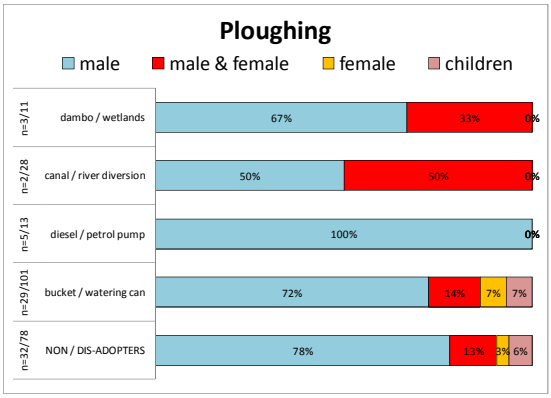


Figure 9.3.1: Ploughing (water source/AWM technology).

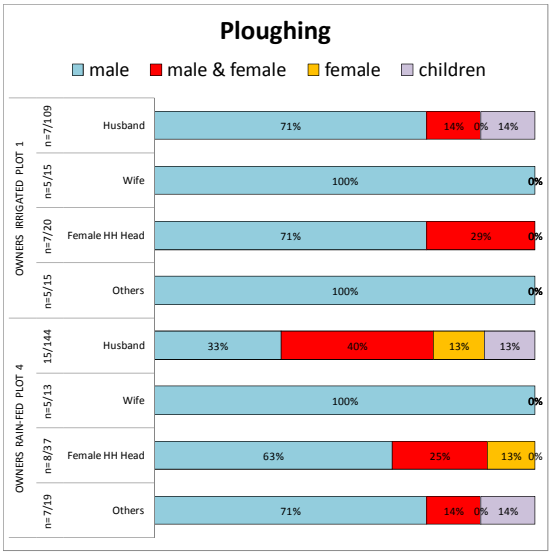


Figure 9.3.2: Ploughing (gender).

Irrigation (Figure 9.4.1 and 9.4.2)

- Labour for irrigation is mainly provided by men and women together. For motor pump adopters, labour is mostly provided by men as most pumps are owned by men.
- n:N ratio: The majority of AWM technology adopters provide labour for irrigation. The low occurrence of irrigation (3 of the 11 *dambo*s adopters) shows that crops benefit from the natural water table, without further water conservation or drainage measures.
- When irrigation is done by motor pumps, this task is exclusively done by men (who usually own the pump).
- On irrigated plots owned by wives, most of the irrigation is jointly done by men and women and the wives are often assisted by children.
- Among the owners of rainfed plots, female household heads are often assisted by children on their irrigated plots.

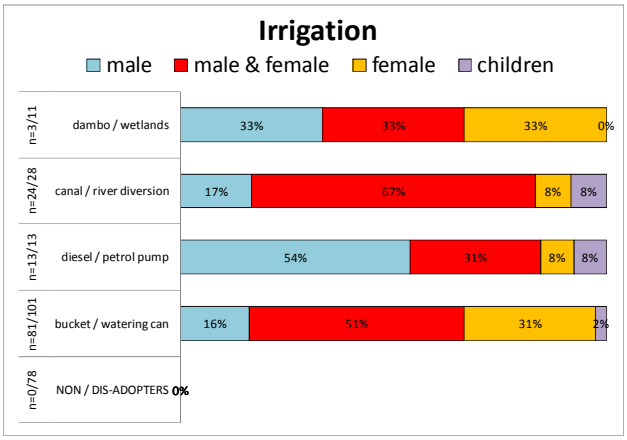


Figure 9.4.1: Irrigation (water source/AWM technology).

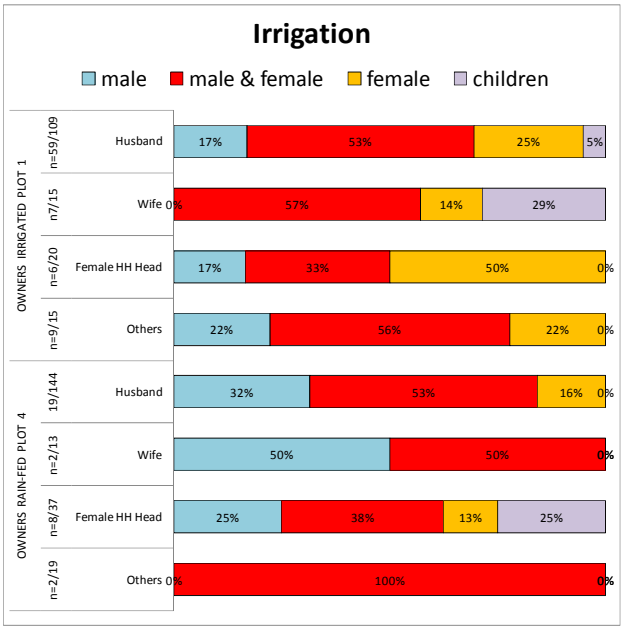


Figure 9.4.2: Irrigation (gender).

Sowing (Figure 9.5.1 and 9.5.2)

- Labour for sowing is mainly provided by women and secondly by women and men together.
- n:N ratio: The majority of the respondents do sowing, but only 8 of 20 female household heads do sowing on their irrigated plots. This may be due to the use of particular vegetables such as sweet potato leaves whereby only cuttings are planted.
- Adopters and non- and dis-adopters: There is a strong similarity in the labour pattern of buckets and watering can adopters and the non- and dis-adopters.
- Sowing on plots of motor pump adopters is mainly done by men.
- Female household heads do most of the sowing on their irrigated and rainfed plots, seldom assisted by men (either jointly or separately).

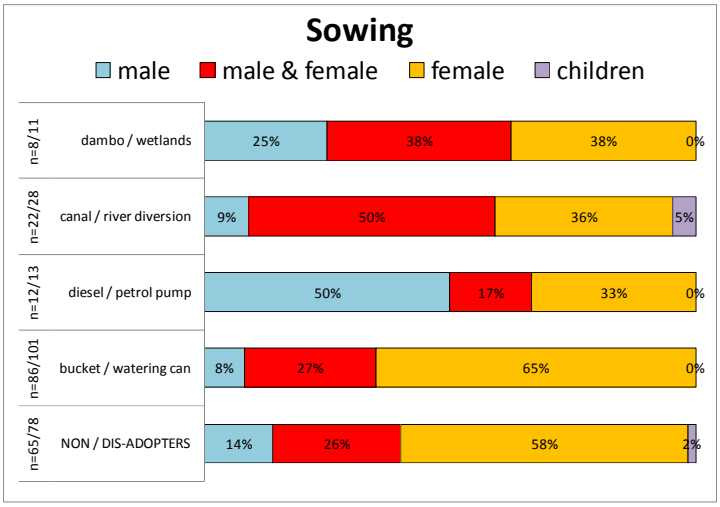


Figure 9.5.1: Sowing (water source/AWM technology).

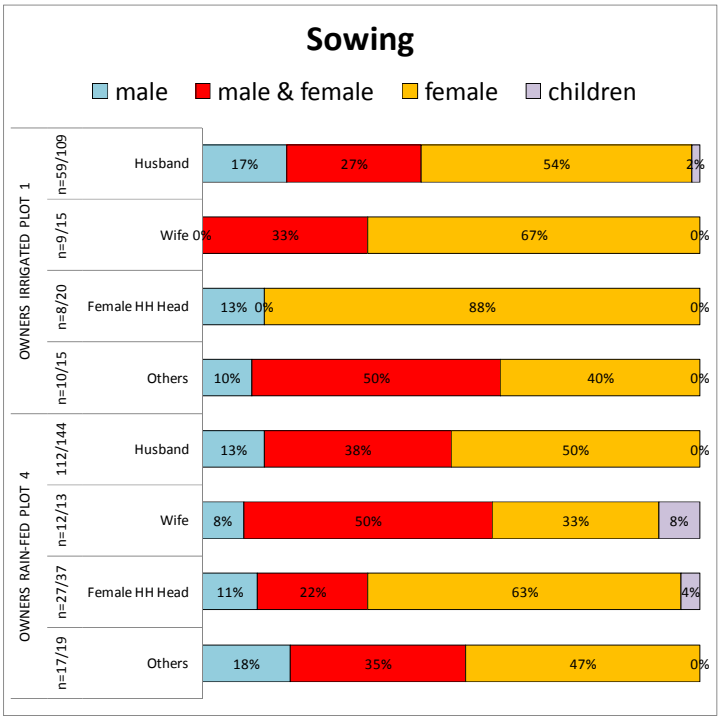


Figure 9.5.2: Sowing (gender).

Weeding (Figure 9.6.1 and 9.6.2)

- Labour for weeding is mainly provided as a joint venture between men and women.
- n:N ratio: Weeding is a common practice both among adopters and non- and dis-adopters.
- Where only a few men do the weeding themselves in rainfed plots, this proportion increases for irrigated fields. Weeding on fields irrigated by pumps is a quarter of the time done by men only. There are no clear differences between owners of irrigated plots and owners of rainfed plots.

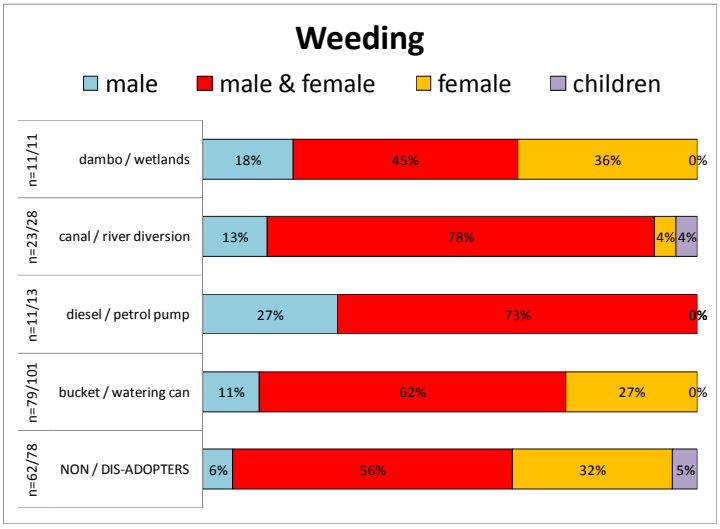


Figure 9.6.1: Weeding (water source/AWM technology).

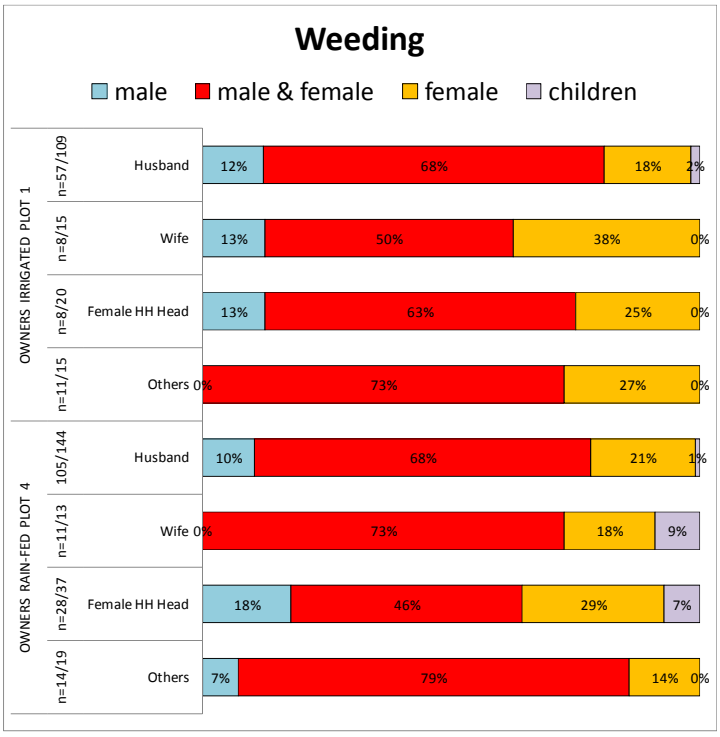


Figure 9.6.2: Weeding (gender).

Disease and pest control (Figure 9.7.1 and 9.7.2)

- Labour for disease and pest control is mainly provided by men, except for wife-owned rainfed plots where it is done as a joint venture or by the wife alone (the latter case has a low frequency).
- n:N ratio: A small number of respondents do disease and pest control. It is not a common practice.
- Adopters and non- and dis-adopters: Among non- and dis-adopters there is more division of labour. In about half the cases it is done by men only and half jointly with women or by women only.
- For adopters of buckets and watering cans, the situation is similar to non- and dis-adopters as regards sharing responsibilities with women. For the other more specialised technologies the men do most of the disease and pest control.

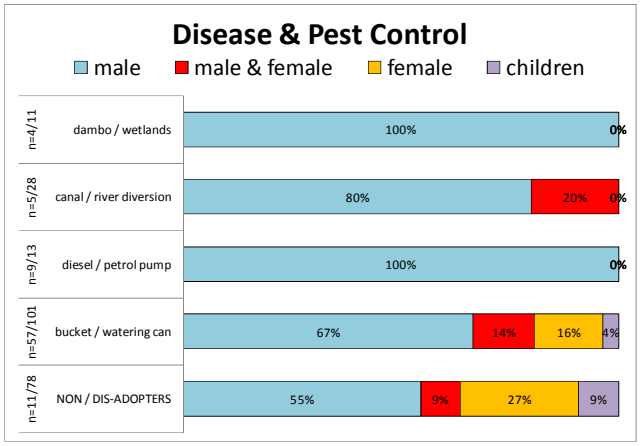


Figure 9.7.1: Disease and pest control (water source/AWM technology).

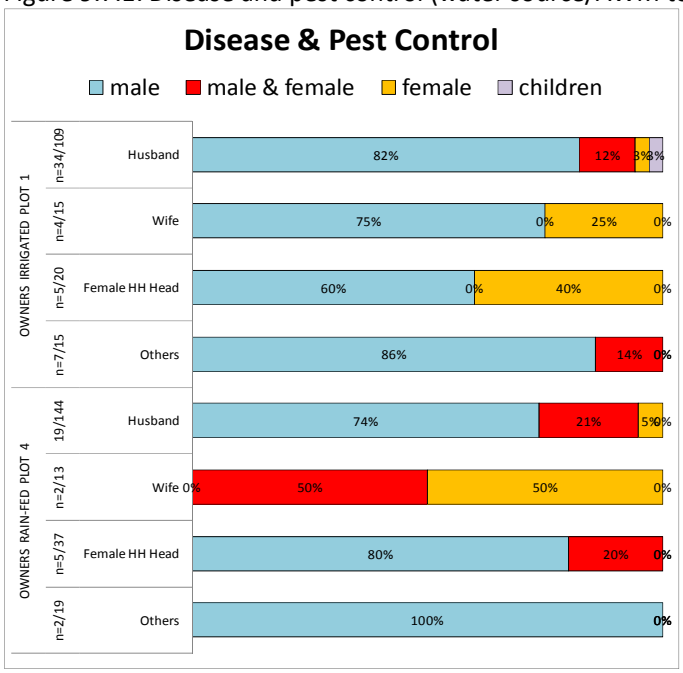


Figure 9.7.2: Disease and pest control (gender).

Supervising paid labour (Figure 9.8.1 and 9.8.2)

- Supervision of paid labour is mainly done by men, but among non- and dis-adopters and among owners of rainfed plots it is done by women in up to 40% of the cases, or responsibilities are shared. Although numbers are small, it seems that men take more responsibility for labour supervision on irrigated fields.
- n:N ratio: Supervision of paid labour is done by only a few of the respondents. There is not much paid labour on small farms.

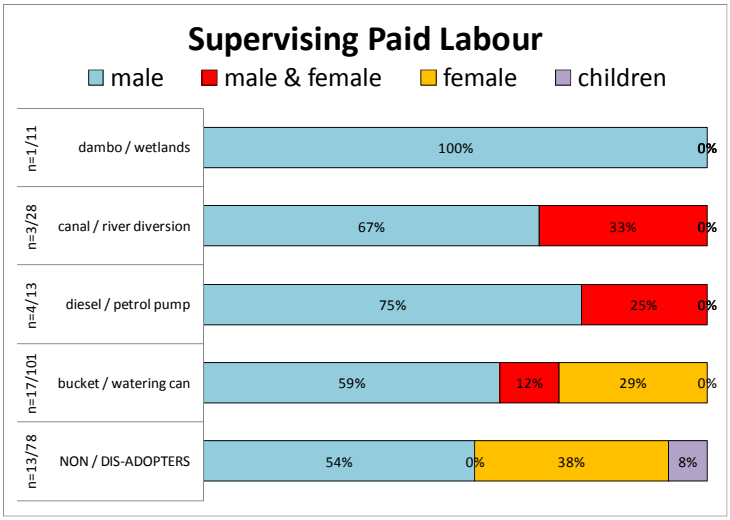


Figure 9.8.1: Supervising paid labour.

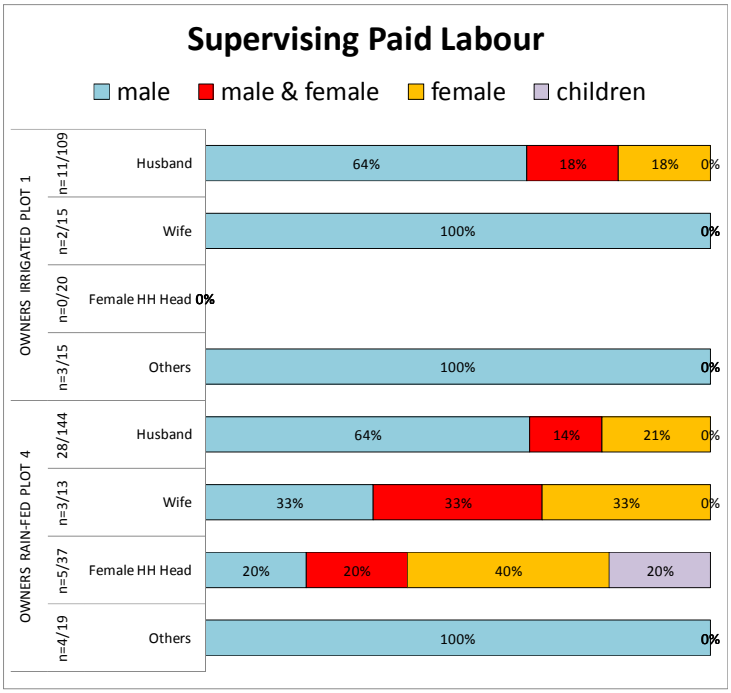


Figure 9.8.2: Supervising paid labour.

Harvesting (Figure 9.9.1, 9.9.2)

- Labour for harvesting is mainly a joint venture between men and women. If harvesting is done by men and women on their own, it is more often done by women than by men.
- There are no major differences in labour patterns between adopters and non- and dis-adopters, between technologies and between owners of irrigated and rainfed plots.

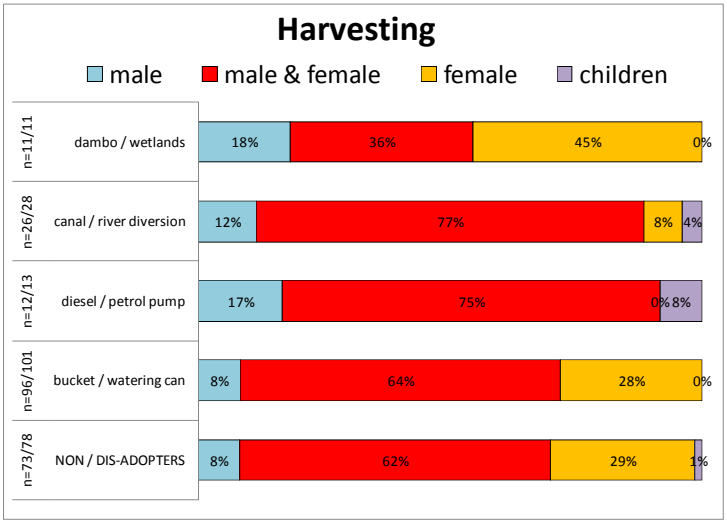


Figure 9.9.1: Harvesting (water source/AWM technology).

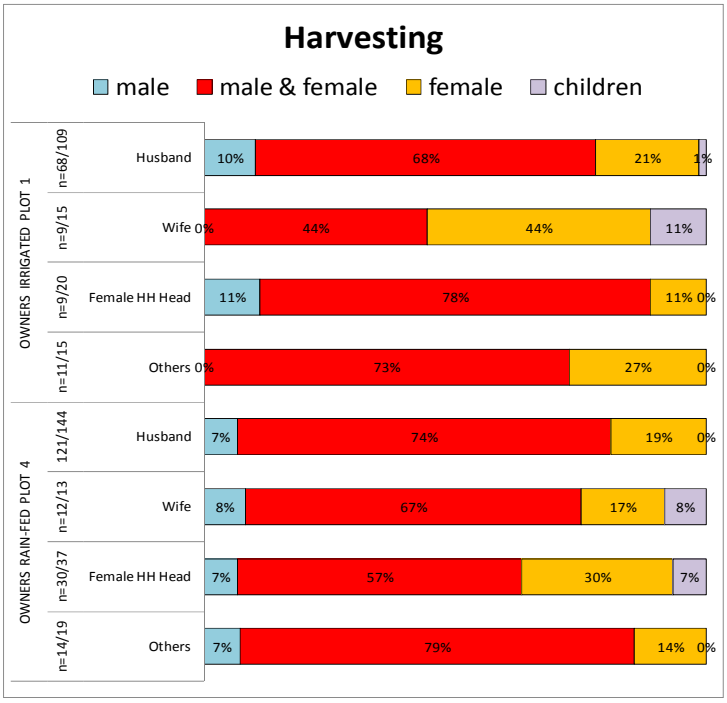


Figure 9.9.2: Havesting (gender).

Plot size in relation to adoption status

Irrigated fields are 3 to 4 times smaller than rainfed plots (Figure 9.10). The rainfed plots of adopters are larger than the rainfed plots of non- and dis-adopters. The average plot size of an adopter is 1.47 ha (0.3 ha irrigated plus 1.17 ha rainfed) and 0.87 ha for a non- and dis-adopter.

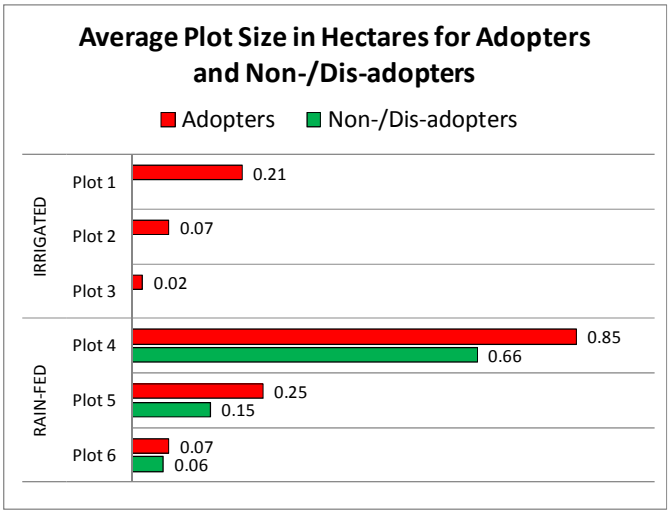


Figure 9.10: Average plot size in ha for adopters and non- and dis-adopters.

Gross yield from sales in relation to adoption status

The money earned from irrigated plots is much higher than from rainfed plots. Small-scale farmers grow mainly cash crops (mostly vegetables) on irrigated fields and food crops as well as cash crops (vegetables and crops like cotton and sunflower) on rainfed fields. The yields of adopters on rainfed plots are generally higher than the yields of non- and dis-adopters on rainfed plots, except for plot 4 (Figure 9.11 and Table 9.2).

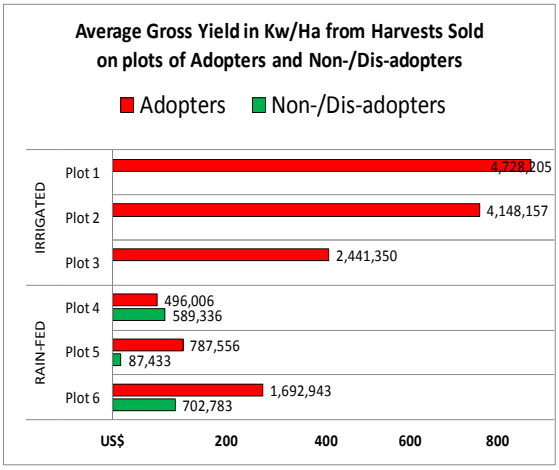


Figure 9.11: Average gross yield in kw/ha from harvests sold on plots of adopters and non- and dis-adopters.

Table 9.3: Gross yields from sales from irrigated and rainfed plots.

			Gross yield from harvest sold in Kwacha/Hectare						
			Irrigated Plots			Rainfed Plots			Ranked
			1	2	3	4	5	6	Total
Irrigated only	1	Cabbage		4,325,000	1,140,000	-	-	-	5,465,000
	2	Onion	875,000	576,923	851,863	-	-	-	2,303,786
	3	Green maize	300,369	694,444	328,947	-	-		1,323,761
	4	Sugar cane		230,769		-	-	-	230,769
		Others	5,977,273	-	-	-	-	-	5,977,273
Rainfed only	1	Rainfed maize	-	-	-	512,796	1,493,478		2,006,274
	2	Cotton	-	-		-	223,750	1,451,613	1,675.363
	3	Millet	-	-	-	-	156,410	204,211	360,621
	4	Sunflower	-	-	-	-	62,500	119,355	181,855
	5	Cassava	-	-	-		41,128	138,889	180,017
Both irrigated and rainfed	1	Tomatoes	8,239,768	9,440,226		2,693,966	2,211,538	9,097,221	31,682,720
	2	Okra	3,969,644	7,056,000	486,842	-	1,644,899	8,000,000	21,157,384
	3	Sweet potatoes	5,000,000	10,000,000	-	-	122,530	1,938.922	17,061,452
	4	Mixed beans	10,000,000	644,372		-	1,141,813	1,459,597	13,246,147
	5	Leafy vegetables	2,372,780	2,967,612	-	-	-	2,650,000	7,990,392
	6	Groundnuts	-	633,333		372,414	83,065	124,545	1,213,358

10. Financing issues for irrigated and rainfed plots

Inputs for men's irrigated and rainfed plots are almost exclusively financed by men. The inputs for women's irrigated and rainfed plots are shared between husband and wife, or financed by the female household head. The husband is still the largest financier on all these women's plots (Figure 10.1 and 10.2).

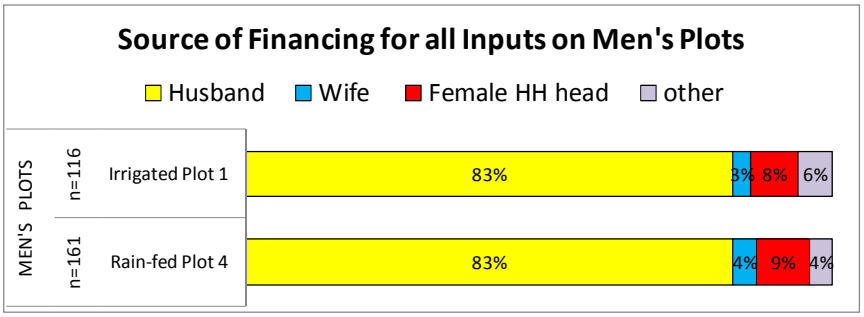


Figure 10.1: Men's plots: source of financing for all inputs.

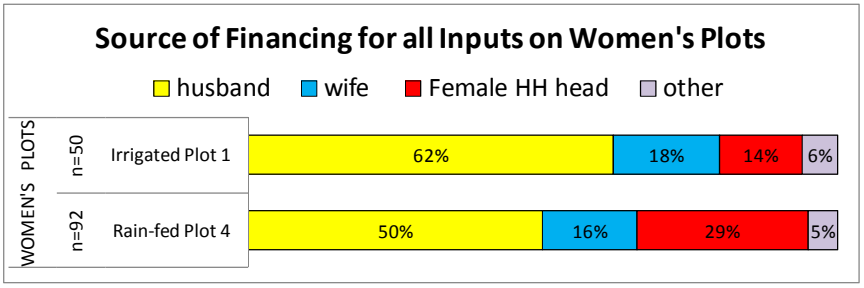


Figure 10.2: Women's plots: source of financing on all inputs.

The majority of irrigated and rainfed plot owners said they encountered problems with financing inputs for their plots. Wife-owners and female household head owners had fewer problems in their rainfed plots than in their irrigated plots. This could be due to more expensive inputs for irrigation (Figure 10.3).

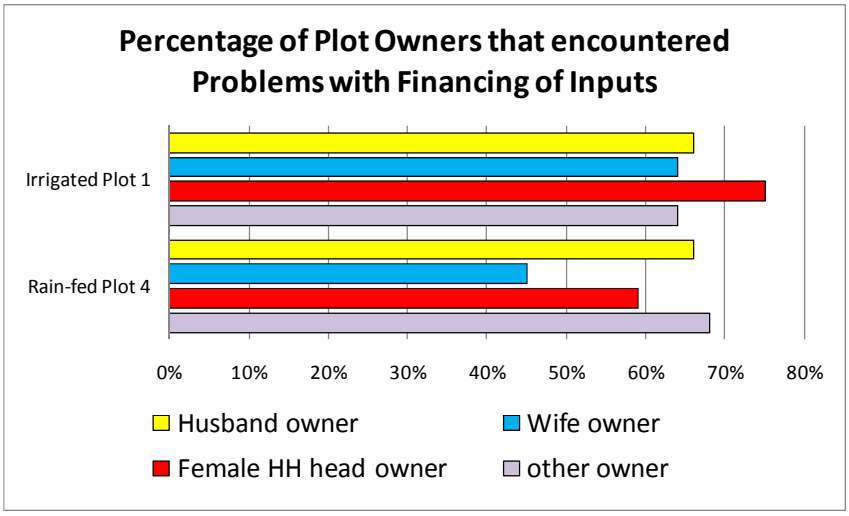
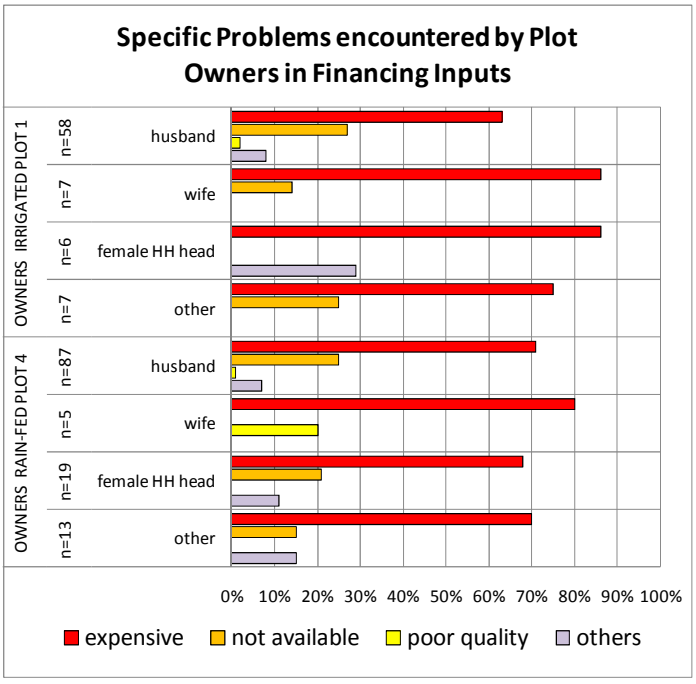


Figure 10.3: Percentage of plot owners encountering problems with financing inputs.

By far the most common problem (more than 60% of all respondents), is the cost of inputs. Few see availability and quality as a problem. There is no clear difference between irrigated and rainfed plots in terms of financing problem (Figure 10.4).



igure 10.4: Specific problems encountered by plot owners in financing inputs.

11. Marketing issues with irrigated and rainfed plots

In Chibombo, marketing crops grown on irrigated plots is more often seen as a problem than in other districts, despite the fact that the survey area in Chibombo District (Katuba) is only 20 km from Lusaka. The problem may be the cumbersome and highly competitive procedures at the main wholesale market in Lusaka, the Soweto Market (Figure 11.1 and 11.2).

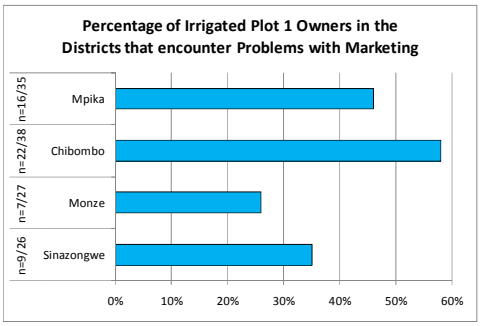


Figure 11.1: Irrigated plot 1 owners: percentage of encountering marketing problems.

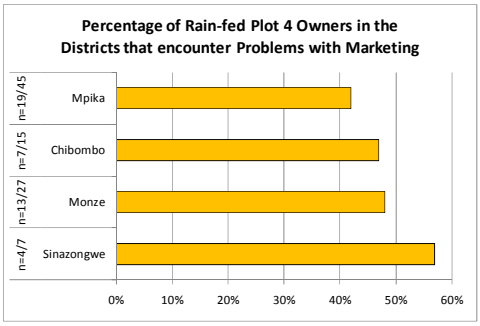


Figure 11.2: Rainfed plot 4 owner: percentage of encountering marketing problems.

Marketing is less often a problem than financing inputs (Figure 11.3. and 11.4), but still between 25% and 50% of plot owners see it as a problem. Owners of rainfed plots see it as a problem more often than owners of irrigated plots, possibly because of the channels for rainfed crops are less established and possibly more centralised than for irrigated crops. Wives and female household heads have fewer marketing problems on their irrigated plots than husbands do on their irrigated plots.

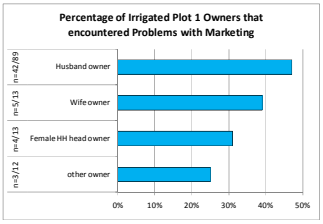


Figure 11.3: Irrigated plot 1 owners: percentage of encountering marketing problem.

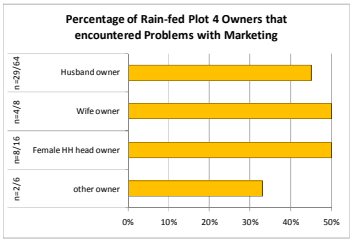


Figure 11.4: Rainfed plot 4 owners: percentage of encountering marketing problems.

The most common problems experienced by plot owners are the low prices for produce and high transport costs (Figure 11.5). The exception is Sinazongwe (the public irrigation scheme) where the main marketing problems mentioned by owners of irrigated plots are flooded markets and too many middle-men. Although too many middle-men are seen as a problem, competition between them could possibly favor the farmer. For example, *"crooked briefcase business men"* or fake buyers who buy on credit but never return to pay. Sinazongwe is in a remote rural area, with low population densities as compared to the other districts which are close to main roads.

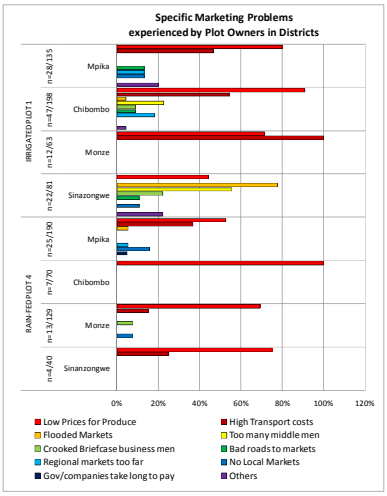


Figure 11.5: Marketing problems experience by plot owners.

Wives and female household heads who are owners of irrigated plots have specific marketing problems, among these low prices and high transport costs, which are more common for them than for the other type of owners (Figure 11.6).

- 40% of wife-owners see flooded markets and too many middle-men as problems, while 50% of female household head owners see crooked briefcase business men, bad roads and distance to markets as specific problems. The general impression is that women mention more and different problems in marketing than men. For owners of rainfed plots, the main problem is low prices for produce.

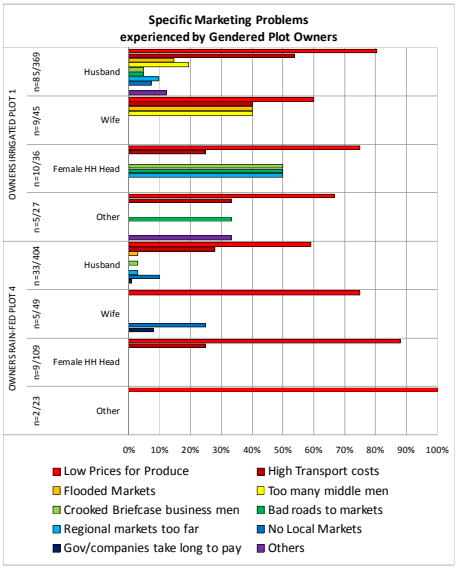


Figure 11.6: Specific marketing problems experienced by gendered plot owners.

12. Changes in the households due to AWM technology adoption

This section compares the situation in adopter households before and after adoption. Observations on food security in adopter households (Figure 12.1) include:

- 20% of households said that buckets and *dambos*/wetlands had not improved their food security, while this was less than 10% for adopters of other technologies.
- Food security increased in the majority of households (60% to 90% of households).
- The most important technologies contributing to food security are:
    - Motor pumps: 92% of households.
    - Conservation agriculture and communal canals: 75% of households.
    - *Dambos*, wetlands and buckets: 64% to 67% of households.

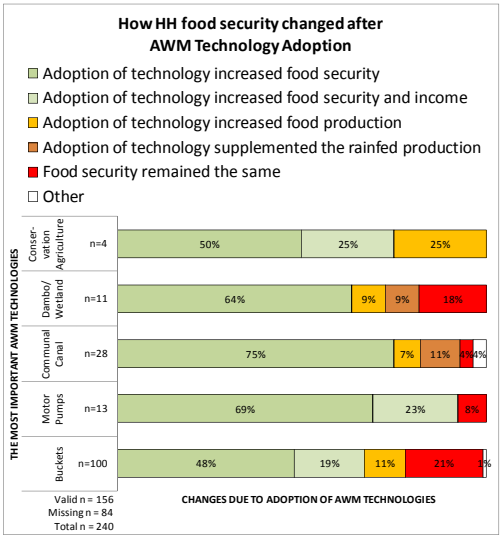


Figure 12.1: How household food security changed after AWM technology adoption.

Change in household income after adoption of specific AWM technologies (Figure 12.2 and 12.3)

- 19% of households said that buckets had not improved their household income, while this was less than 10% for the other technologies.
- Income changed in 80% to 95% of the adopter households.

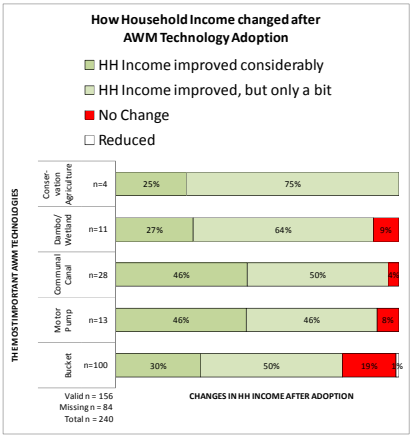


Figure 12.2: How household income changed after AWM technology adoption.

Change in food security and income in adopter FHHs and MHHs (Figure 12.4 and 12.5)

- In 25% of the adopter FHHs, food security did not change while this was only 14% in MHHs.
- In 19% of the adopter FHHs, income from sales did not change while this was only 13% in MHHs.

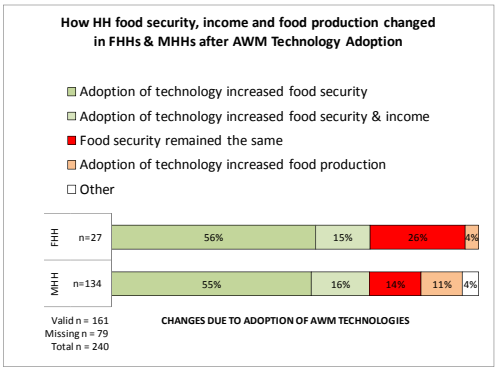


Figure 12.3: How household food security, income and food production changed in FHHs and MHHs after AWM technology adoption.

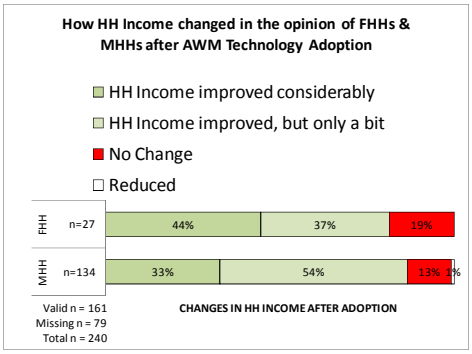


Figure 12.4: How household income changed in the opinion of FHHs and MHHs after AWM technology adoption.

Observations on Food Security and Income from sales in adopter households (Figure 12.5 and 12.6)

- Less than 20% of the households said that food security had not changed after adoption; food security and food production changed in about 80% of the households in the 4 districts.
- 80 to 90% of the adopter households consider that income from sales has considerably improved or improved a little.

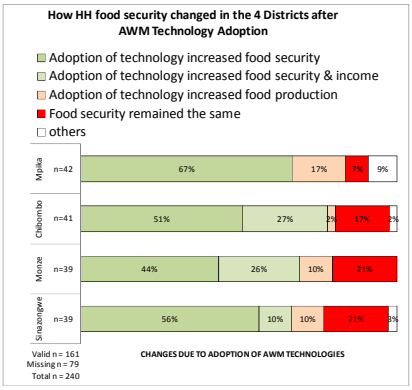


Figure 12.5: Changes due to adoption: How household food security changed in 4 districts after AWM technology adoption.

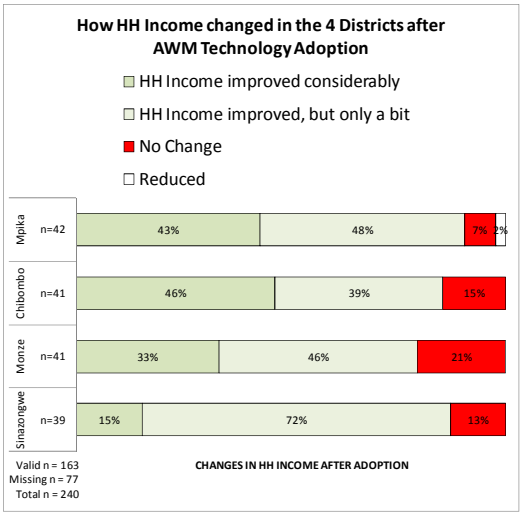


Figure 12.6: Changes in household income: How household income changed after AWM technology adoption.

13. Changes after AWM technology adoption in the households of married adopters

Change in collaboration between spouses after AWM adoption (Figure 13.1)

- Only in Mpika was there a change in collaboration between spouses in 53% of the households.
- In other districts there was hardly a change in collaboration (only 3% to 13% of the households).

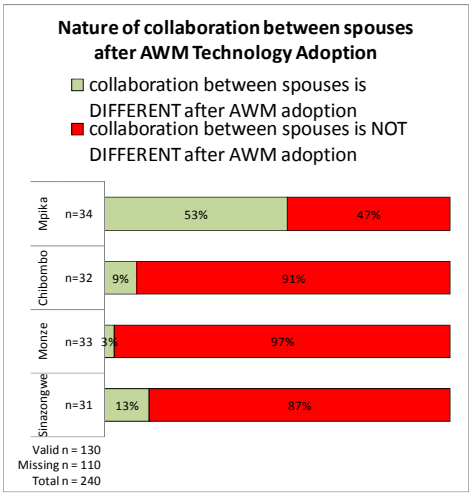


Figure 13.1: Collaboration between spouses after AWM technology adoption.

Change in decision making on outputs and income between spouses after AWM adoption (Figure 13.2)

- Only in Mpika was there a considerable change in decision making (42% of households).
- In other districts there was hardly any change in decision making (6% to13%).

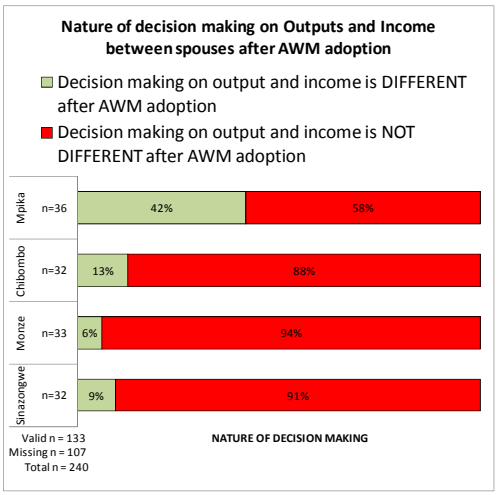


Figure 13.2: Decision making on outputs and income between spouses after AWM technology adoption.

14. Changes related to years after adoption

The majority of respondents said there has been an increase in food security since adoption of an AWM technology. The minority said there has been an increase in household income and about half said there has been only a slight change in income. Increased food security is seen as an impact of AWM technology adoption rather than household income.[9] There is no clear difference in impact between younger and older adopters (Figure 14.1 and 14.2).

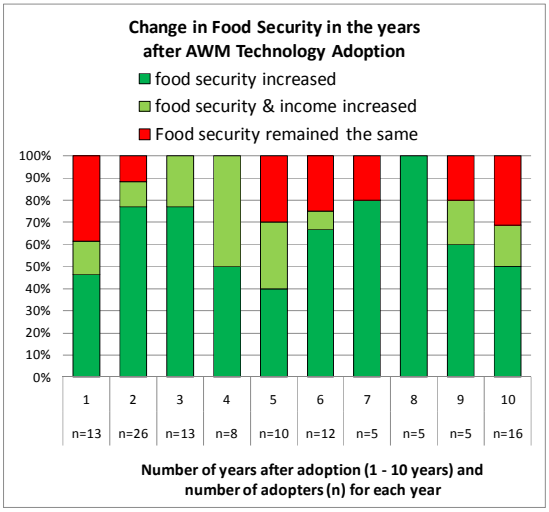


Figure 14.1: Change in food security in the years after AWM technology adoption.

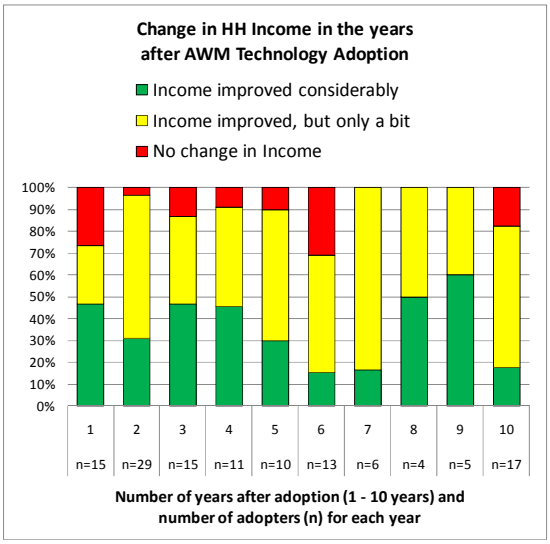


Figure 14.2: Change in household income in the years after AWM technology adoption.

[9] The figures present information for adopters of 10 years ago; information for older adopters was collected but frequencies were too low for a meaningful analysis.

15. Obstacles for future irrigation expansion

Problems in getting suitable land for irrigation for future expansion (Figure 15.1 and 15.2)

- On average, 79% of FHHs said that land acquisition is no problem or if it is it can be resolved, while this percentage is 76% for MHHs.
- There are a major difference between districts in terms of land acquisition. In Mpika and Chibombo, there is no problem, or resolvable problems, in 90% to 100% of the households, while these percentages are 65% to 75% in Monze and 50% in Sinazongwe.
- FHHs in Monze have more problems (38%) in land acquisition than MHHs (25%), while in Chibombo and Mpika, FHHs have fewer problems (0%) than MHHs (5% to 11%).
- In Sinazongwe, the same number of FHHs and MHHs (50%) have problems getting suitable land for irrigation.

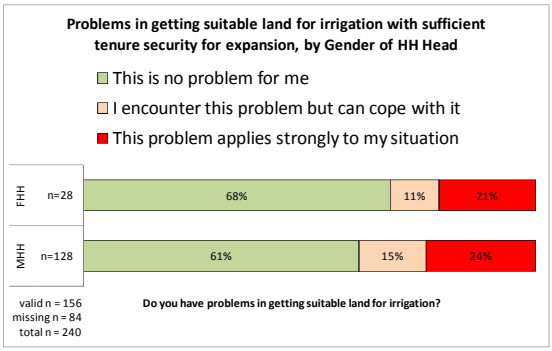


Figure 15.1: Problems in getting suitable land for irritation with sufficient tenure for expansion by gender of household head.

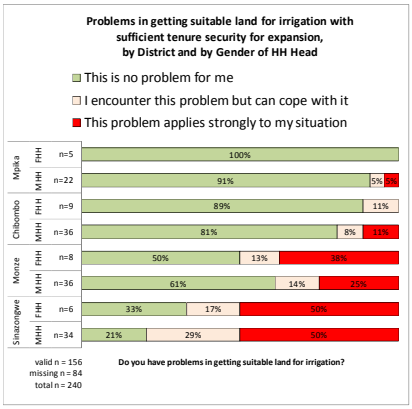


Figure 15.2: Problems in getting suitable land for irrigation with sufficient tenure security for expansion by district and gender of household head.

Availability of inputs for expansion of irrigation (Figure 15.3 and 15.4)

- The majority of households consider availability of inputs a problem for future expansion of irrigation; more FHHs see it as a problem (74%) than MHHs (58%).
- There are major differences between the districts. In Chibombo, 50% of households see inputs as a problem, but in Mpika and Sinazongwe inputs are seen as a problem by 60% to 80% of the households. In Monze the figure is between 60% (MHHs) and 100% (FHHs).

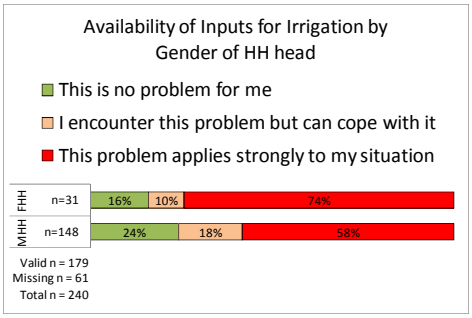


Figure 15.3: Availability of inputs for irrigation by gender of household head.

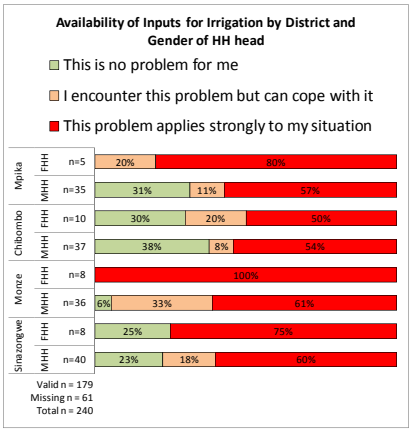


Figure 15.4: Availability of inputs for irritation by district and gender of household head.

ANNEX 1: Additional Figures on AWM Technology and Farm Operations

Note: These are in addition to the Figures in section 9.

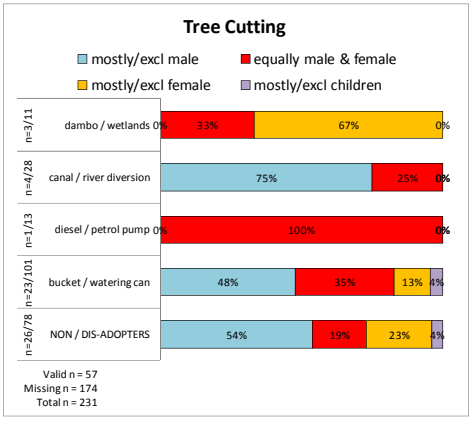


Figure A.1: Tree cutting.

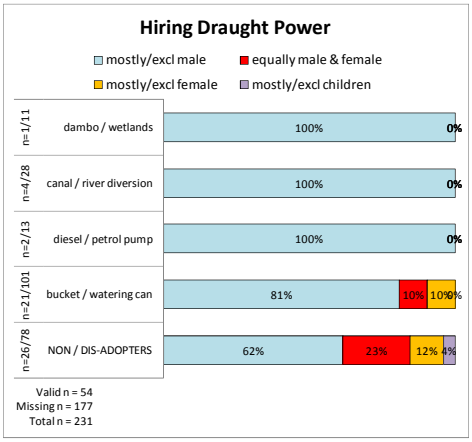


Figure A.2: Hiring draught power.

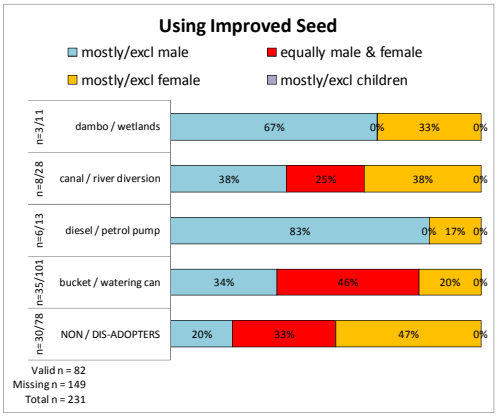


Figure A.3: Using improved seeds.

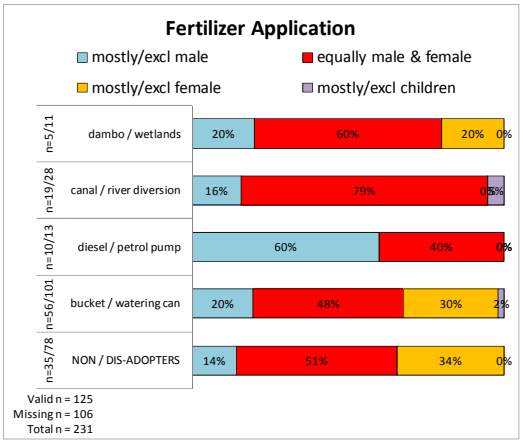


Figure A.4: Fertilizer application.

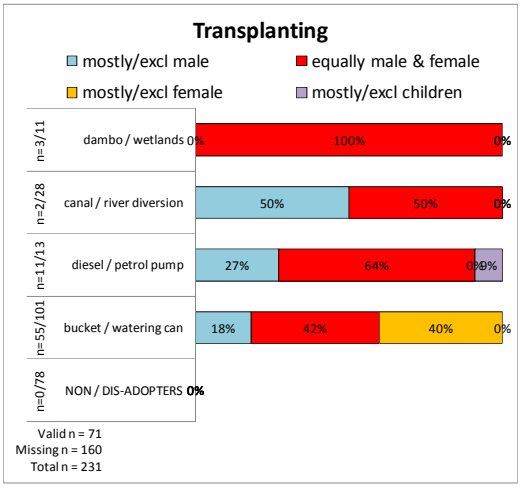


Figure A.5: Transplanting.

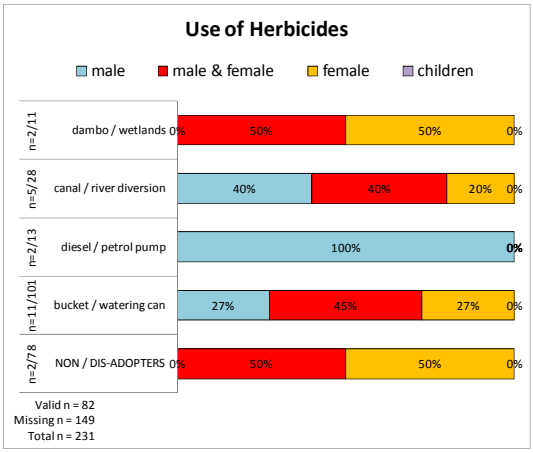


Figure A.6: Use of herbicides.

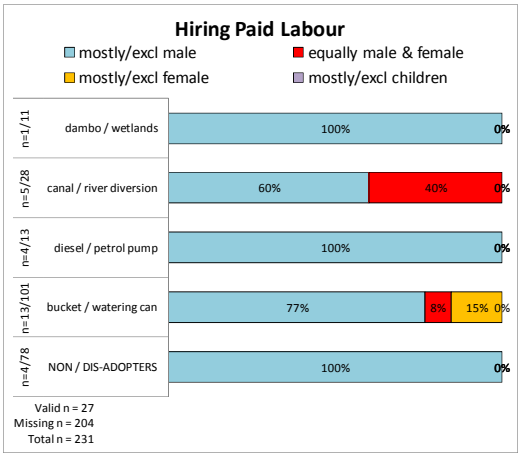


Figure A.7: Hiring paid labour.

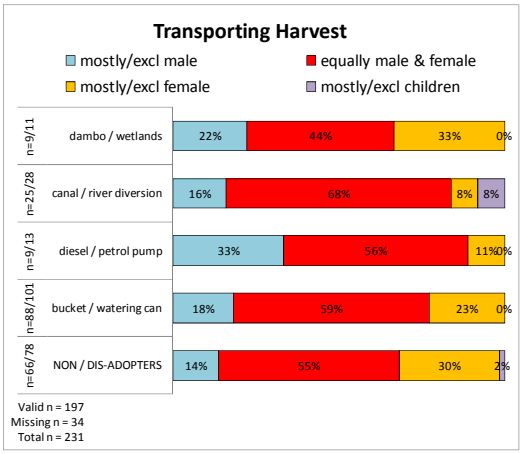


Figure A.8: Transporting harvest.