CHAPTER ONE: INTRODUCTION

1.1 Introduction

Globally rice is one of the most important food crops used to fight against hunger. The total annual world production of milled rice currently stands at 400 million metric tons which compares favorably well with maize and wheat. The area under rice is forecasted to rise by 1.5% (from 153 million hectares to 158.6 million hectares) and yields by close to 1%. In addition, unlike maize and wheat that are consumed as human and livestock feeds, rice remains the most favoured grain globally for human consumption (Ito, 2002).

Development of rice therefore presents an opportunity to reduce the number of gravely food insecure people that stands at 816 million by half by 2015 according to the World Food Summit 1996 - Millennium Development Goals (MDG).

1.2 Generalities on the country of Tanzania

Tanzania is located in Eastern Africa between longitude 29^0 and 41^0 East, Latitude 1^0 and 12^0 South. It covers a total land area of 94.5 million hectares out of which 44 million hectares are suitable for agriculture. However it is estimated that only 10.1 million hectares or 23% of arable land is under cultivation. The population is estimated to be 40 million people with 45% of the population under 15 years of age. The annual population growth rate is 2.8% (URT, 2010).

The existing potentials for rice production in Tanzania include: rain fed lowland, upland rice and irrigated ecosystems ranging from small, medium and large scale producers with comparative advantage of rice production over other food crops for income generation as well as for household food security. There is availability of land (21million Ha) suitable for rice production and abundant water for irrigation

1.2.1 **Physical and Geographical Characteristics**

1.2.2 **Geographical Features**

Tanzania has a landscape of mainly three physiographic regions namely the Islands and the coastal plains to the east; the inland plateau; and the highlands.

The country has also a great rift valley running from the north east of Africa through central Tanzania. The rift valley runs to the south of Tanzania and it is dotted with lakes

which include lake Rukwa, Tanganyika, Nyasa, Kitangiri, Eyasi and Manyara. The uplands include the famous Kipengere, Udzungwa, Matogoro, Livingstone, and the Fipa plateau forming the southern highlands. The Usambara, Pare, Meru, Kilimanjaro, the Ngorongoro Crater and the Oldonyo Lengai, all form the northern highlands. From these highlands and the central saucer plateau flow the drainage system to the Indian Ocean, Atlantic Ocean, Mediterranean Sea and the inland drainage system.

1.2.3Climate

Tanzania enjoys a tropical type of climate. In the highlands, temperatures range between 10^0c and 20^0c.during cold and hot seasons respectively. The rest of the country has temperatures not below 20^0c. The hottest period spreads between November and February (25^0c - 31^0c) while the coldest period occurs between May and August (15^0c - 20^0c).

Two types of rainfall exist in Tanzania. One is unimodal (December - April) being experienced in southern, south-west, central and western parts of the country and the other is bimodal type of rainfall (October -December and March – May which is found to the rest of the country including the north and northern coast.
In the bimodal regime the March - May rains are referred to as the long rains (Masika) whereas the October - December rains are generally known as short rains (Vuli)

1.3 Macro-economic environment

1.3.1 Agricultural production with focus on rice

In 2008, the agricultural sector accounted for 25.7% of the Gross Domestic Product (URT, 2010), and 22% of foreign exchange earnings . It provides 95% of national food requirements and more than 70% of the population in Tanzania (URT, 2009).

Rice is one of the widely grown crops and the second most important food crop in terms of number of households, area planted and production. Other main food crops are maize, sorghum, millets, wheat and legumes. From the experienced food crisis at global and national levels, the

government of Tanzania has accorded high priority in rice production as one of the ways of meeting country's food security and economic growth in rural and urban areas.

Production and consumption of milled rice in Tanzania increased on area cultivated from 490,000 hectares in 1998 to 665,000 hectares in 2007 whereby production of rice increased from 530,000 tones (equivalent to 803,030 tones of paddy) to 818,000 tones (equivalent to 1,258,462 tones of paddy) (URT, 2009). This represents an increase of 36% and 54% of area and production respectively.

Agricultural Sector registered improved performance on food security in 2010 whereby Food Self Sufficiency Ratio (SSR) increased from 102% in 2009 to 105 % in 2010. Rice being one of the food crops contributed to the increased SSR.

1.4 Objectives of Rice Data collection

1.4.1 General Objective

The general objective is to generate better quality rice data in the country to support the implementation and monitoring of National Rice Development Strategy (NRDS)

1.4.2 Specific Objective s

1 To identify all rice varieties in the country used for rice production

2 To identify rice production ecologies used in rice production

3 To asses yields based on varieties and ecologies

4 To evaluate how rice varieties contribute to the country's Food Self Sufficiency

4 To asses rice production

CHAPTER TWO: METHODOLOGY USED

2.1 Methodological background

Seven Agro ecological zones available in Tanzania were purposively selected for the exercise of rice data collection. These zones are Lake zone, Northern zone, Eastern zone, Western zone, Central zone, Southern highland zone, and Southern zone. Districts were sampled from each zone making a total of twenty one districts for the exercise.

The number of districts sampled from each zone based on the relative proportion of rice production data of 2002/03 and 2004/05 for each zone where by more districts were sampled from zones with high relative proportion of rice production data and less districts to zones with less relative proportion of rice production data in the country. By considering this, twenty one districts were taken as sample districts for the exercise in Tanzania. These are Kahama, Bukombe, Shinyanga (R), Geita, Sengerema, Misungwi, Moshi (R), Kilombero, Kilosa, Mvomero, Rufiji, Korogwe (R), Nzega, Igunga, Bahi, Mbarali, Kyela, Mbozi, Sumbawanga,(R), Namtumbo, and Lindi.

Sampling of districts was followed by sampling of villages making a total of 104 villages as village sample size for rice data collection. In each village a total of ten rice growing house holds were sampled making a total of 1040 rice growing households for data collection.

Questionnaires were administered to capture information at producer, village and scientist levels. Administration of village level questionnaire preceded that of producer level purposely to allow for obtaining information required. Producer level questionnaires were administered to individual farmers. Scientists' level involved interviewing different scientists in different rice growing zones.

2.2 Planning and Implementation of data collection

2.2.1 Survey

The survey team constituted experts with different disciplines coming from Statistics unit and Research Development directorate from the ministry of Agriculture Food security

and Cooperatives and Agricultural Extension officers from Prime Ministers Office Regional Administration and Local Government (PMORALG).

The team managers reviewed the data collection instruments, drew a calendar of activities, and trained the enumerators from PMORALG. Supervised the questionnaire administration, controlled the exercise and coordinated the entire survey process.

2.2.2 Tools for data collection

Producer level, Village level and scientist level questionnaires were used. Module one consisted of demographic information while Module 2: Characteristics of the main rice growing Ecology. Module 3 on the other hand had Identification of the varietal heritage of each village while module 5 was on Evaluation of rice production constraints

2.2.3 Field implementation

Data was collected using structured questionnaire which was administered with the help of enumerators. The enumerators were trained in a two day methodology workshop which addressed all aspects of data collection. Verification was done by controllers while the supervision was done by supervisors. The extension personnel served as controllers while the supervisory role was done by team managers.

2.2.3 Rice data entry and data processing

Data entry was done by Statistics unit and Research and Development as well as data entry clerks by using Access Data base template given by Africa Rice.

Data cleaning and processing was done by Statistics Unit in collaboration with Research and Development directorate. Statistical Package for Socio Science (SPSS) programme was used for data analysis.

CHAPTER THREE: RESULTS AND DISCUSSION

(A) Identification and Socio-demographic structures of households

3.1 **Distribution of heads of rice producing households by age and gender**

Age of the head of a household is an important characteristic that reflects the life cycle position of the household (Ifran, 1989). His/her age influences both income generating capacity of the household and its demographic position which in turn implies certain requirements for income

The results of distribution of heads of rice farmers by age and gender suggest that more men with age falling between 35 to 40 years old participate more on rice production than women (Table 1). This is in agreement with Manyong et al (2009) who observed that most households are dominated by men. Men dominate household headship in patriarchal African societies.

Table 1: Distribution of heads of rice producing households by age and gender

Age\Gender	Proportion of Male		Proportion of Female		Whole	
	n	%	n	%	n	%
<20 years	13	1.6	2	1.1	15	1.5
20 - 25 years	33	4.0	4	2.2	37	3.7
25 -30 years	95	11.5	12	6.5	107	10.6
30 - 35 years	95	11.5	21	1.3	128	11.5
35 - 40 years	127	15.4	26	14.0	153	15.1
40 - 45 years	126	15.3	25	13.4	151	15.0
45 - 50 years	121	14.7	24	12.9	145	14.4
50 -55 years	57	6.9	13	7.0	70	6.9

55 - 60 years	48	5.8	23	12.4	71	7.0
Above 60 years	109	13.2	36	19.4	145	14.4
Total	**824**	**100.0**	**186**	**100.0**	**1010**	**100.0**

3.2 **Distribution of heads of rice producing households by marital status**

Marriage is found to be related to poverty in the welfare of the household. For example Katunzi (1999) in his poverty study for the rural households in Dodoma reported that marriage patterns play an important role in shaping social organizations as they associate with many socio-economic, cultural and demographic variables.

Findings from the study indicate that married couples are more involved in rice production than other groups **(**Table 2). It is also indicated that male headed households work more on rice production than female headed households (Table 2**).**

Table 2: Distribution of heads of rice producing households by marital status

Marital status\Gender	Proportion of Male		Proportion of Female		Whole	
	n	%	n	%	n	%
Married	768	93.2	52	28.0	820	81.2
Bachelor/Spinster	32	3.9	31	16.7	63	6.2
Divorced	13	1.6	74	39.8	87	8.6
Widowed	11	1.3	29	15.6	40	4.0
Total	**824**	**100.0**	**186**	**100.0**	**1010**	**100.0**

3.3 **Education level attained by rice farmers**

Table 3: Distribution of heads of rice producing households by education level and by gender

Education\Gender	Proportion of Male		Proportion of Female		Whole	
	n	%	n	%	n	%
None	55	6.7	36	19.4	91	9.0
Primary	670	81.3	112	60.2	782	77.4
Junior high school	36	4.4	5	2.7	41	4.1
Senior high school	3	0.4	0	0.0	3	0.3
Tertiary	4	0.5	0	0.0	4	0.4
Islamic	7	0.8	1	0.5	8	0.8
Literate	46	5.6	28	15.1	74	7.3
Others	3	0.4	4	2.2	7	0.7
Total	**824**	**100.0**	**186**	**100.0**	**1010**	**100.0**

Education being a means of access to economic resources as manifested in household income and welfare, is one of the strongest determinants of poverty (Rodgers *et al*., 1989). As pointed by the World Bank (1996), higher education of a household head does have positive effects on household income.

The results of data analysis show that most of the people in the rice producing households had a primary level of education (77.4%) with a major difference between male headed and females headed households (Table 3).

Observations made during questionnaire administration showed that gender imbalance was greater in some places than in others.

3.4 **Distribution of household size**

The influence of household size is important to the household with positive or negative effect as sighted by Ifran, 1989; Rodgers *et al*.(1989) and Kamuzora and Mkanta (2001)

The study revealed that most of rice producers have household size of 6 to 9 people (32.7%) which is common phenomena to Tanzania. It was also observed that households with family members of 3 to 5 people came second in rice growing households.

Table 4: Distribution of household size

Household Size	Percent (%)
<=2	29.5
3-5	30.7
6-9	32.7
10-15	6.9
>=16	0.2
Total	**100.0**

3.5 Distribution of rice farmers for whom agriculture is the leading income by Household size

From Table 5 the results suggest that most of rice producers with household size ranging from 6 to 9 people consider agriculture to be the leading income source (38%) followed by households with 3 to 5 people (31%).

Table 5: Distribution of rice farmers for whom agriculture is the leading income by Household size

Household Size	Percentage
<=2	25.2
3-5	31.0
6-9	38.0
10-15	5.8
>=16	0.0
Total	**100.0**

3.6 Distribution of rice farmers for whom agriculture is the leading source of income by field size

Table 6 indicates that most of farmers producing rice use agricultural land of less or equal to one hector (72.1%). This might be due to the fact that most farmers in the country are still using hand hoe to produce different types of crops. 26.7 % of farmers use agricultural land of one to five hectors in rice production.

Table 6: Distribution of Rice Farmers for whom Agriculture is the leading income by Field Size

Field Size	Percent
<=1ha	72.1
1-5 ha	26.7
5-10 ha	0.4
10-20 ha	0.4
20-50 ha	0.0
>=50 ha	0.4
Total	100.0

3.7 Average area cultivated by field size and by gender

The highest area cultivated by field size was found to be less or equal to one hector with female headed households participating more in this field size than male headed households (Table 7).Second to this was revealed to be one to five hectors with more male headed households than female headed households. These imply that male headed households cultivate large areas of land than female headed households.

Nothing was revealed on cultivating field size of greater or equal to 50 hectors. This suggests that most of rice growing households and farmers in general in the country cultivate small pieces of land.

Table 7: Average area cultivated by field size and by gender

Field size/Year	Percent				Cumulative percent	
	Male		Female			
	2007 -2008	2008 -2009	2007 - 2008	2008 - 2009	Male	Female
<=1 ha	95.14	96.97	97.81	99.69	96.06	98.74
1-5 ha	2.21	1.87	0.63	0.00	2.04	0.31
5-10 ha	2.10	1.16	0.94	0.00	1.63	0.47
10-20 ha	0.22	0.11	0.00	0.00	0.17	0.00
20-50 ha	0.33	0.06	0.63	0.31	0.19	0.47
>=50 ha	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00

3.8 Average area cultivated by household size

The highest average area cultivated by households in relation to household size was observed from household size with six to nine people (Table 8). Second score of highest average area cultivated was from households with two to five people (Table).

Table 8: Average area cultivated by household size

Household Size	Average Area cultivated (ha)
<=2	264.14
2 - 5	337.26
6 - 9	439.59
10 - 15	93.04
>=16	5.6

3.9 Distribution of rice producing head of households by gender and ecology

From the study, it was revealed that three ecologies are available and used for rice production in Tanzania. These are Lowland, irrigated and upland ecology.

Among the three ecologies used to produce rice in the country, the majority of rice producers use lowland ecology to produce rice. Second to this is Irrigated ecology whereby farmers produce rice through irrigation. Lastly farmers produce rice by using upland ecology where upland rice is produced (Table 9). In all the three ecologies of rice production, it was observed that males take the lead of producing rice as compared to females headed households (Table 9).

Table 9: Distribution of rice producing head of households by gender and ecology

	Upland		Lowland		Irrigated		Others	
	n	%	n	%	n	%	n	%
% Male	7	55.5	409	77.8	187	61.6	0	0.0
% Female	2	44.5	255	22.2	150	38.4	0	0.0
Total	9	100.0	664	100.0	337	100.0	0	0.0

(B) Characteristics of the main rice varieties

3.10 Production and yield by rice variety cropping season 2008-2009

The highest average area cultivated was observed to be that of A60 variety with 15.5 hectors. (Table 10).On yield, Rufiji variety scored the highest 9.9 tons /ha and therefore making the average yield for all varieties captured to be 2 tones /ha (Table 10).

Table 10: Production and yield by rice variety cropping season 2008-2009

Type of Variety	Average area (ha)	Average production (tonnes)	Yield (tonnes/ha)
A60	15.0	1.8	0.1
AFA Mwanza	1.5	1.8	1.2
Bisholi	0.5	0.5	1.1
Boko	0.5	0.4	0.7
burmaha	1.0	0.5	0.5
China	1.4	2.9	2.1
Dakawa	0.6	0.7	1.3
Dunduli ya mlimani	0.9	1.2	1.3

Faya	1.8	2.6	1.4
Gamiti	1.4	1.8	1.2
Ifakara	1.4	1.1	0.8
Improved ADRAO NERICA	1.1	1.5	1.4
Improved ADRAO non-NERICA	1.4	1.6	1.1
India	2.1	1.7	0.8
India red	1.3	1.8	1.3
IR36	1.4	2.2	1.6
IR54	0.9	1.3	1.5
IR56	0.2	0.4	2.2
IR64	1.2	3.3	2.8
IR66	0.6	1.5	2.5
Ita	0.4	2.5	6.3
Japan	0.9	3.0	3.2
Jaribu	1.3	1.1	0.8
Kahogo	1.2	1.5	1.3
Kalamata	1.9	3.6	1.8
Kaliwe wangu	1.0	0.6	0.6
Kikweta	1.0	0.8	0.8
Kilombero	1.4	1.1	0.7
Kisegese	1.0	1.4	1.4
Kishingo	0.9	1.0	1.1

Kishungi	0.5	0.2	0.4
Kubwa jinga	0.9	1.6	1.8
Kudenda	1.5	2.0	1.3
Kula na bwana	1.1	1.0	0.9
Kyela	2.2	2.4	1.1
Lugata	1.5	3.0	2.0
Mabeyenge	1.4	1.9	1.3
Machale	1.0	1.0	1.0
Makaniki	0.8	0.4	0.5
Malamata	1.8	3.2	1.8
Malomogambiti	2.8	2.0	0.7
Maramata	1.0	0.4	0.4
Masantura	0.8	1.5	2.0
Matera	1.4	1.9	1.3
Mbawa2	1.2	1.3	1.1
Mbeya	0.9	0.9	1.1
Miholo	1.1	1.4	1.3
Mlangi	0.2	0.2	1.0
Mpulumpulu	1.7	3.3	2.0
Mramara	0.2	0.2	1.0
Mropa	0.7	0.5	0.7
Mtalima	0.8	0.9	1.0

Mwanga	0.9	1.2	1.3
Mwanza	3.3	2.7	0.8
mwenda mbio	1.2	0.8	0.7
Mwinula	0.7	0.6	0.8
ngome	30.0	0.1	0.0
Ngowe	1.4	2.0	1.4
Ngwindimba	1.5	1.3	0.9
Ngwinula	1.8	2.5	1.4
Nitalima wangu	0.8	0.3	0.4
Njia mbili	1.0	1.2	1.2
Nondo	1.7	1.0	0.6
pamba	0.5	0.2	0.3
Picholi	0.9	0.9	1.0
RD68	0.5	1.5	3.2
Risasi	0.6	1.2	2.0
Rufiji	0.6	6.0	9.9
Rangimbili	1.6	1.7	1.2
SARO	1.1	57.3	50.2
Serena	1.1	1.7	1.5
Shashi	0.5	1.3	2.6
Shikali	1.7	1.2	0.7
Shingo ya mwali	2.7	2.7	1.0

Shosha	1.6	2.6	1.6
Simzigo	0.5	0.3	0.6
Sindano	0.8	1.0	1.3
Sukarisukari	1.1	1.3	1.1
Super	0.9	1.3	1.2
Thailand	0.3	0.7	2.3
Tondogoso	0.9	1.1	1.2
Traditional	1.2	5.6	4.7
Turiani	1.6	1.6	1.0
TXD 220	0.6	0.5	0.8
TXD 306	0.9	1.7	1.9
TXD85	0.5	0.7	1.5
TXD88	0.8	1.2	1.6
Uganda	0.3	0.2	0.8
Umana	1.0	2.3	2.3
Usiniguse	0.8	0.7	0.9
Wahiwahi	0.9	1.1	1.3
Zambia	1.3	1.9	1.5
Whole	**144.1**	**193.1**	**2.0**

3.11 Source of Introduction of the five most frequently cited varieties in Upland Ecology

It was revealed from the study that the source of introduction of knowledge for the most frequent cited varieties in upland ecology are farmers from the village. Second to this are farmers from another village. The rest of the sources of knowledge indicated nothing (Table 11).

This situation suggests that most of varieties used by farmers are normally obtained from within the village through either relatives, friends or by saving their own seeds after harvests.

Table 11: **Source of introduction of the five most frequently cited varieties in upland Ecology**

Type of variety in upland ecology	Source of introduction			
	Research or development institution	Farmers from the village	Farmers from another village	Other
Rufiji	0	6	1	0
SARO	0	4	0	3
Mbawa mbili	0	5	0	0
Masantura	0	2	1	0
Super	0	0	1	0

3.12 Source of knowledge of the five most frequently cited varieties in Low land Ecology

The study indicates that the source of introduction of knowledge for the most frequent cited varieties in lowland ecology are farmers from the village. This is followed by farmers from another village (Table 12).

Table 12: Source of knowledge of the five most frequently cited varieties in lowland Ecology

Type of variety in upland ecology	Source of introduction			
	Research or development institution	Farmers from the village	Farmers from another village	Other
Super	2	199	38	15
Kalamata	2	198	27	11
India	1	118	12	9
Wahiwahi	0	11	1	6
Rangi mbili	0	0	1	0

3.13 **Source of knowledge of the five most frequently cited varieties in Irrigated Ecology**

The study revealed that the source of introduction of knowledge for the most frequent cited varieties in Irrigated Ecology are farmers from the village and followed by farmers from another village (Table 13).

Therefore Farmers from the same village were found to be the main source of knowledge for all the varieties identified in all rice growing ecologies.

Table 13: Source of knowledge of the five most frequently cited varieties in irrigated Ecology

Type of variety in upland ecology	Source of introduction			
	Research or development institution	Farmers from the village	Farmers from another village	Other
Rangi mbili	0	16	2	1
Super	2	75	13	16
TXD 306	7	32	2	32

3.14 Distribution of farmers (%) by variety and field size

A number of rice varieties were observed to be grown by farmers in Tanzania. The grown varieties range from Improved to local varieties (Table 14).

The distribution of farmers by variety and by land size cultivated to produce rice, study findings suggest that field size of less or equal to one hector is used by most of farmers in rice growing areas and followed by field size of one to five hectors. It was observed in totality that the biggest area cultivated by rice farmers was that one which used Kalamata variety (traditional variety) with 208 hectors of land(Table 14).

Table 14: Distribution of farmers (%) by variety and field size

Type of Variety	Field Size					Total
	<=1	1-5	5-10	10-20	20-50	
	6	0	0	0	0	6
A60	0	0	1	0	0	1

AFA Mwanza	4	1	0	0	0	5
Bisholi	31	0	0	0	0	31
Boko	4	0	0	0	0	4
Bumanha	1	0	0	0	0	1
burmaha	1	0	0	0	0	1
China	19	1	0	0	0	20
Chupa	2	0	0	0	0	2
Dakawa	11	0	0	0	0	11
Dunduli ya mlimani	14	0	0	0	0	14
Faya	23	0	0	0	0	23
Gamiti	4	0	0	0	0	4
Ifakara	22	0	0	0	0	22
Improved ADRAO NERICA	11	0	0	0	0	11
Improved ADRAO non-NERICA	4	0	0	0	0	4
India	87	1	16	0	0	104
India red	38	0	0	0	0	38
IR36	5	0	0	0	0	5
IR54	23	0	0	0	0	23
IR56	2	0	0	0	0	2
IR64	32	1	0	0	0	33
IR66	1	0	0	0	0	1

ITA	2	0	0	0	0	2
Japan	9	0	0	0	0	9
Jaribu	2	0	0	0	0	2
Kalamata	191	14	2	0	1	208
Kaliwe wangu	1	0	0	0	0	1
Kahogo	13	0	0	0	0	13
Kikweta	3	0	0	0	0	3
Kilombero	69	1	0	0	0	70
Kisegese	13	0	0	0	0	13
Kishingo	9	0	0	0	0	9
Kishungi	3	0	0	0	0	3
Kubwa jinga	2	0	0	0	0	2
Kudenda	1	0	0	0	0	1
Kula na bwana	6	0	0	0	0	6
Kyela	47	0	1	0	0	48
Lugata	4	0	0	0	0	4
Mabeyenge	19	1	0	0	0	20
Machale	24	0	0	0	0	24
Makaniki	1	0	0	0	0	1
Malamata	37	1	0	0	0	38
Malomogambiti	16	0	1	0	0	17

Maramata	1	0	0	0	0	1
Masantura	12	0	0	0	0	12
Matela	5	0	0	0	0	5
Mbawa mbili	13	0	0	0	0	13
Mbeya	9	0	0	0	0	9
Miholo	4	0	0	0	0	4
Mlangi	1	0	0	0	0	1
Moshi wa taa	2	0	0	0	0	2
Mpulumpulu	3	0	0	0	0	3
Mramara	1	0	0	0	0	1
Mropa	3	0	0	0	0	3
Mtalima	10	0	0	0	0	10
Mushule	6	0	0	0	0	6
Mwanga	1	0	0	0	0	1
Mwenda mbio	3	0	0	0	0	3
Mwinula	8	0	0	0	0	8
ngome	0	0	0	1	0	1
Ngowe	6	0	0	0	0	6
Ngwindimba	12	0	0	0	0	12
Nitalima wangu	1	0	0	0	0	1
Njia mbili	3	0	0	0	0	3

Nondo	2	0	0	0	0	2
Nyanchalombe	1	0	0	0	0	1
pamba	1	0	0	0	0	1
Picholi	28	0	0	0	0	28
Rangi mbili	22	1	0	1	1	25
RD68	2	0	0	0	0	2
Risasi	1	0	0	0	0	1
Rufiji	7	0	0	0	0	7
SARO	143	0	0	1	0	144
Serena	13	0	0	0	0	13
Shashi	1	0	0	0	0	1
Shikali	7	0	0	0	0	7
SHINGO YA MWALI	2	1	0	0	0	3
Shosha	8	0	0	0	0	8
Simzigo	1	0	0	0	0	1
Sindano	4	0	0	0	0	4
Sukarisukari	54	1	0	0	0	55
super	24	0	0	0	0	24
Tela	4	0	0	0	0	4
Thailand	3	0	0	0	0	3
Tondogoso	25	0	0	0	0	25

Toto baya	1	0	0	0	0	1
Traditional	38	0	0	0	0	38
Turiani	7	0	0	0	0	7
TXD 220	35	0	0	0	0	35
TXD 306	79	0	0	0	0	79
TXD 362	1	0	0	0	0	1
TXD 88	2	0	0	0	0	2
TXD85	9	0	0	0	0	9
TXD88	2	0	0	0	0	2
Uganda	1	0	0	0	0	1
Umana	27	0	0	0	0	27
usiniguse	1	0	0	0	0	1
Wahiwahi	29	0	0	0	0	29
Zambia	103	2	0	0	0	105
Total	2,086	34	21	2	2	2,145

Module 3: Identification of the varietal heritage of villages

3.15 Rice production by varietal and by gender

From the study, findings suggest that more male headed households are involved in rice production than female headed households. This was observed for all three years of 2009, 2008 and 2007 (Table 15). On varieties used in rice production, TXD85 indicated to score the highest level being used by many rice growing farmers in 2007.

Table 15: Rice production by varietal and by gender

Type of Variety	Rice producers proportion in growing the variety					
	2009		2008		2007	
	Male	Female	Male	Female	Male	Female
kyela	2	0	2	0	2	0
AFA Mwanza	7	1	6	1	5	1
Bibi wa Mpaka	1	0	1	0	1	0
Bisholi	19	2	13	1	8	1
Boko	2	2	2	2	1	2
China	17	1	16	0	15	0
Chupa	0	1	0	1	0	1
Dakawa	4	2	4	2	4	1
Dunduli ya mlimani	8	2	6	2	6	2
Faya	14	8	13	8	12	7
faya dume	0	1	0	1	0	1
Ifakara	9	3	8	2	8	2
India	75	14	74	13	68	11
India red	23	6	21	6	20	6
IR36	6	1	6	1	6	1
IR54	16	8	16	7	16	7
IR56	3	0	3	0	3	0
IR64	32	16	41	10	39	16

IR66	1	0	1	0	1	0
ITA	1	0	1	0	1	0
Japan	14	3	14	3	14	3
Jaribu	1	0	1	0	13	3
Kahogo	14	5	14	4	150	13
Kalamata	168	16	157	14	2	0
kalinganaula	2	0	2	0	1	0
Kaliwe wangu	1	0	1	0	0	1
kikweta	3	0	3	0	1	0
kilima wangu	1	0	1	0	52	18
Kilombero	59	19	56	18	8	2
Kisegese	10	2	9	2	8	0
Kishingo	8	0	8	0	0	1
Kishungi	0	1	0	1	1	0
Kubwa jinga	1	0	1	0	5	5
Kula na bwana	10	7	7	5	36	2
Kyela	38	2	37	2	4	0
Ligwindiba	0	1	4	0	1	0
Lugata	4	0	2	0	14	1
Mabawa	2	0	15	1	12	4
Mabeyenge	17	1	15	6	1	0
Machale	16	6	8	0	30	2

Makaniki	1	0	24	2	4	0
Malamo	4	0	1	0	8	1
Malomogambiti	10	1	8	1	2	0
Malamata	34	2	16	1	14	1
Masantura	8	1	6	0	6	6
Matela	8	1	9	6	4	0
Mbawa mbili	7	8	1	0	2	1
Mbeya	4	0	2	2	3	0
Mdundiko	1	0	3	0	4	1
Mlopa	2	2	4	1	5	1
Mpulumpulu	3	0	1	0	6	0
Mpyakabili	5	1	5	1	4	0
msoga	1	0	6	0	6	1
Mtalima	5	1	5	0	1	0
Mushule	6	0	6	1	1	0
Mwanza	5	0	1	0	4	0
Mwendambio	8	1	7	0	6	0
Mwinula	5	0	1	0	4	0
ngome	2	0	3	1	2	0
ngoni	1	0	4	0	1	0
Ngowe	3	1	2	0	0	1
Njia mbili	4	0	1	0	6	2

Nondo	3	0	8	4	17	4
Nyanchalombe	0	1	1	0	3	2
Other improved	1	0	21	4	2	0
PANAR	1	0	3	2	15	5
Picholi	8	3	2	0	2	0
Rangimbilii	55	13	127	29	97	20
RD68	2	0	2	0	5	1
Rufiji	6	1	4	1	9	0
SARO	90	25	9	0	1	0
Serena	13	1	1	0	34	3
Shashi	2	0	1	0	3	0
Shikali	4	1	1	0	2	0
Shingo ya mwali	5	1	36	3	134	35
Shosha	9	0	4	0	21	3
Sifala	1	0	2	0	1	0
Simzigo	1	0	156	39	6	0
Sindano	2	0	22	3	6	2
Sukarisukari	36	3	1	0	2	0
Super	253	59	59	13	57	14
Thailand	3	0	3	0	36	10
Tondogoso	12	1	20	9	10	6
Traditional	11	3	44	13	2	1

Turiani	5	1	12	5	8	1
TX85	1	0	2	1	14	3
TXD 220	23	10	1	0	1	0
TXD 306	60	14	9	1	76	15
TXD85	11	1	96	21	1227	255
TXD88	5	6	1,354	284	0	0
Uganda	1	0	0	0	0	0
Umana	12	1	0	0	0	0
Wahiwahi	20	4	0	0	0	0
Zambia	89	19	0	0	0	0
	1,481	318	2,706	561	2,453	509

3.16 Proportion of knowledge of varieties

Findings from the study indicate that the knowledge of farmers on rice varieties vary from one variety to another ranging from improved to traditional / local varieties.

The Super variety was known to 16.64% and 16.94% of males and female farmers respectively. Second to this was knowledge on India variety and third was knowledge to SARO variety (Table 16). This situation might be due to the fact that these varieties have been introduced in the country for a longer period of time.

Table 16: Proportion of knowledge of varieties

Type of Variety	Proportion of farmers who know the variety			
	Male	%	Female	%
kyela	2	0.09	0	0.00
AFA Mwanza	20	0.62	3	0.41
Bibi wa Mpaka	1	0.04	0	0.00
Bisholi	35	1.54	5	1.03
Boko	2	0.09	2	0.41
Bora kupata	0	0.00	1	0.21
Bumanha	1	0.04	0	0.00
Chamoto	1	0.04	0	0.00
China	16	0.71	2	0.41
Chupa	1	0.04	1	0.21
Dakawa	14	0.62	6	1.24
dunduli	1	0.04	0	0.00
Dunduli ya mlimani	1	0.04	0	0.00
Fanya manana	7	0.31	1	0.21
Faya	31	0.00	12	2.48
Gamiti	4	0.18	0	0.00
Ifakara	29	1.28	9	1.86
Improved ADRAO NERICA	6	0.26	0	0.00
India	144	6.35	25	5.17

IR36	7	0.31	3	0.62
IR54	25	1.10	13	2.69
IR56	3	0.13	0	0.00
IR64	49	2.16	18	3.72
IR66	1	0.04	0	0.00
ITA	5	0.22	1	0.21
Japan	12	0.53	1	0.21
Jaribu	3	0.13	2	0.41
Juliana	2	0.09	0	0.00
Kahogo	40	1.77	9	1.86
kikweta	3	0.13	0	0.00
kilima wangu	1	0.04	0	0.00
Kilimawangu	1	0.04	0	0.00
Kilombero	70	3.09	21	4.34
Kisegese	24	1.06	5	1.03
Kishingo	7	0.31	0	0.00
Kishungi	1	0.04	1	0.21
Kubwa jinga	1	0.04	0	0.00
Kudenda	0	0.00	1	0.21
Kula na bwana	23	1.02	8	1.65
Kyela	39	1.72	2	0.41
Line 88	1	0.04	0	0.00

Lugata	5	0.22	0	0.00
Lusendamila	1	0.04	0	0.00
Mbawa mbili	20	0.88	10	2.07
Mabeyenge	20	0.88	1	0.21
Machale	17	0.75	7	1.45
Mahenya	7	0.31	1	0.21
Makaniki	9	0.40	1	0.21
Malamata	40	1.77	3	0.62
Malamo	4	0.18	0	0.00
Malomogambiti	26	1.15	2	0.41
Masantura	8	0.35	1	0.21
Matera	15	0.66	3	0.62
Mbeya	8	0.35	1	0.21
Mchuzi wa jogoo	1	0.04	1	0.21
Mdundiko	1	0.04	0	0.00
Miholo	16	0.71	2	0.41
Mlopa	2	0.09	2	0.41
Moshi	1	0.04	0	0.00
Moshi wa taa	5	0.22	2	0.41
Mpulumpulu	3	0.13	0	0.00
Mpyakabili	5	0.22	1	0.21
Mropa	1	0.04	0	0.00

msoga	1	0.04	0	0.00
Mtalima	9	0.40	1	0.21
Mushule	9	0.40	1	0.21
Mwanga	1	0.04	0	0.00
Mwenda mbio	6	0.26	1	0.21
mwendambio	2	0.09	0	0.00
Mwinula	21	0.93	3	0.62
ngome	2	0.09	1	0.21
Ngome	1	0.04	0	0.00
ngoni	1	0.04	0	0.00
Ngowe	3	0.13	3	0.62
Ngwindimba	4	0.18	6	1.24
Ngwinula	8	0.35	1	0.21
Njia mbili	6	0.26	0	0.00
Nondo	3	0.13	0	0.00
Nyanchalombe	0	0.00	1	0.21
Other improved	3	0.13	0	0.00
pamba	1	0.04	0	0.00
PANAR	1	0.04	0	0.00
Picholi	42	1.85	9	1.86
Rangimbilii	103	4.55	18	3.72
RD68	2	0.09	0	0.00

Risasi	1	0.04	0	0.00
Rubi	5	0.22	3	0.62
Rufiji	8	0.35	1	0.21
SARO	118	5.21	33	6.82
Sembe	7	0.31	1	0.21
Serena	19	0.84	2	0.41
Shashi	2	0.09	0	0.00
Shikali	5	0.22	1	0.21
Shingo ya mwali	5	0.22	1	0.21
Shosha	9	0.40	0	0.00
Sifala	1	0.04	0	0.00
Simzigo	4	0.18	2	0.41
Sindano	6	0.26	1	0.21
Sukarisukari	59	2.60	7	1.45
Super	377	16.64	82	16.94
Tela	7	0.31	0	0.00
Thailand	4	0.18	0	0.00
Tongogoso	32	1.41	5	1.03
Toto baya	1	0.04	0	0.00
Traditional	12	0.53	3	0.62
tulenabwana	1	0.04	0	0.00
Turiani	12	0.53	0	0.00

TX85	1	0.04	0	0.00
TXD 220	27	1.19	10	2.07
TXD 306	80	3.53	19	3.93
TXD 88	4	0.18	6	1.24
TXD85	15	0.66	5	1.03
Uganda	1	0.04	0	0.00
Umana	27	1.19	6	1.24
usiniguse	3	0.13	2	0.41
Wahiwahi	35	1.54	12	2.48
Zambia	101	4.46	27	5.58
	2,266	100.00	484	100.00

3.17 Year of knowledge and year of introduction of varieties

Findings from the study indicate that the most listed year of knowledge on varieties was 1997 with the knowledge on super variety (Table 17). This suggests that super variety was introduced in the country for a long time in 1979 therefore gaining more popularity to farmers

Table 17: Year of knowledge and year of introduction of varieties

Type of variety	Most listed Year of knowledge		Most listed year of of introduction of variety	
	Year	Frequency	Year	Frequency
kyela	2000	2	2000	2
AFA Mwanza	2000	8	2000	9
Bibi wa Mpaka	1979	1	1979	1
Bisholi	2007	5	2007	5

Boko	2007	1	2007	1
Bora kupata	2008	1	2008	1
Bumanha	2008	1	2008	1
China	1995	3	1995	3
Chupa	2005	1	2005	1
Dakawa	2002	4	2002	4
dunduli	1960	1	2001	1
Dunduli ya mlimani	2009	1	2009	1
Fanya manana	2005	8	2005	8
Faya dume	2000	6	2000	6
Fayamosi	1956	1	1956	1
Gamiti	1996	1	2009	1
Ifakara	2000	5	2005	5
Improved ADRAO NERICA	1998	1	2007	1
India	2004	28	2004	28
IR36	2000	3	2000	3
IR54	1988	5	1988	5
IR56	2000	2	2000	2
IR64	2003	16	2003	16
IR66	2004	1	2004	1
ITA	2003	3	2003	3
Japan	2006	5	2009	5
Jaribu	2008	3	2008	3
Juliana	2003	1	2003	1

Kahogo	2000	4	2006	4
Kahyolo	2002	8	2002	8
Kalamata	2005	31	2005	30
Kalimawangu	2004	1	2004	1
kalinganaula	1980	2	1980	2
Kaliwe wangu	2000	1	2000	1
kaniki	1970	1	1980	1
Kihogo	2007	1	2007	1
Kihoro red	1990	1	1980	1
kikweta	2000	1	2000	1
kilima wangu	2003	2	2003	2
Kilombero	2007	8	2007	8
Kisegese	2004	4	2004	4
Kishingo	1997	3	1997	3
Kishungi	2008	1	2008	1
Kubwa jinga	1995	1	1995	1
Kula na bwana	2005	4	2005	4
Kyela	2006	6	2006	5
Line 88	2008	1	2008	1
Lugata	2007	2	2007	2
Lusendamila	1974	1	1974	1
Mabawa mbili	1999	8	2005	9
Mabeyenge	2007	5	2007	4
Machale	2001	4	2007	6

Mahenya	2001	6	2005	2
Makaniki	2005	2	2006	4
Malamata	2002	14	2006	9
Malamo	2003	1	2004	5
Malomogambiti	1999	5	2003	1
Maramata	1999	1	2003	2
Masantura	2007	2	2008	1
Matera	2005	4	2007	9
Mbeya	2007	2	2008	1
Mchuzi wa jogoo	1998	1	2004	1
Mdundiko	2000	1	2008	5
Miholo	2004	5	2004	1
Mlopa	2004	1	2008	1
Moshi	2004	1	2005	1
Moshi wa taa	2005	1	2006	2
Mpulumpulu	2000	2	2006	2
Mpyakabili	1960	2	2000	1
Mropa	2004	1	2006	1
msoga	1960	1	2007	1
Mtalima	2006	1	2007	1
Mushule	2007	1	2008	1
Mwanza	2005	1	2008	1
Mwenda mbio	2002	3	2008	5
Mwinula	2002	4	2004	1

Ngome	1970	2	1999	2
Ngoni	2004	1	2006	6
Ngowe	1996	1	1999	4
Ngwindimba	1980	6	1999	2
Ngwinula	1999	4	2006	1
Njia mbili	1999	2	2005	1
Nondo	2005	2	2006	2
Nyanchalombe	1990	1	2005	1
Other improved	2005	1	2009	1
pamba	1990	1	1998	7
PANAR	2002	1	2009	1
Picholi	1979	7	1990	7
Rangimbilii	1980	34	2007	40
RD68	2006	1	2007	3
Rubi	2004	3	2007	2
Rufiji	2007	3	2007	30
SARO	2007	30	2009	2
Sembe	2004	8	2005	8
Serena	1998	10	1999	3
Shashi	1995	1	2009	2
Shikali	1995	2	1997	3
Shingo ya mwali	1998	2	2009	1
Shosha	1997	3	2004	1
Sifala	1998	1	2005	4

Simzigo	2004	1	2006	15
Sindano	1997	4	2005	2
Sukarisukari	2005	15	2006	1
Super	1997	75	2000	79
Super Zanzibar	2006	8	2009	1
Tela	1998	1	2008	1
Thailand	2009	1	1984	9
Tongogoso	1984	10	2000	8
Toto baya	1994	1	1970	1
Traditional	2000	7	2007	2
Tulenabwana	1970	1	2008	2
Turiani	2007	4	2007	2
TX88	2006	5	2006	25
TXD 220	2008	8	2006	1
TXD 306	2006	22	2007	4
TXD85	2004	7	2006	14
Uganda	1990	1	2006	1
Umana	2005	10	2007	1
usinguse	1960	3	2005	9
wahiwahi	2007	9	2008	23
Zambia	2006	22	2006	0

3.18 **Growing and first cropping year of varieties**

Findings from the study show that Super variety was indicated to be grown by most farmers at least once than other varieties. Also the same variety scored the highest frequency of the most listed first cropping year among varieties grown in the country (Table 18).

Table 18: Growing and first cropping year of varieties

Type of variety	Proportion of farmers who grow the variety at least once	Most listed first cropping year	Frequency of most listed first cropping year of variety
kyela	2	2004	1
AFA Mwanza	15	2008	2
Bibi wa Mpaka	1	1979	1
Bisholi	33	2007	6
Boko	4	2002	2
Chamoto	1	2005	1
China	24	2005	5
Chupa	1	2005	1
Dakawa	9	2001	2
dunduli	1	1960	1
Dunduli ya mlimani	11	2005	4
Faya	26	1999	6
Gamiti	3	2007	1
Ifakara	23	2007	3

Improved ADRAO NERICA	3	2005	1
India	157	2004	33
IR36	9	2000	4
IR54	37	1988	5
IR56	3	2000	1
IR64	67	2003	14
IR66	1	2002	1
ITA	3	2005	1
Japan	19	1990	5
Jaribu	3	2009	1
Kahogo	35	2006	8
Kalamata	206	2005	35
Kalimawangu	1	2004	1
kalinganaula	4	1980	2
Kaliwe wangu	1	1977	1
kikweta	3	2003	1
kilima wangu	2	2003	2
Kilombero	88	2001	8
Kisegese	20	2004	4
Kishingo	8	1997	3
Kishungi	2	2002	1

Kubwa jinga	1	1995	1
Kudenda	1	2008	1
Kula na bwana	26	2008	4
Kyela	47	2006	8
Line 88	1	2008	1
Lugata	5	2004	2
Lusendamila	1	2005	1
Mbawa mbili	28	2007	9
Mabeyenge	12	2007	5
Machale	23	2004	7
Mahenya	4	2001	4
Makaniki	5	1998	2
Malamata	42	2002	14
Malamo	4	2004	2
Malomogambiti	18	2004	5
Masantura	10	2002	4
Matela	15	2008	4
Mbeya	9	2006	3
Mdundiko	1	2003	1
Miholo	12	2008	3
Mlopa	4	2008	1

Moshi	1	2007	1
Moshi wa taa	5	2000	2
Mpulumpulu	3	2006	2
Mpyakabili	4	2007	2
Mropa	1	1994	1
msoga	1	2009	1
Mtalima	10	2002	2
Mushule	10	2007	3
Mwanga	1	2008	1
Mwenda mbio	9	2004	5
Mwinula	10	2004	2
Ngome	3	2008	2
Ngoni	1	2008	1
Ngowe	5	2008	2
Ngwindimba	4	2008	2
Ngwinula	9	2002	2
Njia mbili	4	2000	2
Nondo	3	2005	3
Nyanchalombe	2	2007	1
Other improved	2	2005	1
pamba	1	1998	1

PANAR	1	2009	1
Picholi	37	2008	8
Rangi mbili	98	2008	25
RD68	2	2006	1
Risasi	1	2008	1
Rubi	1	2006	1
Rufiji	9	2007	3
SARO	129	2008	31
Sembe	8	2006	4
Serena	17	2004	10
Shashi	2	1998	1
Shikali	2	2000	2
Shingo ya mwali	6	2009	2
Shosha	10	1997	3
Sifala	1	1998	1
Simzigo	3	1998	2
Sindano	7	2006	2
Sukarisukari	58	2006	15
Super	415	2000	71
Tela	5	2006	2
Thailand	5	2007	2

Tondogoso	18	1984	11
Toto baya	1	1999	1
Traditional	17	2007	5
Turiani	11	2007	3
TX85	1	2007	1
TXD 220	33	2008	7
TXD 306	72	2006	19
TXD 88	12	2007	6
TXD85	13	2008	3
Uganda	1	2006	1
Umana	29	2007	10
usiniguse	4	2006	2
Wahiwahi	38	2007	12
Zambia	130	2006	23
	2,381		263

3.19 Proportion of farmers who grow varieties across seasons

Findings from study indicate that more farmers were able to grow different varieties of rice across seasons in 2008 than other years (Table 19). Second to this was indicated in 2009 and lastly in 2006

Table 19: Proportion of farmers who grow varieties across seasons

Type of variety	2009	2008	2007	2006
kyela	2	2	3	3
AFA Mwanza	8	9	12	12
Bibi wa Mpaka	1	1	1	1
Bisholi	21	21	17	12
Boko	4	4	3	3
China	18	17	17	19
Chupa	1	2	2	1
Dakawa	6	6	5	5
Dunduli ya mlimani	10	9	8	6
Faya	23	22	20	20
Ifakara	12	10	93	8
India	117	128	32	123
IR36	7	7	3	6
Gamiti	0	0	0	1
IR54	24	24	33	28
IR56	3	3	27	3
IR64	64	59	2	57
IR66	1	1	12	1
ITA	1	1	5	1
Japan	17	17	18	15
Jaribu	1	3	1	1

Kahogo	19	20	178	22
Kalamata	184	181	2	156
Kalimawangu		1	0	1
kalinganaula	2	2		3
Kaliwe wangu	1	1	1	1
kikweta	3	3	3	3
kilima wangu	1	2	2	2
Kilombero	78	81	78	72
Kisegese	12	12	11	8
Kishingo	8	8	8	6
Kishungi	1	2	1	1
Kubwa jinga	1	1	1	1
Kudenda	0	0	1	1
Kula na bwana	17	14	14	13
Kyela	41	45	43	35
Line 88		1	0	0
Ligwindiba	1	0	0	0
Lugata	4	4	4	4
Mabawa	2	2	1	1
Mabeyenge	18	17	16	14
Machale	22	22	19	20
Makaniki	1	1	1	7

Malamata	35	40	38	32
Malamo	4	4	4	4
Malomogambiti	11	14	11	15
Maramata	1	1	1	1
Masantura	9	9	9	9
Matela	9	11	10	9
Mbawa mbili	15	14	16	11
Mbeya	4	5	6	5
Mdundiko	1	1	1	1
Miholo	0	1	5	5
Mlopa	4	4	3	3
Moshi	0	1	0	1
Moshi wa taa	0	1	1	2
Mpulumpulu	3	3	3	3
Mpyakabili	6	6	7	6
msoga	1	1	0	0
Mtalima	6	7	8	7
Mushule	6	6	10	7
Mwenda mbio	10	9	9	9
Mwinula	5	4	9	8
Ngome	2	3	2	2
Ngoni	1	1	1	1

Ngowe	4	5	5	4
Ngwindimba	0	2	2	2
Ngwinula	0	1	3	3
Njia mbili	4	4	4	5
Nondo	3	3	3	3
Nyanchalombe	1	1	1	0
Other improved	1	0	0	0
Picholi	11	17	11	13
PANAR	1	0	0	0
Rangi Mbili	68	75	69	60
RD68	2	2	2	2
Rufiji	7	0	0	0
Rufiji	0	8	8	5
Rubi	0	0	0	1
SARO	115	115	92	82
Serena	14	14	16	16
Shashi	2	2	2	0
Shikali	5	5	5	5
Sembe	0	0	0	3
Shingo ya mwali	6	6	6	6
Shosha	9	9	9	7
Sifala	1	1	1	1

Simzigo	1	1	2	2
Sindano	2	3	3	3
Sukarisukari	39	49	47	42
Super	312	309	283	282
Tela	0	4	2	4
Thailand	3	3	2	1
Tondogoso	13	13	13	13
Traditional	14	15	13	9
Turiani	6	6	6	3
TX85	14	13	16	10
TXD 220	33	28	23	16
TXD 306	74	60	50	40
TXD 88	11	11	10	10
Uganda	1	1	1	1
Umana	13	19	21	16
usiniguse	0	0	0	1
Wahiwahi	24	26	29	20
Zambia	108	106	106	103
Total	1,812	1,849	1,718	1,632

3.20 Seed management by variety

Findings from the study indicate that more seeds were used in 2007-2008 as compared to 2008-2009. The amount of seeds used varied from one variety to another with the highest amount being used by India variety 61.3 kg (Table 20).

On the average quantity of paddy produced, more paddy was produced in 2008-2009 with a total production of 189.5 tones (Table20). This also is indicated to vary from one variety to another.

Table 20: Seed management by variety

Type of variety	Average quantity of seed used for the variety (kg)		Average quantity of paddy produced (tonne)	
	2008-2009	2007-2008	2008-2009	2007-2008
A60	10.0	10.0	1.8	1.7
AFA Mwanza	56.3	58.8	1.8	1.8
Bisholi	7.2	13.9	0.5	0.5
Boko	10.0	10.0	0.4	0.4
burmaha	20.0	1.0	0.5	0.5
China	28.2	35.5	2.9	1.5
Dakawa	10.7	15.5	0.7	1.3
Dunduli ya mlimani	12.7	38.7	1.2	23.4
Faya	59.5	56.4	2.6	2.1
Gamiti	22.5	22.5	1.8	1.1
Ifakara	14.1	23.8	1.1	0.8
Improved ADRAO NERICA	14.7	32.1	1.5	2.0
Improved ADRAO non-NERICA	32.3	39.8	1.6	2.3
India	35.3	61.3	1.7	1.5
IR36	47.2	32.8	2.2	1.5
IR54	21.1	19.8	1.3	0.8

IR56	10.0	10.0	0.4	0.6
IR64	40.2	45.3	3.3	2.7
IR66	20.0	15.0	1.5	1.5
Ita	12.0	12.0	2.5	2.0
Japan	25.1	24.7	3.0	2.3
Jaribu	42.0	43.5	1.1	1.0
Kahogo	25.6	30.6	1.5	1.2
Kalamata	32.8	31.3	3.6	2.1
Kaliwe wangu	11.0	10.0	0.6	0.6
Kikweta	19.3	20.0	0.8	1.0
Kilombero	40.9	38.7	1.1	1.0
Kisegese	16.7	16.8	1.4	1.4
Kishingo	19.4	22.3	1.0	1.3
Kishungi	7.5	7.5	0.2	0.2
Kubwa jinga	41.0	41.0	1.6	2.0
Kudenda	32.0	30.0	2.0	0.7
Kula na bwana	15.0	16.1	1.0	0.7
Kyela	35.6	34.2	2.4	2.4
Lugata	57.5	35.0	3.0	1.8
Mabeyenge	26.6	20.9	1.9	2.4
Machale	25.3	25.6	1.0	0.8
Makaniki	15.0	20.0	0.4	0.5

Malomogambiti	39.0	25.6	2.0	1.4
Malamata	21.0	21.2	1.8	1.4
Masantura	16.4	20.7	1.5	4.4
Matera	29.6	30.4	1.9	1.6
Mbawa mbili	12.0	28.8	1.3	1.3
Mbeya	20.7	32.2	0.9	0.8
Miholo	19.2	30.0	1.4	1.3
Mlangi	10.0	10.0	0.2	0.2
Mpulumpulu	58.3	40.0	3.3	2.2
Mramara	3.0	4.0	0.2	0.2
Mropa	15.3	13.7	0.5	0.7
Mtalima	28.9	50.9	0.9	0.8
Mwanga	30.0	30.0	1.2	0.8
Mwanza	84.5	58.0	2.7	1.0
mwenda mbio	40.0	42.0	0.8	1.7
Mwinula	7.8	25.6	0.6	1.6
ngome	180.0	360.0	0.1	0.1
Ngowe	32.0	19.0	2.0	0.8
Ngwindimba	24.8	30.0	1.3	0.7
Ngwinula	32.5	73.0	2.5	3.7
Nitalima wangu	15.0	30.0	0.3	0.7
Njia mbili	20.0	20.0	1.2	0.7

Nondo	22.0	26.7	1.0	0.8
pamba	10.0	30.0	0.2	0.9
Picholi	10.3	25.3	0.9	0.9
RD68	26.0	26.0	1.5	1.6
Risasi	25.0	30.0	1.2	0.9
Rufiji	16.7	18.3	6.0	2.2
Rangi Mbili	31.5	27.1	1.7	1.1
SARO	25.0	25.4	57.3	1.6
Serena	26.4	23.1	1.7	1.3
Shashi	20.0	40.0	1.3	1.0
Shikali	15.6	30.0	1.2	0.8
Shingo ya Mwali	100.0	55.0	2.7	1.5
Shosha	30.0	26.4	2.6	2.3
Simzigo	10.0	30.0	0.3	0.8
Sindano	9.5	20.8	1.0	0.8
Sukarisukari	19.2	29.3	1.3	2.7
Super	46.0	26.3	1.3	1.1
Thailand	10.0	18.3	0.7	0.9
Tondogoso	16.9	30.5	1.1	1.3
Traditional	19.1	21.4	5.6	1.3
Turiani	21.7	24.3	1.6	3.9
TXD 220	16.6	23.7	0.5	0.7

TXD 306	18.8	27.9	1.7	1.4
TXD85	9.6	17.1	0.7	0.9
TXD88	14.0	13.0	1.2	1.2
Uganda	7.5	30.0	0.2	1.2
Umana	18.1	20.4	2.3	1.1
Usiniguse	12.0	15.5	0.7	0.4
Wahiwahi	20.3	19.6	1.1	1.3
Zambia	45.3	52.2	1.9	1.2
WHOLE	2385.4	2820.8	189.5	140.2

3.21Access to seed and average prices by variety in 2009

Most farmers were able to access seeds within their villages. This is from their neighbors or save their own seeds for the year 2009.

Table 21: Access to seed and average prices by variety in 2009

Varieties	Availability of seeds within villages (%)	Average price per kg within villages	Availability of seeds outside villages (%)	Average price per kg within villages
AFA Mwanza	13	243.33	5	68.89
Bibo	0	0.00	0	0.00
Bisholi	37	373.17	23	347.80
Boko	3	600.00	0	0.00
Bumanha	1	29.67	0	0.00

china	1	454.38	0	474.06
China	31	650.00	30	0.00
Chupa	2	500.00	0	254.17
Dakawa	16	627.27	8	704.55
Dunduli ya mlimani	11	293.16	11	148.68
Faya	20	0.00	11	500.00
faya dume	0	0.00	1	0.00
Faya mjinga	0	430.00	0	430.00
fayarangi	1	292.00	1	0.00
Gamiti	3	293.33	0	555.56
Ifakara	20	214.29	31	142.86
Improved ADRAO NERICA	3	0.00	2	0.00
Improved ADRAO non-NERICA	0	518.90	0	300.49
India	94	458.06	55	364.52
India red	30	483.33	23	533.33
IR36	4	416.40	4	278.00
IR54	20	516.67	12	533.33
IR56	3	558.00	3	171.25
IR64	33	661.38	12	637.93
IR64"	28	650.00	25	650.00

IR66	1	840.00	1	0.00
ITA	5	666.67	0	783.33
Japan	12	831.25	12	0.00
Japani	6	450.00	0	300.00
Jaribu	5	680.00	3	0.00
Juliana	1	245.00	0	507.50
Kahogo	14	125.00	28	125.00
Kahogo red	1	553.46	1	320.80
kalamata	1	538.00	0	476.00
Kalamata	209	125.00	118	125.00
kalinganaula	5	430.00	5	250.00
Kaliwe wangu	2	0.00	2	0.00
kaniki	1	2350.00	1	475.00
Kihege	0	433.33	0	166.67
kihogo	0	480.23	1	176.28
Kihogo	3	365.29	2	355.29
Kikweta	3	250.00	1	50.00
kilombero	0	500.00	0	0.00
Kilombero	66	350.00	28	500.00
kisegese	0	750.00	0	0.00

Kisegese	22	633.00	21	31.82
Kishingo	9	342.45	2	217.92
Kishungi	2	450.00	0	340.00
Kubwa jinga	2	0.00	2	1000.00
Kudenda	1	164.29	0	335.71
Kula na bwana	17	315.00	2	0.00
Kyela	40	730.00	23	520.00
Ligwindiba	1	607.08	1	355.77
Line 88	0	655.21	1	145.83
Lugata	3	318.18	5	227.27
Mabawa	1	1054.89	0	693.70
Mabawa2	3	500.00	2	500.00
Mabeyenge	19	275.11	5	178.00
Machale	20	1000.00	4	1000.00
Makaniki	5	195.00	4	70.00
Malamata	41	500.00	25	0.00
MALAMATA	1	1543.75	1	1275.00
MALAMO	1	0.00	1	0.00
Malomogambiti	28	312.70	15	142.96
Maramata	2	380.00	2	510.00

Masantura	3	411.59	1	35.29
Matela	2	0.00	0	0.00
Matera	16	0.00	13	0.00
Mavi ya kuku	0	462.50	0	700.00
Mbawa2	14	1000.00	8	0.00
Mbeya	9	456.67	10	333.33
Miholo	13	0.00	1	0.00
Moshi	0	325.00	0	450.00
Moshi wa taa	0	409.09	0	422.73
Mpulumpulu	3	625.00	3	0.00
Mpyakabili	6	622.73	0	218.18
Mropa	2	500.00	1	500.00
msoga	0	500.00	0	516.67
Mtalima	10	433.33	10	550.00
Mushule	10	457.50	11	632.50
Mwanga	1	633.33	0	450.00
Mwanza	7	310.00	3	650.00
mwedambio	1	533.00	1	0.00
Mwenda mbio	5	608.33	5	400.00
Mwinula	9	650.00	9	875.00

ngome	3	700.00	4	0.00
Ngowe	6	166.67	4	166.67
Ngwindimba	10	0.00	20	700.00
Ngwinula	10	0.00	0	0.00
Njia mbili	3	626.85	2	461.46
nondo	2	465.00	2	1088.33
Nondo	1	312.13	2	178.25
Nyanchalombe	1	347.78	0	483.33
Other improved	1	602.73	1	259.55
pamba	0	400.00	1	200.00
PANAR	0	500.00	0	500.00
Picholi	33	625.00	23	0.00
rangi	5	271.43	5	178.57
Rangi	1	400.00	1	122.22
Rangi mbili	43	411.30	25	197.83
rangimbili	4	691.69	5	386.37
Rangimbili	4	1000.00	4	0.00
Rangimbilii	21	613.46	9	459.62
RD68	2	1000.00	1	0.00
Red Kihogo	1	500.00	1	150.00

Risasi	1	500.00	0	500.00
Rubi	7	1000.00	5	0.00
rufiji	1	310.00	0	0.00
Rufiji	5	1000.00	2	1000.00
Runymbili	19	328.57	11	428.57
Salo	141	475.00	79	130.00
seed.co627	1	681.43	0	280.36
Serena	21	750.00	12	0.00
Shikali	5	256.67	0	169.17
SHINGO YA MWALI	4	362.50	1	0.00
shingoya mwali	1	633.46	1	374.54
Shishali	1	438.41	0	244.93
Shosha	10	250.00	0	0.00
Sifala	1	350.00	1	83.33
Simzigo	3	1485.22	4	329.67
Sindano	10	475.00	3	62.50
Sukarisukari	44	558.33	15	330.00
supa	1	790.00	0	810.00
SUPA Kijive	7	514.29	3	0.00
Supa Tunduru	9	504.06	0	178.89

Super	269	210.00	165	216.00
Super India	52	540.00	25	160.00
Super kalimati	1	595.93	0	446.30
Super kyela	6	0.00	1	0.00
Super Mbeya	9	458.82	4	235.29
Super salo	7	430.00	1	430.00
Super shinyanga	5	284.00	3	320.00
Super Tunduru	20	336.11	20	77.78
Super Utafiti	6	832.05	0	669.23
Super Zanzibar	16	722.90	6	564.43
Tela	6	4000.00	6	600.00
Thailand	4	600.00	1	600.00
Tondogoso	19	1388.89	12	1266.67
Toto baya	0	500.00	0	500.00
Traditional	14	716.67	8	693.33
tulenabwana	1	659.09	1	654.55
Tuliani	2	1000.00	2	0.00
Turiani	7	546.88	3	471.88
TXD 220	39	440.00	24	707.50
TXD 306	96	476.00	69	181.11

TXD 362	1	288.89	1	88.89
TXD 85	1	489.37	1	278.20
TXD 88	9		9	0
TXD306	1		1	0
TXD85	14		11	0
TXD88	11		10	0
Uganda	1		0	0
Umana	27		21	0
usiniguse	2		3	0
Usiniguse	1		1	0
wahiwahi	9		1	0
Wahiwahi	26		14	0
Waiwai	3		1	0
Zambia	115		63	0
WHOLE	2,281	516.69	1,387	286.79

3.22 Access to seed and average prices by variety in 2008

Most farmers were able to access seeds within their villages in 2008. This is from their neighbors or save their own seeds.

11.9% of farmers acquired Super variety seeds from within the village, 9.4% of farmers acquired Kalamata variety seeds and 5.4 % of farmers accessed SARO variety seeds from within the village (Table 22). On acquiring seeds from outside the village, 11.5% of farmers had an opportunity of accessing Super variety seeds from outside the village, 7.9% of farmers acquired Kalamata variety seeds and 4.7 % of farmers accessed SARO variety seeds from outside the village (Table22).

All these suggest that most of the seeds of rice varieties ranging from improved to traditional/local ones are obtained by farmers from their villages.

Table 22: Access to seed and average prices by variety in 2008

Varieties	Availability of seeds within villages		Average price per kg within villages	Availability of seeds outside villages		Average price per kg within villages
	n	%		n	%	
AFA Mwanza	10	0.5	129	5	0.4	79
Bibo	0	0	0	0	0.0	0
Bisholi	30	1.4	300	20	1.5	280
Boko	3	0.1	500	0	0.0	0
Bumanha	1	0	30	0	0.0	0
china	1	0	449	0	0.0	465
China	31	1.5	450	31	2.3	0
Chupa	2	0.1	324	0	0.0	88
Dakawa	16	0.8	600	4	0.3	655
Dunduli ya mlimani	11	0.5	213	11	0.8	164
Faya	15	0.7	500	12	0.9	400

faya dume	1	0.0	0	1	0.1	0
Faya mjinga	0	0.0	650	0	0.0	650
fayarangi	1	0.0	0	1	0.1	0
Gamiti	0	0.0	219	0	0.0	440
Ifakara	21	1.0	214	29	2.1	143
Improved ADRAO NERICA	3	0.1	0	2	0.1	0
Improved ADRAO non-NERICA	0	0.0	359	0	0.0	310
India	82	4	416	54	4.0	406
India red	27	1.3	297	27	2.0	500
IR36	4	0.2	372	4	0.3	238
IR54	20	1.0	483	11	0.8	500
IR56	3	0.1	395	3	0.2	131
IR64	31	1.5	460	11	0.8	597
IR64"	28	1.3	650	26	1.9	650
IR66	1	0.0	412	1	0.1	0
ITA	4	0.2	625	0	0.0	683
Japan	12	0.6	288	12	0.9	63
Japani	6	0.3	76	2	0.1	180
Jaribu	2	0.1	650	2	0.1	0
Juliana	1	0.0	140	0	0.0	443

Kahogo	14	0.7	125	30	2.2	125
Kahogo red	1	0.0	387	1	0.1	293
kalamata	1	0.0	448	0	0.0	512
Kalamata	195	9.4	125	107	7.9	150
kalinganaula	5	0.2	530	5	0.4	430
Kaliwe wangu	2	0.1	0	2	0.1	0
kaniki	1	0.0	300	1	0.1	200
Kihege	0	0	433	0	0.0	250
kihogo	0	0	379	1	0.1	163
Kihogo	3	0.1	280	1	0.1	327
Kikweta	3	0.1	233	2	0.1	33
kilombero	1	0.0	500	0	0.0	0
Kilombero	58	2.8	350	27	2.0	175
kisegese	0	0	0	0	0.0	0
Kisegese	21	1.0	367	20	1.5	35
Kishingo	9	0.4	361	1	0.1	229
Kishungi	2	0.1	400	0	0.0	0
Kubwa jinga	2	0.1	0	1	0.1	1000
Kudenda	0	0.0	83	0	0.0	314
Kula na bwana	18	0.9	325	3	0.2	0

Kyela	44	2.1	730	28	2.1	210
Ligwindiba	1	0.0	319	1	0.1	406
Line 88	0	0.0	415	1	0.1	78
Lugata	3	0.1	180	5	0.4	318
Mabawa	1	0.0	295	0	0.0	689
Mabawa2	3	0.1	500	1	0.1	500
Mabeyenge	18	0.9	256	9	0.7	159
Machale	18	0.9	250	4	0.3	250
Makaniki	5	0.2	50	5	0.4	0
Malamata	33	1.6	500	26	1.9	0
MALAMATA	1	0.0	425	1	0.1	1275
MALAMO	1	0.0	0	1	0.1	0
Malomogambiti	27	1.3	244	13	1.0	147
Maramata	1	0.0	205	1	0.1	200
Masantura	1	0.0	347	0	0.0	35
Matela	2	0.1	0	0	0.0	0
Matera	13	0.6	250	13	1.0	0
Mavi ya kuku	0	0	113	0	0.0	585
Mbawa2	13	0.6	352	9	0.7	0
Mbeya	7	0.3	360	9	0.7	333

Miholo	12	0.6	0	1	0.1	0
Moshi	0	0	280	0	0.0	229
Moshi wa taa	1	0.0	309	0	0.0	382
Mpulumpulu	1	0.0	625	3	0.2	0
Mpyakabili	5	0.2	305	0	0.0	209
Mropa	2	0.1	500	1	0.1	500
msoga	0	0	500	0	0.0	400
Mtalima	10	0.5	419	10	0.7	583
Mushule	8	0.4	328	11	0.8	633
Mwanga	1	0.0	721	0	0.0	313
Mwanza	6	0.3	290	3	0.2	580
mwedambio	1	0.0	466	1	0.1	0
Mwenda mbio	5	0.2	542	4	0.3	400
Mwinula	9	0.4	675	9	0.7	875
ngome	3	0.1	500	4	0.3	0
Ngowe	6	0.3	167	4	0.3	167
Ngwindimba	10	0.5	700	20	1.5	600
Ngwinula	10	0.5	200	0	0.0	750
Njia mbili	3	0.1	347	2	0.1	422
nondo	2	0.1	415	2	0.1	485

Nondo	1	0.0	242	2	0.1	140
Nyanchalombe	1	0.0	332	0	0.0	414
Other improved	1	0.0	450	1	0.1	132
pamba	1	0.0	400	1	0.1	200
PANAR	2	0.1	500	1	0.1	500
Picholi	29	1.4	625	24	1.8	0
rangi	5	0.2	271	5	0.4	229
Rangi	1	0.0	422	1	0.1	0
Rangi mbili	38	1.8	352	22	1.6	213
rangimbili	5	0.2	306	5	0.4	277
Rangimbili	4	0.2	0	4	0.3	0
Rangimbilii	17	0.8	274	5	0.4	508
RD68	2	0.1	464	1	0.1	0
Red Kihogo	1	0.0	500	1	0.1	375
Risasi	1	0.0	500	0	0.0	500
Rubi	7	0.3	0	6	0.4	
rufiji	1	0.0	285	0	0.0	25
Rufiji	6	0.3	380	0	0.0	1000
Runymbili	17	0.8	186	11	0.8	429
SARO	113	5.4	395	63	4.7	50

seed.co627	0	0	280	0	0.0	389
Serena	22	1.1	750	16	1.2	0
Shikali	5	0.2	275	0	0.0	204
SHINGO YA MWALI	4	0.2	200	3	0.2	0
shingoya mwali	1	0.0	355	1	0.1	351
Shishali	0	0	267	1	0.1	194
Shosha	10	0.5	0	1	0.1	0
Sifala	1	0.0	325	1	0.1	83
Simzigo	3	0.1	389	4	0.3	237
Sindano	8	0.4	569	1	0.1	63
Sukarisukari	40	1.9	330	18	1.3	330
supa	1	0.0	556	0	0.0	730
SUPA Kijive	7	0.3	529	3	0.2	0
Supa Tunduru	6	0.3	331	0	0.0	159
Super	246	11.9	178	154	11.5	175
Super India	52	2.5	460	27	2.0	160
Super kalimati	0	0	177	0	0.0	469
Super kyela	4	0.2	500	1	0.1	0
Super Mbeya	7	0.3	444	5	0.4	312
Super salo	8	0.4	530	1	0.1	530

Super shinyanga	3	0.1	280	3	0.2	470
Super Tunduru	20	1.0	246	20	1.5	76
Super Utafiti	7	0.3	516	0	0.0	551
Super Zanzibar	12	0.6	372	6	0.4	531
Tela	5	0.2	400	5	0.4	0
Thailand	3	0.1	600	1	0.1	600
Tondogoso	18	0.9	359	14	1.0	1389
Toto baya	1	0.0	300	0	0.0	500
Traditional	15	0.7	441	9	0.7	449
tulenabwana	1	0.0	562	1	0.1	539
Tuliani	2	0.1	700	3	0.2	0
Turiani	5	0.2	357	3	0.2	448
TXD 220	38	1.8	475	24	1.8	663
TXD 306	85	4.1	328	70	5.2	198
TXD 362	1	0.0	131	1	0.1	89
TXD 85	1	0.0	330	1	0.1	248
TXD 88	9	0.4	0	9	0.7	0
TXD306	1	0.0	0	1	0.1	0
TXD85	13	0.6	0	11	0.8	0
TXD88	11	0.5	0	10	0.7	0

Uganda	1	0.0	0	0	0.0	0
Umana	25	1.2	0	18	1.3	0
usiniguse	2	0.1	0	3	0.2	0
Usiniguse	1	0.0	0	1	0.1	0
wahiwahi	2	0.1	0	1	0.1	0
Wahiwahi	26	1.3	0	16	1.2	0
Waiwai	2	0.1	0	1	0.1	0
Zambia	97	4.7	0	57	4.2	0
WHOLE	2075	100	318	1352	100	260

3.23 Reasons for cultivating several varieties on the same plot

69.3 % of the farmers grow more than one variety mainly to increase production. This is followed by 17.4 % who grow the crop to reduce risks. Only 4.6 % grow it by tradition. Others had diverse reasons (Table 23)

Table 23: Reasons for cultivating several varieties on the same plot

Reasons	Proportion of farmers who select the reason		Total	
	Male	Female		
	n	n	n	%
Increase production	590	110	700	69.3
Reduce risks	141	35	176	17.4
Preserve seed heritage	14	2	16	1.6
By tradition	34	12	46	4.6

Spread harvest over time	23	2	25	2.5
By pleasure	14	2	16	1.6
Control birds	20	7	27	2.7
Taste preference	3	1	4	0.4
Other	0	0	0	0.0
WHOLE	839	171	1010	100

3.24 Evaluation of constraints in upland with supplementary irrigation ecology

Findings from the study indicate that weeds are the major constraints in Upland with supplementary irrigation ecology with 1.9% and followed by insects (1.8%) being considered at different levels of intensity of the problem as high, medium and low (Table 24)

3.24 Table 24: Evaluation of constraints in Upland with supplementary irrigation ecology

Constraints	Upland with supplementary irrigation ecology					
	High	Medium	Low	Not exist	Don't know	Score
	n	n	n	n	n	n %
Weeds	12	4	0	935	43	994 1.9
Insects	4	2	5	912	41	964 1.8
Broadleaf	2	0	0	40	3	45 0.1
Azolla	0	0	0	3	1	4 0.0
African rice gall midge	4	1	1	769	42	817 1.5
Stem borers	1	2	1	823	42	869 1.6

Diopsis thoracica	0	0	0	3	0	3	0.0
brown plant hoppers	0	0	0	3	0	3	0.0
Greenleaf hoppers	0	0	0	3	0	3	0.0
White hoppers	0	0	0	3	0	3	0.0
beetles	0	0	0	3	0	3	0.0
Termites	1	2	3	793	42	841	1.6
Nematodes	1	4	3	781	42	831	1.6
Rodents	0	0	0	9	0	9	0.0
Birds	4	4	2	873	41	924	1.7
Bacterial leaf blights	2	4	1	791	42	840	1.6
Blast	2	5	3	815	42	867	1.6
Rice yellow mottle virus	4	1	1	837	44	867	1.6
Smuts/inofu	0	0	0	11	0	11	0.0
Poor soil quality	3	6	0	868	45	922	1.7
Zn deficiency	1	2	0	768	42	813	1.5
Salinity / Alkalinity	1	2	0	775	44	822	1.5
Deficiency/low use efficiency of N-P-K	1	6	1	791	43	842	1.6
Iron (Fe) toxicity	2	2	1	772	43	820	1.5
Acidity	1	3	0	764	44	812	1.5
Soil erosion	1	1	1	799	43	845	1.6
Siltation	1	1	0	783	42	827	1.5
Poor water conservation measures	1	2	2	857	42	904	1.7

Drought (inadequate water)	4	4	0	869	42	919 1.7
Flooding	2	2	4	820	42	870 .6
Pre-harvest Physical grain loss	3	0	2	813	42	860 1.6
Heat stress	5	0	2	798	41	846 1.6
Cold temperature	2	2	2	797	42	845 1.6
Small land size	5	4	2	867	41	919 1.7
Poor property rights on land	7	3	0	812	42	864 1.6
Difficult to get land for renting	5	4	3	834	42	888 1.7
Difficult to get land for buying	6	3	1	837	42	889 1.7
Poor quality of seed	6	4	1	852	42	905 1.7
Seed not available	5	3	3	825	42	878 1.6
Seed available late	2	0	0	48	12	62 0.1
Fertilizers high cost	8	4	2	858	39	911 1.7
Fertilzer not available through out the year	5	1	5	814	35	860 1.6
Poor quality fertilizer	0	0	0	35	2	37 0.1
Fertilizers available late in the season	6	2	4	817	39	868 1.6
Long distance to the fertilizer market	5	0	4	832	39	880 1.6
Pesticide high cost	1	0	0	24	6	31 0.1
Pesticide not available through out the year	2	1	0	24	10	37 0.1
Pesticide poor quality	2	1	0	19	3	25 0.0
Not enough labor	2	8	2	848	39	899 1.7
Labour cost too high	3	7	4	849	37	900 1.7

Difficult to acquire rice production equipment	7	2	1	842	40	892	1.7
Difficult to acquire rice harvesting and/ or processing equipment	6	3	1	830	40	880	1.6
Difficult to Manage equipment	5	1	3	813	38	860	1.6
Difficult to maintain equipment	5	3	1	817	39	865	1.6
Poor access to the road	3	4	3	845	39	894	1.7
Difficult to access water	5	5	2	816	39	867	1.6
Difficult to manage water	3	5	4	830	39	881	1.6
High cost of water fees	1	6	2	775	40	824	1.5
Non- availability of credit	6	2	3	802	42	855	1.6
High interest rate charges on credit	5	3	1	694	42	745	1.4
Delays in acquiring credit	3	4	3	694	42	746	1.4
Difficult to repay credit	4	4	0	705	41	754	1.4
Threshing	2	5	3	878	43	931	1.7
Winnowing	2	3	5	878	42	930	1.7
Drying	1	0	0	35	12	480	.1
Storage	2	2	7	852	43	906	1.7
Transport	2	3	5	856	41	907	1.7
Milling	1	1	6	849	40	897	1.7
Long distance to market for rice	3	0	6	860	40	909	1.7

Low prices for rice	5	3	3	878	39	928 1.7
High transport cost	5	3	2	851	38	899 1.7
Lack of market/demand for rice	2	1	5	823	40	871 1.6
Unavailability of extension services	1	2	4	826	39	872 1.6
Lack of effectiveness	2	2	2	823	41	870 1.6
Long distance to the extension workers	3	1	3	841	40	888 1.7
Limited economic use of rice straw	0	0	3	810	43	856 1.6
TOTAL	219	175	144	50,408	2,556	53502 100

3.25 Evaluation of constraints in irrigated ecology

Findings from the study indicate that weeds are the major constraint in irrigated ecology rated as high constraint by most of the farmers growing rice. Insects constraint comes second (Table 25).

Table 25: Evaluation of constraints in irrigated ecology

Constraints	Irrigated Ecology					
	High	Medium	Low	Not exist	Don't know	Score
Weeds	217	96	18	642	25	998
Insects	73	153	69	645	26	966
Broadleaf	2	2	1	37	3	45
Azolla	0	0	0	3	1	4
African rice gall midge	32	31	30	606	119	818
Stem borers	48	98	52	601	71	870

Diopsis thoracica	0	0	0	3	0	3
brown plant hoppers	0	0	0	3	0	3
Greenleaf hoppers	0	0	0	3	0	3
White hoppers	0	0	0	3	0	3
beetles	0	0	0	3	0	3
Termites	29	45	57	634	77	842
Nematodes	21	30	49	624	108	832
Rodents	0	0	0	9	0	9
Birds	171	64	33	614	43	925
Bacterial leaf blights	24	41	63	613	100	841
Blast	23	42	61	633	109	868
Rice yellow mottle virus	35	48	60	647	98	888
Smuts/inofu	0	0	0	11	0	11
Poor soil quality	68	103	62	640	50	923
Zn deficiency	16	15	22	588	173	814
Salinity / Alkalinity	28	47	52	580	116	823
Deficiency/low use efficiency of N-P-K	35	73	39	576	120	843
Iron (Fe) toxicity	13	22	31	594	161	821
Acidity	21	28	30	593	141	813
Soil erosion	20	50	69	645	62	846
Siltation	43	58	51	604	72	828
Poor water conservation measures	54	83	88	623	57	905

Drought (inadequate water)	110	72	52	635	51	920
Flooding	51	83	73	622	42	871
Pre-harvest Physical grain loss	32	87	83	603	56	861
Heat stress	35	49	52	611	100	847
Cold temperature	27	56	67	606	90	846
Small land size	121	80	32	644	43	920
Poor property rights on land	77	78	43	608	59	865
Difficult to get land for renting	79	77	36	644	53	889
Difficult to get land for buying	98	68	42	638	44	890
Poor quality of seed	63	124	54	626	39	906
Seed not available	54	89	71	624	41	879
Seed available late	2	2	2	42	14	62
Fertilizers high cost	156	57	23	629	47	912
Fertilzer not available through out the year	40	79	60	636	46	861
Poor quality fertilizer	1	3	1	27	5	37
Fertilizers available late in the season	38	81	57	634	59	869
Long distance to the fertilizer market	70	66	62	631	52	881
Pesticide high cost	2	3	2	20	4	31
Pesticide not available through out the year	2	5	6	19	5	37
Pesticide poor quality	3	2	2	16	2	25
Not enough labor	72	112	49	619	48	900
Labour cost too high	135	81	21	620	44	901

Difficult to acquire rice production equipment	133	84	19	608	49	893
Difficult to acquire rice harvesting and/ or processing equipment	152	61	11	605	52	881
Difficult to Manage equipment	105	64	22	603	67	861
Difficult to maintain equipment	85	68	32	613	68	866
Poor access to the road	66	97	53	625	54	895
Difficult to access water	65	106	54	598	46	869
Difficult to manage water	53	105	62	609	53	882
High cost of water fees	35	46	73	612	59	825
Non- availability of credit	96	74	40	593	53	856
High interest rate charges on credit	57	45	11	577	55	745
Delays in acquiring credit	37	49	19	584	57	746
Difficult to repay credit	39	49	24	587	55	754
Threshing	44	93	119	636	40	932
Winnowing	34	88	138	636	35	931
Drying	2	16	6	20	4	48
Storage	38	103	116	614	36	907
Transport	58	83	105	622	40	908
Milling	52	79	102	622	43	898
Long distance to market for rice	85	78	72	635	40	910
Low prices for rice	122	116	31	627	33	929
High transport cost	118	85	39	620	38	900
Lack of market/demand for rice	92	83	52	607	39	873

Unavailability of extension services	24	75	85	647	42	873
Lack of effectiveness	16	89	97	627	42	871
Long distance to the extension workers	52	57	101	639	40	889
Limited economic use of rice straw	69	62	48	625	53	857
Total	3,970	4,439	3,358	37,930	3,869	53,566

3.26 Evaluation of constraints in lowland ecology

In low land ecology findings from the study indicated that weeds are the major constraints rated as high constraint by many farmers growing rice.(Table 26). This was followed by birds and insects rated as medium constraints by many farmers in the ecology (Table 26).

Table 26: Evaluation of Constraints in Lowland Ecology

Constraints	Lowland ecology					
	High	Medium	Low	Not exist	Don't know	Score
Weeds	360	200	48	355	34	997
Insects	131	257	143	372	63	966
Broadleaf	16	14	14	1	0	45
Azolla	0	1	0	1	1	3
African rice gall midge	37	71	96	385	228	817
Stem borers	53	142	155	354	165	869
Diopsis thoracica	0	1	0	2	0	3
brown plant hoppers	0	1	0	2	0	3
Greenleaf hoppers	2	0	1	0	0	3

White hoppers	2	0	0	1	0	3
beetles	2	0	0	1	0	3
Termites	40	113	157	414	118	842
Nematodes	40	101	114	378	199	832
Rodents	2	5	1	1	0	9
Birds	167	238	107	355	57	924
Bacterial leaf blights	34	95	134	373	204	840
Blast	54	82	128	384	220	868
Rice yellow mottle virus	92	123	122	374	177	888
Smuts/inofu	5	4	0	1	1	11
Poor soil quality	120	230	102	362	109	923
Zn deficiency	25	62	68	373	286	814
Salinity / Alkalinity	29	78	67	377	272	823
Deficiency/low use efficiency of N-P-K	43	103	48	380	269	843
Iron (Fe) toxicity	22	70	41	393	295	821
Acidity	13	59	71	397	273	813
Soil erosion	33	105	126	418	164	846
Siltation	25	90	91	410	212	828
Poor water conservation measures	89	154	130	398	134	905
Drought (inadequate water)	191	216	94	363	56	920
Flooding	55	114	167	447	88	871
Pre-harvest Physical grain loss	27	141	191	383	119	861

Heat stress	28	115	124	421	159	847
Cold temperature	19	93	127	443	164	846
Small land size	138	159	135	407	81	920
Poor property rights on land	126	133	111	397	98	865
Difficult to get land for renting	94	145	118	439	93	889
Difficult to get land for buying	173	104	117	417	79	890
Poor quality of seed	204	185	83	370	64	906
Seed not available	111	162	129	401	76	879
Seed available late	13	21	3	11	14	62
Fertilizers high cost	255	91	69	400	97	912
Fertilzer not available through out the year	162	88	71	433	107	861
Poor quality fertilizer	3	12	4	14	4	37
Fertilizers available late in the season	123	101	88	444	113	869
Long distance to the fertilizer market	136	137	81	416	111	881
Pesticide high cost	5	4	2	16	4	31
Pesticide not available through out the year	4	1	1	22	9	37
Pesticide poor quality	4	2	2	15	2	25
Not enough labor	102	165	119	436	78	900
Labour cost too high	178	153	95	397	78	901
Difficult to acquire rice production equipment	201	149	41	376	126	893
Difficult to acquire rice harvesting and/ or processing equipment	183	122	41	398	137	881
Difficult to Manage equipment	133	105	83	401	139	861

Difficult to maintain equipment	120	112	90	399	145	866
Poor access to the road	152	140	85	421	97	895
Difficult to access water	124	167	74	395	109	869
Difficult to manage water	127	143	79	423	110	882
High cost of water fees	48	75	61	498	143	825
Non- availability of credit	174	90	45	419	128	856
High interest rate charges on credit	77	40	38	452	138	745
Delays in acquiring credit	69	56	38	442	141	746
Difficult to repay credit	56	52	54	470	122	754
Threshing	83	181	198	392	78	932
Winnowing	71	169	215	401	75	931
Drying	2	11	4	20	11	48
Storage	91	191	182	383	60	907
Transport	139	159	151	388	71	908
Milling	115	127	157	416	83	898
Long distance to market for rice	159	159	91	430	71	910
Low prices for rice	235	164	60	412	58	929
High transport cost	234	132	54	414	66	900
Lack of market/demand for rice	119	144	96	448	66	873
Unavailability of extension services	72	197	133	406	65	873
Lack of effectiveness	73	166	124	428	80	871
Long distance to the extension workers	132	137	139	420	61	889

Limited economic use of rice straw	124	87	104	418	124	857
TOTAL	6,701	8,016	6,332	24,832	7,679	53,560

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