Seed Production and Poverty Reduction: Case of Dodoma Rural District

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Abstract

The contribution of seed production to poverty reduction at household level in the participating villages was studied. Food security and household income was used as proxy indicators of poverty. Data was collected through a cross section survey using a structured questionnaire.

The average incomes / Adjusted Adult Equivalent Units /year were TAS 77, 768/= and TAS 70, 303/= for quality declared seed (QDS) producers and non-producers, respectively. A t-test analysis showed that the difference in income was not statistically significant (p>0.05). The average income for QDS users and non-users was TAS 76, 199/= and TAS 67, 168/=, respectively. The difference in income was also not statistically significant. These results are due to the fact that 2002/03 season in which the study was conducted was a bad year, resulting from a general rainfall failure in the area. Results of a regression analysis indicated that use of QDS contributed significantly in explaining the variation in income per Adjusted Adult Equivalent Units in the study area.

Food security analysis shows that 37% and 28% of the sampled QDS users and QDS non-users respectively indicated that their households were food secure. The paper concludes that QDS contributed to household food security and income. However, the extent of impact of QDS is to a large extent influenced by the rainfall.

Introduction of rainwater harvesting technologies is recommended if farmers are to attain the intended benefits from QDS.

Key words: Seed Production, Food security, Income, Poverty

Introduction

It has been estimated that in Tanzania, about 42% of households regularly have inadequate food (URT, 2001b). Any strategy to address rural poverty and food insecurity for the majority of the rural population in Tanzania must involve actions to improve agricultural production and farm incomes (URT, 2001b; URT, 2003).

It is recognized that future agricultural progress depends on the intensification of production rather than the expansion of cultivation (Muliokela, 1997). Hence the use of quality seeds, along with other inputs and appropriate cultural practices, is an-effective way of increasing crop production and productivity.

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Seeds carries genetic potential of the productivity of other inputs, the main role of the other inputs in crop production is to exploit to a maximum the genetic potential of the seed. Thus, seed quality is a prerequisite for improved agricultural productivity.

Empirical evidence shows that most of the seeds used in Tanzania are unimproved seeds (Mbwele *et al.*, 2000). The formal seed sector has been able to supply only 4% of the seed sown by farmers in Tanzania. The remaining 96% originates from the informal sector such as: farm-saved seed and farmer-to-farmer seed exchange (Mbwele *et al.*, 2000; Temu and Mtenga, 2000).

On-farm seed production was implemented in Dodoma between 1998 and 2002 as an alternative approach to supply relatively better quality seed than farmer saved seed. The initial seed for seed production is of known pedigree (approved progeny) to maintain genetic identity and purity. The seed that is produced is identified as Quality Declared Seed (QDS). QDS is defined as seed produced by a registered seed producer that conforms to the minimum standards for the crop species concerned and which has been subjected to the quality control measures outlined in the seed production guidelines (URT, 2001a).

One of the strategies of the programme is to operate the on farm seed production process on commercial basis, so that those who participate will realize the benefits (URT, 1994). The benefits as measured in terms of improved household incomes and food security. Quality declared seed production system has impact on both producers and users of quality declared seed. The producers are expected to benefit through sales of the seed that they produce. The benefits to seed users are to be attained through higher levels of crop productivity resulting from the use of improved seed (quality declared seed). The objective of this paper therefore is to assess the contribution of on farm seed production to household income and food security of QDS producers and users in selected villages in Dodoma Rural District.

Materials and Methods

The study area

The research work presented in this paper was conducted in six villages namely: Mvumi-Makulu, Chibelela, Mwitikira, Mundemu, Bahi-Sokoni and Chalinze in Dodoma Rural District in Dodoma Region. According to URT (2002) Dodoma region is mostly semi-arid due to low and erratic rainfall. About 85% of estimated population (2002) in the region lives in rural areas relying on agriculture and livestock keeping activities for their subsistence and income. Maize and sorghum are the most important in terms of hectares and production. In 2000/01 season, maize and sorghum accounted for 42% and 26% respectively of total hectares under food crops in the region followed by pearl millet that accounted for 15% of total hectares under food crops in the region.

Data collection

Data were collected in two stages: informal survey and formal survey. During informal survey focus group discussions (FGD) were carried out in all the six villages using a checklist of questions. Formal survey was carried out using a structured questionnaire in four (Mvumi-Makulu, Chibelela, Mwitikira and Mundemu) out of the six selected villages. A sample of 160 farming households was randomly selected and interviewed. On-farm seed producers were in small number so they were purposefully selected.

Data analysis

Cross tabulation was used to summarize and present qualitative data. T-test and chi-square were used for significance test. Linear multiple regression was used to determine the contribution of seed to household income. Household income was used as a dependent variable (as an indicator for income poverty). Independent variables included: adjusted household size, farm size (area under cultivation), non-farm activities, value of crops and source of seed (on-farm or otherwise).

The variables used to fit the model were as shown below:

The model: $\mathbf{Y = a+b_1x_1+b_2x_2+ ..... b_nx_n + E}$

Where:

Y = Income per adjusted adult equivalent units (AAEU)

a = Intercept of the equation

b_1 ... b_5 = Regression coefficients for the independent variables

X_1 = Adjusted household size

X_2 = Farm size (area cultivated)

X_3 = Income from n activities

X_4 = Value of crops produced per household

X_5 =Source of seed (or otherwise)

E = Error term representing a proportion of the variance in income of the household that was unexplained by the regression equation.

The tables for: Adult Equivalence Scales: Index of Calorific Requirements by Age and Sex for East Africa and Index of household economies of scale were used in determining the adjusted adult equivalent units (AAEU) (Collier et al., 1990). Household AAEU, average crop value and crop area cultivated were transformed into natural logarithm in order to fit in the model.

Results and discussion

Seed production

The results show that 20% of interviewed households were seed producers under the quality declared seed programme while the rest (80%, n=160) were non-producers. The seed producers were involved in seed production over different time periods. The time ranges from one to five years. Table 1 shows that 53% of seed producers have participated in seed production for 3-5 years. This implies that the study villages had a long experience in QDS production. It is therefore expected that the awareness of the concept and knowledge of QDS among the communities in the study villages is high.

Table 1: Respondents participation in seed production

Number of years	Number of respondents by village									
	Mvumi Makulu (n=4)		Chibelela (n=13)		Mwitikira (n=5)		Mundemu (n=12)		Total (n=34)	
	n	%	n	%	n	%	n	%	n	%
1	-	-	4	31	2	40	1	8	7	21
2	1	25	2	15	1	20	5	42	9	26
3	3	75	2	15	2	40	4	33	11	32
4	-	-	2	16	-	-	1	9	3	9
5	-	-	3	23	-	-	1	8	4	12
Total	**4**	**100**	**13**	**100**	**5**	**100**	**12**	**100**	**34**	**100**

The crops that were involved included cereal crops (sorghum and Pearl millet), legumes (pigeon peas and groundnuts), oil seed crop (sunflower) and a variety of vegetables. The results show that 69% of seed producers produced sorghum seeds (Table 2). Sorghum is important in the study area for food security. This is because the area experiences a semi-arid type of climate, with very unreliable rainfall pattern thus sorghum being drought tolerant is important in mitigating crop loses due to rainfall irregularities.

Table 2: Distribution of households by type of crop in seed production

Crops	Respondents per village									
	Mvumi Makulu (n=4)		Chibelela (n=13)		Mwitikira (n=5)		Mundemu (n=10)		Total (n=32)	
	n	%	n	%	n	%	n	%	n	%
Sorghum	3	75	11	85	4	80	4	40	22	69
Pearl millet	-	-	-	-	-	-	2	17	2	6
Sunflower	1	25	4	31	-	-	-	-	5	15
Pigeon peas	1	25	4	31	-	-	-	-	6	18
Groundnut	-	-	-	-	3	7	-	-	3	9
Vegetables	-	-	-	-		-	4	10	4	12

Figures do not add to 100% due to multiple responses

Use of quality declared seeds

Before analyzing the extent of use of QDS it was important to assess the awareness of the on farm seed production process. Data presented in Table 3 show that 89% of respondents indicated that they knew at least one of the seed producers in the village. Hence, awareness among farmers with regard to seed production was high. However, only 51% of the sample households had used on farm seeds at least in one season from 2001/03 (Table 3). The analysis of the methods by which farmers accessed QDS shows that 39% and 11% of respondents that used QDS obtained through cash purchasing and purchases on

credit respectively (Table 3). The willingness of farmers to buy QDS is an indication that there is a demand for quality seeds among the communities. Hence, this fulfills the aim of introducing seeds production in rural areas so that farmers can access improved seeds timely and at affordable price.

Table 3: Respondents awareness, use and access to QDS (n = 160)

Variable	Respondents	
	n	%
Awareness		
Knows seeds producers	142	89
Do not know	18	11
Total	**160**	**100**
Use of QDS		
Used	82	51
Never used	78	49
Total	**160**	**100**
Access to QDS		
On credit	9	11
By cash	32	39
As gift	18	22
Exchange with grain	15	18
Farm saved	8	10
Total	**82**	**100**

Figure 1 shows the trends in percentages of seed users that were increasing from 5% in 1997/98 to 33% in 2000/03. The results show that farmers have used seeds more than five years; this justifies the assessment if there was any contribution to the farmers' living standards. The increasing proportion of seed users is an indication of the acceptability of the seed technology among farmers.

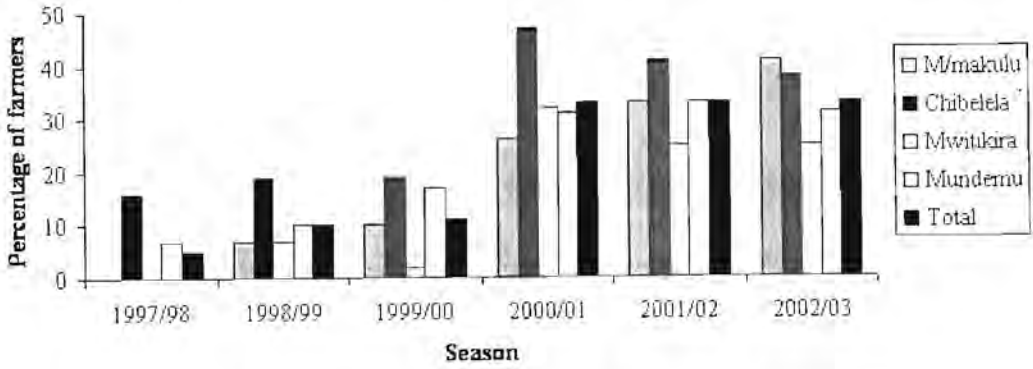

Figure 1: Proportion of QDS users by village over time

Contribution of seed to poverty reduction

An assessment of poverty reduction effects of seed production was done at two levels. First level, the assessment is done at the level of QDS producers and second at the level of QDS users. Household income and food security are used as poverty indicators for QDS users. However for QDS producers only household income is used because poverty reducing pathway of QDS production is direct through income generated from sale of seed.

On farm seed production and household income

Adjusted consumption expenditure of the households was used to compare means of income per adult equivalent per year between QDS producers and non-producers. The average incomes /AAEU/year were TAS 77, 768/= and TAS 70, 303/= for QDS producers and non-producers, respectively (Table 4). The results of t-test showed that the difference income between QDS producers and non-producers was not statistically significant ($p>0.05$). This can be explained by the fact that QDS production is done at small scale that it may not be expected to generate a substantial proportion of the total household income. Under the QDS production, each farmer is allowed to cultivate only 0.4ha of seed. According to the QDS production regulations, farmers can only produce quantities that can be sold within the same community (URT, 2001a) and therefore this emphasizes small scale rather than large-scale seed production.

Table 4: Comparison of income per AAEU per year (n = 160)

Variables	No of cases	Mean	Std Deviation	t-value	p-value
Seed producers	32	77 768	38 964	.994	.163ns
Non-producers	128	70 303	33 939		

Ns=Not statistically significant at p>0.05

Quality Declared Seed use and household income

Adjusted consumption expenditure of the households was used to compare means of income per adult equivalent per year between QDS users and non-users. The adjusted average incomes for QDS users and non-users were TAS 76, 199/= and TAS 67, 168/=, respectively (Table 5). The difference in income between QDS users and non- users was not very large. These results can be due to the fact that the 2002/03 season in which the study was conducted was classified as bad year. During the season most households were facing the problem of transitory food insecurity that was a result of a general rainfall failure in the area.

Table 5: Comparison of income per AAEU per year (n = 160)

Variables	No of cases	Mean	Std Deviation	t-value	p-value
Seed users	82	76 198.6	35 870.39	1.643	.051ns
Non-users	78	67 167.7	33 670.53		

Ns=Not statistically significant at p<0.05

A multiple regression model was used to establish the relative contribution of seed use to household income / AAEU. Households' consumption expenditure was used as an indicator for household income.

The model included all variables that were predetermined to affect the households' consumption expenditure. The following factors were retained: Use of seeds; Household AAEU; Average crop value; Crop area cultivated and Participation in income generating activities (IGAs).

The results of the regression analysis are presented in Table 6.

Use of QDS, adjusted household size; average crop value and crop area cultivated were statistically significant in explaining the variation in income per AAEU in the study area. All the variables tested indicated positive influence except for adjusted household size, which had negative influence. The implication is that the use of QDS contributes positively to household income. The attribution is that the use of improved seeds by farmers improves crop productivity in turn this leads to higher levels of crop sales (assuming all other factors constant). The results are comparable with other similar

studies done in Tanzania. For example Tanzania Agricultural Research Project II (TARP II-SUA 2002) reported that there was increase in farmers' income due to use of improved varieties of potato, rice and cassava in project participating villages. Household size (adult units in the household) was negatively correlated with income per adult equivalent and was statistically significant (0.01). This is because the higher the household size (adult equivalent units) the lower the income per adult equivalent meaning that only few of the adults earn enough while others are dependants.

The model results reflected F-statistics of 11.109 significant at 0.01. At 0.01 levels of significance the proposed equation is acceptable to explain the relationship between the household income and use of seeds, adjusted household size, average crop value, crop area cultivated and participation in income generating activities variables.

Table 6: Regression results on factors influencing household income /AAEU

Predictor	Adjusted Beta (b*)	Coefficient	T-value	P-value
(Constant)			22.744	0.000
Use of QDS	0.143	0.068	1.989	0.048*
Household AAEU	-0.500	0.081	-6.540	0.000**
Mean crop value	0.178	0.044	2.113	0.036*
Crop area	0.165	0.064	1.989	0.048*
Participation IGAs	0.092	0.07	1.301	0.195ns

F-statistics= 11.109; *=Significant at 0.05; **=Significant at 0.01; ns = Not significant

Quality Declared Seed use and household food security

Household food security is an important livelihood indicator for rural households. Food security directly dependents on what a household can produce. Seed is one of the inputs that can contribute to an increase in quantity of food produced on farm. Respondents were requested to carry out their own assessment of household food security. The respondents' responses presented in Table 7 show that 37% and 28% of the sampled QDS users and QDS non-users respectively indicated that their households were food secure. The findings indicate that a large number of food secure households were from seed users. This means that the use of seeds leads to increased crop production at the household level. Further analysis on food security was done using the adjusted adult equivalent units (URT, 1999). Table 8 indicates that the average cereals production per AAEU was 278 kg per person per year among QDS users and 204 kg among QDS non-users.

Table 7: Proportion of food secure households by AAEU

Food security status	QDS users		QDS Non users		Total	
	N	%	N	%	N	%
Food secure	30	37	22	28	52	33
Food insecure	52	63	56	72	108	67
Total	**82**	**100**	**78**	**100**	**160**	**100**

These data show that, on average seed users were more food secure compared to non-users. T-test analysis showed that the difference in average AAEU of cereal between households using QDS and those using non-QDS was statistically significant ($p<0.05$).

Table 8: Average AAEU of cereal for seed users and non-users

Compared pairs	No of cases	Mean	Standard Deviation	t-value	p-value
QDS users	82	278	231.4	2.409	0.016**
QDS Non-users	78	204	149.3		

NB: **=statistically significant at $p<0.05$

Quality Declared Seed use and household poverty

The rural poverty line established during 2000/01 Household Budget Survey was used in the household poverty analysis. The poverty line was extrapolated and inflated to TAS 87,799/= per person per year. The poverty analysis shows that 26% and 18% of QDS users and non-users were non-poor respectively (Table 9). It was expected that a higher proportion of QDS users would be under the non-poor category resulting from increased productivity. Possible factors that contributed to the lower proportions of the non-poor include: 1) the reference year (2002/2003) was categorized as a bad year due to shortage of rainfall which resulted into lower crop harvest. 2) It is likely that the harvested crops were used for home consumption and there was no surplus crop harvests for sale. Therefore, a low consumption expenditure was recorded that made the majority of households to fall below the poverty line.

Table 9: Households poverty status (n = 160)

Poverty status	Seed users		Non-users		Total	
	No of cases	%	No of cases	%	No of cases	%
Non poor	21	26	14	18	35	22
Poor	61	74	64	82	125	78
Total	**82**	**100**	**78**	**100**	**160**	**100**

Conclusions and recommendations

Conclusions

The presentation in this paper is based on a study conducted in a production system that is largely rain fed. Thus the effect of the rainfall pattern and distribution cannot be overlooked in this analysis. Failure of rainfall drastically reduced the expected economic gains from introduction of improved seeds. Failure of rainfall does not only reduce the expected returns to the introduced seeds but also results into loss of improved varieties.

The use of a pre-determined poverty line, to assess impact of QDS use on household poverty level categorized 26% of QDS users as non-poor. The low proportion is likely due to bad weather during the reference year. These results emphasis that climate (especially rainfall) in semi-arid conditions influence significantly the performance of on-farm seed production.

Recommendations

Production and use of QDS should be encouraged and supported by the agricultural departments of the district councils both technically and financially to improve agricultural production and productivity to reduce poverty in terms of food security and income. Deliberate efforts by Local Government Authority to coordinate different institutional efforts that support QDS is required. The activities that need to be coordinated with regard to QDS include: Production that reflects seed demand in communities, development of distribution channels to ensure efficient supply of improved seed in rural areas and building human capacity in management of genetic resources within the communities.

Introduction of rainwater harvesting technologies is also very important if farmers are to attain the intended benefits from QDS. The emphasis of rainwater harvesting technologies requires technical support of agricultural extension services from both government and non-government organizations.

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