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Profitability and factors affecting groundnut production under irrigation in Zimbabwe

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Abstract

The study was aimed at estimating the profitability, as well as factors that affect groundnut (*Arachis hypogea*) production under irrigation in Zimbabwe. Data were collected from 102 households using a structured questionnaire as the main instrument. From individual plot holder analysis, the study revealed that about 72% of interviewed farmers made profits from groundnut production and marketing, with an average of 40% return per United States dollar invested, making groundnut enterprise a profitable venture in the study area. Linear regression analysis results revealed that market information access, farmers' experience and cost of labour significantly affected the profitability level of groundnut production under irrigation. This was magnified by lack of improved seeds and poor road network, which were identified as major production and marketing challenges, respectively. Regular capacity building activities to boost farmers' skills on groundnut production and marketing, as well as increase market information access, could significantly boost profitability level of smallholder groundnuts farming under irrigation.

Key words: Poverty alleviation, return on investment

Introduction

In a bid to eradicate poverty in communal areas, groundnut (*Arachis hypogea*) has been identified as one of the enterprises that generate cash income for smallholder farmers in Zimbabwe due to its resistance to drought as well as low cost of production (Kapopo and Assa, 2012; Katundu *et al*., 2014). Although previously regarded as women's crop, groundnut proved to amplify economic growth in developing countries and to reduce poverty in rural communities, provided its production and utilisation reach the pinnacle (IFPRI, 2012; Kapopo and Assa, 2012; Katundu *et al.,* 2014). In Zimbabwe, Zimtrade (2014) projected that groundnuts will stimulate economic growth by contributing 56.8% after maize (62.8%), to the agricultural sector growth, provided its production reaches the peak.

Despite its increased production under smallholder irrigation schemes to amass cash income for poverty alleviation, there is still information gap about its profitability and factors affecting its production under irrigation systems. This is basically because profitability of groundnut production under irrigation has not been rigorously addressed in Zimbabwe. Hence, there is a need for context specific analysis for Zimbabwe in order to contextualise the findings and provide pragmatic policy recommendations to boost the profitability of groundnut production among smallholder farmers in irrigation schemes in Zimbabwe. The objective of this study was to investigate the profitability and factors influencing profitability of groundnut production under smallholder irrigation farming in Zimbabwe.

Material and methods

Description of study area

The study was conducted in Fuve-Panganai irrigation scheme in Zaka district in Masvingo Province in Zimbabwe. Zaka district is located about 130 Kilometres Southern part of Masvingo city, and 70 km from Chiredzi town. Annual average temperatures and rainfall of about 26 degrees Celsius and 500 mm, respectively characterise Zaka. Major agricultural activities practiced in Zaka include crop production, livestock rearing and market gardening. Crop production is mostly done under dry land production with few irrigation schemes, of which Fuve-Panganai is the largest of them all. The scheme is supplied with water through a canal from Siya dam, which feeds night storage dams. Zimbabwe National Water Authority (ZINWA) oversees the management and delivery of water to the scheme. The irrigation scheme is communally owned and operated.

Sampling procedure

Stratified random sampling was employed in selecting respondents for the survey. Stratified random sampling was suitable in this study since the scheme is divided into four Blocks. Therefore, the strata were categorised with respect to difference in characteristics such as water distribution and location along the scheme. This gave a total of 4 strata, as Block A, B, C and D. Proportionate sampling was used to select farmers from each Block. Sample size for each block was proportional to its contribution to the total population.

The list of all groundnut-growing farmers in each Block was obtained from agricultural extension workers. The selected farmers were interviewed based on their willingness to participate, and as such only 102 farmers were interviewed as opposed to the targeted 115.

Data collection

The study employed both secondary and primary data collection methods. Secondary data were gathered through review of literature, which include journals, irrigation schemes reports and textbooks. In collecting primary data, key informant interviews, observations and a survey were used. Seven key informants were interviewed at their offices and homesteads in order to gather information about groundnut production and marketing in the district and irrigation in particular. The key informants interviewed consisted of one Agricultural Extension Officer (AEO), three Irrigation Scheme Agricultural Extension Workers (AEW) and three members of Irrigation Management Committees. Observations were conducted in order to triangulate primary data collection. The following observations were made: the status of irrigation infrastructure, roads conditions, availability and condition of storage facilities.

A survey was conducted using a pretested structured questionnaire as the main instrument after permission to conduct a study was granted from District Agricultural Technical and Extension Services Officer and after the pre-test survey. Pre-testing of the questionnaire helped in making necessary corrections to the questionnaire.

One hundred and two farmers in irrigation scheme who produced groundnut during 2014/2015 season were interviewed at their homesteads or in the field. Although the questionnaire was in English, it was subsequently administered in local language (Shona) for easy understanding to those who were not able to understand English well.

Data analysis

Data processing and analysis were done with the aid of the Statistical Package for Social Sciences (SPSS) version 20.0, and Microsoft excel packages. In order to

measure the profitability level of groundnut production and marketing, the return on investment, that is return per dollar invested was used. Return on investment was used as the proxy for profitability, rather than other measures such as gross margin analysis. This was so because return on investment was identified as a good estimate of enterprise profitability (Ugwumba and Omojola, 2012; Onoja *et al*., 2012; Nwike and Ugwumba, 2015).

Basically, profit was defined as the net returns after subtracting total costs from revenue obtained (Ugwumba and Omojola, 2012). Subsequently, the return on investment was specified as net farm income divided by total cost incurred therefore measuring how much is generated from each and every single dollar invested (Adinya, 2009; Nwike and Ugwumba, 2015). Accordingly, when the ratio is greater than zero, it means that the benefits exceed the costs and this signals that the enterprise is profitable. When the ratio is below zero it means that the costs exceeds benefits, hence the project is not viable. This emanates from the fact that when the benefits or revenue obtained from investment exceeds the costs incurred means, the enterprise is profitable (Savva and Frenken, 2002).

In order to determine the factors affecting groundnut profitability, a linear regression analysis was employed according to Gujarati (2004). Linear regression analysis is a major technique used to determine the socio-economic factors that affect net income from crop production (Ugwumba and Omojola, 2012; Mogendi, 2014; Samboko, 2011). The diagnostic test were conducted to detect if all the assumptions of linear regression were satisfied. The linear regression model was specified as follows:

$$Y = \beta 0 + \beta 1EXPRNC + \beta 2GNDR + \beta 3EDULVL + \beta 4DPWOWN + \beta 5 COSTLBR + \beta 6TOPLNT + \beta 7MIACS + \beta 8COSTIRRG + \beta 9GRNDNTVRTY + e$$

Where, $\beta 0$ is the intercept term, e is the random residual error, $\beta 1$ to $\beta 9$ are unknown parameters to be estimated and Y is the return on investment. The linear regression variables were specified as in Table 1.

Results and discussion

Groundnut production

All the interviewed farmers grew groundnut mainly for sell to sustain household cash income needs. Most respondents (89%) highlighted that they sell their groundnuts whilst fresh from the field to middlemen as well as neighbours in their vicinity. A total of 81% of farmers grew Flamingo variety, which scored the highest. This was

Table 1. Linear regression variables specification for a study profitability of groundnut production in Zimbabwe

Variable	Description	Coding	Type of measure	Priori expectations
Dependent variable				
ROI	Return on investment	return and cost ratio	continuous	-/+
Independent variables				
EXPRNC	groundnut farming experience under irrigation	Exact years involved	Continuous	+
GNDR	Gender of household head	1 if male, 0 otherwise	Dummy	+
EDULVL	education level	1 if Secondary, 0 otherwise	Dummy	+
DPWOWN	draft power ownership	1 if yes, 0 otherwise	Dummy	+
COSTLBR	Cost of labour incurred	Amount of dollars invested	Continuous	-
TOPLNT	time of planting	1 if July, 0 otherwise	Dummy	+
MIACS	Access to market information	1if Yes, 0 otherwise		+
COSTIRRG	Cost of irrigation incurred	Amount of dollars invested for irrigating groundnuts	Continuous	-
GRNDNTVRTY	Variety of groundnut grown	1 if Flamingo, 0 otherwise	Dummy	+

followed by 15% of farmers who grew Natal common; while 4% grew Makulu red variety which scored the least. The time of planting groundnuts ranged from July to August, and harvesting period ranged from late November 2014 and early February 2015. The harvesting time was affected by the availability of buyers since groundnuts were sold while fresh.

Among the production challenges faced by farmers in the irrigation scheme, lack of improved hybrid seeds was singled out as the major pressing challenge with 99% of farmers confirming that it was difficult to access hybrid seeds within their locality. All the farmers confirmed that they used retained seeds, which significantly affected their yield due to loss of hybrid vigour. Also about 82% of farmers highlighted shortage of inputs like fertilisers and chemicals a serious issue during groundnut production (Fig. 1).

The other challenge of which about 81% of farmers felt to be a major pressing issue in production was the shortage of water to irrigate groundnuts due to the lack of capital to pay water bills during the growing season. These findings also concur with prior studies conducted in other African countries such as Ghana, Malawi and Zambia

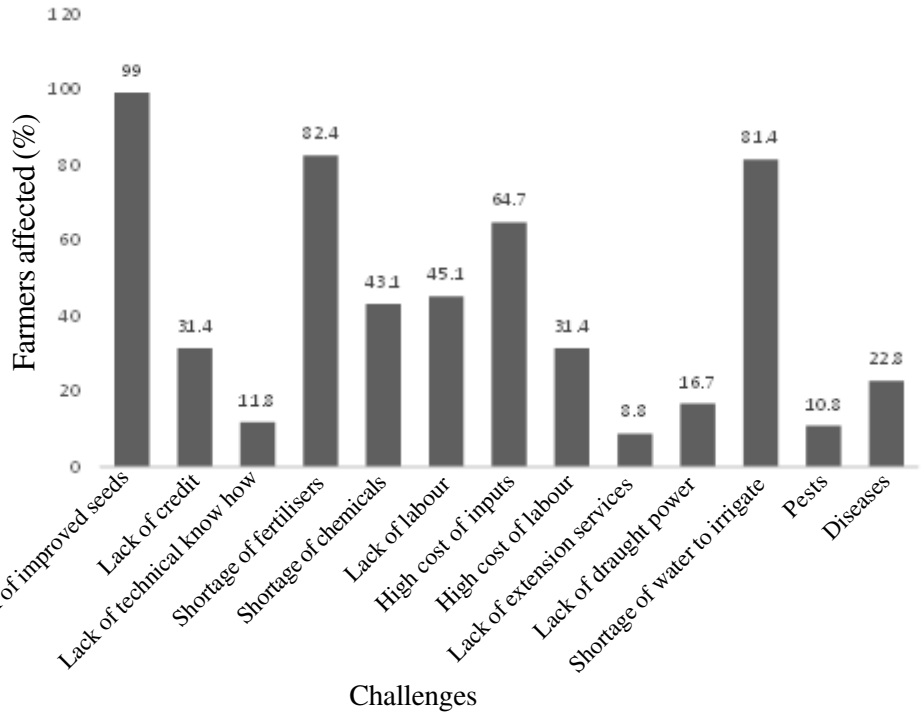

Figure 1. Groundnut production challenges under the Fuve-Panganai Irrigation Scheme in Zimbabwe.

(Mofya-Mukuka, 2013; Okello *et al*., 2013; Nzima *et al*., 2014). These challenges faced by farmers during groundnut production are summarised in the Figure 1.

Groundnut marketing

The most pressing marketing challenges highlighted by 90% of the respondents were poor road conditions and lack of value addition technologies, such as peanut butter processing machines. Farmers also highlighted lack of a well organised local markets (53%) and long distance to the market (67%), as other constraints affecting groundnut marketing. This was buttressed by key informants who indicated that due to long distance to the main market, vendors exploited farmers as they paid low price of 5 dollars per 20 kilogrammes as compared to the market price of 8-10 dollars being offered in Masvingo town during the same period. This coincides with the results obtained in other African countries such as Tanzania, Ghana and Nigeria which indicated that lack of market information, poor roads network and long distance to market are major marketing challenges faced by smallholder farmers (Adinya, 2009; Monyo *et al*., 2009; Angelucci and Bazzucchi, 2013). The marketing challenges discussed above are shown in Figure 2.

Profitability of groundnuts

The study findings indicated that 72% of interviewed farmers were reaping profits from groundnut production with an average profit of 129 US dollars per farmer. More specifically, return on investment analysis showed that on average a farmer obtained 40% from every single dollar invested, making groundnut enterprise a

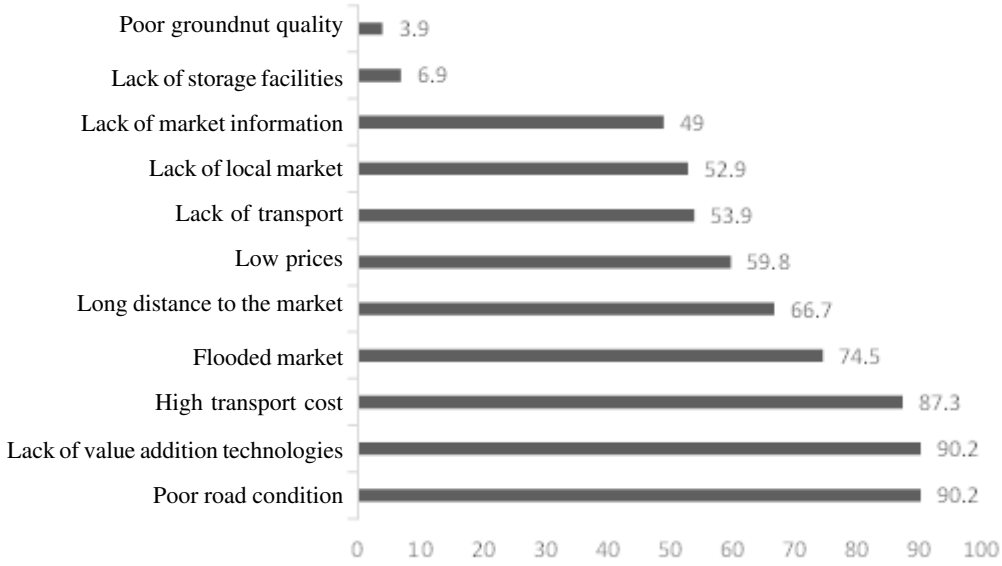

Figure 2. Groundnut marketing challenges,

lucrative venture under irrigation. These findings concur with earlier studies which revealed that groundnuts production is a profitable endeavour in many African countries (Monyo *et al*., 2009; Angelucci and Bazzucchi, 2013; Katundu *et al*., 2014).

To determine the differences across Blocks with respect to production cost, yield, profit and return per dollar invested, a one-way Analysis of Variance (ANOVA) was conducted. The results revealed that there is significant difference in means across Blocks. The Post Hoc Test indicated a significant difference on average cost of production across Block C and all other Blocks ($P<0.05$). Also, it was noted that with respect to yield level per hectare, there was a significant difference across Block A, C and D where Block D was found to have the highest yield while Block A had the lowest average yield per hectare. Regarding average profit level per hectare the results show that there was a significant difference across Block B, C and D where Block D had the highest profit level while Block C had the lowest profit level. There were also significant difference between Block D and all other Blocks where Block D scored the highest return per dollar invested while Block C had the least return on investment from groundnut production (Table 2).

Basically, on individual farmer basis, the average yield obtained was 1.8 tonnes per hectare and the minimum yield harvested was 0.5 tonnes hectare^{-1} while the highest was 4 tonnes per hectare. The average cost per hectare in US dollars were valued as follows: land preparation was 16, seeds 24, labour 253, transport from the field to homestead was 7 and water cost was averaged at 12 US dollars. All the costs on groundnut production per individual farmer were averaged at 312 US dollars per hectare, giving an average revenue of 441 US dollars.

Factors affecting profitability

Linear regression analysis

Results of linear regression analysis (Table 3) indicate that farmers' experience ($p<0.05$) and farmers' access to market information ($p<0.1$) significantly and positively

Table 2. Costs, profits and returns per individual Block in the groundnut Irrigation Scheme in Zimbabwe

Block	Average yield	Average revenue	Average cost	Profit	Return/$
A	1.2	321	242	79	0.3
B	1.9	487	303	183	0.6
C	1.5	337	350	-13	-0.04
D	2.2	574	290	284	0.98

Table 3. Linear regression analysis coefficients for return on investment (ROI)

Variable	Coefficient	Standard	Sign.	Collinearity statistics	
				Tolerance	VIF
Gender of household head	0.162	0.207	0.438	0.941	1.062
Education level of household head	0.256	0.254	0.317	0.923	1.083
Draft power ownership	0.93	0.193	0.633	0.814	1.229
Time of planting	-0.106	0.244	0.666	0.423	2.366
Market information access	0.343	0.178	0.057*	0.604	1.655
Cost of irrigation incurred	-0.014	0.009	0.132	0.562	2.781
Farmers' experience	0.111	0.020	0.000*	0.469	2.132
Labour cost invested	-0.004	0.002	0.026*	0.481	1.079
Variety of groundnut grown	-0.105	0.187	0.575	0.902	1.109
Constant	0.243	0.434			
R-Square	0.599				
Durbin-Watson value	1.905				

affected returns on investment; hence a unit increase in these factors will lead to an increase in return per dollar invested; while the cost of labour was found to be significantly and negatively related with the level of return on investment ($p<0.05$).

More specifically, it was noted that one more year increase in farmers' experience resulted in 11% increase in return on investment. The positive relationship between experience of the farmer and return on investment is consistent with the priori expectations. Also, the results are in line with prior findings which revealed that as experience accumulates the farmer is likely to follow recommended production methods and mastered resource allocation, thereby producing higher output and hence higher profit margins (Adisa and Sofoluwe, 2013; Masuku and Xaba, 2013; Osondu and Ijioma, 2014).

Access to market information was found to be significantly and positively affect return on investment (Table 3), thus farmers who obtained market information were reaping more profits compared to those who failed to access market information. It was noted that an increase in market information access would increase returns on investment by 34%. This is because those who have access to market information have higher chances of negotiating and bargaining with middlemen; hence sell groundnuts at higher prices. This coincides with earlier findings that access to market information, like prices, allows farmers to have negotiation power when selling their produce (Alemu *et al*., 2006). In the same view, it was also indicated that in Uganda, access to market information significantly improved farmers' bargaining power at the

farm gate and farmers with information access were receiving fifteen percent higher farm gate price as compared to other farmers (Courtois and Subervie, 2013).

The cost of labour incurred significantly and negatively affected return on investment obtained from groundnut production (Table 3). Thus, an increase in labour cost will significantly lead to a decline in the level of return on investment realised in groundnut production. This concurs with the priori expectations that labour cost negatively affect the profitability of groundnut production under irrigation.

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