

## Constraints to Rice Production in Malawi: A Case of Nkhulambe Irrigation Scheme in Phalombe District, Southern Malawi

Joseph Timothy Before<sup>1,3</sup>, Chris James L. Tembo<sup>2\*</sup>, Dexter Mandala<sup>3</sup> and Lerisha Nthala<sup>3</sup>

<sup>1</sup>Extension Department, Phalombe District Agriculture Office, Phalombe, Malawi

<sup>2</sup>Agriculture Department, Nalikule College of Education, Kanego, Lilongwe, Malawi

<sup>3</sup>Faculty of Agriculture, Malawi Adventist University, Lakeview Campus, Ntcheu, Malawi

\*Corresponding author: Chris James L. Tembo, Agriculture Department, Nalikule College of Education, Kanego, Lilongwe, 40680, Malawi, Tel: +265881111283; E-mail: tembo.c@nalikule.ac.mw

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### Abstract

Rice production in most developing countries is constrained by many challenges including limited access to farm inputs, extension services, climate change, and water availability. This study was designed to explore the challenges that are contributing to low production in Malawi using Nkhulambe Irrigation Scheme as a case study. Random sampling technique was used to get the sample to work with. Questionnaires and Focus Group Discussions were used to collect data. The research concluded that limited access to improved rice seed, low fertilizer use, overreliance on family labor, and limited access to technical support from agricultural extension officers are the major factors limiting rice production and productivity in the scheme. Other factors included damaged irrigation infrastructures, and climate change associated rainfall patterns.

**Keywords:** Rice production; Improved seed; Technical support; Fertility

### Introduction

Malawi is a landlocked country in the Sub-Saharan Africa whose economy is heavily dependent on agriculture. Agriculture contributes 35-40% of the gross domestic product (GDP), 85-90% of the foreign exchange earnings, employs more than 85% of the work force, provides 60-70% of the inputs into the manufacturing sector, and dominates the commercial and distribution industry [1,2]. The main cash crops are: tobacco, tea, sugar, coffee, cashew nuts and macadamia nuts. The main food crops include: maize, cassava, rice, groundnuts, sweet potatoes, beans, soybeans, pigeon peas, sorghum, millets, vegetables and fruits.

Rice provides food and income to many households in Malawi. It is an important food crop second to maize, and it is mostly consumed in urban areas. In rural communities, rice consumption is significant along the lakeshore areas of Lake Malawi in Nkhata-Bay, Karonga, Salima and Nkhotakota, Bwanje Valley in Ntcheu, along the Lake Chilwa covering Zomba, Phalombe and Machinga districts. It is also an important food and cash crop in the Eastern Bank of Lower Shire Valley. Rice is also grown as a cash crop to meet other household demands. In Nkhata-Bay, Karonga and Zomba, rice is an important cash crop.

### Rice production and consumption in Malawi

Rice is an important food and cash crop in Malawi. The crop is grown by smallholder farmers under irrigation in rice schemes and in wetlands during the rainy season. Most of these farmers have a land holding size averaging 0.5 hectares [2].

Notable irrigation schemes in Malawi are Limphasa and Hara in the northern region, Domasi, Muona and Nkhate in the southern region.

There are also other irrigation schemes new and old which are also important in rice production in the country [3].

According to Ministry of Agriculture and Food Security [4], rice production in Malawi has been declining since 1975. Both area under production and yield per hectare of the crop has been fluctuating, and production is not enough to meet the market and national demand and as a result, Malawi depends on imports to meet the shortfall. Imported rice is mainly sold and consumed in urban areas. For example, in 2002 rice production was about two-third of the national demand [5]. In 2017, prices for rice were around MK480 kg while the imported rice was around MK600 per kg. During the period between 2001 and 2005 the average milled rice production in Malawi was 49,990 metric tonnes. Growth rates for yield, harvest area and production were -11.79%, -5.88% and -16.97% respectively. These were against the rice consumption growth rate of 8.53%. During this period, Malawi had a rice self-sufficient ratio of 0.97 and rice imports represented 3% of the total quantity consumed [6]. As a result of the growing rice demand, rice prices have also been going up from one year to another [7].

In general, agricultural development in Malawi is challenged by three critical issues, in the face of declining agricultural productivity. Firstly, the need to keep pace with the growing demand for food; secondly, the need to ensure cash crop production for foreign exchange; and finally how to achieve these core objectives while ensuring that soil fertility is properly managed. Government and agricultural research and development organizations have been developing different technologies with an aim of achieving the stated objectives. Most of the developed technologies have been lowly adopted and utilized by smallholder farmers. Low adoption rate of the developed technologies has been attributed to the fact that they only targeted increase in yields for food security without considering improving profitability, competitiveness and sustainability of agricultural production [8]. In an attempt to put farmers first, the use

of participatory learning approaches have been a focal point in building capacity of farmers to understand markets, to identify challenges and opportunities and deal with them using participatory research that draws on new information and indigenous knowledge [8].

Currently, irrigation agriculture is being promoted in Malawi not only as a way of fostering development, but also as a means of reducing rural poverty, malnutrition, diseases and the growing social and economic inequalities between the rural and the urban areas [7]. In order to increase and sustain rice productivity, there is need for sound soil fertility management including use of fertilizers.

Adoption of sound soil fertility management technologies in rice production is affected by many factors including income, availability and affordability of the technology. A major factor discouraging use of fertilizer in rice production is low rice prices as a result of poor markets. However, Diao and Hezell [9] have argued that sustaining success in productivity-based agricultural growth critically depends on expansion of market opportunities and requires thinking beyond productivity to incorporate profitability and competitiveness.

Magreta et al. [7] further noted that income levels from rice are the major problem for smallholder rice farmers in Southern Malawi. This is a serious problem for farmers in an area where rice production is their main livelihood strategy and low income levels mean inability of farmers to actively participate in the day to day economic activities.

Though rice has the potential of replacing tobacco as the number one foreign earner, its production is limited by a number of factors. These factors include lack of improved rice varieties, low prices of the produce at harvest, poor access to input and output markets and poor agronomic practices among others [7]. Low rice productivity has resulted in low contribution of the crop to Malawi's economic development.

Nkhulambe Irrigation Scheme in Phalombe is one of the rice schemes in the Lake Chilwa catchment area. Rice produced in this scheme and adjacent fields has played an integral part in the social and economic development of Nkhulambe community as a whole. As a cash crop, it has been used as a source of capital for people to start big businesses ranging from wholesale shops, hardware and retail shops. The impact of rice on the communities is substantial, especially in the smaller centers, where it ensures competitive businesses and supply a wide range of services.

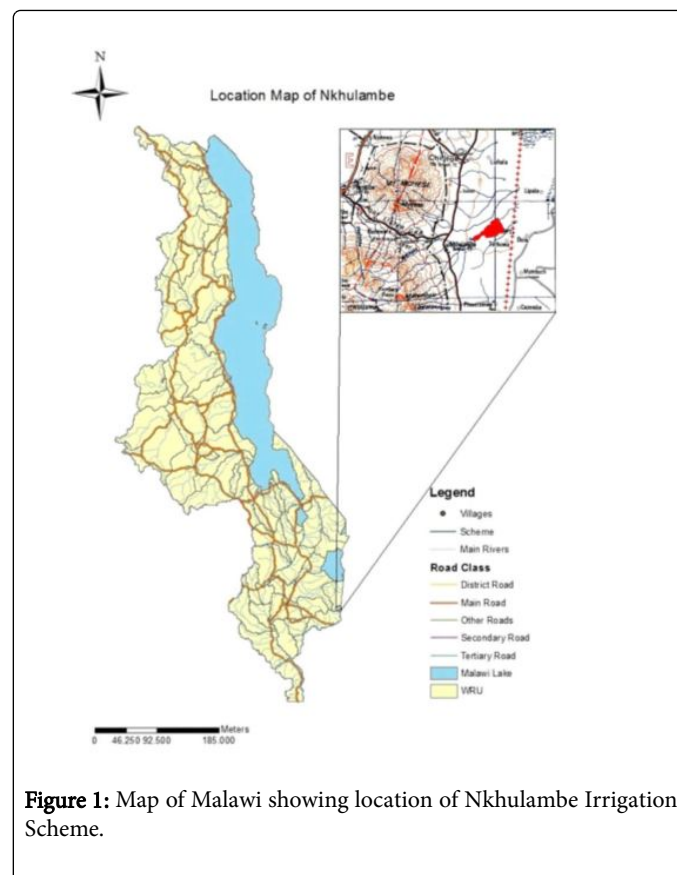
Though rice is considered a supplementary crop to maize as a food and an important cash crop, its yield and production has been decreasing over the years. It has been suggested that the reasons for poor production are lack of improved rice varieties, low fertilizer application, low and erratic rainfall, and poor access to markets and low prices. There is, therefore, a need to understand rice production constraints. The study, therefore, was carried out to explore the factors that are contributing to low rice production in Malawi.

## Material and Methods

### Study site

This study was conducted at Nkhulambe Irrigation Scheme (Figure 1) in Phalombe during the 2017-2018 farming calendar. The scheme is located to the east of the Nkhulambe Extension Planning Area (EPA) in Phalombe district. It lies at latitude S15°51'105" and longitude E035°46'717" with the highest point in the scheme at 703 meters above

sea level. It was established in 1983 with canal constructions in 1995 by the Malawi Government with funding from Chinese Government. The scheme is gravity fed and managed by farmers themselves organized into.



The scheme has a total of 491 hectares with only 285 hectares being cultivated by 234 farmers with an average land holding size of 0.6 hectares. The rest part of the scheme is dilapidated and needs maintenance.

Beans, maize, tomatoes and leafy vegetables are other crops grown in this scheme apart from the main crop, rice (Figure 2). Rice is grown during rainy season when water is abundant and during dry season the scheme grows maize and other crops. Water is diverted from Nanyowa River to improve water availability in the scheme. During the research, water was managed by the farmers through a cooperative.

### Farmer selection for the study

A simple random sampling technique was used to capture a sample from the population for the study. The sample size that was used for the study is 70 farmers.

### Data collection

Data was collected by using both primary and secondary sources. Primary source of data was collected from respondents using the questionnaire with both open and close ended questions. Key informants and focus group discussions were also used to capture some details especially on perceptions. Respondents were allowed to express their ideas freely using some open questions and the focus group discussions.

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Rice												
Bean												
Maize												

Figure 2: Cropping calendar for Nkhulambe Irrigation Scheme.

### Data analysis

The data collected from the respondents were cleaned and coded in order to ensure that only reliable information and relevant information was used. Both qualitative and quantitative data were analyzed using Statistical Package for Social Scientists (SPSS). Means, median and range and frequencies were presented.

## Results and Discussion

### Socio-economic characteristics

In order to have a clear understanding of the study population, the following demographic features were analyzed as presented below: gender, age, marital status, highest level of education and primary occupation. The characteristics are summarized in Table 1.

Characteristic	Variable	Number of farmers	Percent (%)
Sex	Male	29	41.4
	Female	41	58.6
Age	<25 years	2	2.9
	26-29 years	14	20
	30-35 years	35	50
	36-45 years	14	20
	>45	5	7.1
Marital Status	Single	3	4.3
	Married	56	80
	Divorced	5	7.2
	Widowed	6	8.6
Primary Occupation	Farming	69	98.6
	Business	1	1.4
Education	No Education	12	17.1
	Primary School	52	74.3
	Secondary	5	6.2
	Adult Literacy	1	1.4

Table 1: Socio-economic characteristics of respondents.

According to the study, women make a majority of the farmers in the scheme (58.6%) as compared to males (Table 1). This situation

might be due to the fact that most men in the community surrounding the scheme are involved in fishing and other income generating activities. In terms of age, the largest proportion of farmers in the scheme is between the ages of 30 and 35 years which represented 50% of the total sampled farmers. Only four out of the 70 sampled farmers were above 45 years of age. The lowest number of respondents was within the age group of 21 and 25 years, accounting for only 2.9%.

Table 1 above also indicates that married people are the ones mostly engaged in farming in the scheme (80%). Widows and widowers make 8.6% while divorced and single make 7% and 4% of the farmers respectively. Most of the farmers in this scheme have not reached secondary school level (91.4%). Only 7.6% of the respondents reached secondary school level while 1.4% underwent attended adult literacy education. 17% of the respondents are illiterate. 78% of the farmers at least reached primary school for some time and were able to read and write.

### Factors limiting rice production and productivity

Table 2 shows mean yield. An average yield in the scheme was 165 kg per acre (407.4 kg per hectare). This yield is far below the national average of 1500 kg per hectare [3]. The study, therefore, explored at a number of factors which could have resulted in low yields in the scheme. It considered the relationship between these factors and rice production in terms of yield. It also considered the perception of farmers on the reasons for low yields in the scheme.

	Mean	Range	SD	Variance
Rice yield this year (kg/acre)	165	200	69.34	4807.97

Table 2: Mean Rice yield at Nkhulambe Irrigation Scheme.

This source of labor tends to limit size of production [10]. Family labor has been found not to be a very reliable source of since it may be forced to tend to other activities during the critical periods of crop growth thereby affecting the yield due to poor crop management (Figure 3). The labor output from this source of labor may also be limited by other factors especially household size [11].

The study found that the average plot size for a farmer in the scheme is about 0.4 of a hectare and a majority of framers in the scheme (48.6%) have less than an acre of land (Table 3). It further revealed a strong relationship between land holding size and yield. Land holding size generally limits farmers' level of production making them unable to produce enough rice for consumption and sale. Although Kidney represented 32.9% of the rice varieties grown in the scheme due to its high production per unit area, it was observed that most farmers (59%) grow Tchuwabo, a Mozambican variety, due to its high yielding ability and ease of access (Figure 4).

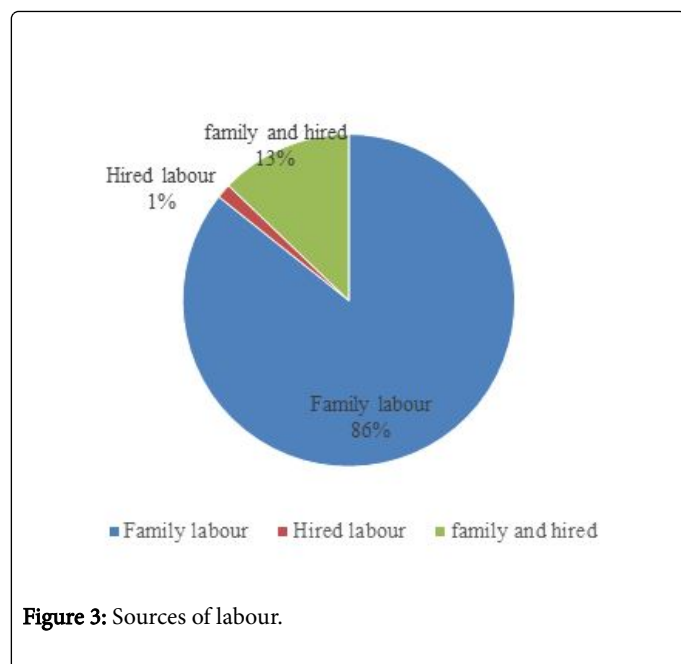


Figure 3: Sources of labour.

Land holding size (acres)	Number	Percentage
Less than an acre	34	48.6
An acre	12	17.1
More than one acre	24	34.3
Total	70	100
SD	0.905	
Variance	0.82	

Table 3: Farmer's plot size in the scheme.

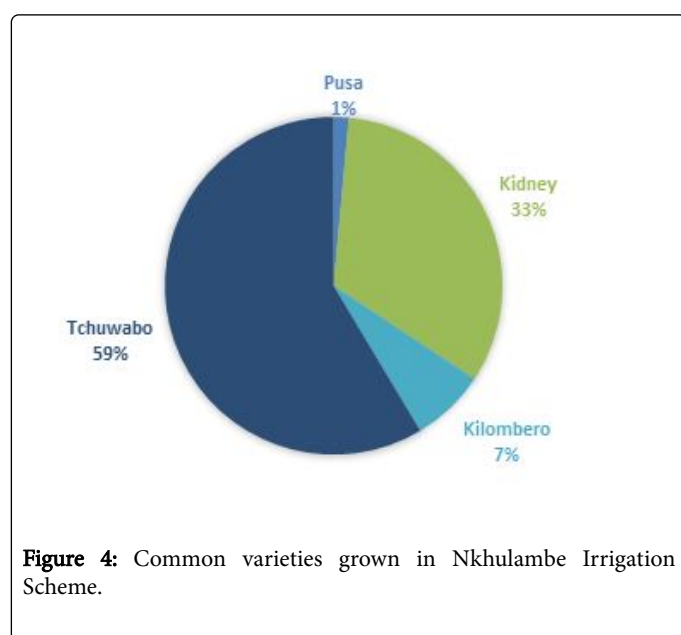


Figure 4: Common varieties grown in Nkhulambe Irrigation Scheme.

Though the variety is widely grown in the scheme, it is not recommended in Malawi. Both of the varieties are high yielding but Tchuwabo it has low aroma. Most farmers use recycled Tchuwabo seed.

During the research, it was observed that most farmers use recycled rice seed. This could suggest that farmers in this scheme do not have access to seed of improved varieties. This claim was also supported by farmers questioned in the scheme.

The study has established that 94.3% of farmers in Nkhulambe Irrigation Scheme used recycled Tchuwabo seed (Table 4). Two farmers out of the sampled 70 accessed the seed from government and two farmers used seed given to them by friends.

Source	Frequency	Percent
Own recycled seed	67	95.7
Government	2	2.9
not specified	1	1.4
Total	70	100

Table 4: Source of seed used in the scheme.

On plant spacing it has been observed that 95.7% of the farmers do not follow any recommended spacing. Most of them transplant rice when it's time to do so. Some do dibbling which is dry planting and no spacing is followed for growing rice. While the recommended spacing is 10 cm.

And no specified number of seeds is used per planting station as a result of this there is bunching in the field, no space for air circulation.

It was discovered that most farmers (51.4%) access information on rice farming from friends with longer experience of growing the crop while 34.3% get the information from extension workers in the area (Table 5). But as observed farmers have been growing rice for some years without an extension worker since the one who was working in that area retired. Very few said they got information of rice production from radio and field days, representing 4.3% and 1.4% respectively. This finding suggests that farmers lack accurate information on rice farming which reduces the potential to improve production [10,12].

Source of information	Frequency	Percent
Radio	3	4.3
Friends	36	51.4
Field day	1	1.4
Extension worker	24	34.3
Other	6	8.6
Total	70	100

Table 5: Source of information on rice farming.

Most farmers do not use fertilizers in rice production. Only one out of the 70 respondents indicated to have used fertilizers in rice at least once within the past five growing seasons. Most farmers argued that fertilizers are expensive as such they cannot afford it. However, the farmers use fertilizers in maize because it is a staple food crop in the area unlike rice. However, different authors have underlined the

importance of fertilizers in rice production [3,13]. Under maize production, fertilizers are purchased using coupons in through Farm Input Subsidy Programme (FISP). Ministry of Agriculture and Food Security [3] and Makuvaro et al. [10] pointed out that inadequate access to agricultural credit, output and input markets, unfavorable weather, small land holding sizes and failures in technology development and transfer further exacerbate to low productivity. This study has also revealed that most of the farmers in the scheme do not apply fertilizer. This has the potential of reducing the production of rice as the crop is deprived of some nutrients which are important to the crop to do well hence increase production [13].

About 53% of respondents said they did not know any government extension officer working in the scheme. This may mean that most farmers were not accessing technical support on rice production. This has a negative effect on production as farmers are not advised on the best management practices for improved rice production [10,12].

### Farmers perception on the causes of low rice yields

Table 4 shows the level of agreement of farmers to different factors that affect rice production in the scheme. The research used a Likert Scale of five levels to measure level of agreement of farmers to importance of these factors to affect rice production. 1 means strongly disagree while 2 means agree and 3 means neutral. A scale of 4 means agree while 5 means strongly agree. Most farmers agreed or strongly agreed to all factors. Farmers think access to good and stable markets was the major factor influencing rice production (mean 4.357) followed by access to improved seed with a mean score of 4.257. Damaged irrigation infrastructure especially irrigation canals was also agreed or strongly agreed as a major factor affecting rice production (Table 6) with a mean of 4.042. The findings are consistent with work by other researchers. For example, Matto et al. [14] studied constraints faced by paddy growers in adoption of recommended paddy production practices in India and found that major constraints faced by the farmers in adoption of the recommended paddy production practices were lack of technical advice for seed storage (93.33%), irregular visits of agricultural officers (94.44%), low rate of paddy in local market (84.44%), high cost of fertilizers (82.22%), and inadequate and untimely supply of loans (80%) among other constraints.

Perceived factor	N	Mean	SE	SD
Access to extension services	70	3.586	0.112	0.94
Access to improved seed	70	4.257	0.107	0.896
Access to fertiliser	70	3.014	0.145	1.209
Access to water	70	3.3	0.128	1.068
Climate Change	70	4	0.115	0.963
Crop damage by pests and diseases	70	3.329	0.13	1.086
Damaged infrastructure	70	4.042	0.105	0.875
Poor access to good markets	70	4.357	0.084	0.703
Valid N (listwise)	70			

**Table 6:** Perception of farmers on the factors affecting rice production in Nkhulambe Irrigation Scheme.

According to this study, 75.7% of the respondents need government and other stakeholders to improve access to improved seeds while 15.7% would prefer improved extension service delivery. Some farmers (5.7%) want government to extend the fertilizer subsidy to rice growing farmers. 2.9% of the respondents said government should rehabilitate the irrigation scheme to improve water management as opposed to the current situation where water is not controlled.

Focus group discussions also revealed that access to steady markets is also a challenge to farmers in the scheme. Most farmers sell their produce to vendors who buy at low prices thereby not meeting the production costs discouraging them from growing the crop. The farmers also asked government to intensify farmer trainings on rice production technologies that will result in farmers yielding more with the problem of climate change.

### Conclusion

The research concludes that though farming is the primary occupation of most farmers in Nkhulambe Irrigation Scheme, production is far much below the national average due to lack of access to improved rice varieties, poor market price and lack of stable markets, limited access to technical support by extension officers, and damaged irrigation channels resulting in poor water management. Use of family labour and low fertiliser use are the other main factors that are contributing to low productivity of the crop.

The research, therefore, recommends improvement of extension service delivery from various stakeholders including government agents, improvement in the access to improved and recommended rice seed, supporting farmers to reduce the cost of rice production.

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