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Assessment of Rice Production Constraints and Farmers Preferences in Nzega and Igunga Districts

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Abstract

This study analyses perceptions on rice varieties and factors that leads to reduced yield in rice production in Nzega and Igunga districts in Tabora region, Tanzania. Data from 102 randomly selected farmers identified 21 rice varieties with majority of farmers citing high yielding, good aroma, marketability, grain heaviness, and disease and drought resistance as prime traits in rice variety selection. Five abandoned rice varieties due to low yield, disease susceptibility, high water demand, and late maturing were reported. Major rice production constraints were lack of improved varieties, diseases susceptibility, and seeds unavailability, drought and high input prices. Thirteen rice diseases existed in fields with grain rot, rice blast, and sheath brown rot as the most devastating diseases. Mean income from rice production was 5,446,217 TSh with male having high income than female farmers. The Gini coefficient observed to be 0.6265 which indicated high income inequality distribution. Regression analysis model predicted the total income from rice production as 3,927,733.23 TSh. These findings draw attention to researchers, farmers and policy makers for the introduction of preferred rice varieties with high yielding potential, drought and disease resistance coupled with acknowledgements of indigenous technical knowledge for increased adoption rate of varieties in area.

Key words: Africa, gender, income inequality, preferences, rice constraints, Tanzania

Introduction

Rice (*Oryza sativa* L.) is one of the world's most important food at which about half of the world's population depends for consumption and income generation[1]. In eastern and southern Africa, Tanzania ranked second after Madagascar for rice production and consumption[2].

It is estimated that, about 60% of Tanzanian population consumes rice and its derivatives per day each year[3]. Rice also plays a great role in human being by which, stalks are utilized as animal feed and thatching materials.

In Tabora, rice plays a significant role in sustaining food security in the wetland areas. It is produced in all districts with varying production potentials depending on soil and climatic conditions. However, rice yield per unit area is still very low. Yield of rice as 1.5 to 2.1 tha^{-1} is far below than rice yield in the developed countries which hikes to over 10 tha^{-1} in some seasons. Additionally there is wide gap among research, potential farmers and actual farmer's yield in developing countries themselves[4]. The major reasons for these wide yield gaps includes environmental conditions, technology incompatibility, management, use of low yield potential cultivars and socio-economic factors.

Researchers cites socio-economic as one of the major contributing factors to low yields among farmers[5,6]. Farmers have peculiar ways of cultivar evaluation which normally targets multiple uses. This elaborates that, to produce acceptable variety a researcher must meet some farmers' preferences like local dish preparation which can be easily neglected by plant researchers. On rice cultivars, farmers can prefer palatability and other cooking qualities on the expenses of other traits like high yielding potentials[7]. This condition increases the possibility of using locally adapted rice cultivars which are normally associated with low yield per unit area. At the same time, some of the introduced varieties receive very low adoption rate, abandoned and neglected in many cases. This accelerates the yield gap expansion which leads to food insecurity in the area. There is a need of narrowing these ever increasing gaps.

On the other hand conventional research is cited to be more formal concentrating on researchers' objectives of problem solving leaving behind farmer's preferences, opinions and other complementary factors[8]. Failure to acknowledge farmer's preferences in breeding process can result into total rejection and reduced crop yield per unit area[9]. In order to have sustainable crop production, there is a need of combining farmer's and researcher's objectives. These combinations have reported elsewhere by which they brought significant contribution to agricultural developments[10]. Gathering rice production constraints and farmers varieties preference with the purpose of incorporating them into rice breeding programme is expected to contribute to increased rate of adoption, improved food security, reduced poverty, minimized food shortages and crises. Thus, the study on the assessment of rice production constraints and farmers preferences in Nzega and Igunga districts was conducted.

Experimental

The study was conducted in Nzega and Igunga districts in Tabora region, Tanzania. Fifty farmers from Igunga and 52 from Nzega districts were interviewed in this study. In total 102 farmers from Igurubi, Mwanzugi, Chamapulu, Nata and Mwaluzwilo villages with 25, 25, 22, 14 and 16 farmers respectively were used to gather agricultural information in the area. Quantitative data was collected as suggested previously[11]. The collected data was subjected to analysis in SPSS[12] computer package to perform descriptive statistical analysis. Lorenz curves were constructed[13] to assess inequalities of socio-economic factors that lead to reduced rice production in the studied area.

Results and Discussions

Sex and ethnic groups of respondents

Majority of rice farmers were male (84.3%) which indicates farming specialization in relation to gender. According to previous studies, male farmers prefer to grow market crops as well as food security considerations[14]. On the other hand majority of farmers (63.6%) belonged to Sukuma ethnic group (Table 1) probably due to cattle keeping. Rice farming has high implement demand especially during land preparation and transportation[15].

Keeping animals which is the case of many Sukumas have the added advantage of using oxen implements such as oxen ploughs and ox-carts in rice farming system in Igunga and Nzega districts.

Table 1. Ethnic groups of Nzega and Igunga districts, 2008/2009

Group	Frequency	Per cent
Nyamwezi	12	11.8
Sukuma	65	63.6
Nyiramb	10	9.8
Nyaturu	2	2.0
Muha	4	3.9
Fipa	2	2.0
Luo	1	1.0
Ngoni	1	1.0
Sumbwa	2	2.0
Jita	3	2.9

Marital status and heads of households

In Igunga and Nzega districts, 90.1 of the respondents were married followed by single 6, divorced 2 and 2% widowed. At the same time, 84.3% were heads of households and the remaining 15.7% were members of families. Heads of households plays significant role in decision making on issues related to farming, market, choice of crops and varieties to grow in Tanzania[16].

Crops grown

Farmers grow many crops either solely, intercropped or relayed. The most common crops were: rice (*Oryza sativa* L.), maize (*Zea mays* L.), sorghum (*Sorghum bicolor* (L.) Moench, cotton (*Gossypium hirsutum* L), sweet potatoes (*Ipomoea batatas* L.) Lam, lentil (*Lens culinaris*), sunflower (*Helianthus annuus*), onion (*Allium cepa)*, tomatoes

(*Solanum lycopersicum)*, green grams (*Vigna radiate*), groundnuts (*Arachis hypogea*), chick peas (*Cicer arietinum)* and cow peas (*Vigna unguiculata*). Growing of multiple crops per farmer is the typical characteristic of majority of small holder farmers. Farmers practice this farming system as the way of avoiding harsh environment, total crop failure and family sustenance interns of food security and income generation[17,18].

Rice grown and sources of varieties

Farmers identified 21 rice varieties in the area (Table 2). SARO 306 dominated by accounting for 18.63% of all the varieties followed by SUPA 12.75%, the most popular variety in the area. SARO 306 is replacing SUPA rice variety due to vigorous promotion and campaign which is done by the Government and other Non-government organization agencies. On the other hand, Mwamapuli irrigation scheme occurred as the major source (41.2%) of varieties followed by seed recycling (20.6%) and neigbour variety sourcing (10.8%) as highlighted on Table 3.

Table 2. Rice varieties grown by farmers in Nzega and Igunga, 2008/2009

Variety	Frequency	Percentage
SARO 306	19	18.63
DAKAWA	6	5.88
Sukari	6	5.88
SUPA	13	12.75
Bishori	5	4.90
Wahiwahi	9	8.82
TXD 88	7	6.86
IITA	4	3.92
PSBRC-28	1	0.98
IR 64	1	0.98
Madoke	1	0.98
Umanu	2	1.96
Kalamata	3	2.94
AFAA Mwanza	1	0.98
Nondo	3	2.94
Lugata	7	6.86
Tule na bwana	5	4.90
Moshi wa sigara	2	1.96
Mabawa ya nzige	1	0.98
Rangi mbili	2	1.96
Serena	4	3.92

Table 3. Sources of variety of rice grown by farmers in Nzega and Igunga, 2008/2009

Sources	Frequency	Per cent
Research	1	1.0
Neighbor	11	10.8
Friends	2	2.0
Market	4	3.9
Seed recycling	21	20.6
DALDOs' office	5	4.9
Mwamapuli scheme	42	41.2
Moshi	3	2.9
Morogoro	9	8.8
Nzega	1	1.0
Research	3	2.9

Characteristics of preferred rice varieties in Nzega and Igunga districts

Figures 1a-d denotes good and bad traits of SARO 306 and SUPA rice varieties which are mostly grown in Nzega and Igunga districts, Tabora region. Majority of farmers mentioned high yielding, good aroma, marketability, grain heaviness, and disease and drought resistance as prime traits in rice variety selection. These findings are accordance with previous observation[5] on rice preferences using conventional and farmer's analysis which resulted into increased rate of adoption among participating farmers.

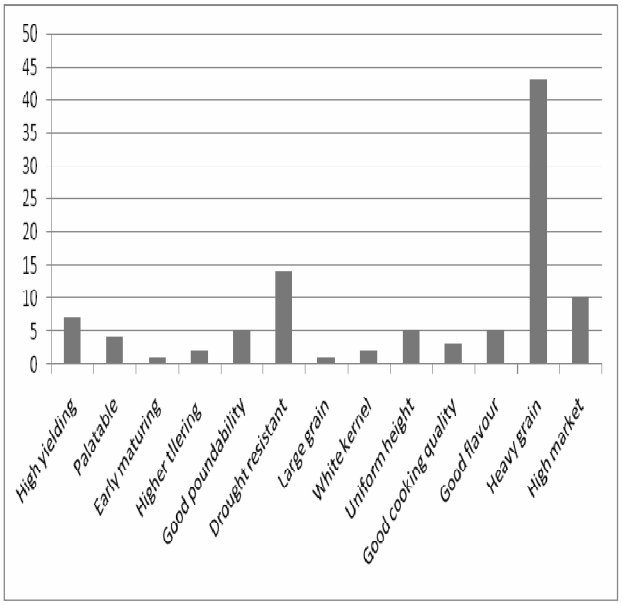

Fig. 1a: Preferred SARO Variety traits

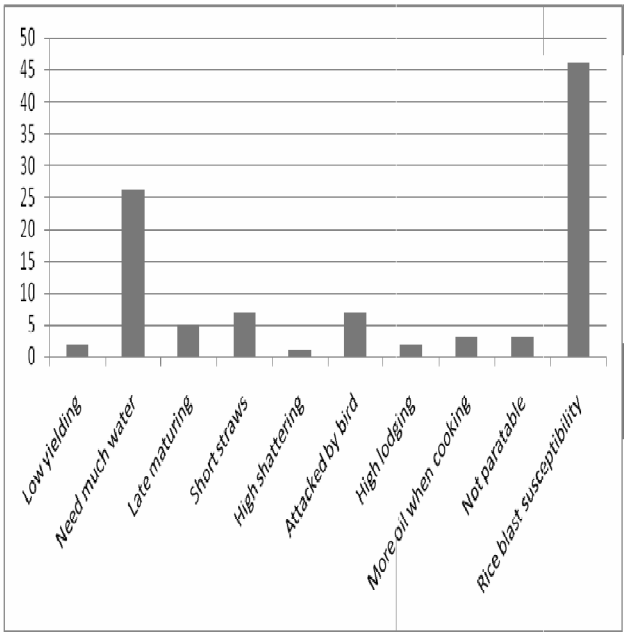

Fig. 1b: Bad SARO Variety traits

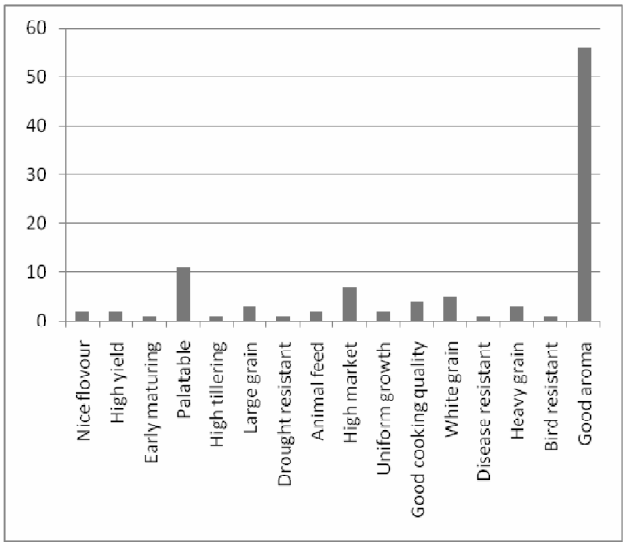

Fig. 1c: Preferred SUPA variety traits

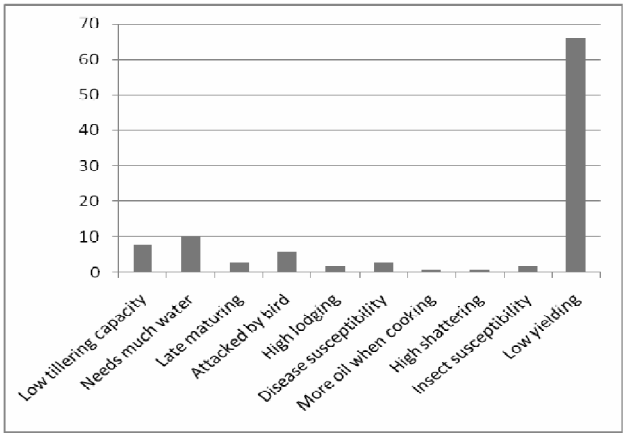

Fig. 1d: Bad SUPA variety traits

Abandoned rice varieties

Farmers reported five abandoned rice varieties in the area. These included Dakawa, Lugata, Kahogo, Kalamata and a variety from IITA which they failed to provide the specific name. Table 4 depicts some reasons for variety abandoning in Igunga and Nzega districts of Tabora region.

Low yield accounted for 37.3% as the major reasons of rice variety abandoning. This was followed by disease susceptibility which accounts for 22.5%, low aroma (9.8%), high water demand (5.9%) and days to mature (5.9%). To abandon or reject a certain crop variety is the last powerful weapon used by farmers to protest against top down approach and calls for immediate remedy of using participatory plant breeding as instituted by some breeders elsewhere[19,20,21].

Yield is one of the quantitative traits that controlled by multiple genes[22]. Thus, there are many ways of solving yield problems. Introduction of drought, disease and insect resistant with high yield potential cultivars can result into increased yield in rice production and thus solving the problem of food shortage in the area.

Table 4: Reasons for variety abandoning in farmers of Nzega and Igunga districts, 2008/2009

Reasons	Frequency	Per cent
Low yield	38	37.3
Not resistant to draught	5	4.9
Bad cooking quality	2	2.0
Low aroma	10	9.8
Liked by birds	4	3.9
Need more water	6	5.9
Small grain size	3	2.9
Disease susceptibility	23	22.5
No market	1	1.0
Insect damage susceptibility	1	1.0
Late maturity	6	5.9
Not white grain color	3	2.9

Major problems affecting rice production

Lack of improved rice varieties was mentioned as one of the major constraints facing farmers in rice production (Table 5). This factor contributed 42.2% which was followed by unavailability of seed (17.6%), diseases susceptibility (11.8%), unreliable rains (7.8%) and high input prices (4.9%). These are the mostly mentioned agricultural production problems that

lead to reduced crop yield in the world and calls for appropriate measures to ensure sustainable food availability[23,24]. Introduction of improved rice varieties coupled with improvement or initiation of good seed system channels could help in solving this persistent menace.

Table 5: Rice production constraints in Nzega and Igunga, 2008/2009

Constraints	Frequency	Per cent
Seeds unavailability	18	17.6
Lack of market	1	1.0
Lack of enough labor	3	2.9
Lack of enough land	1	1.0
Lack of capital	4	3.9
Low selling price	2	2.0
High input price	5	4.9
Low yield	3	2.9
Birds attack	2	2.0
Unreliable rains	8	7.8
Lack of improved varieties	43	42.2
Diseases	12	11.8

Rice diseases

There were 13 identified rice disease in Igunga and Nzega districts (Table 6). The most mentioned devastating diseases were grain rot (23.5%), rice blast (19.6%) and sheath brown rot (17.6%). The incidence of many diseases observed in this study highlights a potential danger to rice farmers in the area. Diseases are for reduced rice yield and quality of crop products in many areas of the world[25,26]. Yield losses caused by diseases can range from negligible to 100% depending on severity, pathogenicity, environment, crop and time of disease incidence[27]. Efforts are needed so as to curb these diseases through breeding for disease resistant varieties.

Sources of agriculture information

Majority of farmers in Nzega and Igunga districts receive agricultural information from Extension services followed by farmer's field schools activities. At the same time tradition farming inheritance (family) seems to diminish in this area (Figure 2). Similarly, agricultural research sector contributes less information to farmers which highlights potential danger to farmers of Nzega and Igunga districts. Sources of agricultural information are vital for spear heading agricultural technologies dissemination as information is power[28,29].

Table 6: Rice disease affecting rice potential in Nzega and Igunga, 2008/2009

Disease affecting potential	Frequency	Per cent
Sheath brown rot	18	17.6
Bacterial leaf streak	4	3.9
False smut	9	8.8
Kernel smut	1	1.0
Panicle blight	1	1.0
Sheath blight	1	1.0
Bacterial blight	7	6.9
Grain rot	24	23.5
Black kernel	9	8.8
Rice blast	20	19.6
Eye spot	2	2.0
Brown spot	4	3.9
Downy mildew	2	2.0

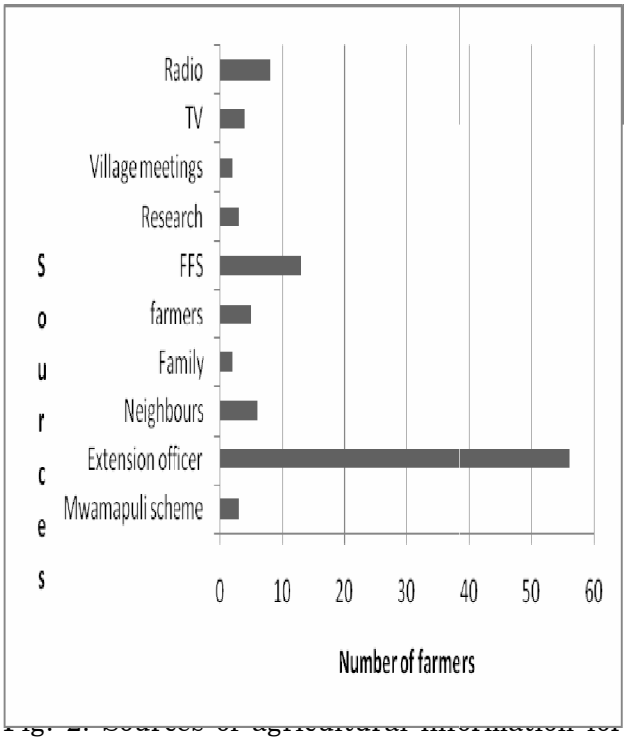

Fig. 2: Sources of agricultural information for farmers of Nzega and Igunga districts, 2008/2009

Income distribution for farmers of Nzega and Igunga districts

The mean income of farmers from rice production was 5,446,217/= with male having high income than female farmers (Figure 3). This finding agrees with previous observation[30] in Zimbabwe and in Tanzania[31].

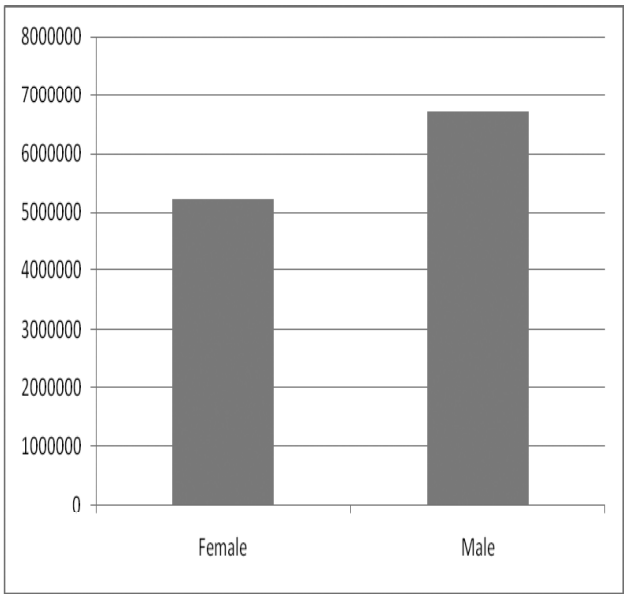

Fig. 3. Income distribution by sex in Nzega and Igunga districts, 2008/2009

The Gini coefficient observed to be 0.6265 and the curve lied below the line of equality (Figure 4). The Gini coefficient approached one which showed a high income inequality distribution among farmers. The coefficient of asymmetry was 0.7612. This coefficient was less than one lied below the axis of symmetry of the Lorenz curve to denote further uneven income distribution in the area.

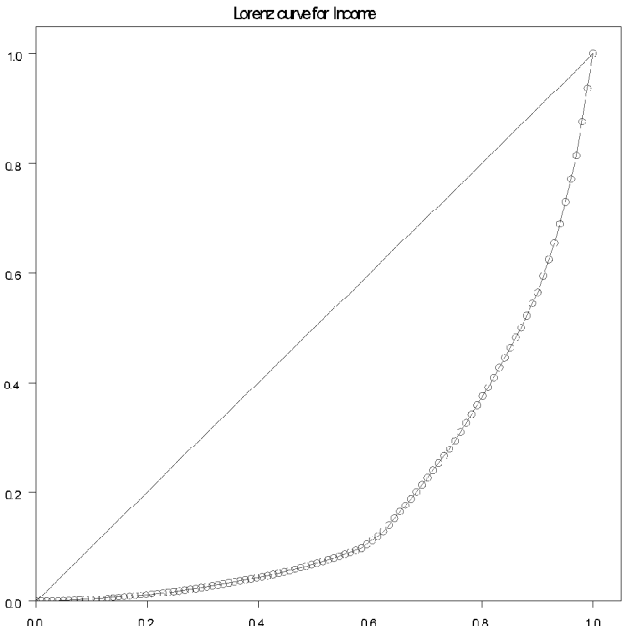

Fig. 4. Lorenz curve for income in Nzega and Igunga districts, 2008/2009

Regression analysis

The total income from rice production in Nzega and Igunga districts can be explained by the following model:

$$Y = 3927733.23 + 728477.98X_1 - 84170.98X_2 + 460446.15\ X_3 + 188726.99X_4 - 72411.16\ X_5 + 59718.07\ X_6 + 2038217.28\ X_7 - 173240.66X_8 + \varepsilon$$

Where, X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8 and ε are sex of respondent, age of respondent, ethnic group, level of education, number of household members, type of crop grown, rice variety, source of agriculture information and error term respectively. This model suggests that, the total income from rice production can be predicted to be 3,927,733.23 TSh while other variables (sex of respondent, age of respondent, ethnic group, level of education, number of household members, type of crop grown, rice variety and source of agriculture information) are zero. Also by making other variable constant, a farmer to be female or male increases income by 7,284,77.98 while age of the farmer can reduce income by 84,170.98 TSh. In Igunga and Nzega districts, belonging to a certain ethnic group can increase income by 460,446.15 while changing levels of education leads to an increase of 188,726.99 TSh. As family member's increases, the total income from rice drops by 72,411.16 TSh. On the other hand, selection of crop to grow and choice of appropriate variety leads to an increase of income by 59,718.07 and 2,038,217.28 Tsh respectively. Sources of agricultural information are very important in Nzega and Igunga district. Failure to obtain agricultural information from proper channel can result to income reduction amounting to 173,240.6 TSh.

Conclusions

The potential income realized from rice production can be predicted to be 3,927,733.23TSh. Lack of improved rice varieties was found as one of the major constraints facing farmers in rice production. Farmers can decide to abandon a variety by using criteria developed by themselves. Some of the preferred traits include high yielding, good aroma, marketability and drought resistance which are commonly used by farmers for variety selection in Nzega and Igunga districts. Breeding for high yielding which coupled with disease and drought tolerance is highly recommended in this area.

The way forward and recommendations

Based on the findings from this research, the following are highly recommended- Introduction of rice varieties with high yielding potential and preferred traits in the area could be the best option so as to increase yield of rice in Nzega and Igunga districts. This can be achieved through sourcing breeding germplasm in collaboration with national rice breeding program, regional collaborations (IITA, WARDA) and International collaborations (IRRI). Another area which needs much attention is the agronomic practices improvements. Inappropriate crop husbandry may contribute to low crop yield in the area. This can be rectified by improving agronomic practices such as timely planting, proper spacing, timely weeding, timely and correct use of fertilizers and insecticides, timely harvesting and reducing post harvest losses.

Enhancing collaborations with other stakeholders such as irrigation department, market and seed production systems that operates in the area is another option of accelerating the rate of rice variety adoption in Nzega and Igunga districts. This could be coupled with farmer's Indigenous technical knowledge acknowledgement so as to smoothen the introduction of improved rice varieties developed by breeding centres.

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