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Substantial factors influencing the performance of rice farmers in Mbeya Region, Tanzania

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Crops production subsector depends on various factors including natural factors as well as non-natural factors. Meanwhile, in vast areas of Tanzania including the Mbeya Region, rice farmers struggle to make their living through rice farming regardless of various challenges with which the subsector is crumbled. This study aimed at assessing the factors influencing the performance of rice farming in the Mbeya Region of Tanzania. Multi-stage sampling technique was applied to obtain representative samples. Data was collected from a field survey of 240 small-scale farmers by the use of questionnaires from January to March 2018. Descriptive statistics method was used to analyze the data and the Ordinary Least Square regression model was used to estimate parameters. The results indicate excess rainfall and droughts events significantly influenced rice production negatively by reducing 3 and 5% for each occurrence, respectively. Marital status and gender significantly influenced positively rice production in the study area. Other influential production factors including market price lag, pest and diseases, and farm size were statistically significant in rice production. The study recommends possible interventions such as increased accessibility to extension services, agricultural financial services, improved seeds, fertilizers, and pesticides to mention a few by government and other responsible institutions which hamper the growth of the rice industry to increase food security to the farming populace.

Key words: Rice, performance, factors, regression, Tanzania.

INTRODUCTION

Agricultural crop production remains the mainstay for the majority population in the rural areas of Tanzania (Reincke et al., 2018). Among other crops, rice production is the dominant cereal crop in the country ranked second after maize production (Alam and Effendy, 2017). According to the Tanzania Ministry of Agriculture, approximately total rice harvested area is 1,109,814 ha (MOA, 2019). Currently, rice is been cultivated in more than 64 districts from different regions of Tanzania (RCT, 2015). The leading regions are Mbeya, Morogoro, and Shinyanga regions which are characterized by various ecosystems. It is mainly produced under a rainfed ecosystem (95%) and the remaining amount is under small-scale irrigation schemes (USDA, 2019). Rice is

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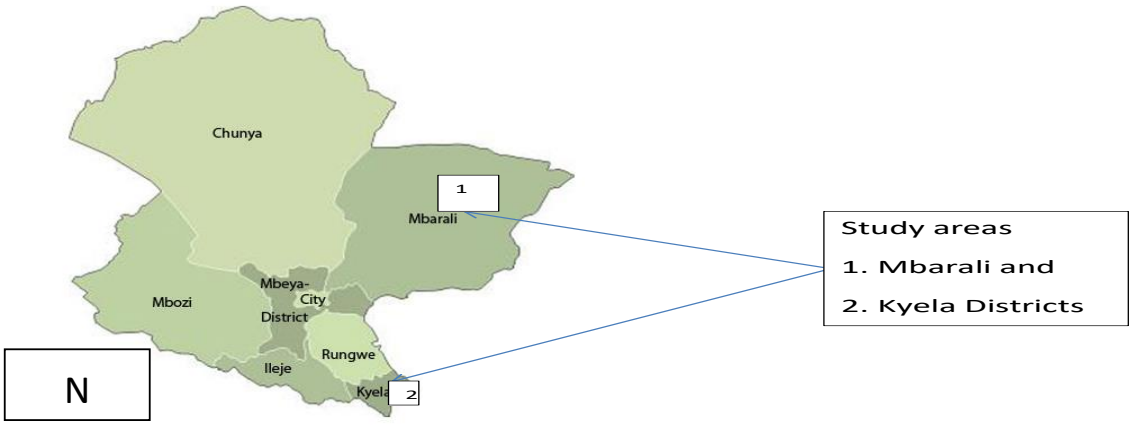

Figure 1. Map of Mbeya region showing the Mbarali and Kyela districts.
Source: Field Data (2018).

grown by small-scale farmers for both households' consumption and commercial purposes. The production has been varying from time to time due to various challenges including the climate and weather variability especially with seasonal and insufficient rainfall (Boniphace et al., 2014).

Realizing the importance of the rice industry the Tanzania government has been supporting rice production by initiating various programs and addressing the prominent challenges. The programs aimed at reducing the obstacles to increasing production and productivity. Therefore, the government and private organizations are working together to investigate and provide amicable solutions for the challenges which hold back rice productivity. Some of the solutions include an introduction and recommendation of the adoption of new technologies such as improved seed varieties, fertilizers, and irrigation services (Mligo and Msuya, 2015) to boost rice production. Nonetheless, weather variability remains the dominant challenge to crop production in the country (Kaliba et al., 2018). The situation has led to a decrease in food and income for most rural families relying on agriculture production (Global Information Network, 2019). At the household level, most challenges include poor access to education, poor technology adoption, lack of extension services, and poor prices (Urassa, 2015; Haji et al., 2018). Therefore, this study aimed at investigating the main challenges for increasing rice yield in the study region.

MATERIALS AND METHODS

Description of the study area

Mbeya region is among the oldest regions located in the South-west of the Southern Highlands of Tanzania. It lies between latitude 7° and 9°31' South of the Equator and between longitude 32° and 35° east of Greenwich. The region receives reliable rainfall annually varying from 650 mm in the great Usangu plains and Chunya district to 2600 mm in the Northern areas of Lake Nyasa. Normally the rains occur from October through May and experience a temperature average ranging from 16 to 25°C. The total population is 2,707,410 with 52.1% females and 47.9% men according to the Tanzania National Bureau of Statistics (NBS, 2012).

The paper is based on data collected from a survey conducted in Mbarali and Kyela districts of the Mbeya Region of Tanzania. The targeted population is the small scale rice farmers in the region. Cross-section research designs were used whereby data was collected from the respondents once at a time. The survey was conducted from January to March 2018 which was the period of active farming. The study was conducted on time as it was during the active agricultural season in which most farmers were working in the fields doing weeding and applying fertilizers. Mbarali and Kyela (Figure 1) are the two leading districts in rice production in the region and from each district, two wards were purposively selected. Four villages were again purposively selected where a total of 240 respondents were obtained by a random sampling technique. Thereafter, face-to-face interviews were used to solicit responses from the farmers based on socio-economic and demographic factors, general rice production practices, factors affecting rice production practices, agricultural information, and technology services. The interviews were guided with a set of written questions. Also, focus group discussions were conducted by involving the selected key personnels: the villages' leaders, agricultural extension officers, and other important social leaders in the respective villages (Table 1).

Analytical techniques

OLS regression equation was used to estimate the parameters used in the model. The regression equation relates the rice production in kilogram as a dependent variable with a set of independent variables. OLS regression was used because it is simple and useful to estimate the linear regression model. The equation could be demonstrated as follows:

$$Y_i = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \cdots\cdots + \alpha_n X_n + \mu_i \quad (1)$$

where Y is the rice production in kilogram per unit area, α is the constant of the regression equation, $\alpha_1 \ldots \alpha_n$ are the respective parameters to be estimated by the regression model, $X_1 \ldots\ldots X_n$ are the respective explanatory variables and μ_i is the error term.

Table 1. Distribution of respondent by sex, age, marital status, education, and off-farm income.

Variable name	Characteristics	Frequency	%
Sex	Male	186	77.5
	Female	54	22.5
Age	≤ 45 years	134	56
	> 45 years	106	44
Marital status	Single	10	4.2
	Married	230	95.8
Education	Illiterate	6	2.5
	literate	41	17.1
	Primary	169	70.4
	Secondary	22	9.2
Income off-farm	Yes	116	48
	No	124	52

Source: Field Data (2018).

RESULTS AND DISCUSSION

Descriptive statistics of the respondents

Distribution by sex, age, and marital status

A total of 240 rice farming households are involved in this survey. Among them 75.5% were males and 25.5% were females. The findings imply that rice farming activities are dominated by males in the Mbeya region. This result agrees with Diiro (2015) in Uganda. However, it went contrarily with (Chidi et al., 2015) who documented that in Ebony State female farmers dominated males by 58.3%. The study revealed that 56% of the respondents were having from 45 years and below while 44% were above 45 years. The study further revealed that the majority 96% of respondents were married while a few 4% were single. This indicates that almost all the rice farmers are married (Ajah and Chukwumah, 2014), and the situation could be an added advantage for family labor. About 70.4% of the entire population had attained primary education, 17.1% had read and write knowledge (Literate), 9.2% had secondary school education, and 2.5% were illiterate. Similar statistics are reported by Afolami et al. (2012) that the majority of farmers had primary education which is low and hampered them from technological adoption and attending agricultural extension services.

In terms of family size, the majority of households 83.3% have between 2 and 4 members, 9.2% have less than 2 members, 7.5% have from 5 to 7 members and none of the households were having a family size greater than 7 members. This trend shows that family labor size was inadequate in the study as compared to Kim et al. (2017) who reported that households with up to ten members were self-sufficient in terms of house labor. Additionally, 48% of the respondents were having off-farm jobs while 52% were only doing farming activities. This is an indication that farmers in Mbeya Region do not depend on rice farming only and this could be an advantage for adding income in the household apart from the income reaped in agriculture. These findings agree with Diiro (2015) who found that in Uganda farmers with off-farm income were better off in terms of income. Diiro also claimed further that because of extra earns from the off-farm jobs farmer could practice diversification at the same time adopting new technologies.

Land size, farm-size, crops type, reasons for cropping, and outputs

The results in Table 2 show that the majority of respondents (89%) own land. Land is regarded as an important asset to any household in rural areas. Owning to land ownership helps farmers to plan holistic allocation of resources including crops, livestock, and settlements. Our findings agree with the statistics provided by the Tanzania Bureau of Statistics (NBS, 2014) that almost 85% of the rural people own land. The further description shows that the majority of 73% of farmers in rural areas own less or equal to 2 ha of land, while only 27% own above 2 ha of land. This implies that although the majority of farmers own land the sizes are too small, thus, proper allocation of land is required as the number of people is increasingly more land will be in demand (Diiro, 2015). Additionally, about 80.8% have farm size less than 2 ha, while 16.75 and 2.5% of the respondents were having from 1-3, 4-6, and above 6 ha, respectively. This implies that the majority of farmers own a smaller amount

Table 2. Distribution of respondent by landownership, size, crops types, reasons for cropping, and outputs.

Variable name	Response	Frequency	%
Land ownership	Yes	214	89
	No	26	11
Land size (ha)	≤2	176	73
	>2	64	27
Farm size (ha)	1-3	194	80.8
	4-6	40	16.7
	>6	6	2.5
Major crops types			
Rice	Yes	240	100
Maize	Yes	141	59
	No	99	41
Crop uses	Food	26	3
	Cash	2	0.8
	Food and cash	211	88
Rice outputs(Kg/ha)	≤15000	163	68
	>15000	77	32

Source: Field Data (2018).

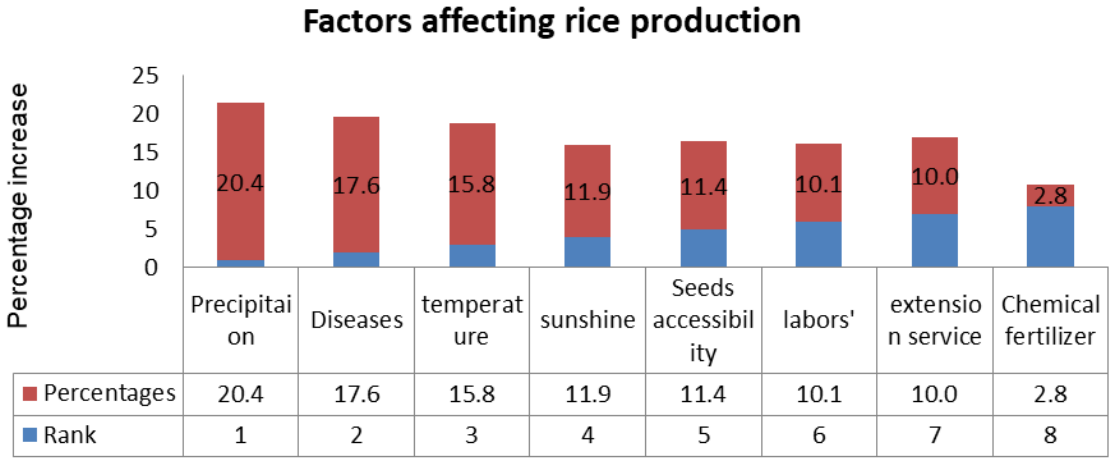

Figure 2. Perceived factors by priority.
Source: Field Data (2018).

of land. The present situation reflects the real traits of rural farmers as they tend to own small land and also cultivate small-sized farms in Tanzania (NBS, 2014). In terms of crops production, all 240 farmers attested to grow rice as a major crop. This agrees with the findings of Ngailo et al. (2016**)** who documented that almost all the households in Kyela district produce rice. However, some farmers (59%) revealed that depending on the season, weather variability, and market challenges they opt to produce maize as an alternative crop. Additionally, about 41% of the households in the same research area grow maize as their main crop.

Factors affecting rice production

Figure 2 shows the perceived factors influencing rice production in the Mbeya region. Among the factors, the

Table 3. Results from the OLS regression model.

Variable	Definition of Variables	Coef.	Std. Err.	t	P>t
gender	Gender of the household's head	0.235	0.126	1.860	0.065*
maritacode	Marital status of household's head	0.840	0.216	3.890	0.000***
lnlaborsize	Family labor size	-0.275	0.111	-2.480	0.014**
educode	Education of household's head	0.090	0.085	1.050	0.294
agecode	Age of household's head	0.151	0.091	1.650	0.102
lnArea	Logarithm of area	0.981	0.071	13.850	0.000***
inco_offam	Off-farm income of household's head	0.000	0.000	1.430	0.155
landown	Land ownership by household's head	0.204	0.136	1.500	0.136
excess_rains	Excessive reins	-0.030	0.016	-1.890	0.061*
drought	Occurrence of drough	-0.047	0.015	-3.110	0.002***
lnprice_rice	Logarithm of price lag	0.564	0.239	2.350	0.020**
lnSeed_Q	Seed quantity	0.092	0.073	1.250	0.213
lncrop_diseases	Occurrence Crop diseases	-0.123	0.066	-1.870	0.064*
lnFert_Q	Logarithm of fertilize quantity	-0.035	0.094	-0.380	0.708
_cons	Constant of the model equation	2.419	1.911	1.270	0.208

*P>0.01, **P>0.05, ***P>0.1; F=0.000, R^2= 0.73, Adj R^2 = 0.6982.
Source: Field Data (2018).

majority of farmers ranked rainfall as a number one (20.4%) factor affecting rice farming in their localities. However, farmers insisted on the existence of frequent rainfall variability, especially during the farming seasons. It is also noted that the wet season has been shrinking from time to time (Kulyakwave et al., 2019). Based on that, some farmers have decided to adopt small-scale irrigation by utilizing seasonal water available in the Mbarali district, especially the Usangu basin to increase agricultural productivity (Gudaga et al., 2018).

Pest and diseases were earmarked as a second (17.6%) important factor influencing rice farming. This finding implies that the economic losses as a result of pest and disease calamities are well noticed by farmers. The current finding goes in line with a study of Kihoro et al. (2013) as they documented that diseases cause approximately 60 to 100% of farmers' rice yield losses in Kenya. The temperature was perceived as the third most important factor affecting rice farming activities in the study region. Farmers claim that the temperature is increasing as compared to previous years. They have also associated the eruption of pests and diseases as a result of the prevailing high temperature. This finding is in good agreement with the findings of Rahman et al. (2017) in Bangladesh. The results depicted in Figure 2 showed that sunshine is ranked fourth at 11.4% as among the earmarked factors. Sunshine increases evapotranspiration of soil moisture leaving the soil to dry and hence less to support plants. However, sunshine is important to support photosynthesis activities in the plant but when exacerbate beyond could damage chloroplast within the plant cell and affect the whole system of plant development and output (Zhao and Fitzgerald, 2013).

The fifth challenge affecting rice production is the accessibility and availability of quality seeds (Figure 2). Farmers have acknowledged that it has been difficult to access both quality and certified seeds and have therefore continued using local seeds. Meanwhile, the local seeds have a reputation for producing low yields and are also prone to diseases. This fact goes in line with Elias (2018) who suggested proper accessibility to quality seed for better farmers' yields. Another factor identified by farmers was the poor availability of labor to work in their fields. Most farmers depended on insufficient family labor. Poor access to extension service is also an important factor for reduced crop production. Most farmers confirmed that they have never received extension services. Extension services are essential for farmers because it is through the services farmers receive important information and knowledge concerning better agricultural practices. This includes services such as time for field preparation, planting time with regards to rainfall availability, availability of important inputs like seed, fertilizers and also pesticides, market, and market prices (Boniphace et al., 2014). The last factors observed by farmers were the availability of fertilizer. Most farmers attested to not using fertilizer because it is not accessible. Through focus discussions, it was revealed that although fertilizer is sold by government agents the prices are higher than the one set by the central government.

Empirical estimate from OLS results

Table 3 presents the results of the estimated parameters for the factors influencing rice production in the study

area. Therefore, the estimated parameters are presented (Equation 2) and analyzed.

$$y = 2.419 + 0.235 * gender + 0.840 * marital - 0.275 * lnlabsize + 0.981 * lnArea - 0.030 * excessrain - 0.047 * drought + 0.564 * lnpricelag + -0.123 * lncropdisease \quad (2)$$

The empirical results indicate that the gender of the households' heads significantly influences rice production positively. This implies there is an increase in rice yield by 23.5% for each household led by a female in the study area. Regardless of the fact, female-headed households are few but the mean rice yield reaped was higher as compared to males. The results in Table 3 revealed that farming areas significantly influence rice production positively and it was very significant at 1%. This shows that there is a direct relationship between the increase in farm size and an increase in rice production. A similar result was documented by Kulyakwave et al. (2019) in Tanzania; however, it added that farmers try to increase their yield by increasing farm size. Quantitatively, it indicates that as households increase, their farming size increases rice production by 98%. A study by Fakkhong and Suwanmaneepong (2015) documented similar findings in Thailand. Nevertheless, the empirical results have revealed that receiving excess rainfall significantly influences rice production negatively. That is if rainfall exceeds the optimal requirement for plant, growth by 1 mm during farming season reduces rice output by 3%. On the other hand, the result discloses drought which significantly reduces rice production. As the dryness increases by 1 unit, rice output reduces up to 4.7%. This implies that a prolonged period of dryness is not conducive to rice performance. Likewise, the previous rice market prices significantly influenced rice production positively.

The results in Table 3 show that as market price increase by 1 Tanzania Shilling, then there could be an increase in rice output for the next season by 56.4%. With this trend, it alerts that farmers are sensitive to market price and the condition of market price determines farmers' decision of whether to increase or decrease their rice outputs (Kim et al., 2017). Likewise, results indicate that crops' pests and diseases significantly influence rice production negatively. Albeit of its significance at the 10% probability level but reduces rice outputs by 12.3%. The findings of Nalley et al. (2016) reported on a similar note regarding the effect of pests and diseases on global rice production. Similarly, Kihoro et al. (2013) expressed that crops pest and diseases have caused both quantitative and qualitative loss to crops resulting in a big economic loss to farmers.

Conclusion

This work found that rice production is the major activity conducted by the rural population in the study area. Farmers have perceived different challenges that affect their rice performance including environmental factors such as variations in rainfall, temperature, and sunshine. Other variables are limited access to extension and technological services such as improved seeds, farmers' extension training, chemical fertilizers, and labor. Through empirical estimates, it revealed the extent to which key specific variables including households gender, marital status, labor size, and farm size influence rice production. Others include variation in rainfall and droughts, pest and diseases, and previous market price. Therefore, the study recommends possible interventions by the government and other responsible institutions on the identified factors which hamper the growth of the rice industry. The collaboration of the central government as policymakers and other partners should target on establishing irrigation schemes so that farmers would be able to produce rice continuously and other crops to increase their income. It also should go in hand with increasing access to improved seeds, extension services, fertilizer, and pesticides. Finally, a special eye looks on farm size since it was found that an increase in farm size increases rice outputs. Thus, there is a risk of diminishing outputs as a result of the population increase not in line with the land size.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Afolami CA, Obayelu AE, Agbonlahor MU, Lawal-Adebowale OA (2012). Socioeconomic Analysis of rice farmers and the effects of group formation on socio-economic analysis of rice farmers and the effects of group formation on rice production in Ekiti and Ogun States of South-West Nigeria. Journal of Agricultural Science 4(4):233. https://doi.org/10.5539/jas.v4n4p233

Ajah J, Chukwumah AF (2014). Socio-economic determinants of small-scale rice farmers' output in Abuja, Nigeria. Asian Journal of Rural Development 4(1):16-24.

Alam M, Effendy N (2017). Identifying factors influencing production and rice farming income with approach of Path Analysis. American Journal of Agricultural and Biological Sciences 12(1):39-43. https://doi.org/10.3844/ajabssp.2017.39.43

Boniphace NS, Fengying N, Chen F (2014). An analysis of factors affecting smallholder rice farmers' level of sales and market participation in Tanzania; evidence from national panel survey data 2010 -2011. Journal of Economics and Sustainable Development 5(23):185-205.

Chidi I, Anozie RO, Chinaza N (2015). Analysis of socio-economic factors and profitability of rice production among small-scale farmers in Ebonyi State. IOSR Journal of Agriculture and Veterinary Science 8(2):20-27.

Diiro GM (2015). Impact of off-farm income on agricultural technology adoption intensity and productivity. Uganda Strategy Support Program. (II No. II). Kampala.

Elias SG (2018). The importance of using high quality seeds in agriculture systems. Agricultural Research and Technology 15(4):1-2.

Fakkhong S, Suwanmaneepong S (2015). Socio-Economic Factors Influencing Rice Production in Peri-Urban Area, Bangkok, Thailand. Journal of Agricultural Technology 11(8):2053-2062.

Global Information Network (GIN) (2019). Tanzania Corn, Wheat and Rice Report. United Republic of Tanzania, the Annual Report of Grain and Feed.

Gudaga JL, Kabote SJ, Tarimo AKPR, Mosha DB, Kashaigili J (2018). Groundwater users' awareness of water institutions in Tanzania: A case study of Mbarali District, Mbeya Region. Journal of African Studies and Development 10(3):29-42. https://doi.org/10.5897/JASD2017.0485

Haji AK, Salehe FS, Msinde J (2018). Adoption of Rainfed Paddy Production Technologies among Smallholder Farmers: A Case of Central. Asian Research Journal of Agriculture 8(2):1-19.

Kaliba AR, Mazvimavi K, Gregory TL, Mgonja FM, Mgonja M (2018). Factors affecting adoption of improved sorghum varieties in Tanzania under information and capital constraints. Agricultural and Food Economics 6(2018):1-21.

Kihoro J, Bosco NJ, Murage H, Ateka E, Makihara D (2013). Investigating the impact of rice blast disease on the livelihood of the local farmers in greater Mwea region of Kenya. SpringerPlus 2(308):1-13.

Kim I, Elisha I, Lawrence E, Moses M (2017). Farmers adaptation strategies to the effect of climate variation on rice production: Insight from Benue State, Nigeria. Environment and Ecology Research 5(4):289-301. https://doi.org/10.13189/eer.2017.050406

Kulyakwave PD, Shiwei X, Wen Y (2019). Estimating Impact of Weather Variables on Rice Production in Tanzania : What is the Contribution of Increase in Planting Area? International Journal of Business Marketing and Management 4(4):36-42. http://ijbmm.com/vol4-issue4.html

Kulyakwave PD, Shiwei X, Wen Y (2019). Rice farmers' perceptions and indicators for weather variability in Tanzania : What are the Obstacles for in situ Adaptations ? Journal of Physics, 1176(4):042074. https://doi.org/10.1088/1742-6596/1176/4/042074

Mligo F, Msuya C (2015). Farmers adoption of recommended rice varieties: A case of Kilombero district of Morogoro Region. Tanzania. South African Journal of Agricultural Extension 43(1):41-56.

MOA (2019). National Rice Development Strategy Phase Ii (NRDS II) 2019-2030. The Tanzania Ministry of Agriculture.

Nagabhatla N, Macnee R (2017). Impacts of temperature and rainfall variation on rice productivity in major ecosystems of Bangladesh. Agriculture and Food Security 6(1):1-11. https://doi.org/10.1186/s40066-017-0089-5.

Nalley L, Tsiboe F, Durand-morat A, Shew A (2016). Economic and environmental impact of rice blast pathogen (Magnaporthe oryzae) alleviation in the United States. PLoS ONE 11(12):e0167295. https://doi.org/10.1371/journal.pone.0167295

National Bureau of Statistics (NBS) (2014). The 2012 population and housing census: basic demographic and socio- economic profile; Key findings. Dar es Salaam, Tanzania: NBS and OCGS. Available from: <tanzania.countrystat.org>. Accessed: May. 30.

National Bureau of Statistics (NBS) (2012). The 2012 population and housing census: NBS and OCGS. Available at www.nbs.go.tz. Accessed on May 30, 2021.

Rahman MA, Kang SC, Nagabhatla N, Macnee R (2017). Impacts of temperature and rainfall variation on rice productivity in major ecosystems of Bangladesh. Agriculture and Food Security 6(1):1-11.

Rice Council of Tanzania (RCT) (2015). Rice Council of Tanzania Strategic Plan 2015-2019.

Reincke K, Vilvert E, Fasse A, Graef F, Sieber S, Lana MA (2018). Key factors influencing food security of smallholder farmers in Tanzania and the role of cassava as a strategic crop. Food Security 10(4):911-924.

United States Department of Agriculture-Foreing Agricultural service (USDA) (2019). United Republic of Tanzania Grain and Feed Annual 2019 Corn, Wheat and Rice Report. Tanzania.

Urassa JK (2015). Factor's influencing maize crop production at household levels: A case of Rukwa Region in the Southern Highlands of Tanzania. African Journal of Agricultural Research 10(10):1097-1106. https://doi.org/10.5897/AJAR2014.9262

Zhao X, Fitzgerald M (2013). Climate Change: Implications for the Yield of Edible Rice. PLoS One 8(6):e66218 https://doi:10.1371/journal.pone.0066218