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FOOD SECURITY AMONGST SMALL GRAINS AND LONG GRAINS SMALLHOLDER FARMERS OF MASVINGO PROVINCE IN ZIMBABWE

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ABSTRACT

This study compared the food security status for small grains and long grains smallholder farmers and analysed the factors that affect food security status for smallholder farmers in Zimbabwe. The study was conducted in Masvingo Province of Zimbabwe and the respondents were stratified into small grains cultivators and long grains cultivators. Data used in the analysis of food security was collected through a researcher administered structured questionnaire. The results established that the adoption of small grains is widespread within the province. Demographic and socio-economic characteristics had an effect on the dependence of either small grains or long grains farming. The results of the study revealed that both small grains and long grains smallholder farmers had at least attained primary education which reveals that all farmers are functionally literate. Results of the Household Dietary Diversity Score HDDS revealed that on average 76 percent of small grains smallholder farmers were measured to be food secure whilst only 41 percent of long grains farmers were food secure. The (HDDS) reflected the dietary diversity consumed by members of the household in the previous 24 hours Similar trends were observed from the descriptive statistics which showed that small grains smallholder farmers consumed relatively greater percentage of nutritious food groups than long grains smallholder farmers. Results of the Binary logit regression model indicated that the significant factors which explain food security status for smallholder sampled households are farming activity, education, number of livestock, remittances, income and access to credit.

Contribution/ Originality: This study is one of very few studies which have compared the contribution of small grains and long grains cultivation to food security of smallholder farmers in Zimbabwe. The paper contributes to existing literature on food security for smallholder farmers in developing countries.

1. INTRODUCTION

The aspect of household food security has received increased attention particularly due to deteriorating economic conditions worldwide (Regassa and Stoecker, 2011). Food security is understood to exist when all people have physical, social and economic access to sufficient, safe and nutritious food (at all times), to meet their dietary needs and food preferences for an active and healthy life as defined by Faridi and Wadood (2010). For the household, food security exists when all members has access to enough food for an active, healthy life at all times.

Furthermore, the concept of household level food security has also been extended to include related concepts of accessibility, sufficiency, security and sustainability. Consequently, food insecurity may indicate poverty and is an important indicator of well-being. Erratic rainfall patterns being experienced in Zimbabwe have played a part in reducing agricultural yields hence poverty and food insecurity (Mushunje, 2005). The Household Dietary Diversity Score (HDDS) was used to measure food security status of smallholder farmers in this study.

Furthermore, this study investigates the factors affecting food security for small grains and long grains smallholder households in three different districts of the Masvingo Province of Zimbabwe. To obtain the factors affecting food security, a Binary Logistic regression model based on primary data source from 3 districts of Chivi, Mwenezi and Bikita smallholder farmers was used.

1.1. Background

Smallholder farmers in Masvingo are moving away from production of long grains to production of small grains like millet varieties and sorghum because they are drought resistant crops. Mushore *et al.* (2013) noted that the biggest challenge to farming and food security in Zimbabwe today is climate change and global warming which has caused temperatures to increase by an average of 2.5 percentage from 1980 to 2012. This is in contradiction to the contribution of the paper by FAO (Food and Agriculture Organization) (2008) which reiterated that inadequate funding and skills shortage were the major causes of food insecurity in Zimbabwe. According to FAO (2011) the impacts of climate change are already being felt in Southern Africa with increased occurrence of droughts, strong winds, floods, heat weaves which cause a major challenge to agricultural production and economic development.

There has been increased occurrence of droughts in Zimbabwe from the year 2002 with the worst affected provinces included Masvingo, Manicaland, Mashonaland East and Matabeleland South (FAO, 2008). As a result of changing weather systems and climate change, agriculture has been adversely affected due to disruption of rains and increased temperatures. It is therefore imperative to look at strategies which effectively minimize the impacts of climatic trends such as droughts in most affected areas such as in Masvingo in Zimbabwe. One way which has been proposed is by adopting traditional grain crops such as millet varieties and sorghum which are drought resistant.

2. THEORETICAL FRAMEWORK

2.1. Related Literature

Regassa and Stoecker (2011) examined household food insecurity and hunger in Sidama Zone in Ethiopia and used the Household Food Insecurity Access Scale (HFIAS) and the Household Hunger Scale (HHS), both developed by the Food and Nutrition Technical Assistance Project to calculate food insecurity. The HFIAS measures the prevalence and severity of food insecurity mainly depicted by the experiences of households when faced with limited access of food requirements whereas the HHS is used to rank households according to the severity of food insecurity with regard to food access (Regassa and Stoecker, 2011). Gandure *et al.* (2010) used the Household Food Insecurity Access Scale (HFIAS) and The Household Dietary Diversity Score (HDDS) to provide an analysis of the indicators which can be used to measure food security status in Zimbabwe. Although the results the two approaches complemented each other HDDs showed a clearer picture of the food security situation since it revealed that access of food obtained is not enough to determine the food security situation but it was important to examine the variety and nutrition of the food which households consume over time hence it is adopted in this paper.

According to Arene and Anyaeji (2010) results derived from linear regression analysis may lead to fairly unreasonable estimates when the dependent variable is dichotomous. Therefore, the use of the logit or probit models is recommended to counter the drawbacks of the linear regression models (Gujarati, 2003). Which model to choose between logit and probit is, however, difficult for they are similar in most applications. However for its comparative mathematical, interpretational simplicity and close approximation to the cumulative normal distribution many researchers tend to choose the logit model (Hosmer and Lemeshew, 1989). Consequently, this

study employed the binary logistic regression model following the footsteps of Bogale and Shimelis (2009); Arene and Anyaeji (2010) and Sekhampu (2013).

3. MATERIALS AND METHODS

3.1. The Study Area

Masvingo province is divided into seven districts which are; Chivi, Chiredzi, Gutu, Masvingo, Bikita, Zaka and Mwenezi. Masvingo province occupies the drier lowveld area in the south of Zimbabwe. Major agricultural activities in the province are cattle ranching, subsistence crop farming and irrigated sugar growing. The rainfall pattern in this province is highly variable and uncertain, making the province prone to natural disasters especially droughts (Mapfumo and Madesha, 2014). Figure.1 shows the location of the study area. The specific study areas within the province (Chivi, Mwenezi and Bikita) were chosen in terms of high adoption of small grains in these districts.

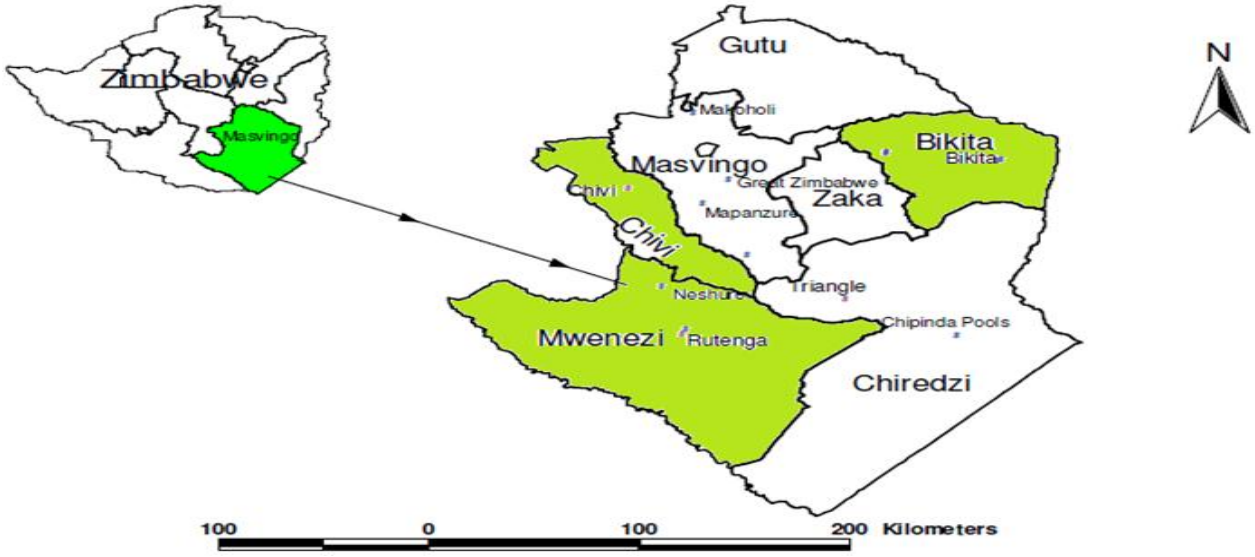

Figure-1. The location of the study area: Masvingo province

(Source: Simba *et al.* (2012))

3.2. Sampling Procedure

This study employed a multi-stage sampling technique with stratified and random components. Samples were drawn from three districts namely Chivi, Mwenezi and Bikita. Stratification was carried out according to whether smallholder farmers are engaged in long grains farming or small grains farming. A total of 100 respondents were surveyed, consisting of 40 small grains smallholder farmers and 60 long grains smallholder farmers.

Initially, purposive sampling technique was applied to ensure small grains smallholder farmers such as Chivi, Mwenezi and Bikita were included. Purposive sampling technique is particularly useful since this is an evaluation research which involves identifying the small grains smallholder farmers. A total of one hundred respondents were interviewed using a researcher administered structured questionnaire to obtain information on food security status and factors affecting food security status amongst smallholder of Masvingo Province in Zimbabwe.

3.3. Mathematical Representation of the Binary Logistic Regression Model

The parameter of the logistic regression model was estimated with the Maximum Likelihood Estimation (MLE) technique. A binary response function was specified and estimated by the logistic procedure. Food security status will be measured using a bid value of one or zero, where one represents food secure and zero represents food insecure. The logistic regression then provides a model of observing the probability of a household becoming food

secure or food insecure. The binary logistic model adopted from Bogale and Shimelis (2009) is econometrically specified explicitly as:

$$P_i = F(Z_i) = \frac{1}{1+e^{-(\alpha+\sum\beta_i X_i)}} \quad \ldots\ldots\ldots\ldots \quad (1)$$

Where P_i is the probability that an individual is being food insecure,

X_i stand in for the i^{th} explanatory variables,

α and β are regression parameters to be estimated,

and e is the base of the natural logarithm

Furthermore, for simplicity and ease of interpretation of the coefficients, a logistic model could be written in the form of the odds and log of odd. The odds ratio is the ratio of the probability that an individual or household would be food secure (P_i) to the probability of a household would not be food insecure ($1- P_i$). There by yielding;

$$\left(\frac{P_i}{1-P_i}\right) = e^{Z_i} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Taking the natural logarithm of equation (2) yields:

$$In\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \quad \ldots\ldots\ldots \quad (3)$$

If the disturbance term U_i is taken into account, the logit model becomes:

$$Z_i = \alpha + \sum_{i=1}^{n} \beta_i X_i + U_i \quad \ldots\ldots\ldots\ldots\ldots \quad (4)$$

Where α and β are parameters of the model and can be estimated using the maximum likelihood (ML) method.

Where Z_i = Food security status (1, if household is food secure; 0, if household is food insecure) and β_i is the slope of the equation in the model. The explanatory variables are farming activity, age, household size, education, employment status, number of livestock, remittances, income, access to extension services and access to credit.

4. RESULTS

Food groups consumed by households in the study area are shown on Figure 1 below. The information presented includes 14 different types of food groups for both small grains and long grains farmers.

Food consumption by sampled households

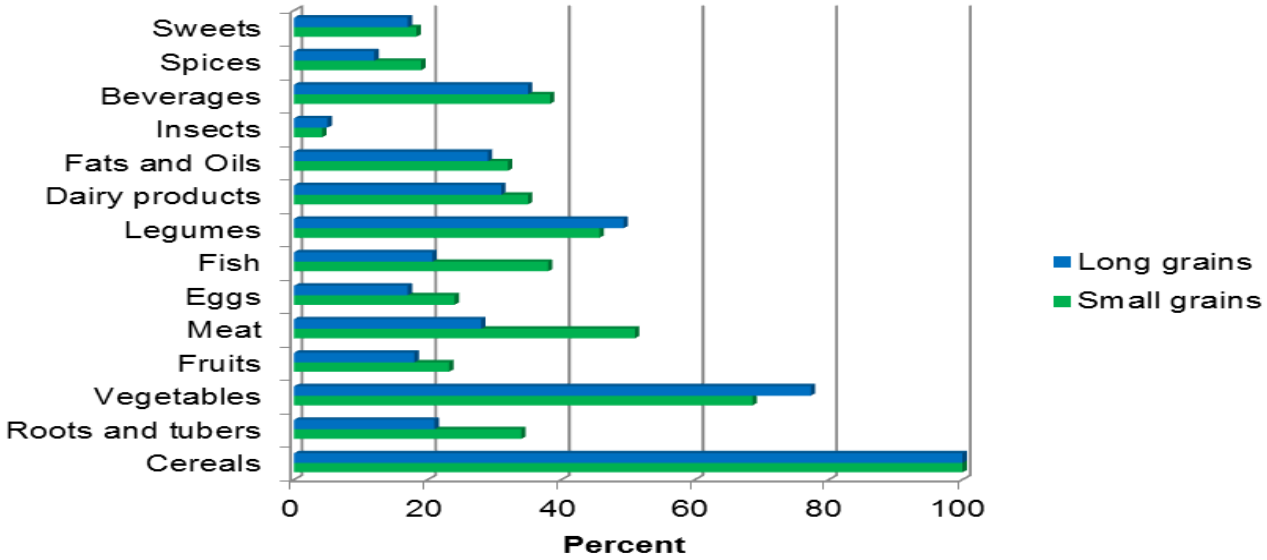

Figure-1. Percentages of food groups consumed by small grains and long grains sampled households
Source: Field Data 2016

Results revealed that the main types of food groups consumed in the study area are cereals, vegetables, meat, legumes and beverages. This is in agreement with the findings (Gandure *et al*., 2010) which established that cereals and vegetables are the main food crops consumed in rural Zimbabwe and that of Monde (2003) which also established that cereals, vegetables and meat are the main food crops consumed in rural areas in South Africa. Furthermore, the results show that small grains farmers consumed relatively greater percentage of nutritious food groups such as roots and tubers, fruits, meat, eggs and dairy products. Consequently, small grains farmers are more likely to be more food secure than long grains farmers since they consumed food varieties than the latter.

4.1. Food Security Status for Smallholder Farmers in the Study Area

Household food consumption information obtained from sampled smallholder households during the previous day was used to establish their food security status. The Household Dietary Diversity Score (HDDS) was used to determine food security status of smallholder farmers by summing the number of food groups from which food had been consumed; the 14 food groups which were used are cereals; roots and tubers; vegetables; fruits; meat; eggs; fish; legumes; dairy products; foods made with fats or oils; insects; beverages; spices and sweets. The lowest possible HDDS therefore is zero and the highest possible score is 14. Consequently, households with less than the HDDS of seven were classified as food insecure whilst those with seven to fourteen were classified as food secure as prescribed through the guidelines by FAO (2011). The Household Dietary Diversity Score (HDDS) reflected the dietary diversity consumed by members of the household in the previous 24 hours. Results of the food security status of smallholder farmers using the HDDS are presented on Figure 2.

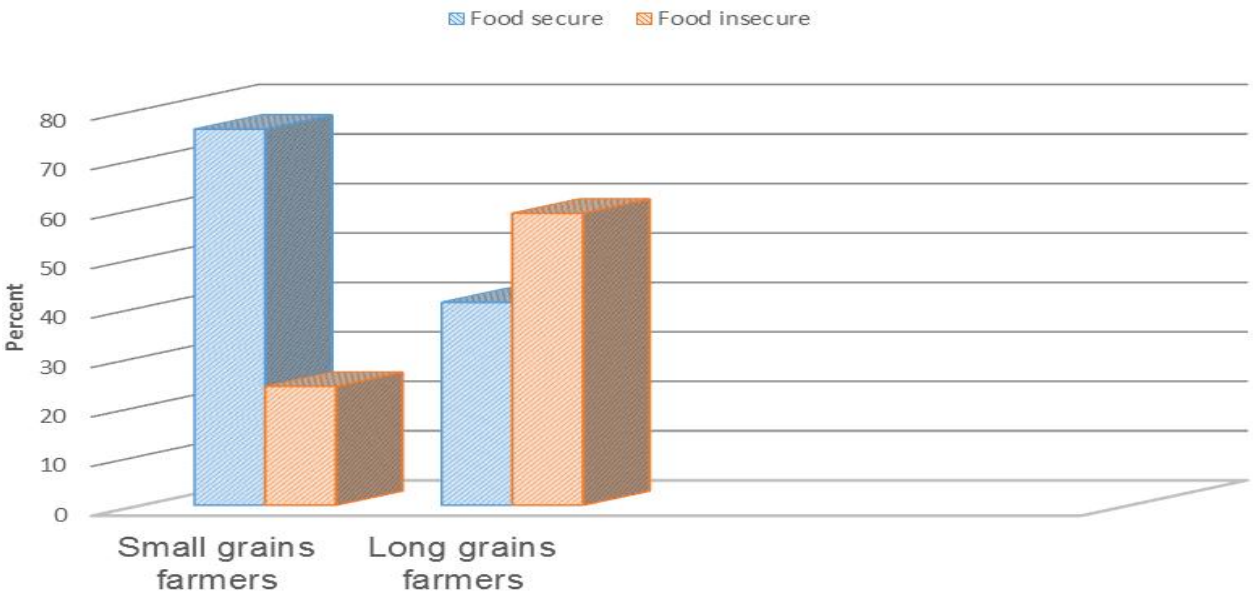

Figure-2. Food security status by respondents

Source: Field Data 2016

The obtained results show that a greater percentage of small grains farmers are food secure as compared to long grains farmers. Furthermore, more than 50 percent of long grains farmers reflected that they were food insecure. This indicates that small grains farming households had access to a greater variety of foods which they afforded to purchase using mainly income obtained from sale of the harvested small grains as compared to long grains farming households.

4.2. Factors Affecting Food Security for Sampled Smallholder Households

Table 1 shows a summary of results for socio-economic factors which influence the food security status of smallholder farmers by the respondents in Masvingo province.

Table-1. Results of Binary logistic regression: Estimated parameters of factors that influence food security of smallholder households in the study area.

Predictor Variables		β	S.E	Wald Statistics	Significance
Constant	β_0	-10.922	5.440	4.030	.045
Farming activity	β_1	1.325	.795	4.189	.043**
Age group	β_2	.958	.822	1.865	.185
Household size	β_3	.198	.356	1.137	.213
Employment status	β_4	.577	.446	1.676	.196
Education	B_5	.856	1.869	4.156	.065*
Number of livestock (TLU)	B_6	.039	.186	3.356	.068*
Remittances	B_7	.701	.102	3.393	.081*
Annual gross income	B_8	.827	.483	4.456	.026**
Access to credit	B_9	.753	2.112	4.989	.073*
Access to extension services	β_{10}	0.971	1.123	1.427	.251

1) Chi-Square (df = 14) = 273.305
2) (- 2) Log Likelihood = 36.476
3) Accuracy of prediction; Overall (%) =89.3
4) Nagelkerke R^2 = .844
Note: ***, ** and * indicate significance at 0.01; 0.05 and 0.10 probability level respectively

4.3. Interpretation of Econometric Results

The Hosmer and Lemeshew Goodness-of-Fit test statistic was used to test the model fit and the value of 1.000 was obtained, implying that the model`s estimates fit the data at an acceptable level. The *Nagelkerke* R^2 was

computed in this study, which was noted by Norusis (2004) to measure proportion of the variation in the response that is explained by the model as a proxy estimate to R^2 in OLS regression. In this study, *Nagelkerke* R^2 of 0.844 was obtained indicating that more of the variation was explained by the model with an overall prediction percentage of 84.4 as shown in Table 1 above.

All the six significant predictor variables five had positive signs (farming activity, education, number of livestock, remittances, income and access to credit) meaning that an increase in one of these variables would be associated with an increase in households` likelihood of being food secure. The detailed explanations of these significant explanatory variables and food security status as well as how they are related to other studies is analysed below.

Farming activity of the household was found to be an important factor which significantly influences the food status of the smallholder farmers in Masvingo province. The study reveals that food security is higher for those engaged in small grains farming than long grains farming. This category of households earns relatively higher annual incomes mainly from the sale of harvested small grains than long grains whose output is adversely affected by increased occurrence of droughts. The implication of the coefficient is that the probability of being food secure increases by a factor of 1.325 for households engaged in small grains farming.

The variable education was expected to positively influence food security which is in line with the results obtained on Table 1 using the binary logit regression model in the study area. The coefficient of 0.856 indicates that the probability of the household to become food secure increases by the factor 0.856 as a result of acquiring minimum relevant education for understanding cultivation techniques of small grains as well as long grains and benefits of cultivating different types of crops. This is in line with the findings by Bogale and Shimelis (2009) carried out in Ethiopia which established a positive relationship between education and food security.

Number of livestock is a significant factor in determining food security status of the household at 10 percent probability level. The positive relationship is explained by the fact that rural households with large herd size have better chances of earning more income from selling livestock. As a result, this enables them to purchase food when they are faced with food shortages (which may indicates that ownership of livestock, in the study area, acts as a hedge in case of crop failure) and also invest in purchase of farm inputs that increase food production. Ownership of livestock such as cattle provides draught power and timely cultivation of land which improves the likelihood of smallholder farmers to obtain better agricultural output for consumption or sale which directly or indirectly increase the chances of the household to become food secure. Moreover, these livestocks can also be consumed by the households thus ensuring food security at household level. The implication of the coefficient is that the probability of being food insecure decreases by a factor of 0.039 for households owning livestock. This is in agreement with the findings of the study by Eneyew and Bekele (2012) in Ethiopia which established that livestock holdings were negatively related to the probability of being food insecure.

Access to remittances was obtained to positively influence the likelihood of the household to become food secure. The sign of the coefficient of access to remittances variable showed a positive relationship with food security and is significant at 10 percent probability level. Households with access to remittances stand better chances of affording to purchase farming inputs, livelihood assets which increase the potential of smallholder farmers to increase agricultural output. Furthermore, households with access to remittances also can afford to purchase a variety of nutritious and health food hence increasing the probability of becoming food secure. This is in line with the findings by Mango *et al.* (2014) which established a positive relationship between access to remittances and food security on a study carried out on smallholder farmers in Zimbabwe (Case study of Mudzi district).

The variable annual gross income was hypothesized to positively affect food security in the study area. In line with the expected sign, its coefficient was obtained to be positive and statistically significant. This imply that smallholder households who obtain more income mainly from small grains farming have better chances to become food secure than those households who are involved in long grains farming. The results indicate that an increase in

income will increase the chances of a household to be able to afford more nutritious and health food varieties at all times and become food secure. This is in agreement with the findings of Bashir *et al.* (2012) which obtained a positive and significant relationship between monthly income and food security in three different regions of the Punjab Province of Pakistan.

Access to credit for farming activities was obtained to positively related to food security and is statistically significant at 10 percent probability level. The positive relationship obtained entails that smallholder households who have access to credit service have more chances to be food secure than without access ones. This result is fully in agreement with the expected relationship since credit for farming activities capacitates smallholder farmers to be able to purchase necessary farming assets and inputs hence increasing probability of the household to obtain more income from increased agricultural output which can be used to purchase more food varieties and become food secure. These results are in conformity with the findings of the study by Gebre (2012) which showed a negative relationship between credit use for agricultural activities and food insecurity in Ethiopia.

5. CONCLUSION

From the results obtained on Figure 2, it may be concluded that on average 76 percent of small grains smallholder farmers were measured to be food secure whilst only 41 percent of long grains smallholder farmers were food secure using the HDDS. Similar trends were observed from the descriptive statistics which showed that small grains smallholder farmers consumed relatively greater percentage of nutritious food groups than long grains smallholder farmers. Results of the Binary logit regression model indicated that the significant factors which explain food security status for smallholder sampled households are farming activity, education, number of livestock, remittances, income and access to credit.

6. RECOMMENDATIONS

The government should also support the efforts by smallholder farmers to improve food security as well as contribution of agriculture towards GDP through unveiling credit lines for farming activities. This will go a long way in enabling smallholder farmers to engage in better livelihood strategies such as small grains farming. Long grains smallholder farmers reported that they failed to adopt small grains farming due to lack of access to credit hence mobilising and increasing rural credits to smallholder farmers in Zimbabwe should be prioritised during policy formulation. Consequently, Agribank needs to be capacitated so that it will be able to effectively extend financial support to smallholder farmers in the country. Moreover, it is not entirely up to the government alone to fund agriculture other players such as private companies and Non-Governmental Organisations (NGOs) should also chip in to help the cause and also systems should be put in place for the bulk of agricultural production to be self-financing.

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