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Socio-economic Determinants of Rice Production Yield in Benin

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study aims to analyze the determinants of rice production yield in Benin. Data were collected in the central part of Benin, which includes the districts of Bantè, Dassa, Glazoué and Savalou. A total of 300 randomly selected rice producers were surveyed. The results indicate that the contract farming participation, membership in an innovation platform, and the location of the producer are the main determinants of rice yield. The design of policies to improve producer yield should focus primarily on these factors.

Keywords: Rice; yield; produces characteristics; Benin.

1. INTRODUCTION

In Benin, rice has become a staple food as the Beninese appetite for rice has increased significantly. Once considered a food for the rich and festive, rice is now consumed as a daily food in most households. The average rice consumption in Benin has increased from 46 kg

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per capita between 2005 and 2007 to 75 kg per between 2015 and 2017 [1]. Despite this significant increase in consumption, rice production, although increasing rapidly, has not been able to catch up with the upward trend in rice consumption. Rice production has more than double between 2013 and 2017, increasing from 36921 tons to 83665 tons (APRM/Crop Series, 2017). The gap between national rice production and consumption is filled by the massive import of rice from Asian countries. This dependence on imports is detrimental to the development of domestic rice value and may jeopardize food security in the long term.

Implementing food policies that support increased national production and reduce dependency requires an understanding of the factors that positively impact rice yield. Furthermore, increasing Benin's national rice production will contribute to improved food security. According to Stuart et al [2], the critical contribution of rice to food security requires a good understanding of yield gaps in rice production. Also, improving the national rice sector requires increasing production [3]. In order to boost rice production in Benin, governments and supporting partners need to have information on the factors that can positively impact yield.

A large amount of research has been conducted in the rice value chain in Benin. According to Codjo et al [4], yield represents an important factor for domestic rice producers to improve the comparative advantage over imported rice. Results from other research suggest that the domestic resource cost of rice production in Benin is less than 1, implying that the domestic resources used to produce rice valued at one dollar is less than one dollar [5].

The organization of the domestic rice value chain, particularly participation in contract farming, has received a great deal of attention over the past decade [6,7]. Studies show that factors such as pre-financing of production, payment mechanism, and price are significant in producers' participation in contracts [8,9]. In Benin, research on rice consumers has largely addressed their willingness To Pay (WTP) for local and imported rice and the factors that influence their preference for rice [10-14] and that the substitution pattern between domestic and imported rice is limited [15]. This research has focused on the physical and intrinsic characteristics of rice, and socio-economic factors to explain consumer preference, without addressing factors that can boost the performance of domestic rice. This research focuses on the socio-economic factors that explain rice production yields in Benin in order to provide policy makers with useful information to stimulate production. The results of this research can be used to provide appropriate support to rice producers to increase yield. This study contributes to the literature by its focus on socioeconomic factors.

2. STUDY FRAMEWORK AND METHODOLOGY

2.1 Study Card

This commune has favorable conditions for rice production. Fig. 1 shows an image of this commune. The study area is considered the rice development of Benin. This hub includes the districts of Dassa, Glazoue, Savalou, and Bante.

2.2 Research Methodology

2.2.1 Data

Data were collected in 2015 in the Glazoué rice development hub, which includes the districts of Bantè, Dassa, Glazoué and Savalou. A total of 300 producers were randomly selected from the rice hub. The data collected include producers socioeconomics characteristics, cultivated area, quantities harvested, and the inputs used in rice production.

2.2.2 Empirical model

In the empirical model, rice yield is regressed on a set of potential determinants including, producer participation in contract farming, membership in an innovative platform, producer district, and producer's main activity. Equation 1 presents the model:

$$\log(Yield_i) = \alpha + \beta_3 Platform_i + \beta_4 \sum_{i=1}^{4} District_i + \beta_5 Contract_i + \beta_6 Activity_i + \varepsilon_i \quad (1)$$

With :

$Yield_i$:	Producer i's rice yield (kg/ha)
$Platform_i$:	Binary variable indicating whether producer i belongs to an innovative platform or not
$District_i$:	Categorical variable indicating whether producer i is from the Dassa, Glazoue, Savalou, or Bante district
$Contract_i$:	Binary variable indicating whether producer i is participate in contract farming
$Activity_i$:	Categorical variable indicating whether producer i has rice production, rice processing, or other activities as its main activity

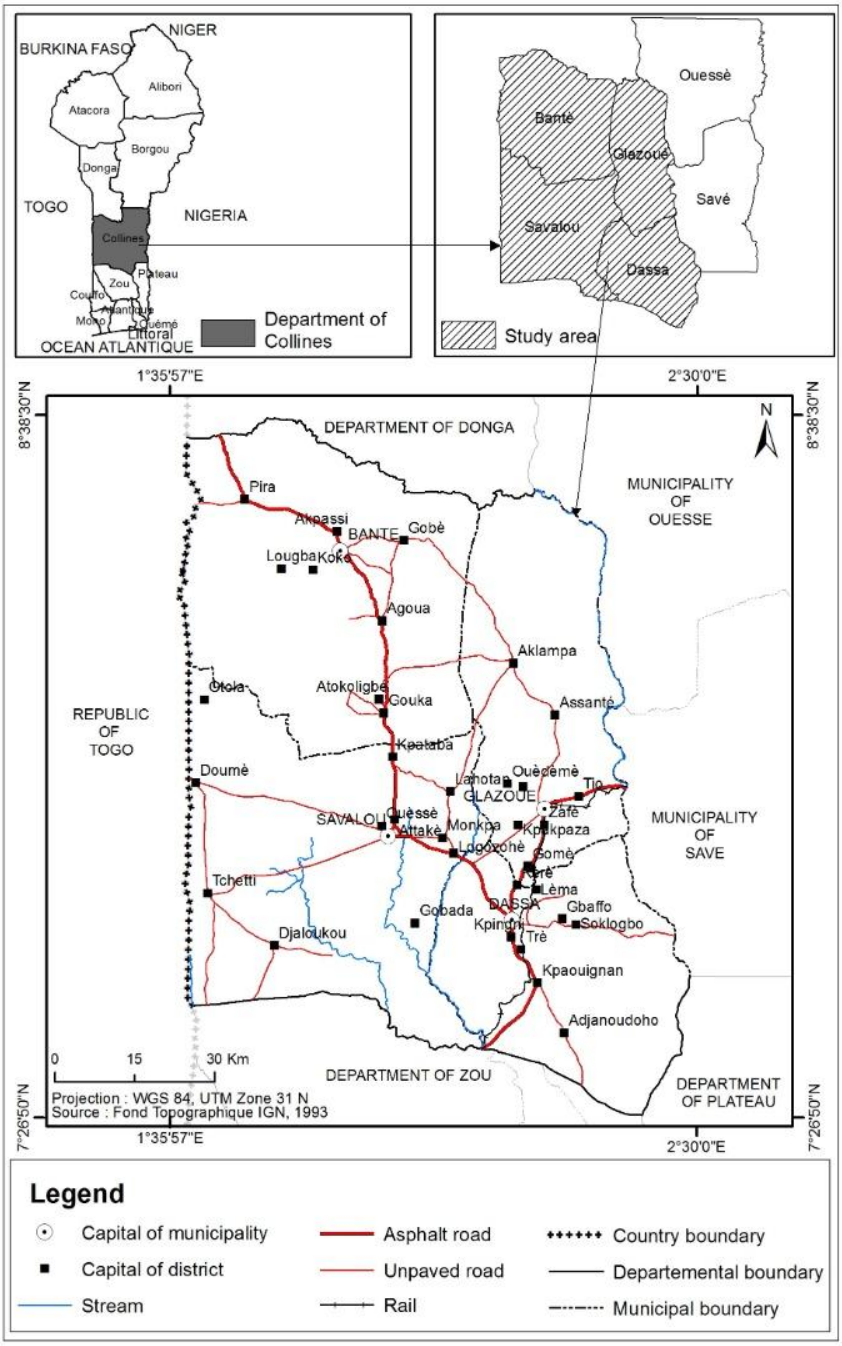

Fig. 1. Geographical location of the commune of rice development pole of Glazoué

3. RESULTS

3.1 Characteristics of Respondents

Table 1 shows the characteristics of respondents. The average rice yield in the sample is 1.29 hectares. The mean age of the respondents is estimated at 46 years which shows that rice producers are not that old. The sample encompasses 52% of producers with no education. Accordingly, most producers don't have a formal education. Thirty two (32%) of producers participate in contract farming and nearly 29% are members of rice innovation platforms.

3.2 Determinants of Rice Production Yield in Benin

Table 2 presents the explanatory factors for rice production yield in Benin. The model is significant ($P<0.001$) at the 1% level, which means that all estimated coefficients are not simultaneously equal to zero. The evolution of rice yield is explained at 13.59% by the variables introduced in the model ($R2 = 0.1359$).

The results presented in Table 2 show that participation in contract farming and membership in an innovative platform (IP) are significant at 10%. Rice production in the Dassa district have a significant impact on yield at 5%. The other variables that are not significant can be minimized in the implementation of a yield-related policy. Their influence on yield is not significant.

The intercept is equal to 7.31 kg. This value means that a producer in Bante district, not belonging to an innovative platform, not participating in contract farming, and having agriculture as her main activity can generate a yield of 7.31 kg/ha.

The coefficient associated with contract farming participation is 0.16, which means that producers participating in contract farming have on average 16% more rice yield than those not participating. This result seems reasonable because contract farming participants can benefit from various support including technical assistance, prefinancing, inputs supply. These purses can help producers achieve better than the others.

The coefficient associated with producers belonging to an innovative platform is equal to 0.15. Thus, producers belonging to an innovative platform have on average 15% more rice yield than those who do not belong to these innovative platforms. Indeed, the platform is a tool used to facilitate exchanges between actors. It allows them to meet, share knowledge and facilitate collaboration. Many support partners use these platforms as the main channel for their intervention. As a result, producers on these platforms are more likely to have access to new technologies and agricultural training, which can have a positive impact on their performance.

Producers in Dassa district have an average of 24% less rice yield than those in Bante. The coefficients for the other districts are not significant, meaning that the yields of producers in these districts are not affected by these locations.

The main activity is not significant, meaning that it influence on yield is insignificant. Whether or not the producer has farming as a main activity is not important, and therefore does not affect yield. Therefore, the most important thing could be, for example, to use an appropriate amount of inputs and to respect the time spent on each activity.

Table 1. Characteristics of respondents

Characteristics	Values
Rice field area (ha)	1.29
Age	46.35
Platform participation (%)	28.7
Contract farming participation (%)	32.77
Education (%)	
No education	52.33
Primary	23
Secondary	24.67
Main activity (%)	
Rice production	72.33
Rice processing	13.33
Other	14.33

Table 2. Determinants of rice yield in Benin

Independent variable	Coefficients	T-statistic
Intercept	7.31 (0.08)***	82.05
Contract farming		
No	-	
Yes	0.16 (0.09)*	1.67
Belonging to an innovative platform		
No	-	
Yes	0.15 (0.09)*	1.66
Districts		
Bante	-	
Dassa	-0.24 (0.11)**	-2.1
Glazoue	-0.11 (0.11)	-1
Savalou	0.03 (0.11)	0.26
Main activities		
Agriculture	-	
Processing	-0.21 (0.12)	0.07
Other	-0.02(0.11)	0.98

*Standard error in the parentheses. *significant at 10%, **significant at 5%, ***significant at 1%*

Equation 2 presents the final model:

$$\log(Yield)_i = 7.31 - 6.33contract_i + 0.15Platform_i - 0.24Dassa_i - 0.11Glazoue_i + 0.03Savalou_i - 0.21Processing_i - 0.02Other_i$$

4. DISCUSSION AND CONCLUSION

Rice is an important staple food that plays a vital role not only in food security but also in maintaining social stability in Benin. It is clear that every factor that affects its yield is important for recommending useful policies increase the yield of producers. Therefore, this research has identified a number of factors that may be useful in developing policies for rice producers in Benin. Our results are congruent with previous studies. For example, Bidzakin et al. [16] show that contract farming is positively correlated with rice yield and producers' income. This demonstrates the importance on contract farming in improving yield.

The design of policies to increase rice yield can revolve around membership in an innovative platform and participation in contract farming. Innovation platforms can be used to connect producers and potential partners such as traders or processors. Such connection would be beneficial as producers can harness this connection to have access to improved varieties and other production inputs. Access to these inputs could positively impact their production yield. Therefore, policy makers should encourage the participation of producers in these platforms in order to benefit from the advantages they offer and improve their yield. These platforms can also be used to encourage contract farming participation, which will also have an impact on yield.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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