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RESEARCH ARTICLE

Factors affecting labour-use efficiency of soybean farming among smallscale growers in north west, Nigeria

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Abstract

This research work focused on factors affecting labour-use efficiency of soybean farming among small-scale growers in North West, Nigeria. The study employed the use of simple random sampling approach to select 200 soybean growers. Primary data of cross-sectional sources were utilized with the aid of well-organized questionnaire that was subjected to reliability and validity test. Data were analyzed using descriptive and stochastic labour-use efficiency frontier model. The outcome shows that the mean age of soybean growers was 42 years. The soybean growers have approximately 9 years of school education with 10 years' experience in soybean farming. The significant factors influencing the labour-use efficiency were seed, farm size, depreciation cost at 5% alpha level, respectively. The significant socio-economic factors influencing the labour-use inefficiency were age ($P < 0.10$), education ($P < 0.10$), and experience ($P < 0.05$). The mean labour-use efficiency score was 0.654. The worst and best labour efficient soybean farmers attained efficiency scores of 0.2084 and 0.9653, respectively. The worst and best practiced soybean farmers lost potential labour inputs of 79.16 and 3.47% in soybean output due to factors that are within their control. The worst, average, and best practical soybean farmers to be on the frontier level they need to increase their labour efficiency by 79.16, 34.6, and 3.47%, respectively. The study recommended that labour-use saving technologies and machines should be made available to soybean growers at affordable prices. In addition, appropriate farm wages should be given farm labour to motivate them for productivity and efficiency.

Keywords: Factors, Labour-Use Efficiency, Small-Scale Soybean Growers, Nigeria

1. Introduction

Soybean (*Glycine max* L. *Merril*) is a significant crop globally, and it is a source of bio-fuel, protein and vegetable oil for human diet, aquaculture and livestock feed (Saliu et al., 2017). Nigeria is the second highest producer of soybean in Africa with a production of 1, 060, 000 tonnes (FAO, 2024). Brazil and USA are the highest producer of soybean in the world with production approximately 121290103 and 116220720 tonnes (FAO, 2024). Soybean farming plays an important role in the agricultural sector of Nigeria, it contributes significantly to economic development, food security, and employment opportunity (Aboki et al., 2024). Soybean can be successfully grown in many states in Nigeria with higher concentration in the northern states using low level of agricultural inputs utilization. According to Oyenpemi et al. (2023) in Nigeria, the low soybean output can be attributed to the sparing use of fertilizers, high cost of labour, the use of low yielding varieties, and inconsistence government policies to subsidize the farming of soybean. Efficiency is an important indicator of the economic performance of a farm enterprise as it helps to recognize factors that are

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responsible for the high productivity of a farm enterprise, it has remained an important discussion especially in developing countries where the majority of producers are resource-poor. Efficiency is an effort to achieve the desired production and productivity by using minimum input, and its influenced by a considerable parts of labour and input costs (Oyenpemi et al., 2023). Efficiency is one of the key considerations in increasing agricultural production, which can be achieved through proper allocation of limited farm resources. Research has shown that mismanagement in the allocation of resources for farm production reduces output and revenues accruable to farmers (Ansah et al., 2014). There is the need to make judicious use of basic production factors including land, labour and other farm resources as this will enhance sustainable agricultural growth. As a critical factor of production, labour influences the efficiency of other resources and drive innovation and growth. The inadequate farm labour has had a negative effect on improved weed control, planting accuracy, timely harvesting, crop processing, and other farm operations (Oluyole et al., 2011, Kadurumba et al., 2020). Farmers usually weigh the availability of labour over the season when they make decision on which crops to plant and the amount of area to cultivate (Salm and Lanting, 2011). Labour allocations to planting, weeding, and harvesting fluctuates during the seasons and between years. Human labour appears to be the primary source of labour available to smallholder farmers in Nigeria (Akanni and Dada; 2012; Anyiro et al., 2013). Human labour organizes other factors of production to effectively and efficiently transform farm inputs into required outputs for economic benefit. According to Food and Agriculture Organization (FAO) (2003), about 65% of agricultural land in Sub-Saharan Africa is prepared by hand power. Major sources of farm labour in Africa include family labour, hired labour and sometimes exchange/ cooperative/rotational labour. Hired labour accounts for about 88% of on-farm total labour usage (Ajibefun et al., 2000; Okuneye, 2000; Indira Devi, 2012). Other types of labour that can be employed include exchange labour and family labour. Labour not only constitute a primary source of employment but also plays a significant role in sustaining agricultural operations and other farm businesses (Koledoye, 2024). In fact, some studies have indicated that the share of hired labour in total farm labour has also increased in some developed countries over the last decade (Blanc et al., 2008). Farm labour demand is not homogenous but rather depends on the type of operation and season. Soybean farming is a labour- intensive activity demands skilled, semi-skilled and unskilled labour. This is because soybean production will involve operations like land preparation, planting, application of crop protection chemicals (pesticides), weeding, harvesting and storage. The adoption of new innovations, technologies in agriculture and small-scale industries can significantly enhance output, improve efficiencies, and pave the way for the diversification of rural economies. This transition brings challenges, especially in terms of workforce adaptation and the potentials displacement of traditional labour practices (Ujah and Okoro, 2009). Producers in the area complain of the high cost and unavailability of labour, long period of propagation and high use of crude technologies in soybean farming (Gocowski and Oduwole, 2003). The poor economic status of the farm families made most of the producers to rely on family labour for farm activities, thus keeping most of their children and young ones out of school. Enhancing the production of soybean requires increased productivity in the use of labour, increased land use and increased use of technology (Sadiq et al., 2022). This study will provide a roadmap that will guide policymakers and producers on productive labour-use enhancement in soybean farming. The literatures show no information on labour use efficiency among soybean farmers' in North West, Nigeria.

Research Questions

This work proffer answers to the following research questions:

(i) What is the farm-specific and producers' characteristics of soybean growers?

(ii) What are the predictors affecting labour-use efficiency among soybean growers?

(iii)What are the institutional and socio-economic predictors affecting the labour-use inefficiency among soybean growers?
(iv)What are the labour-use efficiency scores among soybean growers?

Objectives and Scope of the Study

The main aim of the work focused on factors affecting labour-use efficiency of soybean farming among small-scale growers in North West, Nigeria. Specifically, the objectives were:
(i) determine the farm-specific and producers' characteristics,
(ii)evaluate the predictors affecting labour-use efficiency,
(iii) assess the institutional and socio-economic stimuli affecting labour inefficiency,
(iv) estimate the cost efficiency scores among soybean growers.

Hypotheses of the Study

The research work was guided by the following null-hypotheses:
(i) The estimates of input labour elasticities are not positive.
(ii)There is no significant relationship between socio-economic predictors and labour inefficiency.
(iii)The labour-use efficiency scores are not significantly different from zero.

3. Materials and Methods

This study was carried out in North West, Nigeria. The purposive sampling approach was utilized to select Kaduna and Kano States because the soybeans are mostly grown in the two states. A simple random sampling approach was utilized to select 200 soybean growers within the two states. The technique was used because it avoids element of bias in selecting the respondent. Secondly, the sampling approach afford the opportunity for every respondent to have equal chance of being selected. The disadvantages of the simple random sampling approach were under-representation of certain sub-groups, difficulty accessing lists of the full population, time consuming, the process may cost individual a substantial amount of capital, sample selection bias can occur, cumbersome, and challenging when the population is heterogeneous and widely spread. The sample frame of soybean growers approximately 400 respondents. The total sample number consists of 100 soybean selected each from the two states, respectively. Primary data of cross-sectional sources were utilized based on a well-planned questionnaire that was subjected to reliability and validity test. The data obtained were evaluated utilizing descriptive statistics, and stochastic labour-use efficiency frontier model.

3.1. Stochastic Labour-Use Efficiency Frontier Model

The study follows the work of Akanni and Dada (2012) and Anyiro *et al.* (2013), a labour-use efficiency frontier model in a Cobb-Douglas form is specified as follows;

$$Ln\ Z_i = \beta_0 + \sum_{j=1}^{5} \beta_i\ LnX_i + \beta_k LnX_k + \beta_l LnY_i + v_i - u_i \quad (1)$$

$$LnZ_i = Ln\beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \beta_6 LnX_6 + Vi - Ui \quad (2)$$

Where,
Z_i = Labour-Use (Mandays)
β_0 = Constant Term
X_1 = Fertilizer (Kg)
X_2 = Seed (Kg)
X_3 = Agrochemical (Litres)
X_4 = Farm Size (ha)
X_5 = Depreciation of Capital Items (₦)
X_6 = Output of Soybean (Kg)
β_1-β_6 = Regression Coefficients
V_i = Random Errors
U_i= Error Term as a result of LIE (Labour-Use Inefficiency).

3.*2. The Labour-Use Inefficiency Model is specified as follows*

$$U_i = \propto_0 + \propto_1 Z_1 + \propto_2 Z_2 + \propto_3 Z_3 + \propto_4 Z_4 + \propto_5 Z_5 + \propto_6 Z_6 \quad (3)$$

Where,
U_i = Labour-Use Inefficiency
$\propto_0$ = Constant Term
$\propto_1 - \propto_6$ = Parameters to be Estimated
Z_1 = Age (Years)
Z_2 = Education (Years)
Z_3 = Experience (Years)

Z_4= Household Size (Number)
Z_5 = Cooperative (1, Member; 0, Otherwise).

3. Results and Discussion

3.1. The Farm-Specific and Producers Features of Soybean Growers

The continuous variables of farm-specific and farmers' features of soybean growers was presented in Table 1. The mean age was 42 years with standard deviation of 11.94. This means that the soybean growers are young, active and in their productive age. This study agrees with the work of Saliu et al. (2017) who obtained an average age of 42 years among small-scale soybean farmers in Kaduna State, Nigeria. This study is in line with FAO (2017) who recommended that the viable and productive age of farmers fell within the age brackets of 30 to 50 years. This study is also similar to the work of Sadiq et al. (2022) who investigated labour-use efficiency of rice farmers in Nigeria's north central region and obtained an average age of 41 years among producers with a standard deviation of 10.83. Girei et al. (2018) noted that age of producers has an important effect on the perspective and judgement of farmers' relative to risk aversion, adoption of new technologies and other farm production related decisions. The soybean growers had approximately 9 years of school education. This implies that the soybean growers had the necessary education to process information on improved technologies that will enhance soybean productivity. According to Girei et al. (2018) education is a key socio-economic factor that influence producers' decision because of its effect on the perception, awareness, quick processing, reception, and adoption of innovation that could enhance efficient farm management and increased productivity. Averagely, the producers had 10 years' experience with standard deviation of 5.22 in soybean farming. This study is similar to the work of Oluwafemi et al. (2022) who obtained farming experience approximately 8 years with standard deviation of 2.6 among soybean producers in Oyo State, Nigeria. The number of years of experience in soybean farming determines the producers' ability to make effective farm management decisions, not only in adhering to agronomic practices but also with respect to resource allocation and input combinations. The household size was estimated at 5 persons per household. The work of Olorunsanya et al. (2009) noted that large families appeared to save more extra-cost for engaging labour than small families. This study is in line with the results of Canwat (2012) who investigated modelling seasonal farm labour demand in western Kenya and reported that the mean household size was estimated at 6 persons per household. Also, this work is in line with results of Bowlus and Sicular (2002) who investigated the moving towards markets, labour allocation in rural China reported that the labour demand is positively related to household size and confirmed the theoretical suggestion that when production and consumption decisions are simultaneously made, increase in household size drives down the cost of labour (shadow price) because of increased labour supply by farm houseolds. The average farm size was 1.89 hectares with standard deviation of 0.24, this means that they are small-scale farmers. This work is similar to the study of Oyenpemi et al. (2023) who obtained an average farm size of 1.8 hectares among soybean farmers in Kwara State, Nigeria. This study agrees with the outcomes of Onumah et al. (2010) who investigated the productivity of hired and family labour and determinants of technical inefficiency in Ghana's fish farms and reported that the average land size and experiences were 0.75 ha and 7 years, respectively. The output was evaluated at 1, 161 kg per ha with standard deviation of 88.24. This outcome agrees with the work of Aboki et al. (2024) who obtained an average output of 1004 kg per ha among farmers in Taraba State, Nigeria. This result is in line with outcome of Changkid (2007) who reported that the productivity of Thai rice production remains at a low level.

Table 1. The Summary Data of Continuous Variables of Farm-Specific and Farmers' Features of Soybean Growers

Variables	Unit of Measurement	$\bar{X}_i$	SD
Age	Years	42	11.94
Education	Years	9	5.86
Experience	Years	10	5.22
Household Size	Number	5	3.73
Farm Size	Ha	1.89	0.24
Output of Soybean	Kg per ha	1,161	88.24

Source: Field Survey (2024)

3.2. The estimates of the cobb-douglas labour-use frontier

The estimates of the Cobb-Douglas labour-use frontier was presented in Table 2. The significant variables influencing labour requirements are seed, farm size, and annual depreciations on capital items. The labour requirement frontier can be defined as the minimum amount of labour that is technically required to produce a given level of output. The coefficient of seed was evaluated at (0.1782) and was statistically significant at 5% probability level. The positive and significant of seed coefficient reveals that high labour requirement was utilized during seed sowing. The elasticity of seed was estimated at (0.1782), this shows that a unit increase in seed quantity, while keeping all other variables constant will lead to an increase in labour-use by 0.1782 man-days. This result is similar to the outcome of Saliu et al. (2017) who reported that a unit increase in seed quantity will lead to an increase in labour-use by 0.08 man-days among rice farmers in North central, Nigeria. The estimated coefficient (0.1932) for size of cultivated farm land was positive and significant at 5% alpha level. This reveals that for every one-unit increase in farm size, while keeping all other variables fixed will lead to 0.1932 man-days increase in the amount of labour used. This result is similar to the work of Onyenweaku (2007) and Effiong (2005) who reported that the larger the farm size and quantity of produce harvested, the higher the level of labour used. The coefficient of annual depreciation was evaluated at (0.1408). The coefficient of annual depreciation was significant at 5% alpha level. The positive and significant of annual depreciation on capital items revealed that the obsolete farm implements due to wear and tear resulted in high labour quantity used in soybean farming. The elasticity of annual depreciation of (0.1408) indicated that a unit increase in the wear and tear of the capital items while keeping all other factors fixed will lead to an increase in labour-use by 0.1408 man-days. This result is similar to the study of Saliu et al. (2017) who reported that a unit increase in wear and tear of the capital will lead to an increase in labour-use by 0.003 man-days among rice farmers in North Central, Nigeria. The variables such as fertilizers, agrochemicals, and outputs were not used in sufficient quantity, thus the reason for the non-significant of their estimated values. There is high cost of fertilizer and agrochemicals, also they are not readily available at the appropriate time. The non-significant of the output depicts diseconomies of size which denotes that the producers cultivate soybean on a small-scale basis. According to Saliu et al. (2017) who noted that an increase in output means increase in labour utilization for post-harvest activities. The estimate of the overall model variance of γ (0.4381) and σ^2(0.4138) are significantly different from zero at 1% alpha level. This connotes a good fit and correctness of the specified

distribution assumption. This study agrees with the outcomes of Onumah et al. (2010) who investigated the productivity of hired and family labour and determinants of technical inefficiency in Ghana's fish farms and reported that the gamma value was estimated at 0.979. The value of the sigma square was 0.4138 which indicates the correctness of fit of the model as assumed for the composite error term. This study is similar to the work of Akanni and Dada (2012). The labour-use efficiency evaluation of soybean growers revealed that there was the presence of labour inefficiency effect in soybean farming as evidenced by the significance of gamma value of 0.431 at 1% alpha level. The gamma coefficient of 0.4381 connotes that 43.81% of the variation in the total labour use among the soybean farmers is due to the differences in their labour efficiencies. The model is assumed to be the representation of the data considering the highly significant of the Log Likelihood function assumed with the maximum likelihood approach.

4.3. Determinants of labour-use inefficiency

The determinants of labour-use inefficiency in soybean farming was displayed in Table 2. The result shows that age, education, and experiences were statistically significant in affecting labour-use inefficiency. The age of soybean growers shows a negative relationship (-0.0484) with labour-use inefficiency. The coefficient of age was significant at 10% alpha level. This revealed that older soybean farmers are more labour efficient. A unit increase in the farmers' age, while keeping all other factors fixed would give rise to 0.0484 decrease in labour-use inefficiency. This study is in line with outcome of Sadiq et al. (2022). The coefficient of education (-0.138) was negative and had significant (10% alpha level) relationship with labour-use inefficiency. This means that education leads to decrease in labour-use inefficiency. A unit increase in education, while keeping all other variables fixed would give rise to 0.138 decrease in labour-use inefficiency. This study is in line with a priori expectation and Sofoluwe et al. (2011) who noted that education increases the ability of farmers to use their resources efficiently. The negative coefficient of experience in soybean farming (-0.1413) was significant at 5% probability level. This implies that increase in experience in soybean farming would lead to increase in labour-use efficiency. A unit increase in experience in soybean farming, while keeping all other factors fixed would give rise to 0.1413 decrease in labour-use inefficiency. The non-significance associated with household size and cooperatives convey some useful information. The negative coefficient of household size (-0.0394) implies that more of the able-bodied household membership are involve in the soybean farm operations, but this do not significantly affect labour-use efficiency. The advantage benefited by producers that belongs to cooperative associations made them to be more labour efficient than their counterparts who had no cooperative association.

Table 2. Maximum Likelihood Estimates of the Stochastic Labour-Use Efficiency Frontier

Variable	Coefficient	Standard Error	Z-Score
Fertilizer	0.1283	0.1069	1.20
Seed	0.1782**	0.0629	2.83
Agrochemicals	0.1649	0.1499	1.10
Farm Size	0.1932**	0.0648	2.98
Depreciation Cost	0.1408**	0.0491	2.87
Output of Soybean	0.0863	0.0743	1.16
Constant	3.9719***	0.7364	5.394
Labour-Use Inefficiency Component			
Age	-0.0484*	0.0277	-1.75
Education	-0.138*	0.0719	-1.92
Experience	-0.1413**	0.0699	-2.02
Household Size	-0.0394	0.0368	-1.07
Cooperatives	-0.1531	0.1405	-1.09
Diagnostic Statistics			
Log Likelihood	-121.74		
Sigma Square	0.4037**		
Gamma	0.4184**		

Source: Field Survey (2024)

3.4. The labour-use efficiency scores

The mean labour-use efficiency was 0.654, this means that an average producers achieved efficiency of 65.4% that is below the defined frontier level (Table 3). In addition, an average producers' labour-use efficiency fell short of the maximum defined frontier level by 34.6%. Thus, an average producer lost a potential labour-use of 34.6% in the production of soybean. Approximately, 34.6% of labour man-days used in soybean farming of average producers were wasted relative to the best practiced farms facing the same technology and producing the same output. The frequencies of occurrences of the predicted labour efficiency above the mean score represents 57.5% of the sampled producers, this means that most of the producers are fairly efficient in labour-use at a given level of output using available technology at their disposal. Approximately, 62% of the sampled soybean growers had their labour efficiency in the range of 30 – 70%, this means that at minimum 30% of their potential labour-use is lost to inefficiency. The worst and best labour efficient producers achieved efficiency scores of 0.2084 and 0.9653 respectively, while the most frequent efficiency scores are 0.59 and 0.99. This implies that the worst and best practiced producers lost potential labour-use of 0.7916 and 0.0347% in soybean output as a result of factors that are within their control. For the worst, average, and best practiced producers to be on the frontier level they require to increase their labour efficiency by 79.16, 34.60, and 3.47%, respectively. Furthermore, for

the worst and average producers to be on same level with the best practiced producers they require to raise their labour efficiency by 78.41% [1-(0.2084/0.9653)×100] and 32.25% [1-(0.654/0.9653)×100], respectively. Most of the soybean producers were relatively efficient but there still exists an opportunity for them to raise their labour efficiency so as to optimize allocation of labour resource in soybean farming. This study agrees with the work of Saliu et al. (2017).

Table 3. Labour-Use Efficiency Scores

Efficiency Level	Frequency	Percentage
0.20 – 0.29	8	4.00
0.30 – 0.39	18	9.00
0.40 – 0.49	22	11.00
0.50 – 0.59	37	18.50
0.60 – 0.69	35	17.50
0.70 – 0.79	12	6.00
0.80 – 0.89	31	15.50
0.90 – 0.99	37	18.50
Total	200	100.00
Minimum	0.2084	
Maximum	0.9653	
Mean Labour-Use Efficiency	0.654	
Standard Deviation	0.2105	

Source: Field Survey (2024)

4. Conclusion

This study focused on the factors affecting labour-use efficiency of soybean farming among smallscale growers in North West, Nigeria. A simple random sampling approach was used to select 200 soybean growers. Primary data of cross sectional sources were utilized based on a well-planned questionnaire. Data were analyzed using descriptive statistics and stochastic labour-use efficiency frontier model. The following conclusion were based on the research hypotheses:

〖H0〗_1: The estimates of input elasticities in the labour-use frontier estimates are not positive. The signs and significance of the coefficients in the labour-use efficiency component are important in taking the decision of accepting or rejecting the null hypothesis. The coefficient provides a measure of the input elasticities, from the findings, all the input elasticities were positive, and the seed, annual depreciation, output, and farm size, are significantly different from zero, they were estimated as follows;
fertilizer (β= 0.1283, SE = 0.1069, z = 1.20),
seed (β= 0.1782, SE = 0.0629, z = 2.83), agrochemicals (β= 0.1649, SE = 0.1499, z = 1.10), farm size (β= 0.1932, SE = 0.0648, z = 2.98), annual depreciation (β= 0.1408, SE = 0.0491, z = 2.87), and soybean output (β= 0.0863, SE = 0.0743, z = 1.16). This means the null-hypothesis which stated that the coefficient of input elasticities in the labour-use frontier estimates are not positive was rejected, while the alternative hypothesis 〖(Ha〗_1) was accepted. This study agrees with outcomes of Anyiro et al. (2013) who noted that the input elasticities were positive among yam farmers in Abia State, Nigeria, and they were estimated as follows; output of yam (0.3506), fertilizer (0.4943), and farm size (2.158). 〖H0〗_2: There is no significant relationship between socio-economic predictors and labour inefficiency. The signs and significance of the socio-economics factors in the labour-use inefficiency component are important in taking decision to accept or reject the null hypothesis. The negative signs of the coefficient of socio-economic stimuli indicates decrease in labour-use inefficiency or increase in labour – use efficiency, while, the positive signs of the coefficient of socio-economic stimuli indicates increase in labour-use inefficiency or decrease in labour-use efficiency. The study showed that the significant socio-economic stimuli affecting labour-use inefficiency (labour-use efficiency) include age, education, and experience in soybean farming. Therefore, the null hypothesis which stated that there is no significant relationship between socio-economic factors and labour-use inefficiency was rejected, while the alternative hypothesis 〖(Ha〗_2) was accepted. This work agrees with studies of Akanni and Dada (2012) who noted that age to be positively related to labour-use efficiency among cocoa farmers in South Western Nigeria. 〖H0〗_3:The labour-use efficiency scores are not significantly different from zero. The size or magnitude of the labour-use efficiency scores is significant in taking decision of accepting or rejecting the null hypothesis. The labour-use efficiency scores were greater than zero, this study further revealed that the estimated mean of labour-use efficiency score of 65.4% is positive and greater than zero. The minimum and maximum labour-use efficiency scores were 20.84% and 96.53%, respectively. The null hypothesis which stated that the labour-use efficiency scores are not significantly different from zero is rejected, while the alternative hypothesis 〖(Ha〗_3) was accepted. This study is in line with works of Sadiq et al. (2022) who reported the mean labour-use efficiency score of 0.8657, among rice growers in Nigeria. Based on the outcomes of this , the under-listed suggestions were made:

(i)The soybean growers should form themselves into cooperative groups, this will enables them to share labour, they can pool their resources together, have access to farm resources, get adequate funds to finance soybean farming activities., this will enhance labour-use efficiency and productivity.

(ii) Labour saving technologies and machines should be made available to producers at affordable prices to improve labour-use efficiency.

(iii) There should be increase in remuneration paid to hired farm workers interms of farm wages so as to properly motivate them in soybean farming.

(iv) Policies should be targeted on subsidies of farm inputs such as fertilizers, agrochemicals, and capital items for increasing labour-use efficiency and productivity.Adequate credit in cash and in kinds should be made available to soybean growers.

(v) Policies and programmes of governement should focus on encouraging more young people to agriculture. The young people are active, strong and energetic, this labour resources and potentials should be harnessed to increase soybean output and efficiency.

Declarations

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Data presented in this study are available on fair request from the respective author
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Consent for Publication
Not applicable
Conflicts of Interest
The authors disclosed no conflict of interest

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