



## **Impact of Soybean Technology Adoption on Income of Farming Households in Borno and Kaduna States, Nigeria.**

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### **ABSTRACT**

The study evaluates the impact of Tropical Legume II (TL II) on income of beneficiary farmers in Borno and Kaduna States, Nigeria. The objective was to assess the impact of improved soybean technology among the benefiting farming households and examine the changes in income of the TL II benefiting farmers. Multistage sampling procedure was used to sample 162 respondents from whom data were collected using structured questionnaires. Descriptive statistics and Double Difference (DD) analytical techniques were used to analyze the data collected. Results revealed that a large proportion (35%) of the TL II beneficiaries comprised relatively young and active farmers (less than 30 to 40 years). It also showed that the TL II beneficiaries had less household size made of 5 compared to 9 persons but larger farm size (mean 2-3 hectare) compared to the non-TL II beneficiaries with mean farm size of 1.69 hectare. The finding revealed that majority (71%) of the TL II beneficiaries earn ₦80, 000.00 and above from soybean production annually. On the other hand 61% of the non-beneficiaries earn less than ₦20, 000.00 from their conventional method of soybean production. The mean difference of income obtained from other sources between the beneficiaries and non-beneficiaries was ₦30, 310.90. Double difference (DD) revealed that the difference in per capita income of the TL II beneficiaries and non-beneficiaries was ₦13, 452.48 and ₦6, 464.14 respectively before and after the TL II projects. TL II project had positive impact on income of the beneficiaries in the study area. It is therefore recommended that TL II project be replicated and scaled out to the farmers so that potential benefit could also accrue to them.

**Key words:** Tropical Legume II (TL II), Soybean, Technology, Income, Beneficiary and Impact

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### **INTRODUCTION**

Soybean has long been recognized primarily to improve nutrition of farm families and diversify income sources. Soybean performs well in the southern and northern Guinea Savannas of Nigeria where rainfall is usually higher than 700 mm. The crop can be successfully grown in many states in Nigeria. Nigeria's soybean output increased from 480,000 metric tons (MT) in 2010/11 to 510,000 MT in 2011/2012 (Abate, 2012). The increase in supply is attributed to favorable weather condition, greater awareness and attractive producer prices. Despite this steady increase in output, domestic production continues to lag behind increasing demand.

The cultivation of legumes like soybean for increased yield, income and poverty reduction created an opportunity for Government and non-governmental organizations to encourage farmers to increase their income. The study by Kabuli *et al.* (2005) showed that majority of the soybeans adopting households were in the highest income bracket and asset ownership compared to the non-adopting households. This is an indication that soybean technology has the potential to increase per capita income of farmers.

It has been established by many researchers (Nwara, 2007 and Ajibefun, 2002) that increased farm income can be achieved through agricultural project/program that is designed to increase capacity utilization in agricultural production, reduce operational cost and adopt strategies that ensure participatory approach in the plan and implementation of agricultural project.

The results from Adeolu *et al.* (2013) show that participation in Integrated Agricultural Research for Development (IAR4D) had positive and significant impact on the beneficiaries at the 10 percent level. The quantum of the impact made the beneficiaries about 139 percent better than the baseline condition. A comparative analysis shows that the participating farmers are better (with higher household income) than the farmers in the two counterfactuals of conventional and clean sites. Gwary *et al.* (2013) in their study on Constraints to Extension Service Delivery in the Production, Processing and Marketing of Gum Arabic in Magumeri Local Government Area of Borno State, Nigeria revealed that 44% of the respondents earn between ₦100, 000- ₦200, 000, while 33.3% and 22.6% earn between ₦201, 000- ₦500, 000 and above ₦500, 000 respectively.

Sanginga *et al.* (1999) showed in his work carried out on adoption and social impact of agricultural technologies: The case of soybean in Benue State that the status of soybean has changed from a traditionally minor export crop to the most important crops cultivated by the majority of male and female farmers. More women have become involved in soybean production as improved varieties and household utilization technologies are readily available. On the average, soybean provided 44% of the total farm income for male soybean producers and 36% for female producers. A multivariate analysis of the nutritional status of children showed that soybean consumption; income earned from soybean and women's production of soybean have significant positive impact on both the short and long term nutritional status indices at 1% confidence level. Their study further revealed that income derived from soybean contributes significantly to the acquisition of material assets such as radios (48.4%); mattress (71.9%); bicycles (27.7%); livestock (58%); and metal-roofed houses (14%) for men. On the other hand, majority of women seemed to spend more of their soybean income on human capital investment items for themselves and their children, paying school fees (89.7%); medical bills (45.9%); buying high-valued food and other food items (67%). Finally, they concluded that more and more women were increasingly switching to soybean production as the crop became more lucrative and improved varieties were more readily available. The result of their work provides a strong case for the promotion of soybean as a cheap solution for nutrition and a means of poverty alleviation for poor people.

The TL II project was implemented in Borno and Kaduna States in collaboration with the International Institute of Tropical Agriculture (IITA). The TL II project developed, tested and promoted improved soybean variety and its associated management practices which can enhance productivity and production of soybean. This was done primarily to diversify the income sources of the farming household and improve the livelihoods of the beneficiaries of the TL II project.

This paper therefore, attempted to determine its impact on income of the benefiting communities as a result of adoption of improved soybean technology. The research specifically assessed the impact of improved soybean technology among the benefiting farming households in Borno and Kaduna States, Nigeria and examined the changes in income of the TL II benefiting farmers.

Governmental and non-governmental organizations that are interested in the TL II project can use these findings to evaluate whether the improved soybean technology had increased income of the beneficiaries and whether those effects are attributable to the project intervention in the study area. This finding can be useful in sending out the result to other similar areas in Nigeria.

## METHODOLOGY

The study was conducted in Borno and Kaduna States. Borno State lies between latitudes 11°30' N to 14°30'N and longitudes 10° 30'E to 14°13'E in the Savannah of Nigeria. Kaduna state lies between latitudes 09° 20'N to 12° 25'N and between longitudes 06°33'E to 09° 75'E. These are the states where

TL II soybean project was implemented as a commercial crop in four and three Local Government Areas (LGAs) of Borno and Kaduna States, respectively. The LGAs were Biu, Damboa, Hawul and Kwaya Kusar in Borno State and Kachia, Zangon Kataf and Jama'a in Kaduna State.

**Sampling procedure**

The sample used was based on the baseline survey conducted in 2008. The same respondents located in the same community were used. Multistage sampling was utilized to select sixteen communities from the two states. This was followed by proportionate random sampling technique (since the populations are not the same in the communities) to select 107 TL II beneficiaries and 55 non-beneficiaries giving a total of 162 respondents.

Data for the study were obtained from two main sources - primary and secondary. The primary data were collected through the use of structured questionnaire administered to the respondents. Major source of secondary data was the baseline data collected by the TL II project in 2008.

**Analytical technique**

The analytical tools used for the data analysis include descriptive Statistics and Double Difference Estimation Model

**Descriptive statistics**

Descriptive statistics, such as mean, frequency distribution and percentages were computed and used for the analysis of household socio-economic characteristics.

**Double Difference estimation model**

The study used double difference estimation model. The Double Difference (DD) model is a standard estimator used to measure the short term or long term program effects or impacts on participants (Verner and Verner, 2005; Wakawa, 2014).

The model can be specified as follows:

$$DD^s = \left[ \frac{I}{F} \sum_{i=1}^P (Y_{i-a} - Y_{i-b}) \right] - \left[ \frac{I}{C} \sum_{j=1}^e (Y_{oja} - Y_{ojb}) \right] \dots\dots\dots(i)$$

- Y<sub>1ia</sub> = per capita income (₦) of beneficiaries after TL II project
- Y<sub>1ib</sub> = per capita income (₦) of beneficiaries before TL II project
- Y<sub>0ja</sub> = per capita income (₦) of non.beneficiaries after TL II project
- Y<sub>0jb</sub> = per capita income (₦) of non.beneficiaries before TL II project.
- P = number of beneficiaries
- C = number of individuals in the control group

**RESULTS AND DISCUSSION**

**Socioeconomic characteristics of the TL II beneficiaries and non-beneficiaries**

**Age:** The distribution of age of household heads varied among the beneficiaries and the non-beneficiaries. Table 1 shows that the mean age (47) of the soybean farmers comprised relatively young and active farmers between the ages of 30 and 40 years. They are likely to be more productive, have higher degree of risk aversion and can participate in new agricultural projects. As such given adequate farming resources; the farmers have the potential to maximize their farm output thereby increasing their income and livelihoods.

They revealed that the Fadama farmers cultivated more land after the project, thus, indicating that Fadama irrigation farmers benefitted from the program. The finding of the research also revealed that the benefiting farmers were allowed by the program to plant crops of their choice.

**Sex:** The result shows that majority (83%) of the beneficiaries and non-beneficiaries (91%) were male and only 17% and 9% were female for the two groups respectively. The finding indicates that most of

the soybean farmers were male. The most probable reason for such overwhelming majority of male respondents is that, the male farmers constitute the household heads and they respond on behalf of the households except in situation where the household head is female. Result from this study showed that due to socio-cultural reasons women participation in commercial crop production is less than that of men in the study area.

**Table 1: Demographic characteristics of the respondent's socioeconomic variable**

	Beneficiaries (n = 107)				Non-beneficiaries (n = 55)			
	F	%	Means	Std.	F	%	Means	Std.
<b>Age category</b>								
< 30	4	4			1	2		
30-40	33	31	46	8.4	10	18	47	11.43
41-50	37	34			17	31		
51-60	20	19			20	36		
Above 60	13	12			7	13		
<b>Sex</b>								
Male	89	83			50	91		
Female	18	17			5	9		
<b>Educational level (years)</b>								
No Education	5	7			4	7		
Non-formal Education	7	5			8	14		
1-6	31	36			16	29		
7-12	25	29	10.04	4.90	14	26	8.66	4.08
Above 12	39	23			13	24		
<b>Household size</b>								
< 3	11	10			2	4		
3 – 6	17	16	5.6	3.8	19	34	9.0	4.88
7 – 10	54	50			16	29		
>10	15	24			18	33		
<b>Years spent in growing soybeans</b>								
1-3	47	44			12	21		
4-6	23	21	8.7	7.2	18	33	5.67	2.62
7-9	15	21			3	5		
10 and above	22	14			10	18		
Not applicable	-	-			12	22		
<b>Farm size(ha)</b>								
< 1	16	15			34	62		
1 - 2	43	40	2.38	3.58	12	22	1.69	2.17
2.1 – 3	20	19			4	7		
3.1 – 4	16	15			2	4		
4.1 – 5	12	11			3	5		

**Source:** Field Survey, 2011. Key: % for percentage and F for frequency.

**Education:** Table 1 presents the distribution of farmers according to years spent in school. The level of education among the TL II participants indicated that 88% are educated and 52% spent more than six years in school. While the non-participants revealed that 79% were educated and 50% had more than primary education. The result for the two groups implied that large proportion of the respondents were educated and could easily understand the potential of soybean to increase the yield of cereals when inter-cropped and to control Strigar. Educated farmers can explore opportunities of other markets and can take risk to participate in the TL II project. This is in conformity with the study of Asfaw *et al.* (2011) on technology adoption and seed access, which revealed that adopters have higher

proportion of household heads with at least secondary education as a result; education is correlated with decision to adopt.

**Household size:** The household sizes differ across the two groups surveyed. It is clear that the household sizes for the category 7-10 for beneficiaries and non-beneficiaries were 50 and 29 respectively. This result indicated that the TL II beneficiaries have less household size compared to the non-TL II farmers. The household size category 3-6 is higher among the non-beneficiaries they are likely to be among those that are not educated or sceptical in adopting the improved soybean technology.

**Years spent in soybean farming:** The farming experience of household heads in the project area varied widely with about 44% beneficiaries having 1-3 years only. An average of 56% of the beneficiaries were producing soybean before the TL II project. This suggests that soybean production was not new in the study area except the improved varieties and its management practices provided by the TL II project.

**Farm size:** The result revealed that about 40% of the TL II beneficiaries' farm sizes range from 1-2 ha in the soybean communities. The majority (62%) of the non-beneficiaries of the TL II had less than 1 ha in the non-soybean project communities. The finding showed a disparity between the minimum and the maximum farm sizes; the minimum size was 0.3 ha, while the maximum was 4 ha for all areas covered in the study. The findings indicate that small-scale farmers were characterized by small and fragmented land holdings particularly the non-TL II farmers in the study area. This result agrees with the study by Ango *et al.* (2012) on Impact of Fadama on Participating Farmers in Kebbi State where the farmers cultivated more land in project participation.

#### Income from Soybean

Table 2 revealed that majority (71%) of the TL II beneficiaries earn ₦80, 000.00 and above from soybean production annually. On the other hand 61% of the non-beneficiaries of the improved soybean technology earn less than ₦20, 000.00 from their conventional method of soybean production. This indicates that adoption of the improved soybean technology had the potential to improve farmers' income. The implication is that TL II project participation had positive effect on the income of the participants.

**Table 2: Comparison of TL II Beneficiaries and Non-beneficiaries Income**

	Beneficiaries (n = 107)				Non-beneficiaries (n = 55)			
	F	%	Means	Std.	F	%	Means	Std.
<b>Soybean income</b>								
<20000	4	4			28	61		
20000 – 40000	8	7	78,755.00	39,830.84	13	28	5,431.0	1,231.30
40001-60000	6	6			5	11		
60001-80000	13	12			0	0		
>80000	76	71			0	0		
<b>Income from other sources</b>								
<20000	4	4			3	5		
20000 – 40000	8	7	99,434.40	43,210.84	4	7	69,123.50	45,231.30
40001-60000	6	6			7	13		
60001-80000	24	22			16	29		
>80000	65	61			25	45		

Source: Field Survey, 2011. Key: % for percentage and F for frequency.

**Income from other sources:** The result of the analysis for income from other sources showed that the TL II project beneficiaries had higher income (Table 2). The mean difference between the beneficiaries and non-beneficiaries was ₦30, 310.90. This is as a result of introduction and adoption of improved crop varieties and agronomic practices by farmers particularly on soybean and cereal rotation by farmers in the project communities. Also, improved access to inputs, especially fertilizers, through the TL II project, contributed to these higher yields and income.

### Changes in income of respondents

The per capita income from soybean of the TL II beneficiaries and non-beneficiaries before and after the project was calculated into real income using composite price index. The results are presented in Table 3

**Table 3: Average per capita income (₦) from soybean before and after TL II project**

	Beneficiaries Difference in Per Capita Income (before and after)	Non-beneficiaries Difference in Per Capital Income (before and after)	DD
Per Capita Household Income	13,452.48	6,464.34	6,988.14

**Source:** Field Survey, 2011.

The difference in real income from soybean between beneficiaries and non-beneficiaries before and after the TL II project is shown in Table 3. The findings revealed that the difference in per capita income of the TL II beneficiaries and non-beneficiaries was ₦13, 452.48 and ₦6,464.14 respectively, before and after the TL II projects. The result indicates that the TL II beneficiaries had greater increase in per capita income compared to the non-beneficiaries. The DD estimate showed ₦6, 988.14 in real terms. The result revealed by DD is symptomatic that TL II has made the beneficiaries to realize increase in income.

The above results could be partly explained to be as a result of the benefits of the TL II project through which beneficiaries had access to inputs such as credit, improved soybean seed and fertilizer in an agreed form of repayment. This conforms to the findings of Verner and Verner (2005) on the Effects of the Training Component of the Labor Force Training Support Project in Cote d'Ivoire.

### CONCLUSION AND RECOMMENDATIONS

The study analysed the impact of TL II on income of beneficiary farmers in Borno and Kaduna States, Nigeria. It mainly assessed the impact of improved soybean technology among the benefiting farming households and examines the changes in income of the TL II benefiting farmers. Socioeconomic characteristics of the TL II beneficiaries showed increase in the following variables- income obtained from soybeans; income from other crops; and farm size. The project impacted positively on the per capita income and assets of the TL II beneficiaries compared to that of non-beneficiaries. The DD results indicate that per capita income among the TL II beneficiaries compared to non-beneficiaries increased by ₦6988.14. Based on the impressive impact of the project on the beneficiaries, it was recommended that the project be scaled out to the non-benefiting communities and other areas in the study area.

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