Assessment of Sorghum/Soybean Farmer's Perception on the Benefits of Strip Intercropping Techniques In Tofa Local Government Area of Kano State, Nigeria

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Abstract: **The study assessed sorghum/soybean farmer's perception on the benefits of strip intercropping techniques in Tofalocal government area of Kano State, Nigeria.Data for the study was obtained through the use of structured questionnaire administered on seventy-five(75) respondents. Two specific objectives were raised; to determine the benefit derived by sorghum/soybean strip intercropping farmer before adoption and after adoption in terms of output and to describe sorghum/soybean farmers' perceptions on other benefits of strip intercropping techniques and sources of information regarding the techniques. Result of study shows that100% ofthe respondents practiced sorghum/soybean strip intercropping techniques at 4:4 crop arrangements where TGX-1835-10E and TGX-1448-2E soybean varieties and CSR01, SK, ICSV400 and GAYA EARLY sorghum varieties were used for the period of 4 years, giving rise to 2-rotations.The study revealsed that there was high increase in the level of output gotten by the farmer, soil fertility restored, incidences of pest and disease infestation reduced and reduction in maturity periods of crops. The problems reportedwere that of the first and third sorghum varieties given (SK and ICSV400 sorghum varieties) in which the former displays a misfit to their ecology and the latera short stalk and small seeds similar to their local varieties, and also constraint of not having basic farm inputs to carry out their farming activities was also reported and a meager cases of insect pest infestation. Conclusively, this technique is highly beneficial to the farmers in the study area. It is therefore recommended that inputs should be made available to these farmers before the rainfall season.**

***Keywords*: Sorghum, Soybean, Intercropping, Farmer's Percepti on**

I. INTRODUCTION

Agriculture is the oldest occupation of man. It is important for many reasons; it is an important source of food for humanand livestock; it provides employment for over seventy percent of the population as well as being an important source of revenue. It provides raw materials to our industries and it is a good source of foreign exchange to the country (Carsky, 2015). The development of any country is very much dependent upon the ~~a~~way and manner in which such a country develop its agricultural policies.

Nigeria agriculture is characterized by large number of relatively small family operated farms. These small-scale farmers accounted for 90-95% of the total food production. A typical small-scale farmer is the one who cultivate 0.1-5.99 hectares. The Nigerian population does not only live in the rural areas, but also derive their sources of livelihood from agriculture, and are still characterized by low level of income, low level of capacity to satisfy the food and fiber needs of their countries and the use of primitive techniques in production. Inspiteof the peasantry nature of the sector, agriculture continues to play its traditional role of not only providing food for both human animal consumption, employment, raw materials for industries and revenue generation, but also contributes to both total export and gross domestic product (GDP) of the country(Ajeigbe, 2012)

Intercropping is the practice of producing multiple crops in a given space. Throughout time and around the world, intercrops have been used to better match crop demands to available sunlight, water, nutrients, and labor (Bandyopadhyay, 2011). The advantage of intercropping over sole cropping (growing a single crop in a field) is that competition for resources between different species is less than between the same species. Intercropping has a long history, and is employed in many regions. In tropical agriculture, for example, tall and short crops are grown together to maximize production (Singh, 2001). In arid regions, intercropping improves the conservation of water. The "three sisters" of corn, beans, and squash grown by Native Americans offer another example of intercropping. Strip intercropping is the adaptation of this system to contemporary mechanized agricultural practices.

For many years, crop rotations have been recommended because of the temporal diversity they provide in plant species and their resource requirements(Mohammed, 2015). Strip intercropping adds a spatial diversity to species across the landscape. It also distributes the labor requirements of that landscape more evenly through the growing season, and allows complimentary interactions that can boost yields and profits (James, 2006).

Intercropping of compatible plants also encourages biodiversity, by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. This in turn can help limit outbreaks of crop pests by increasing predator biodiversity (Ajeigbe, 2012). Additionally, reducing the homogeneity of the crop increases the barriers against biological dispersal of pest organisms through the crop. The degree of spatial and temporal overlap in the two crops can vary somewhat, but both requirements must be met for a cropping system to be an intercrop. Numerous types of intercropping, all of which vary in temporal and spatial mixture to some degree have been identified.

II. OBJECTIVES OF THE STUDY

The broad objective of the study is to assess the benefits derived by sorghum/soybean farmer using strip intercropping techniques in Tofalocal government area of Kano State. The specific objectives of the study are to;

i. Determine the benefit derived by sorghum/soybean strip intercropping farmer before adoption and after adoption of the techniques in terms of output.
ii. Describe sorghum/soybean farmers' perceptions on other benefits of strip intercropping techniques and sources of information regarding the techniques.

III. METHODOLOGY

3.1 Study Area

The climate of the study area is typically characterized by tropical wet and dry classified as AW by Wkoppen with an emphasis on seasonality of rain being the most critical weather element of the area (Olofin, 1989).The natural vegetation of the area is Sudan savannah, comprising of variety of trees scattered over a vast area of grassland and can hardly exceeds 20meters. The agricultural practice in the area is mainly mixed cropping involving cereals, legumes, tuber crops and livestock farming. Cereals production such as (maize, millet, sorghum,), leguminous crops (cowpea, soybean), vegetables and fruit are also cultivated in the area.Fruits such as mango, cashew, guava, and oranges are so seen produced in a significant amount.

3.2 Sampling Technique and sample size

A multistage sampling technique was used for the study which involves purposively selecting Tofalocal government area out of the 44 LGAs in Kano State, because of their homogenous activities and high concentration of sorghum/soybean strip intercropping farmers. A total of 5 villages which included; Doka, Dansudu, Ginsawa, Wangara, and Yanoko were randomly selected out of the 15 villages in the study area, to which a simple random sampling techniques was used in selecting the respondents based on the number of associations in each of the five (5) villages selected, giving rise to a total of seventy-five (75) respondents. Data was collected through the use ofa structured questionnaire.

3.3 Analytical tools

The analytical tool employed in this study was a simple descriptive statistics (mean, standard deviation and percentage) to achieve the stated objective. Descriptive statistics which are methods of summarizing, presenting and analyzing data as well as drawing valid conclusion and making reasonable decision on the basis of such analysis (Adamu, 1997).

$$X = \sum \frac{X1+X2+X3.....Xn}{N}$$

i.e $\times = \sum \frac{Xn}{N}$

IV. RESULTS AND DISCUSSION

Table 1: Distribution of Respondents According to Participation, and Usage of Strip Intercropping Techniques in Farming Activities

Participation, and Usage	Frequency	Percentage
Participation		
Yes	64	85.3
No	11	14.7
Usage		
Yes	75	100
No	0	0
Total	75	100

Source: Survey data, 2017

4.1 Respondents participation and usage of strip intercropping techniques.

Table 1showsedrespondents participation in the training activities conducted by KNARDA-BUK-AGRA SOIL HEALTH PROJECT and its usage on their respective farm lands. This study showed that 85.3% of respondents participated in the demonstration exercise conducted by the aforementioned project while 14.7% took up the techniques either through opinion leaders in the area or friends as the case may be. Furthermore this report also shows that 100% of the respondents used the technique on their farm lands.

4.2 Crop varieties used by the respondents

The different crop varieties used by the respondents, according to the (table32) first year (2010) sorghum varieties used was sorghum variety (type-1) namely CSR01 also known as (Farfara) and SK (Kaura) where the latter is a late maturing variety and not compatible with the study area and the former also a late maturing variety but a high yielding variety. In view of this, yield of sorghum for year one is very low, where 81.3% of the respondent used 'SK' and 18.7% used 'CSR01' sorghum varieties. In line with this in the subsequent year, sorghum variety was changed to sorghum variety (type-2) namely ICSV400 and GAYA EARLY which are all early maturing varieties and subsequently yield increasedwith 89.3% of the respondents usedusing GAYA EARLY and 10.7% of the respondentsusing ICSV400. While in the case of

soybean, two varieties were used also which are TGX-1835-10E; early maturing, short length, moderate yield, drought tolerant and shattered resistant and TGX-1448-2E; high yielding, late maturing, long length, shattered resistant, to which 66.7% of the respondents used TGX-1835-10E and 33.3% used TGX-1448-2E (Table 32).

Table 2: Distribution of respondents according to crop varieties used

Respondents according to crop varieties used	Frequency	Percentage
Sorghum variety (Type -1)		
SK	61	81.3
CSR01	14	18.7
Sorghum variety (Type -2)		
GAYA EARLY	67	89.3
ICSV400	8	10.7
Soybean variety		
TGX-1835-10E	50	66.7
TGX-1448-2E	25	33.3
Perception on yield difference after adoption		
Yes	74	98.7
No	1	1.3
Total	75	100

Source: Survey data, 2017

The yield difference of farmer after practicing the techniques on the farm land, as reported by the respondents shows there is a tremendous increase in yield quantity. This study indicated that 98.7% of the respondents have positive increase in their yield, while only 1.3% reported no yield difference (Table 2).

4.3 Respondents distribution according to the type of strip intercropping techniques arrangement and size of farm land used for four years.

Table 3 depicts the type of strip intercropping techniques arrangement practiced by the respondents considering the fact that there are different types of strip intercropping arrangements ranging from 1:1, 1:2, 2:2, 2:4, 4:4 etc, where 100% of the respondents used the 4:4 arrangements. So also this study shows the various farm sizes used by the respondents after adopting the technique to which 48.1% used 0.5ha while 30.6% used 1ha and 21.3% used the recommended farm size of 0.25ha of land

Table 3: Distribution of Respondents According to type of Strip Intercropping Techniques (2-Rotation).

Strip Intercropping Techniques Arrangements and Sizes of Farm	Frequency	Percentage
Type of strip intercropping arrangements		
4:4	75	100
Others	--	----
Size of farm land		
0.25ha	16	21.3
0.5ha	36	48.1
1ha	23	30.6
Total	75	100

Source: Survey data, 2017

Table 4a: Distribution of mean yield of sorghum before and after project according to village selected

Village selected	Mean yield of sorghum before project	Mean yield of Sorghum after adoption (2010)	Mean yield of sorghum after adoption (2011)	Mean yield of sorghum after adoption (2012)	Mean yield of sorghum after adoption (2013)
Doka	4.07	0.53	6.40	8.07	8.40
Dansudu	3.82	2.00	5.07	4.47	7.13
Ginsawa	2.67	0.60	4.20	4.87	4.40
Wangara	2.75	------	4.13	4.73	4.67
Yanoko	3.48	0.20	5.07	6.40	6.20

Source, field survey 2017

4.4 Respondents yield before project (before adoption) and after adopting the techniques

Table 4a showed respondents mean yields for each crop differently (i.e. sorghum and soybean) before project based on the village and concentration of respondents in each village, and mean yield of each crop for each year after project (after adopting the new techniques). Table 4a shows that Doka having high concentration of sorghum/soybean strip intercropping farmers had average yield of 4.07 before the project, while Dansudu had 3.82, Ginsawa with 2.67, Wangara had 2.75 and Yanoko had also 3.48 whereby after adopting the new techniques in the first year (2010), 'SK' (Kaura) sorghum variety and 'CSR01' sorghum variety was given to the respondents where 'SK' variety displays a crop misfit to their ecology and it's a late maturing variety for this reason those that use 'SK' variety recorded very low yield with Doka having average yield of 0.53, Dansudu where some used 'CSR01' had average yield of 2.00, Ginsawa had average yield of 0.60 while Wangara had zero (0) yield and Yanoko had 0.20. So in the subsequent year (2011) the sorghum variety was changed to ICSV400 which also has short stalk and small seeds similar to their local variety where most of the respondents used CSR01 with Doka having average yield of 6.40, Dansudu had5.07, Ginsawa had 4.20, Wangara had 4.13 and Yanoko had 5.07. In 2012 GAYA EARLY sorghum variety was given to them where they recorded the highest yield with long stalk and big seeds to which they are using up to date.

Table 4b Percentage difference (increase) in output of sorghum in the study area.

Community	Before	Now	% Increase
Doka	4.07	8.40	51.5
Dansudu	3.82	7.13	46.5
Ginsawa	2.67	4.40	39.4
Wangara	2.75	4.67	41.1
Yanoko	3.48	6.20	43.8
Yanoko	3.48	6.20	43.8

Source: field survey 2017

Table 4b showed the percentage increase in yield between what the respondents gets before the project and what is obtainable now where Doka had 51.5% increase, Dansudu had 46.5% increase, Ginsawa had 39.4% while Wangara had 41.1% and Yanoko had 43.8% increase in yield.

Table 5a: Distribution of mean yield of soybean before and after project according to village selected

Village selected	Mean yield of soybean before project	Mean yield of Soybean after adoption (2010)	Mean yield of soybean (2011)	Mean yield of soybean (2012)	Mean yield of soybean (2013)
Doka	4	5.60	7.13	8.66	9.46
Dansudu	3.61	6.26	7.40	8.33	8.33
Ginsawa	2.81	4.0	7.80	5.4	5.40
Wangara	2.70	3.66	4.40	4.93	5.33
Yanoko	4.13	5.40	6.80	7.53	7.80

Source, field survey 2017

Table 5a showsed the mean yield of soybean in the study area, where Doka which has the highest concentration of sorghum/soybean where the strip intercropping farmers had average yield of 4.0 soybean before the project, so also Dansudu had average yield of 3.61, Ginsawa reported average yield of 2.81, Wangara had average yield of 2.70 and Yanoko also had an average yield of 4.13. After the project in the first year of adoption (2010) Doka village had an average yield of 5.60, Dansudu had average yield of 6.26, Ginsawa also had average yield of 4.0, Wangara reported average yield of 3.66 and Yanoko had average yield of 5.40. In the second, third and fourth year, there is a very huge increase in the level of output of soybean as reported in the table below.

Table 5b Percentage difference (increase) in output of soybean yield

Community	Before	Now	% Increase
Doka	4	9.46	57.72
Dansudu	3.61	8.33	56.66
Ginsawa	2.81	5.40	47.96
Wangara	2.70	5.33	49.34
Yanoko	4.13	7.80	47.1

Source: field survey 2017

Table 5b shows the percentage increase in yield between what the respondents gets before the project and what is obtainable now where Doka had 57.72% increase, Dansudu had 56.66% increase, Ginsawa had 47.96% while Wangara had 49.34% and Yanoko had 47.1% increase in yield.

Table 6: Perceptions on other Benefits Derived from Sorghum/soybean Strip Intercropping

S/N	Statements	Mean	Standard deviation	Ranking
1.	I adopt sorghum/soybean strip intercropping technique because of a strong sense of social obligation, so as to render assistance to the community.	4.84	.36907	1st
2.	I adopt sorghum/soybean strip intercropping because of the belief that working with my people as a group will be personally rewarding to all and the benefits far outweigh the various cost involved.	4.57	.88796	6th
3.	As a result of my involvement in sorghum/soybean strip intercropping there is an increase in level of output.	4.33	.77692	8th
4.	As a result of my participation in sorghum/soybean strip intercropping there is high reduction in labor cost and time.	4.34	.96553	7th
5.	As a result of my involvement in sorghum/soybean strip inter cropping technique there is a reduction of maturity period.	4.81	.42532	2nd
6.	As a result of my participation in sorghum/soybean strip intercropping technique, there is high increase in capital income.	4.20	.49320	10th
7.	Farm size is not an obstacle to my involvement in sorghum/soybean strip intercropping techniques.	4.66	.64375	3rd
8.	As a result of my involvement in sorghum/soybean strip intercropping techniques, there is improvement of soil fertility.	4.64	.69048	5th
9.	After my involvement in sorghum/soybean strip intercropping, there is a control of pest and diseases infestation.	4.65	.84619	4th
10.	After my involvement in sorghum/soybean strip intercropping techniques my farming knowledge is increased	4.28	.48099	9th

Source, field survey 2017

Table 6 shows that respondent were of the general opinion that strip intercropping had bring about drastic change to increased level of output (X=4.33); reduction in labor cost and time (X=4.34); reduction in maturity periods of crop (X=4.81); high increase in capital income (X=4.20); farm size is not an obstacle (X=4.66); increase in farming knowledge (X=4.2); improvement in soil fertility (X=4.64); reduction of pest and diseases infestation (X=4.65). The findings is in line with that of Andrew (1974) that strip intercropping has several advantages, it reduces damage caused by pests and diseases and ensures greater yield stability by producing some yield even though some components crops failed. So also Blade (1992) reported that resources such as light, water and nutrients are maximized. Result of this study confirmed that sorghum/soybean strip intercropping is highly beneficial to the respondents.

V. CONCLUSION

It is concluded that strip intercropping technique in the study area hasimmense benefits to the farmers, this is linked to the farmer's 100% involvement in sorghum/soybean strip intercropping techniques of 4:4 crop arrangements where TGX-1835-10E and TGX-1448-2E soybean varieties and CSR01, SK, ICSV400 and GAYA EARLY sorghum varieties was used for the period of 4 years given rise to 2-rotations.

Based on the research findings, there was high increase in the level of output gotten by the farmers, soil fertility restored, incidences of pest and disease infestation reduced and reduction in maturity periods of crops. The only problems reported are that of the first and third sorghum varieties given (SK and ICSV400 sorghum varieties) in which the former displays a misfit to their ecology and the later had short stalk and small seeds similar to their local varieties, and also constraint of not having basic farm inputs to carry out their farming activities was also reported and a meager cases of insect pest infestation. It is therefore recommended that inputs should be made available to farmers before rainfall season.

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