

## ORIGINAL ARTICLES

### Evaluation Of The Age Of Incorporating Lablab Purpureus Into The Soil On Soil Chemical Properties And Yield Of Sorghum In Southern Guinea Savanna Agroecological Zone, Nigeria

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#### ABSTRACT

Field trials were conducted during 2010 rainy season to determine the effect of the age of incorporating lablab into the soil on soil chemical properties and yield of sorghum. The treatments consisted of four ages of lablab: 0, 2, 4, 6WAP which were laid in a Randomized Complete Block Design (RCBD) and replicated three times to form twelve plots. The result showed that, the age of lablab had a significant ( $p < 0.05$ ) effect on some of these chemical properties of the soil: Total N, Avail P, K, % C, Ca and CEC. At the early age of 2weeks after planting and incorporating lablab into the soil, it was able to return substantial amount of 4.94 %N, 0.36Avail.P, and 29.24K into the soil compare to the other ages of lablab. Whereas, at the age of 6weeks after planting and incorporating lablab into the soil, higher amount of 1.98%C, 8.94Ca, and 2.82 CEC where return into the soil, which is statistically the same with lablab at the age of 2weeeks after planting. Also, The age of lablab had significant ( $p < 0.05$ ) effect on number of panicle/m,<sup>2</sup> 1000 seed weight and grain yield of sorghum. At the age of 2weeks after planting of lablab, when incorporated into the soil, it produced the highest number of 7.69 panicles/m, 1000 seed weight of 38.45g and sorghum grain yield of 1354.45kg/ha. However, the result is statistically the same when lablab at 4WAP was incorporated into the soil. The age of lablab showed a significant ( $p < 0.05$ ) effects on both fresh and dry matter weight of lablab; with 6weeks after planting and incorporating lablab into the soil, reported fresh weight of 181.14g/plant and dry matter weight of 112.34g/plant which is significantly higher than the weight of lablab incorporated into the soil at the age of 2 and 4weeks after planting. Therefore, harvesting and incorporating lablab in to the soil at 2weeks after planting is the best.

**Key words:** sorghum, yield, age, lablab and chemical properties

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#### Introduction

The rapid depletion of soil nutrients and poor physical condition of the savanna soils are strong limitations to crop production especially sorghum that is the main crop of the southern guinea savanna agro ecological zone (Salako, 2003). Sorghum constitutes the staple food for the bulk of the Nigerian population in the Sudan and Guinea savanna ecological zones (Mohammed et al, 2008). Sorghum is fast becoming a very important commodity in the food and beverage industries. The industrial demand for sorghum in Nigeria is estimated to be about 200,000 metric tons (USAID MARKET, 2009). The decline in soil productivity has led sorghum farmers to embrace the use of inorganic (chemical) fertilizers to revitalize the soil. However in Nigeria, inorganic fertilizers are expensive, particularly with the reduction of fertilizer subsidies by Government at all levels. This has brought untold hardship on the peasant farmers, who can hardly afford to meet the high cost of inorganic fertilizers. Also, frequent use of inorganic fertilizers for a prolonged period deteriorates the surface soil characteristics and affects the availability and uptake of nutrients by plants (Kerenhap *et al.*, 2007). In view of the poor economic resource base of rural farmers and the need to prevent the degradative effect of inorganic fertilizers, it becomes pertinent to resort to other alternative means of regenerating the productivity of the soil. The use of green manures in combination with little inorganic fertilizers is gaining recognition in Africa especially in eastern countries of Africa like Malawi, Kenya, and Uganda etc. These green manures are less expensive and ecological friendly way of increasing soil fertility (Sakala, 2000).

Lablab (*Lablab purpureus*, formerly *Dolichos lablab*), also called hyacinth bean, Egyptian bean, and (in Japan) Fuji mame, is a popular legume vegetable in South Asia, China, Japan, West Africa, and the Caribbean. It is also popular as a nitrogen-fixing green manure to contribute to soil N and improve soil quality. Lablab is a popular choice as a cover crop on infertile, acidic soils, and it is drought tolerant once established. Like other legumes, it can be incorporated into the soil to replenished lost nutrients (Ibrahim, 1994). There are a lot of researchers (Fischler, et al 1999; Kamidi et al 2000; Mohammed, 2008; and Odhiambo, 2011) who reported

on the use of lablab as a green manure crop when intercropped with other crops or incorporated into the soil. However, there is still dearth of information regarding the appropriate age of lablab that will give a maximum return of soil nutrient when incorporated as green manure into the soil. Therefore, the objective of this research is to find out at what age lablab will return the highest nutrients into soil when incorporated, their effect on the yield of sorghum and the chemical properties of the soil.

## Materials And Methods

The study was carried out at the teaching and research farm of college of agriculture Lafia; Nasarawa state, Nigeria. The study falls within the guinea savanna zone of North central Nigeria and is located between latitude 08.33 N and longitude 08.32 N. The mean annual temperature and rainfall of the study area for 2010 is 30-31°C and 118.56 mm (NIMET, 2010). The study was carried out during the wet season of 2010. The treatments consisted of lablab grown and incorporated into the soil at different ages: 0, 2, 4, and 6 weeks of age. The experiment was laid out in a Randomized Complete Block Design (RCBD) and replicated 3 times. Seed beds were properly prepared by ploughing and harrowing the land, then plots of 16 m<sup>2</sup> were marked out; 2 seeds of lablab were planted per hole at the depth of 5 cm and spacing of 75×75 cm. Lablab was harvested at 0 (control), 2, 4 and 6 weeks after planting and incorporated in the same plots where it was harvested at 2 weeks intervals. The last lablab to be incorporated into the soil was allowed in the soil for three weeks to decompose before early maturing local variety of sorghum called fara-fara(ex kano) was planted on the same plots at spacing of 75cm X 50cm. Weeding and other agronomic practices were applied. The yield components of sorghum assessed include the following: panicle length, number of panicles/m<sup>2</sup>, and 1000 seed weight.

Soil samples were collected at the depth of 0-15cm after crop harvest and bulked together based on the number of plots. Therefore, a total of 12 soil samples were collected, after which standard laboratory procedures as described by Agbenin (1995) was used to determine chemical properties of these soil samples.

The data collected were subjected to analysis of variance using GENSTAT, and where there is a significant difference; the means were separated using F-LSD at 5% probability level.

## Results:

The result on (Table 1) gave the physico-chemical composition of the experimental site before cropping. The essential macro-nutrients (N, P, K and C) were low (0.13%, 18.08mg/kg, 0.16Cmol/kg and 0.52 mg/kg respectively).

**Table 1:** Soil samples at a depth of 0-15cm before planting.

Soil properties	2010
Mechanical composition	
Clay (g/kg)	8.64
Silt	26.21
Sand	65.22
Textural classification (USD)	Loamy Sand
Chemical composition	
pH(H <sub>2</sub> O)	6.59
pH(0.01M CaCl <sub>2</sub> )	6.24
T N%	0.13
Avail. P	18.08
K(mg/kg)	0.16
C(mg/kg)	0.52
Mg(mol/kg)	4.49
Ca(mol/kg)	6.34
Na(mol/kg)	89.85
CEC(mol/kg)	2.75

The age of lablab showed a significant ( $p < 0.05$ ) effects on both fresh and dry matter weight table 2); with 6 weeks after planting and incorporating lablab into the soil, reported fresh weight of 181.14g/plant and dry matter weight of 112.34g/plant which is significantly higher than the weight of lablab incorporated into the soil at the age of 2 and 4 weeks after planting. However, the weights of lablab in both 2 and 4 weeks of age were statistically the same. The control plots were not planted with lablab.

The age of lablab had a significant ( $p < 0.05$ ) effect on some of these chemical properties of the soil: Total N, Avail P, K, % C, Ca and CEC (table 3). At the early age of 2 weeks after planting and incorporating lablab into the soil, it was able to return substantial amount of 4.94 %N, 0.36 Avail.P, and 29.24K into the soil compare to the other ages of lablab. Whereas, at the age of 6 weeks after planting and incorporating lablab into the soil, higher amount of 1.98% C, 8.94Ca, and 2.82 CEC where return into the soil, which is statistically the same with lablab at the age of 2 weeks after planting.

**Table 2:** effect of age of lablab on the fresh biomass and dry matter weight per plant

Treatments	Fresh Biomass Weight(g)	Dry matter weight(g)
Age of lablab (WAP)		
0 (no lablab)	-	-
2	25.70b	12.23b
4	30.81b	14.56b
6	181.14a	112.34a
LSD(0.05)	12.45	8.36

Wap = weeks after planting. Means followed by the same letter in each column are not significantly different at 5% probability level using F-LSD

**Table 3:** effect of age of lablab on the soil chemical properties of the soil at 0-15cm depth

Treatment	Soil chemical properties								
Age of lablab(WAP)	Total N %	Avail P(ppm)	K (cmo/kg)	% C (mg/kg)	pH	Mg (cmol/kg)	Na (cmol/kg)	Ca (c/mol/kg)	CEC (cmol/kg)
0 (no lablab)	0.13d	0.04c	4.68c	0.67c	6.24	5.78	88.64	6.12d	2.52c
2	4.94a	0.36a	29.24a	1.83a	6.21	6.54	89.52	8.86a	2.72a
4	3.46b	0.23b	25.18b	1.32b	6.20	6.82	88.87	8.24b	2.70b
6	2.93c	0.22c	17.93c	1.98a	6.23	6.79	89.67	8.94a	2.82a
LSD(0.05)	1.21	0.12	3.54	0.23	0.65*	2.78*	3.12*	0.17	0.11

Wap = weeks after planting \* = Not difference at 5% probability. Means followed by the same letter in each column are not significantly different at 5% probability level using F-LSD

The age of lablab had significant ( $p < 0.05$ ) effect on number of panicle/m<sup>2</sup>, 1000 seed weight and grain yield of sorghum (Table-4). At the age of 2weeks after planting of lablab, when incorporated into the soil, it produced the highest number of 7.69 panicles/m, 1000 seed weight of 38.45g and sorghum grain yield of 1354.45kg/ha. However, the result is statistically the same when lablab at 4WAP was incorporated into the soil.

**Table 4:** effect of age of lablab on the yield component of sorghum

Treatments	Panicle length(cm)	Number of panicles/m <sup>2</sup>	1000 seed weight(g)	Grain yield (kg/ha)
Age of lablab(wap)				
0 (no lablab)	29.12	3.98c	34.62c	776.36d
2	30.06	7.69a	38.45a	1354.45a
4	30.78	6.95a	37.65b	1212.12a
6	30.65	6.12b	37.58b	1035.56b
LSD(0.05)	2.85*	1.32	1.08	143.14

Wap = weeks after planting \* = Not difference at 5% probability. Means followed by the same letter in each column are not significantly different at 5% probability level using F-LSD

### Discussion:

The soil was generally very low in productive capacity. This may be because the soil contained minimal amount of essential nutrients. This result agrees with the findings of Sabo and Odus (2008), who reported that these soils are exhausted due to intensive cultivation and no adequate application of replenishment measures to sustain their productivity. The age of lablab significantly affected the chemical composition of the soil nutrients. Lablab at age 2weeks after planting when incorporated into the soil performed better than lablab at any other age assessed during this study. Lablab at the age of 2wap increases these; Total N, Avail P, K, % C, Ca and CEC in the soil. This may be attributed to the fact that when lablab start growing older it consumed more of these nutrients, because it uses them to enhance growth, development of meristematic tissues, flowering and seed formation. This agrees with the report of (Mbor,2010). The study generally revealed that most of macronutrients decrease when lablab was aging.

The results indicated that 1000 seed weight, panicle number/m<sup>2</sup> and grain yield of sorghum were all affected by the age of lablab incorporated into the soil. Lablab at age 2weeks after planting when incorporated into the soil tend to performed better in promoting yield and yield component of sorghum. This is because lablab at this tender age (2wap) was discovered to contain highest quantity of soil macronutrients (NPK) that has the capacity to enhance the growth and yield of sorghum. However, panicle length was not affected by the age of lablab incorporated into the soil. This may be attributed to the fact that panicle length is more of genotypic character of the type of sorghum used for this study. This submission agrees with the report of (USAID MARKET, 2009).

### Conclusion:

Lablab at age 2weeks after planting when incorporated into the soil performed better than lablab at any other age assessed during this study. The results indicated that 1000 seed weight, panicle number/m<sup>2</sup> and grain yield of sorghum were all affected by the age of lablab incorporated into the soil. Lablab at age 2weeks after

planting when incorporated into the soil tend to performed better in promoting yield and yield component of sorghum.

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