RESIDUAL EFFECT OF MAIZE-LEGUME SYSTEM FALLOW AND NPK FERTILIZERS ON MAIZE PERFORMANCE AND WEED GROWTH

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ABSTRACT

A Field experiment was conducted at the Faculty of Agriculture Teaching and Research, University of Port-Harcourt, Nigeria between May to September 2018, to evaluate the residual effect of maize-legume system fallow and NPK fertilizers on maize performance and weed growth. The experiment was a 3 x 3 factorial scheme consisting of 3 levels of NPK-15-15-15 (0 kg NPK ha^{-1}, 15kg NPK ha^{-1} and 30 kg NPK ha^{-1}) and (3) levels of legume system fallow (Natural fallow (Fallow, Mucuna pruriens (MP) and Lablab purpureus (LP) fallows, making up of 9 treatment combinations which were laid out in a randomized complete block design (RCBD) replicated three times. The data showed that there were no significant *($P > 0.05$) residual interaction effects of fallow species and NPK fertilizer on weed growth, maize yield and yield components. Although there were* no significant *interaction effect between legumes system and NPK fertilizer, yet all the legume fallow with or without NPK had higher whole plant yield (Biological yield) and grain than the NF with NPK at 30 kg NPK ha^{-1}. Both legumes without NPK (0 kg NPK ha^{-1}) had grain yield advantages of 87 % (MP) and 28 % (LP) respectively over NF without NPK; and about 53 % (MP) and 4 % (LP) grain yield advantages over NF + 30 kg NPK ha^{-1}. Mucuna pruriens (MP), Lablab purpureus (LP) plots showed better growth and yield when compared to plots with Natural fallows (NF). Legume systems at 6 and 12 WAP significantly ($P < 0.05$) suppressed weed growth when compared to NF. Highest weed densities of 58 weeds/m^2 and 132 weeds/m^2 were recorded respectively at 6 and 12 WAP, in plots with NF, while the lowest weed densities of 21 weeds m^{-2} and 39 weeds m^{-2} were recorded in plots with LP fallow at 6 and 12 WAP respectively. There were no significant differences among the legume systems on weed dry weight throughout the sampling time except at 12WAP, with LP (88 g m^{-2}) and MP (116 g m^{-2}) having the lower weed dry weight compared to the NF. Among the legume systems at 12WAP, NF fallow plots had the highest weed dry weight but at par with MP plots while plots grown with LP had the lowest weed dry weight but at par with MP. This implies that Mucuna pruriens fallow and Lablab purpureus suppressed weed growth better than the natural fallow and it is more beneficial than NF in terms of soil fertility enhancement. Farmers can be encouraged to adopt leguminous fallow as way of suppressing weeds and enhancing subsequent crop performance. It also reduces the cost weeding on farm and cost of fertilization as well as encourages production and land utilization.*

Keywords: Corn, fallow, *Lablab purpureus,* legume system, *Mucuna pruriens,* weeds*, Zea mays.*

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INTRODUCTION

Maize (*Zea mays* L.), is widely grown in almost all the different ecological zones of Nigeria and after wheat and rice it is the third most populous cereal crop in the World (FAO, 2002). In 2014 world total production record of maize was 990 million tons (USDA, 2014). In Africa, Nigeria produced about 11.3 million tons of maize in 2013 making it the largest producer from the continent (FAOSTAT, 2014). In Nigeria it is the second most useful cereal crop after sorghum (Fakorede *et al.,* 1993). Greater solar radiation and lesser prevalence of diseases and pest associated with Savanna region account for its bulk of production in Nigeria (Badu– Apraku *et al.,* 2006).

Farmers usually face limiting factors like weed competition and poor soil fertility for maize production. As maize is popularly grown during the months of May, June and August, when cultural methods of weed control such as hand weeding is difficult to apply, less feasible, very laborious and uneconomical because of high relative humidity, intensive rainfall and scarcity of labour. Several weed species are strong competitors with the maize crop and thus lead to reduction in yield. Low fertility enhances weed competitiveness over maize or any crop. Soil fertility also poses a threat in production of maize, low soil fertility affects maize productivity and especially soil with limited amount of nitrogen. Soil health is a primary factor affecting the overall agricultural crop production. Soils provide the structure and nutrient content for healthy plant growth, fertility is a major constraint in maize production. The problem is compounded especially in the sub-Saharan Africa, and in Nigeria where fertilizers are also not made available to farmers. This situation causes farmers to abandon their land as fallow for a period of time to allow soil fertility regeneration. This long fallow period is not sustainable as human population pressure is becoming unbearable and the need to feed this teeming population is daunting. However, legumes can be used as fallow species for a short fallow period to replace the traditional fallow management practiced by farmers. Leguminous plants bear nodules on their roots that contain nitrogen fixing bacteria. Apart from fixing nitrogen in soil, legumes also often reduce density and biomass of annual weeds in no-till cropping systems (Fisk *et al.,* 2001). Weed is a plant growing where it is not wanted and are undesirable can cause reduction in yield and quality of crop plants, which will translate into high cost of food production (Pandya *et al.,* 2005). Haider *et al.* (2019), describe weeds as one of the most serious pests that compete with crop for limited resources needed for growth, development and potential yield attainment. Therefore, weed control is one of the most important components of crop production in agricultural systems. Although appropriately selected herbicides may perform an important role in weed infestation reduction, increasing weeds resistance to herbicides, high cost and, especially, negative effects of herbicides on environment have increased the need for non-chemical weed control in agro ecosystems (Augustin, 2003; Spliid *et al.,* 2004). Therefore, the objective of the study was to evaluate the residual effect of legumes (cover crops) fallow and basal fertilizer NPK on maize performance and weed suppression.

MATERIALS AND METHODS

Experiment site

The experiment was conducted at the Research and Teaching Farm of the Faculty of Agriculture, University of Port Harcourt, Choba, Rivers State, Nigeria during 2018 cropping season. The experimental site was located at the University Park Campus. The University of Port Harcourt lies on latitude 4^o 3″ N to 5^o N and longitude 6^o 45″ E to 7^o E, with average temperature of 26^oC, relative humidity of about 81% and rainfall of about 3000-4000 mm (Nwankwo and Ehirim, 2010).

Source of planting materials

Hybrid maize (OBA SUPER 6) cultivar was used for the experiment. OBA SUPER 6 is yellow coloured maize developed by Premier Seed, Nigeria Limited, Chikayi Industrial Estate, Zaria, Kaduna State, Nigeria.

Treatments, Experimental Design and Plot Size

The experiment was a 3 x 3 factorial scheme consisting of 3 levels of NPK (0, 15 and 30 kg NPK ha^{-1}) and 3 levels of legume system fallow (Natural fallow (NF), *Mucuna pruriens* (MP), and *Lablab purpureus* (LP) fallows making up of 9 treatment combinations. The 9 treatment combinations were laid out in a randomized complete block design (RCBD) replicated three times on a plot size of 4 x 4 m^2. The treatments were randomly assigned to each plot; plots were separated by one-meter pathway or alleyway while replicates were separated by two-meter alleyway.

Cultural Practices

The experimental site was slashed and planting was done by placing 3 seeds per hole at 75cm row to row and 25cm plant to plant spacing, and thinned to one stand per hill at 1 WAP (week after planting) was also done two weeks after planting. NPK fertilizer was applied 2 weeks after planting; and weeding at 3 and 6 weeks after planting. Nitrogen fertilizer was applied 7 weeks after planting. Harvesting of maize was performed at physiological maturity (about 13 weeks after planting).

Data collection

Data were collected on weed and crop parameters to assess performance.

Weed parameters

Weed parameters assessed were: weed density m^{-2}, weed dry weight (dry biomass) after drying to constant weight. Weed density and biomass were assessed three times at three weekly intervals reflecting 3, 6 and 9 WAP. The weed density and biomass was determined by using 50 x 50 cm^2 quadrat frame. Three of these quadrats were thrown at a diagonal transect in each plot, giving a quadrat sampled area of 0.75 m^2. The density and biomass values were expressed in no/m^2 and gram/m^2 respectively. At each sampling period the weed samples collected were oven dried at 80^0C for two days until constant weight for weed dry weight was achieved.

Crop Parameters Maize

Data collected on maize yield components and grain yield were taken per plot. The maize data collected were emergence count, plant height, number of leaves, leaf area [expressed as leaf area index (LAI)], time to 50% tasseling, stand count, Stover weight, number of cobs, cob field weight, biological yield (whole plant yield) and grain yield were all determined at harvest. Plant height of maize was taken with a metre rule at 4 and 8 WAP from 3 plants selected per row of five rows per plot. The mean height value of these plants represented the height value per plot, Number of leaves per plant and leaf area was determined from 8 plants selected randomly from the 5 rows/plot at 4 and 8 WAP. Number of leaves were assessed by physically counting while leaf area was determined by measuring the length (L) and width (W) of each leaf, and multiplying the product by 0.75 (L x W x 0.75) correction meant to cater for leaf shape (Remison, 1997). The average number of leaves per plant and mean leaf area per leaf were used to compute number of leaves per plot, leaf area per plot, and then leaf area index calculated as the total leaf area divided by total ground area covered by the leaves as described by Remison (1997).

The maize was harvested and dehusked. The dehusked ear (cob) was sun dried to constant weight and cob weight per plot was taken. After shelling grain weight per plot was determined for each treatment.

Statistical analysis

Data collected were subjected to Analysis of Variance (ANOVA), and significant treatment means were separated by using LSD test at 5% level of probability. Data were analysed using statistical analysis system (SAS, 2002)

RESULTS AND DISCUSSION

Effect of legume species fallow and NPK on weed density

The effect of legume species fallow and NPK on weed density is presented in Table –1. The data showed that there was non significant residual interaction effects of legume system and NPK fertilizer on weed density at 3 WAP, 6 WAP and 12 WAP (P >0.05) (Table –1). In the same way there were non significant differences among the different rates of NPK fertilizer at the various sampling intervals. However, except at 3 WAP significant weed density differences among the legume systems fallow were observed. The non-significant differences at 3 WAP among the legumes system may be attributed to poor weed emergence. At 6 WAP and 12 WAP, plots with NF produced the highest weed densities of 58 weeds m^{-2} and 132 weeds m^{-2}, respectively, compared to the LS, probably due to enhanced rapid weed growth resulting from active photosynthesis as the NF was not shaded by legume cover as was the case in the MP and LP legume fallows. Plots fallowed with LP had the lowest weed densities of 21 weeds m^{-2} and 39 weeds m^{-2}, respectively (Table –1) probably as a result of faster growth and proper ground coverage resulting in higher leaf area index. Legume fallow reduced the density of weeds, which is in agreement with Narayan (2012) and Kiff *et al*. (2000) who observed that the aggressive legume cover crops such as mucuna and lablab grow rapidly, forming quick ground cover that suppressed weed growth. The legume residue resulted to mulch that further hindered the emergence of weeds, this is also in agreement with Nwaichi *et al*. (2010) who observed that mucuna residues or mulch was capable of regulating weed growth in their studies.

Table–1. Effect of legume species fallow and NPK on weed density (No. M^{-2})

		3 WAP				**6 WAP**				**12 WAP**		
Legume System	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30 kg NPK ha^{-1}**	**Mean LS**	**0 kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30 kg NPK ha^{-1}**	**Mean LS**
NF	36	38	44	**39**	60	68	44	**58**a	147	92	156	**132**a
MP	27	24	24	**24**	31	43	38	**37**b	16	108	61	**92**b
LP	24	24	17	**22**	30	19	16	**21**c	71	96	68	**79**b
MEAN NPK	**29**	**29**	**28**		**40**	**43**	**33**		**108**	**99**	**95**	
$LSD_{0.05}$												
LS		NS				14.39*				39.69*		
NPK		NS				NS				NS		
LS × NPK		NS				NS				NS		

LS=Legume System, WAP = Weeks after planting. * = Significant and NS = Not significant at 5 % level of probability respectively.

Effect of legume species fallow and NPK on weed dry weight

The effect of legume species fallow and NPK fertilizer on weed dry weight is presented in Table–2. The data showed that there was non significant residual interaction effects of legume system and NPK fertilizer on weed dry weight *(P>0.05)* (Table–2). Similarly, there were non significant differences among the NPK fertilizer rates throughout the sampling intervals. There were non significant differences among the legume system throughout the sampling time except at 12WAP. Among the legume systems at 12WAP, NF fallow plots had the highest weed dry weight but at par with MP plots while plots grown with LP had the lowest weed dry weight but at *par* with MP. This implies that *Mucuna pruriens* fallow and *Lablab purpureus* suppressed weed growth better than the natural fallow. Although, *Mucuna pruriens* fallow and *Lablab purpureus* had identical weed suppression effect but the suppression was more in LP probably because the leaves had a good ground coverage resulting in higher leaf area index. Chikoye *et al*. (2001) and Sakala *et al.* (2003) observed that plots previously planted with legume cover crops suppressed the incidence of weed growth. Akobundu *et al*. (2000) and Innocent *et al*. (2006) also reported that legumes can be used as cover crops to suppress weed growth.

Table-2. Effect of legume species fallow and NPK on weed dry weight (g m^{-2}).

	3 WAP				6 WAP					12 WAP		
Legume System	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0 kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30 kg NPK ha^{-1}**	**Mean LS**	**0 kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30 Kg NPK/ ha**	**Mean LS**
NF	4.3	3.4	8.4	5.4	10.4	5.4	8.1	8	175.8	110.5	169	151.8a
MP	4.3	2.4	2.6	3.1	10.4	6.7	2.5	7.6	135.7	111.4	99.6	115.6b
LP	1.4	1.5	1.7	1.6	2.9	2.7	2.4	2.6	98.4	91.6	75.4	88.4b
MEAN NPK	3.3	2.4	4.3		7.9	4.9	5.3		136.6	104.5	114.7	
$LSD_{0.05}$												
LS		NS)				NS				39.8 *		
NPK		NS				NS				NS		
LS × NPK		NS				NS				NS		

LS=Legume System, WAP = Weeks after planting. * = Significant and NS = Not significant at 5 % level of probability respectively.

Effect of different fallow species and NPK on number of leaves and leaf area index of maize.

The effect of legume fallow species and NPK on number of leaves and leaf area index of maize are presented in Table–3. There were non significant residual interaction effects of fallow species and NPK fertilizer on number of leaves and leaf index at 4WAP and 8WAP (P >0.05). There were also non significant differences among the legumes system on number of leaves and leaf area index at both sampling times. Although there were non significant differences among the legumes system on number of leaves at the two sampling intervals but at 4 WAP NP had fewer number of leaves than LP and MP. The leaf area index among the legumes system were statistically at par, however the LP had the highest leaf area index when compared to NF and MP. The results of this study are not in agreement with that of Ewansiha, *et al*. (2007, 2012), who noted that legume fallow improved the vegetative growth of maize. Legumes cover enhanced good growth of maize because of their ability to fix nitrogen into the soil (Carsky *et al*., 2001).

There were also non significant differences among the NPK fertilizer levels on number of leaves and leaf area index in both sampling times but higher level (30 kg ha^{-1}) of residual NPK had the highest number of leaves and leaf area index when compared to the other rates probably because it has more quantities of residual nutrients for plant uptake when compared to the other levels of NPK.

Table–3. Effect of Legume fallow species and NPK on number of leaves plant^{-1} and leaf area index of maize.

	No. of Leaves plant^{-1}								Leaf area index							
	4WAP				8WAP				4WAP				8WAP			
Legume System	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15Kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**
NF	5	5	6	5	8	8	9	9	0.14	0.16	0.10	0.13	1.80	1.77	2.64	2.07
MP	6	6	6	6	9	10	9	9	0.10	0.13	0.20	0.14	2.45	2.23	1.85	2.18
LP	6	6	6	6	9	10	10	9	0.15	0.14	0.22	0.17	2.52	2.65	3.21	2.79
Mean NPK	5	6	6		9	9	9		0.13	0.14	0.17		2.26	2.22	2.57	
$LSD_{0.05}$																
LS		NS				NS				NS				NS		
NPK		NS				NS				NS				NS		
LS x NPK		NS				NS				NS				NS		

LS=Legume System, WAP = Weeks After Planting. NS = Not significant at level of probability respectively,

Effect of Legume species fallow and NPK on maize emergence, tasselling and height.

The effect of legume fallow and NPK on maize emergence, tasselling and plant height is presented in Table–4. There were no significant differences on legumes system, NPK fertilizer and their interactions on maize growth. Maize seed emergence were not influenced by the interaction of legumes system and NPK fertilizer but legume systems differ significantly ($P< 0.05$) on their effect on emergence. Among the legumes system, plots fallowed with MP numerically had higher maize emergence than others. Similarly among the NPK fertilizers, plot treated with 15 kg ha^{-1} had higher emergence counts than the other levels of NPK. There were non significant differences among the legume systems on plant height both at 4 WAP and 8WAP. Although, there were non significant differences in plant height at 4 WAP and 8 WAP by the legumes system, but plants grown under mucuna and lablab species plots seemed to be taller than plants on natural fallow plots probably because they had more nutrients than natural fallow. The effect of NPK fertilization indicated that plant height slightly increased with increase in levels of NPK fertilizer. Hence, plots that received 30 kg ha^{-1} of NPK seemed to grow taller than other levels of NPK. This could probably be attributed to more of residual nutrients in the soil for plant uptake. There were non significant differences on number of days to 50% tasselling among the legumes system. However, the NF tassels earlier than other legume systems. Similarly, the various levels of NPK plots had identical tasselling periods but plot that received 30 kg ha^{-1} of NPK tassel earlier than the other levels.

Effect of Legume species fallow and NPK on maize yield and yield components.

The data in Table–5 exhibit the effect of legume species fallow and NPK on maize stand and cobs at harvest. At harvest, maize stand counts and cob field weight were not affected by legume system, NPK fertilizer rates and their interactions. Although there were no significant differences among the legumes system on number of stands at harvest, plots with NF tended to have more stands at harvest than other legumes system. Similarly, the effect of NPK levels on stand counts indicated that plots that received 15 kg ha^{-1} of NPK tended to have more number of stands than the rest levels of NPK.

Legume system and NPK Fertilizer interactions influenced cob weight but the effect was not significantly pronounced. Plots with a combination of MP and 15 kg ha^{-1} produced the highest cob weight (1708.3 kg ha^{-1}) while plots with a combination of LP and 0 NPK kg ha^{-1} produced the lowest cob weight (541.7 kg ha^{-1}). Legumes fallow system had a positive influence on weight of cobs when compared with NF, and plots grown with MP gave the highest cob weight (1479.2 kg ha^{-1}) but it was statistically at *par* with those of LP (986.1 kg ha^{-1}). The lowest cob weight was in NF which probably may have been due to poor nutrient status of the soil. There were no significant differences among the NPK levels though cob weight increased as the level of NPK increases. However, plots that received 30 kg ha^{-1} of NPK tended to have the highest cob weight (1201.4 kg ha^{-1}) when compared to other levels of NPK. Ewansiha *et al*. (2012) concluded that that legume fallow is beneficial to soil and thus promotes the growth of subsequent maize crop. There was a 10 and 66 % cob weight (yield) advantage of LP and MP, respectively when compared to NF, while MP had 50 % cob yield advantage over plots fallowed with LP.

Table–4. Effect of Legume fallow on maize emergence, tasselling and height.

	Emergence count (No. ha^{-1})				**Time to 50% tasselling (days)**				**Plant height cm 4WAP**				**Plant height cm 8WAP**			
Legume System	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15 kg NPK ha^{-1}**	**30 kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15Kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**	**0kg NPK ha^{-1}**	**15kg NPK ha^{-1}**	**30kg NPK ha^{-1}**	**Mean LS**
NF	45833	43750	39792	43125	61	61	62	61	56.8	57.3	56	56.7	77.8	94.8	70.9	81.1
MP	46875	47083	45833	46597	62	62	62	62	62.7	59	61.2	60.9	87.9	78	86.7	84.2
LP	40625	43750	4217	42431	63	62	61	62	51.8	55.3	70.3	59.2	75.3	99.3	140.9	105.2
MEAN NPK	44444	44861	42847		62	62	61		57.1	57.2	62.5		80.3	90.7	99.5	
$LSD_{0.05}$																
LS	3502.*			NS				NS				NS				
NPK	NS			NS				NS				NS				
LS × NPK	NS			NS				NS				NS				

LS=Legume System, WAP = Weeks after planting. * = Significant and NS = Not significant at 5 % level of probability respectively

Table –5. Effect of Legume species fallow and NPK on maize stand and cobs at harvest.

Legume System (LS)	Stand at harvest (No. ha^{-1})				Weight of cobs (kg ha^{-1})			
	0 kg NPK ha^{-1}	15 kg NPK ha^{-1}	30 kg NPK/ha	LS Mean	0 kg NPK ha^{-1}	15 kg NPK ha^{-1}	30 kg NPK ha^{-1}	LS Mean
NF	35000	38542	35208	36250	812.5	958.3	895.8	888.9b
MP	37917	36458	30417	34931	1541.7	1708.3	1187.05	1479.2a
LP	33542	32083	37917	34514	541.7	895.8	1520.7	986.1ab
MEAN NPK	35486	35694	34514		965.3	1184.5	1201.4	
$LSD_{0.05}$								
LS		NS				545.1		
NPK		NS				NS		
LS × NPK		NS				NS		

LS=Legume System, WAP = Weeks after planting. NS= Not significant at 5 % level of probability.

Effect of Legume species fallow and NPK on maize yield.

There were no significant residual interaction effects of fallow species and NPK fertilizer on both whole plant (biological) and grain yield (Table –6). However, averaged over NPK levels, plots that had mucuna gave the highest biological yield as well as the grain yield (Table–6). Although there was no significant differences among the legume systems on grain yield, plots that were fallowed with mucuna performed best followed by lablab fallow and then the natural fallow. Plots that had MP + 0 kg NPK ha^{-1} and LP + 0 kg NPK ha^{-1} had grain yield of 2725.7 kg ha^{-1} and 1856.0 kg ha^{-1}, respectively, which were higher than that of NF + 0 kg NPK (1450.0 kg ha^{-1}). Both legume fallow system without NPK (0 kg NPK ha^{-1}) had yield advantages of 87 % (MP) and 28 % (LP) over NF without NPK; and 53.4 % and 4.4 % grain yield advantages over NF with 30 kg NPK ha^{-1}, respectively (Table–6). This finding implies that some legumes may not respond significantly to increasing level of NPK or nitrogen as it can probably fix its own nitrogen. However, this observation was peculiar to MP in this study. This data confirms earlier studies that mucuna does not respond positively with increasing levels of fertilizers especially with nitrogen element (Akobundu *et al*., 2000). Generally the grain yield was low, probably due to late planting, high relative humidity and army worm infestation. At 15 kg ha^{-1} NPK legume plots also had better grain yield of 1849.2 kg ha^{-1} (MP) and 2073.4 kg ha^{-1} (LP) than NF (1065.5 kg ha^{-1}). These results are in agreement with that of Becker *et al*. (1995) and Fageria *et al*. (2005) who reported better yield of maize planted after legume fallow than after natural fallow. Legume cover crop fallow had a positive influence on maize performance. Hauser *et al.* (2002) attributed better performance of maize to the nitrogen fixing nature of leguminous cover crops.

CONCLUSIONS AND RECOMMENDATIONS

This study has shown that *Mucuna pruriens* fallow and *Lablab purpureus* fallow suppressed the weed growth, and that it is more beneficial to farmers to plant short leguminous fallow than to allow their farms fallow naturally. This practice of legume fallow will also reduce the cost of weeding on farms and cost of fertilization as well as encourage organic farming and land utilization.

In the light of this study, *Lablab purpureus or Mucuna pruriens* species fallow system is highly recommended for farmer.s and will be of great benefit in terms of both high yield and less cost of production

Table –6. Effect of Legume species fallow and NPK on maize biological yield and grain yield

Legume System (LS)	Biological yield (kg ha^{-1})				Grain yield (kg ha^{-1})			
	0 kg NPK ha^{-1}	15 kg NPK^{-1}	30 kg NPK ha^{-1}	LS Mean	0 kg NPK ha^{-1}	15 kg NPK ha^{-1}	30 kg NPK ha^{-1}	LS Mean
NF	2812.5	4354.2	3125.0	3430.6	1450.1	1065.5	1776.9	1430.8
MP	4958.3	4229.2	3833.3	4340.3	2725.7	1849.2	1782.4	2119.1
LP	2770.8	3437.5	5062.5	3756.9	1855.9	2073.4	2123.1	2017.5
MEAN NPK	3513.9	4006.9	4006.9		2010.6	1662.7	1894.2	
$LSD_{0.05}$								
LS		NS				NS		
NPK		NS				NS		
LS × NPK		NS				NS		

LS=Legume System, WAP = Weeks after planting. NS= Not significant at 5 % level of probability.

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