EFFECT OF NITROGEN AND PHOSPHORUS ON THE PERFORMANCE OF EGUSI MELON (*CITRULLUS LANATUS* THUMB.) IN MINNA, NIGERIA

Yakubu, **Zubairu**[1*], Abubakar Sadiq Ibrahim **Gudugi**[2]
[1]Department of Crop Production, Federal University of Technology, Minna, Niger State
[2]Department of Crop Production, Ibrahim Badamasi Babangida University, Lapai
*E-mail: asigud@yahoo.com

Abstract
Fruit yields of egusi melon (Citrullus lanatus Thumb.) can be enhanced by the application of inorganic nitrogen (N) and phosphorus (P) fertilizers. The effects of N and P fertilizers on the growth and fruit yields of 'egusi' melon (Citrullus lanatus Thumb) were determined during the 2011, 2012 and 2013 cropping seasons at the Teaching and Research Farm of the Department of Crop Production, Federal University of Technology, Minna. The treatments were N at 0, 40, 60 and 80kg /ha, and P at 0, 10, 20 and 30 kg/ha that were factorially combined and fitted into randomized complete block design with three replicates (RCBD). Data were collected on growth and fruit yield parameters. Results shows that vine length and number of lateral branches were significantly affected by N and P application. Male and female flower bud's appearance and male and female flowers opening were significantly delayed by the application of high levels of N and P fertilizers. Fruits harvested from plants with high N and P were significantly longer compared to those from low N and P. Application of 80 kg N and 30 kg P/ha produced the highest fruit yields. The interaction effects of N and P were not significant.

Keywords: nitrogen, phosphorus, egusi-melon

Received: 13.04.2018 Reviewed: 03.09.2018 Accepted: 21.09.2018

1. INTRODUCTION

Egusi melon (*Citrullus lanatus* Thumb.) is an herbaceous annual vegetable crop with a trailing hairy, ridged vine which bears tendrils and lobed leaves on petioles. It belongs to the cucurbitaceae family (Ogbonna and Obi, 2009). Egusi is highly drought resistance, and productivity is enhanced during dry, sunny periods and reduces with excessive rainfall and high humidity (Olaniyi, 2008). Charment and Akoh (1997) reported that on dry weight basis, melon seed consisted of 52.3 % of testa and 47.7 % of kernel. According to Omidiji (2008), melon seeds contain 38% protein and 30 – 50 % of semi drying oil, and that the oil content is comparable to those of other oil plants. In Nigeria, egusi melon is grown majorly in the South, Western and Eastern part of the country. Production of egusi melon is usually supported with fertilizer application in order to optimize yield. The crop can be grown twice in a year and the early planting takes advantage of soil nutrient reserves (Ogbonna and Obi, 2009).

Tropical soils are generally low in total nitrogen and phosphorus due to high temperature and low rainfall leading to sparse vegetation and high rate of mineralization, leaching and erosion (Okafor, 2010). This low nitrogen and phosphorus is further depleted by continuous cultivation of the soils (Ogbonna and Obi, 2009). Deficiency symptoms of nitrogen in soil where egusi melon is grown resulted to poor growth, thin vine and bristle leaves (Dass, 1999). Phosphorus if lacking in soil will also drastically reduce the yield due to its synergy with nitrogen (Uchida, 2007). Unlike nitrogen, once phosphorus is removed from soil, it can only be replenished from external sources (Hilda, 2012). The need for continued P addition in many tropical soils is as a result of slow convertion of P to a plant available forms, or P fixation (Sanchez, 2000). Researches have shown that egusi melon benefits from combined applicstion of nutrient elements. Thus, between 350 to 400 kg ha^{-1} of NPK (15-15-15) was recommended for egusi melon in the southern guinea savanna zone of

Nigeria (NIHORT, 1983, Olaniyi and Fagbayide, 2007). Davidson (2013) recommended 400 kg N P K for melon production with N been split applied. There is very little information on the effect of single fertilizer application on the growth and yield of egusi melon in the savanna area of Nigeria. This study was conducted to determine the effects of N and P on growth and fruit yields of egusi melon in Minna, southern Guinea Savanna of Nigeria.

2. MATERIALS AND METHODS

Field trials were conducted in 2011, 2012 and 2013 cropping seasons at the Teaching and Research farm of the Department of Crop Production, Federal University of Technology, Minna (Latitude $9^0 33' 35''$N and longitude $6^0 27' 11''$ E) in the southern guinea savanna agro ecological zone of Nigeria. The total annual rainfall in the area ranges from 1284 mm – 1383 mm with an average of 1332.5 mm. The area has a dairly mean temperature of 29^0C in the raining season and 34^0C in the dry season [Meteorological station of FUT Minna (MET), 2015]. The treatments consisted of four levels of N (0, 40, 60 and 80 kg/ha and four levels of phosphorus 0, 10, 20 and 30 kg/ha) that were factorially combined and fitted into a RCBD with three replications. Prior to land preparation, soil samples were collected and analysed for pH in water (6.9), Organic carbon (0.4g/kg), N (0.32g/kg), Available P (8.00mg/kg) and K (0.72 cmol/kg). Egusi melon seeds were planted on a well-prepared land and divided into plots measuring 10m x 8m. The planting was done at a spacing of 2m x 2m with three seeds sown per hole, which were later thinned to one seedling per hill after two weeks. Each plot was made up of six rows of egusi melon plants. At planting, basal application of 30 kg K ha^{-1} in the form of muriate of potash was carried out by spot application 5cm away from the plant and about 5 cm deep and covered. Phosphorus was applied to the plots in which it is required in the form of single superphosphate also at planting using the same method of K application. One- third of N (in form of urea) was applied at planting while the remaining two- thirds was applied at six weeks after sowing (6WAS). First weeding was done by hoe as at when due and subsequent weeding was by hand pulling to prevent disturbances to flower that could result in abortion. Data were collected from the four middle rows on vine length, number of lateral branches, days to male and female flower formation, number of male and female flowers, number of fruits on the main vine and number of fruits per plot, fruit weight and number of seed per fruit, Data collected were subjected to Analysis of variance (ANOVA) and where significant differences were recorded, means were separated using DMRT at 5% level of probability.

3. RESULTS AND DISCUSSION

The effects of application of N and P on vine length and number of lateral branches of egusi melon were significant in 2011, 2012 and 2013 (Table 1). Stem length increased with increasing N and P levels. The 80 kg N/ha had significantly longer length compared to other levels in all the seasons. Application of P at 30 kg /ha resulted in significantly longer stem than at lower levels in 2011 and 2012. The N and P interaction on stem length was not significant in all the season but were significantly higher than the values recorded at 0 and 40 kg /ha. In 2013, the significantly greater number of branches was recorded at 80 kg /ha than at other rates. Application of P in 2011 and 2012 had no significant effect on lateral branches. However, in 2013 application of 30 kg /ha resulted in greater number of branches than at 0 and 10 kg /ha but the differences between the values recorded at 20 and 30 kg P/ha were statistically similar. The effects of application of nitrogen and phosphorus fertilizers on days to first male flower bud formation and days to first female flower bud formation was shown in Table 2.

Table 1: Effects of nitrogen and phosphorus on vine length and number of lateral branches in 2011, 2012 and 2013 cropping seasons

	Main vine length (cm)			Number of lateral branches		
Treatment	2011	2012	2013	2011	2012	2013
Nitrogen(N) (kg/ha)						
0	142^{d}	167^{c}	247^{c}	8^{b}	8^{b}	9^{c}
40	235^{c}	226^{b}	324^{b}	9^{b}	10^{b}	12^{b}
60	268^{b}	246^{b}	358^{b}	12^{a}	15^{a}	13^{b}
80	330^{a}	403^{a}	462^{a}	14^{a}	15^{a}	16^{a}
SE$\pm$	20	20	40	1.4	2.4	1.4
Phosphorus(P) (kg/ha)						
0	265^{b}	225^{c}	312^{b}	10^{a}	10^{a}	12^{b}
10	267^{b}	253^{b}	332^{b}	10^{a}	11^{a}	12^{b}
20	281^{b}	255^{b}	362^{ab}	11^{a}	12^{a}	13^{ab}
30	306^{a}	299^{a}	384^{a}	11^{a}	12^{a}	13^{a}
SE$\pm$	20	20	40	1.4	2.4	1.4
Interaction						
N x P	NS	NS	NS	NS	NS	NS

Means followed by same letter in a column within a treatment group are not significantly different from one another at 5% level of probability. NS - Not significant

Table 2: Effects of nitrogen and phosphorus on buds of flowers in 2011, 2012 and 2013 cropping seasons

	Number of days to first male flower bud appearance			Number of days to first female flower bud appearance		
Treatment	2011	2012	2013	2011	2012	2013
Nitrogen(N) (kg/ha)						
0	35^{c}	42^{d}	44^{c}	40^{d}	46^{d}	47^{d}
40	40^{b}	45^{c}	47^{b}	45^{c}	49^{c}	52^{c}
60	44^{a}	48^{b}	49^{a}	48^{b}	54^{b}	57^{b}
80	44^{a}	51^{a}	49^{a}	50^{a}	56^{a}	59^{a}
SE$\pm$	0.2	0.4	0.2	0.4	0.4	0.4
Phosphorous(P)						
(kg/ha)	37^{d}	44^{c}	43^{d}	42^{c}	46^{d}	48^{b}
0	39^{c}	45^{b}	46^{c}	42^{c}	49^{c}	48^{b}
10	41^{b}	46^{b}	48^{b}	46^{b}	52^{b}	55^{a}
20	44^{a}	47^{a}	49^{a}	50^{a}	55^{a}	55^{a}
30	0.2	0.4	0.2	0.4	0.4	0.4
SE$\pm$						
Interaction	NS	NS	NS	NS	N S	NS
N x P						

Means followed by same letter in a column within a treatment group are not significantly different from one another at 5% level of probability. NS - Not significant

The appearance of male flower bud was significantly delayed by application of N and P fertilizers. The greatest delay was at 80 kg N /ha in all the seasons. Application of 30 kg P /ha resulted in significantly greater delay in the appearance of the bud of female flowers than the other treatments.
The days at which female flower buds appeared in the three cropping seasons were significantly ($P < 0.05$) delayed with increasing N level (Table 2). Similarly, time of female flower bud appearance was earliest at 0 kg P /ha and latest at 30 kg P/ha. However, the differences in appearance at 0 and 10 kg P /ha was not significant in all through the cropping seasons. Application of P at 30 kg /ha resulted in significantly greater delay in appearance than at 20 kg /ha only in 2011 and 2012. The interaction effects of nitrogen and phosphorus on the flower bud appearance was not significant in any of the cropping seasons.
The effects of nitrogen and phosphorus on male and female flowers were presented in Table 3.
Days to first male flower opening was significantly delayed by N application in the three cropping seasons with N at 80 kg /ha causing the greatest delay compared to the values obtained at 0 kg N/ha throughout the

study period. Phosphorus application did not significantly affect the trait in 2011 but the effect was significant in 2012 and 2013 cropping seasons. Days to first female flower opening was significantly delayed by N application except in 2011, when the difference between 0 N and 10 kg N /ha was insignificant. The difference between N at 60 and 80 kg /ha was also not significant in 2012. Phosphorus significantly affected this trait in 2012 and 2013 but not in 2011.

Days to 50% drying of the vine were significantly affected by the application of N and P during the three cropping seasons (Table 4). As N and P levels increased there was significant increase in delay in the drying of vines. Increased in the application of P from 0 to 30 kg P/ha also recorded significant increased in the number of days in the drying of vine. Interaction of N and P on the drying of vine was not significant.

Table 3: Effects of Nitrogen and Phosphorus on Male and Female Flowers in 2011, 2012 and 2013 Cropping Seasons

	Number of days to first male flower opening			Number of days to first female flower opening		
Treatment	2011	2012	2013	2011	2012	2013
Nitrogen(N)(kg/ha)						
0	40^{d}	47^{d}	47^{d}	47^{c}	52^{d}	55^{d}
40	44^{c}	48^{c}	50^{c}	48^{c}	54^{c}	57^{c}
60	48^{b}	52^{b}	52^{b}	54^{b}	57^{a}	61^{b}
80	55^{a}	58^{a}	67^{a}	62^{a}	56^{a}	67^{a}
SE±	0.6	0.2	0.4	0.6	0.6	0.4
Phosphorous(P)(kg/h						
a)	45^{a}	52^{c}	53^{c}	52^{a}	57^{d}	59^{c}
0	45^{a}	52^{c}	57^{b}	53^{a}	59^{c}	63^{b}
10	45^{a}	53^{b}	57^{b}	52^{a}	61^{b}	63^{b}
20	45^{a}	54^{a}	59^{a}	53^{a}	63^{a}	69^{a}
30	0.6	0.2	0.4	0.6	0.8	0.4
SE±						
Interaction N x P	NS	NS	NS	NS	NS	NS

Means followed by same letter in a column within a treatment group are not significantly different from one another at 5% level of probability. NS - Not significant

Table 4: Effects of Nitrogen and Phosphorus on Number of Fruits on the Main Vine at maturity and Days to 50% Drying of Vines in 2011, 2012 and 2013 Cropping Seasons

	Number of fruits per plant on the main vine at maturity			Days to 50% drying of vine		
Treatment	2011	2012	2013	2011	2012	2013
Nitrogen (N) (kg/ha)						
0	1^{a}	1^{a}	1^{a}	73^{d}	73^{d}	76^{d}
40	1^{a}	1^{a}	1^{a}	74^{c}	76^{c}	77^{c}
60	1^{a}	1^{a}	1^{a}	75^{b}	78^{b}	78^{b}
80	1^{a}	1^{a}	1^{a}	77^{a}	79^{a}	81^{a}
±SE	0.2	0.2	0.2	0.4	0.2	0.2
Phosphorous (P)						
(kg/ha)	1^{a}	1^{a}	1^{a}	74^{d}	75^{d}	75^{d}
0	1^{a}	1^{a}	1^{a}	75^{c}	76^{c}	76^{c}
10	1^{a}	1^{a}	1^{a}	76^{b}	77^{b}	77^{b}
20	1^{a}	1^{a}	1^{a}	77^{a}	78^{a}	79^{a}
30	0.2	0.2	0.2	0.4	0.2	0.2
±SE						
Interaction N x P	NS	NS	NS	NS	NS	NS

Means followed by same letter in a column within a treatment group are not significantly different from one another at 5% level of probability. NS - Not significant

The effects of nitrogen, phosphorus, on fruit weight, number of seeds in a fruit are presented in Table 5. Fruit weight was significantly affected by nitrogen while P had no significant effect in 2011. The difference in fruit weight at 0 and 40 kg N /ha was not significant. Nitrogen and phosphorus had significant effect in 2012 and 2013 on fruit weight. As N and P levels were increased, fruit weight also significantly increased. Although, the differences at 0, 10 and 20 kg /ha were not significant in 2013. Application of nitrogen significantly increased the number of seed in a fruit from about 76 at 0 N kg/ha to about 149 at 80 kg/ha in 2011 and from about 87 to about 101 in 2013. Significant differences in number of seeds in a fruit were not recorded among N treatments in 2012. The number of seeds in a fruit was not significantly affected by P in 2011 and 2012. In 2013 however, P at 30 kg/ha resulted in significant increase in number of seeds compared to the values obtained at 0, 10 and 20 kg P /ha which were statistically similar.

Table 5: Effects of Nitrogen and Phosphorus on Fruit Weight and Numbers of Seeds in 2011, 2012 and 2013 Cropping Seasons

	Fruit weight (g)			Number of seeds in a fruit		
Treatment	2011	2012	2013	2011	2012	2013
Nitrogen(N) (kg/ha)						
0	830^{c}	1260^{d}	1300^{d}	76^{d}	84^{a}	87^{c}
40	840^{c}	1320^{c}	1420^{c}	95^{c}	85^{a}	89^{c}
60	980^{b}	1460^{b}	1540^{b}	111^{b}	88^{a}	94^{b}
80	1050^{a}	1560^{a}	1690^{a}	149^{a}	88^{a}	101^{a}
SE+	11	10	20	14.0	4.0	4.0
Phosphorus (P)						
(kg/ha)	910^{a}	1350^{d}	1450^{c}	98^{a}	84^{a}	89^{b}
0	920^{a}	1380^{c}	1470^{b}1490^{b}	99^{a}	89^{a}	90^{b}
10	940^{a}	1400^{b}	1540^{a}	100^{a}	88^{a}	92^{b}
20	940^{a}	1450^{a}	20	111^{a}	88^{a}	98^{a}
30	0.1	10		14.0	4.0	4.0
SE+			NS			
Interaction	NS	NS		NS	NS	NS
N x P						

Means followed by same letter under each column within a treatment group are not significantly different from one another at 5% level of probability. NS – Not significant

The effects of N and P were significant on seed yield in the three cropping seasons as shown in Table 6. As N and P rates increased, there were significant increases in seed yield. The highest seed yield in all the three years was obtained when N was applied at the rate of 80 kg/ha and P at 30 kg/ha.

The effect of interactions of N and P on seed yield per ha in the three cropping seasons are shown in Table 7. Seed yield generally increased with increase in P, though no significant difference in values at 10 and 20 kg P /ha combined with 40 and 60 kg N/ha in 2011. Similarly, the difference between the yield at P 0/10 and at P 20/30 kg/ha was not significant at 0 kg and 60 kg N/ha respectively in 2012.

Table 6: Effects of Nitrogen and Phosphorus on Seed Yield (kg) Per Hectare in 2011, 2012 and 2013 Cropping Seasons

	Seed yield (kg/ha)		
Treatment	2011	2012	2013
Nitrogen(N)(kg/ha)			
0	347.8^{d}	347.6^{d}	364.6^{d}
40	464.4^{c}	466.8^{c}	470.4^{c}
60	611.6^{b}	611.6^{b}	568.8^{b}
80	807.4^{a}	807.8^{a}	722.0^{a}
SE+	20	20	20
Phosph (P)(kg/ha)			
0	506.2^{d}	506.^{2d}	479.4^{d}
10	543.6^{c}	543.6^{c}	513.6^{c}
20	573.4^{b}	573.4^{b}	550.6^{b}
30	608.4^{a}	608.4^{a}	582.2^{a}
SE+	20	20	20
Interaction			
N x P	*	*	*

Means followed by same letter in a column within a treatment group are not significantly different from one another at 5% level of probability, * significant

Table 7: Interaction Effect of Nitrogen and Phosphorus Fertilizer Levels on Seed Yield Per Ha in 2011, 2012 and 2013 Cropping Seasons

	Seed yield (kg /ha)			
Nitrogen(kg/ha)	P (Kg/ha)			
	0	10	20	30
		2011 cropping		
0	336.70^{m}	347.50^{l}	368.20^{k}	379.64^{j}
40	390.24^{i}	406.53^{h}	410.53^{h}	424.40^{g}
60	430.90^{g}	441.35^{f}	446.00^{f}	460.60^{e}
80	540.80^{d}	558.40^{c}	628.00^{b}	702.80^{a}
SE$\pm$		**10.1**		
		2012 cropping		
0	311.62^{n}	307.22^{n}	378.73^{m}	394.37^{l}
40	420.33^{k}	445.26^{j}	470.73^{i}	522.04^{h}
60	565.021^{g}	607.40^{f}	630.00^{e}	644.31^{e}
80	727.80^{d}	777.43^{c}	815.00^{b}	872.100^{a}
SE$\pm$		**20**		
		2013 cropping		
0	325.53^{i}	312.34^{i}	403.28^{h}	417.35^{h}
40	435.00g^{h}	468.26^{fg}	482.93^{efg}	495.64^{ef}
60	530.75^{de}	554.86^{d}	564.4^{d}	625.60^{c}
80	628.80^{c}	719.34^{b}	752.22^{ab}	790.22^{a}
SE$\pm$		**20.1**		

Means followed by same letter (s) within a set of trial in a year are not significantly different from one another at 5% levels of probability

The longest vine and highest number of lateral branches produced by application of 80 kg N /ha and 30 kg P/ha might be due to nutrient availaibility. The increase in vine length with increase in N application could also be attributed to the ability of nitrogen to stimulate cell division and extension which in turn increased the length of internodes that translated into longer plants. This agrees with the work of Opayemi (2011) who reported that application of 80 kg N/ha resulted in the production of greater number of lateral branches in water melon. Similar observation was also reported by Olaniyi (2008), that application of 80 kg N/ha gave the longest vine and highest number of lateral branches but that the values of the two parameters were greatest at 17.6 kg P/ha. Haggai *et al*. (2011) also reported that watermelon vine length was increased by addition of up to 80 kg N/ha. However, this result is contrary to the findings of Barua (2010) who reported that watermelon vine length was greatest at 40 kg/ha beyond which there was drastic reduction in value. The increase in the number of lateral branches with increasing N could also be attributed to the ability of N to promote meristematic activity and increase photosynthetic rate. Olaniyi (2008) however cautioned that excessive vine growth in both watermelon and 'egusi' melon could result from application of large amount of N fertilizer which should be discouraged.

There was delay in the appearance of male and female flower bud and male and female flower opening due to application of N and P. The greatest delay was recorded at 80 kg N /ha and 30 kg P/ha. In the report of Olaniyi (2008), increasing N application from 0 up to 60 kg/ha significantly reduced the delay in male and female flower opening. Mehmood *et al*. (2012) also recorded a significant increase in days to flowering in tomato as N fertilizer application was increased from 0 to 200 kg /ha. This significant delay in flowering could be an indication that N application increases vigour of the plant, which ultimately increases vegetative growth period. Olaniyi, *et al*. (2010) cautioned that the use of excessive nitrogen may result in luxuriantly plant growth which will in turn lead to delay flowering and poor yield. Delayed flowering could be to enable the plant have a robust and efficient utilization of nutrients at the vegetative stage, which will translate into longer stems, more nodes,

flowers and invariably higher fruits and seed yield as confirmed by this study.
The delay in the drying of vine at high levels of N and P agrees with the results of Sahar (2010) who ascribed this delay in vine drying to availability of nutrient and rainfall distribution. Sarkin- Fulani (2011) also listed nutrient, rainfall distribution and time of planting as been responsible for delay in vine drying in watermelon.
At higher N and P application, the number of seeds in fruit increased compared with those with lower fertilizer application. Generally, seeds from plots with higher fertilizer doses significantly outnumbered those from plots with lower fertilizer doses across the study periods. This can be attributed to the significant role of higher fertilizer application, which is available to stimulate development at seed filling stage. This is similar to the reports of Haggai (2004), Olowe and Busari (2010) and Noorka *et al*. (2011) on effect of nitrogen on Sesame seed. The increase in the number of seeds in a fruit with the application of relatively high N and P is an indication that most vegetable crops respond well to adequate use of fertilizers (El-Naim and Ahmad, 2010). Number of seeds were optimum at the highest levels N and P rates of 80 kg N and 30 kg P/ha. Generally, the result of this study revealed that 'egusi' melon seed yields increased with increasing N application. Haggai (2011) attributed this trend to the ability of the crop to take up these nutrients for its use, to be a confirmation of the vital role played by N in protein synthesis and utilization of carbohydrate for cell and enzyme development. The higher yields recorded in this study could be as a result of increased nutrient uptake in plants leading to enhanced chlorophyll content and carbohydrate synthesis, higher accumulation of photosynthates and their distribution to the developing ovules (Aiyelagbe and Kintomo, 2002; Ali *et al.*,1999). Contrary to the 80 kg N/ha which was used to get maximum seed yield in this study, Barua (2010) used 40 kg N/ha to obtained maximum seed yield in water melon while Faizus and Shahedur (2012) used up to 90 kg N/ha to obtained maximum seed yield in Musk melon.

4. CONCLUSION

There was general improvement in the growth and development of egusi melon which consequently led to increased in seed yield.

5. REFERENCES

[1]. Ogbonna, P.E. & Obi, I.U. (2009). Effect of poultry manure and planting date on growth and yield egusi melon (Colocynthis citrullus L) in the Nsuka plains of South Eastern Nigeria. Samaru Journal of Agricultural Research, 16, 63 -74
[2]. Olaniyi, J.O. (2008). Growth and seed yield response of egusi melon to nitrogen and phosphorus fertilizers application. American-European Journal of Sustainable Agriculture, 2(3), 255-260.
[3]. Charment, O. & Akoh, C.C. (1997). Lipase-Catalyzed Incorporation of Oleic Acid into Melon Seed Oil. Journal of American Oil Chemical Society.74, 177-179.
[4]. Omidiji, M.O. (2008).Tropical Cucurbitaceae oil plants of Nigeria. Vegetable for the Hot Humid Tropics, 11, 37-39.
[5]. Okafor, L.J. (2010). A Preliminary study of the nitrogen response and yield potential of twenty barley varieties in Lake Chad Basin. Nigeria Journal of Agricultural Technology 9: 20-25.
[6]. Dass, R. (1999). Effect of growth regulators on size and quality of cucumber (Cucumis sativus L) in plastic greenhouse during rabi season. Crop Research (Hissar)18 (3), 390-396.
[7]. Uchida, R. (2007). Plant Nutrient Management in Hawaii's Soils. Approaches for Tropical and Subtropical Agriculture J. A. College of Tropical Agriculture and Human Resource, Hawaii University. 3, 564 – 568.
[8]. Hilda, M.M. (2012). Effect of inorganic fertilizer types and weeding frequency on the yield and yield components of melon. Crop Physiology, 12, 110 – 115.
[9]. Sanchez, P. A. (2000). Plant nutritional problems in marginal soils of developing countries. ICRAP Annual Report. International Centre for Research in Agroforestry, Nairobi, Kenya.pp: 1- 44.
[10]. NIHORT, (1983).Vegetable programme. National Horticultural Research Institute (NIHORT) Annual report, pp.60-62.
[11]. Olaniyi, J. O. & Fagbayide, J. A. (2007). Influence of source and time of nitrogen

application on growth, yield and n utrient composition of egusi melon. Research Journal of Agronomy. 1 (3), 99- 104.
[12]. Davidson, K. (2013). Response of Watermelon to Levels of Nitrogen, Phosphorus and Potassium fertilizer in Yam rotation. International Journal of sustainable Crop Production,23 (4), 127- 130.
[13]. Meteorological station of FUT Minna (MET). (2015). Meteorological unit of Federal University of Technology, Minna, Niger State, Nigeria.
[14]. Opayemi, L (2011). Effect of storage on the nutrient composition and the my processing and handling of water melon seeds (Citrullus lanatus) African Journal of Biotechnology, 3, 432-435.
[15]. Olaniyi, J.O. (2008). Growth and seed yield response of egusi melon to nitrogen and phosphorus fertilizers application. American-European Journal of Sustainable Agriculture, 2(3), 255-260.
[16]. Haggai, P.T., Singh, L. & Oseni, T.O. (2011). Effects of nitrogen and phosphorus application on the growth characters of sesame (Sesammum indicum L) in northern Guinea Savanna of Nigeria. Samaru Journal of Agricultural Research, (19), 79 -90.
[17]. Barua, H. (2010). Effect of storage container Environment at Different storage period on the quality of chilli seed. International Journal of sustainable Crop Production,4 (4), 26-27.
[18]. Mehmood, N., Ayub,G., Ullah,I,; Ahmad, N., Noor, Khan, M.A., Ahmad, S., Saeed, A. and Farzana (2012). Response of tomato (lycopersicon esculentum Mill). Cultivar to nitrogen levels. Pure Applied Biology, 1(3), 63- 67.
[19]. Olaniyi, J. O., Adelasoye, K. A., Jegede, C. (2010), Influence of Nitrogen Fertilizer on the Growth, Yield and Quality of Grain Amaranth Varieties. World Journal of Agricultural Sciences 4(4), 506-513.
[20]. Sahar, H. (2010). Effects of fertilizers NPK on growth and yield of Cucumber in the southern Benin. Asian Journal of Crop Science, 6,165-175.
[21]. Sarkin Fulani, M. (2011), Response of Watermelon to Levels of Nitrogen and Phosphorus in Sudan Savanna of Nigeria. Savannah Journal of Agriculture, vol. 6(1), June, 2011.
[22]. Haggai, P. T. (2004). Effect of nitrogen and phosphorus application on yield attribute and seed yield of sesame (Sesamum indicum L.) in northern Guinea Savanna of Nigeria. International Journal of Agricultural Science, 2, 661-662.
[23]. Olowe, V.I.O & Busari, L.D.(2010). Response of sesame (Sesanum indicum L) to nitrogen and phosphorus application in southern Guinea savanna of Nigeria. Tropical Oilseed Journal, 5, 6-7.
[24]. Noorka, I.R., Hafiz, S.I. & El-Bramawy, M.A.S (2011). Response of sesame to population densities and nitrogen fertilization on newly reclaimed sandy soils. Pakistan Journal of Botany, 43, 1842-1845.
[25]. El-Naim, A.M & Ahmad, A.A. (2012). Determination of suitable variety and fertilizer rates in Sesame (Sesammum indicum L.) in sandy dunes of Kordofon, Sudan. International Journal of Agriculture and Forestry, (2), 175- 179.
[26]. Haggai, P.T., Singh, L. & Oseni, T.O. (2011). Effects of nitrogen and phosphorus application on the growth characters of sesame (Sesammum indicum L) in northern Guinea Savanna of Nigeria. Samaru Journal of Agricultural Research, (19), 79 -90.
[27]. Aiyelaagbe, I. O. & Kintomo, A. A. (2002), Nitrogen response of fluted pumpkin (Qelfairia occidentalis Hook) Grown sole or intercropped with banana. Nutrient Cycling in Agro-ecosystems, 64, 231-235.
[28]. Ali, M. H., Rahman A. M. & Ullah, M. J. (1999), Effect of plant population and nitrogen on yield and oil content of rape seed (Brassica campestris). Indian Journal of Agricultural Science, 60(9), 627-630.
[29]. Faizus S. & Shahedur R. (2012). Effects of zinc and nitrogen fertilizer and their application method on yield and yield components of (Phaselus vulgaris L.) Indian Journal of Tropical Agriculture, 3.1, 9-13.