IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 10, Issue 7 Ver. III (July 2017), PP 40-45
www.iosrjournals.org

Nitrogen, Phosphorus and Potassium Uptake by Some Varieties of Groundnut (*Arachis Hypogaea* L.) As Influenced By Phosphorus Application in Yola and Mubi, Adamawa State, Nigeria

Musa, A. M1*, Singh, L[1], Tame V.T[2], Bubarai M.L[1]
[1] *Dept. of Soil Science, Modibbo Adama University of Technology Yola, Adamawa State Nigeria*
[2] *Dept. of crop production, Modibbo Adama University of Technology Yola, Adamawa State Nigeria*
Corresponding author: MUSA, A. M1

***Abstract*: *A field experiment was conducted at the Modibbo Adama University of Technology Yola Teaching and Research Farm and the Adamawa State University Mubi Teaching and Research Farm to study uptake of nitrogen, phosphorus and potassium by some varieties of groundnut (**Arachis hypogeae L.**) as influenced by phosphorus application in Yola and Mubi, Adamawa State Nigeria. The study comprised 3 varieties of groundnut (Samnut -10, Samnut -21 and Ex-Dakar) and 4 phosphorus levels (0, 8, 16 and 24 kg P/ha) all laid out in RCBD and replicated 3 times. At harvest, desired plant parts were analyzed for nitrogen phosphorus and potassium. The results revealed that Uptake of nitrogen by haulm, kernel and shell at both locations with respect to phosphorus application levels increases with increase in phosphorus levels though not linearly. The effect of phosphorus application on phosphorus uptake is significant ($P<0.05$) at both locations with respect to phosphorus levels except Mubi shell this indicates that uptake of phosphorus by different plant parts was influenced by applied phosphorus. Potassium uptake with respect to phosphorus application was highly significant ($P< 0.001$) in Yola at kernel and shell while at Mubi it was not significant. Uptake of nitrogen, phosphorus and potassium is thus influenced by variety of groundnut used and the application of phosphorus fertilizer.*

Keywords: *groundnut, phosphorus, Yola, Mubi*

Date of Submission: 14-07-2017 Date of acceptance: 27-07-2017

I. Introduction

Groundnut (***Arachis hypogeae* L.**) originated from Latin America and was introduced into West Africa by Portuguese traders in the 16th century (Taru *et al.*, 2008). Groundnut is a legume that is widely grown as a food crop. It is an annual crop primarily grown for its protein rich kernel and edible oil. It bears its seeds below the surface of the ground and there abound many locally named varieties e.g. Boro light, Boro red, Ela, Mokwa, Guta and Kampala (Ayoola and Adeyeye, 2010). It provides considerable amounts of mineral elements to supplement the dietary requirements of humans and farm animals (Asibuo *et al*., 2008).

Groundnut is the fifth most important oil seed in the world after soya bean oil, cotton seed oil, rape seed oil, and sun flower seed oil (Nwokolo, 1996). Groundnut is an important cash crop for tropical farmers. Even though it is fairly drought tolerant, production fluctuates considerably as a result of rainfall variability (Reddy *et al.*, 2005).Peanut (Arachis hypogaea L.) is a cash crop that is normally cultivated during the rainy season in the semi-arid regions of the world (Junjittakarna et al. 2013). Drought has been attributed to cause drop in yield which automatically leads to reduced nutrient uptake (Pimratch et al., 2008; Songsri et al., 2008) and it also increases aflatoxin contamination (Waliyar et al., 2003; Girdthai et al., 2010).

With increasing global population particularly in developing countries, and a limited or even shrinking supply of arable land, the challenge to agriculture is to meet the world's food and fiber needs without reducing the capacity of the resource base (soil and water) to enable guaranteed production for posterity and also to accommodate society's environmental and energy concerns. This is especially important in the arid and semi arid regions where drought and related biophysical factors create a fragile and uncertain environment (Ryan *et al.,* 2008) Brick (2001). observed that maintaining proper soil fertility ensures nodulation and Nitrogen fixation. Plant nutrient requirement are driven by demands to satisfy vegetative growth and reproductive metabolic processes. Since the structural chemistry of plant tissue permits definite limits of plant nutrient concentration for tissue build up normal uptake of nutrients must therefore be within established interactive ratios for the plant (Uyovbisere and Lombin, 1991). Tarawali and Quee (2014) observed that single super phosphate fertilizer (SSP) application significantly enhanced crop performance and nodule formation in groundnut

Phosphorus is the second major essential nutrient element for crop growth and quality yield and one of the visible effect of phosphorus is exhibited on plant root system development. There is higher requirement for phosphorus in legumes in comparison to non-legume crops because of its role in nodule formation and fixation of atmospheric nitrogen (Brady and Weil, 2002). Kamara et al. (2011) reported an increase in biomass of groundnut after the application of phosphorus fertilizer and attributed it to availability of soluble phosphate that enhanced extensive root development. Adequate phosphorus nutrition has been attributed to enhanced yield and income of groundnut farmers because of the role played by phosphorus in the physiological process of plant growth and development. (Henry 2016). Bala et al.(2011) reported that increased pod and seed index and shelling percentage of groundnut was due to early and plentiful availability of nitrogen and phosphorus to plants which favorably influenced the kernel development and kernel size,

Nitrogen and Phosphorus are important for effective production of groundnut. Groundnut requires phosphorus for growth and development, nitrogen fixation as well as nodule formation (Daft and Elgiahmi 1975 and Hayman 1986). Nitrogen need of the crop can be met through nitrogen fixation in most soils while inorganic fertilizer is applied to supply the phosphorus requirements. In most tropical soils phosphorus deficiency remains a major problem and the response and uptake of different varieties of crops to applied phosphorus varies considerably. Significant variations are noted among local varieties of groundnut and even among the improved cultivars in response to phosphorus fertilization (Babalola *et al.,* 2004). Kwari, (2005) phosphorus is needed by plants for efficient root development for nodulation and also phosphorus is a constituent of nucleic acid and thus aids in stimulation of root growth and nodule activity

Balasubramanian and Singh (1990) reported that the higher the concentration of phosphorus, the higher will be the amount of nitrogen fixed. Similarly Balasubramanian and Singh (1990) reported that total nitrogen uptake and proportion of nitrogen present in kernel is greatly influenced by phosphorus level and that interaction between phosphorus and potassium had significant influence on kernel yield. Phosphorus is the second most limiting nutrient in the Nigerian savanna next to nitrogen. The soils are inherently deficient in phosphorus and response to other nutrients is often limited by the absence of phosphorus in the soils and thereby limiting crop production to a very large extent (Babalola *et al.,* 2000). Uma and Sathiyavani, (2012) observed that a major limiting factor in plant nutrition is deficiency of phosphorus i.e. unavailability of soluble phosphate in solution

Nutrient requirements of a crop and uptake pattern also vary according to growth and yield performance of varieties and season. Further knowledge of nutrient content and uptake by crop helps manage their fertilizer need on sustainable basis. So, nutritional needs of groundnut must be satisfied to produce maximum yield (Hossain *et al.,* 2007). Balasubramanian *et al.,* (1981) reported that under continuous cultivation over the period of 1972-1976 at various locations in the savanna region of Nigeria, sorghum responded significantly to applied phosphorus up to 16kg P/ha when sorghum-groundnut rotation was followed.

Hossain *et al.,* (2007) reported that nitrogen uptake by leaf increased from pre flowering to pod development stage and declined at maturity stage and that the decrease corresponded to increase of nitrogen uptake in seeds. Gabasawa *et al.,* (2009) who worked with groundnut varieties Samnut -10, Samnut -21 and Samnut -23 reported that Samnut -23 had significantly higher grain nitrogen content and that phosphorus level significantly affected haulm and grain nitrogen contents. In a separate experiment Singh and Vidya (2007) reported that increasing level of nitrogen, phosphorus, potassium, calcium and sulphur increased their uptake and that there was interaction among macronutrient absorption and also that increasing nitrogen levels increased phosphorus, potassium, and calcium and magnesium uptake.

Balasubramanian *et al.,* (1980) reported that the uptake of phosphorus significantly increased with fertilizer levels and that a greater percentage of phosphorus was in the kernels thereby indicating the importance of phosphorus in the formation of kernels. Study conducted by Hossain *et al.,* (2007) showed that uptake of nitrogen and phosphorus by leaf and stem at different growth stages and also by seed was influenced by applied nitrogen and phosphorus. Ranjit *et al.,* (2007) further reported that phosphorus uptake by groundnut was significantly influenced by lime and phosphorus levels.

Ranjit *et al.,* (2007) observed in their study that potassium uptake by groundnut genotypes were significantly affected by lime and phosphorus levels. Balasubramanian *et al.,* (1980) also reported that the content of potassium in kernels significantly increased with increasing phosphorus levels and that a greater percentage of the potassium was present in the haulms and shell thus adequate return of these residues will minimize the depletion of soil potassium during continuous cultivation. Thus this study was carried out with the sole aim of studying the effects of phosphorus application levels and varieties of groundnut used on the uptake of nitrogen phosphorus and potassium in different plant parts.

II. Methodology

Groundnut seeds Samnut-10 and Samnut-21 were acquired from the institute for Agricultural research, (IAR) Zaria, Kaduna State, Nigeria while Ex- Dakar was acquired from the Jimeta central market Adamawa State Nigeria. The seeds were sown at Mubi and Yola at the rate of 2 seeds per hole and were spaced 75cm between rows and 20cm between stands. Weeding was carried out using manual labour at 3 and 9 weeks after emergence and was repeated as necessary. Single super phosphate (SSP) was applied as source of phosphorus at 0, 8, 16 and 24 kg P/ha. The fertilizer was broadcast and properly mixed with soil at the time of sowing. At harvest groundnut haulm, kernel and shell were harvested, air dried and their weights noted. The haulm, kernel and shell were then grounded and analyzed for nitrogen, phosphorus and potassium contents and subsequently uptake was calculated. Triacid digestion method (wet ashing) was used to digest the plant samples as described by Jaiswal (2003). Total nitrogen was determined by Macro Kjeldahl method as described by (Jaiswal 2003). Total phosphorus was determined using Bray 1 method as described by Jaiswal (2003). Potassium in plant samples were determined using the Flamephotometre as described by Jaiswal (2003)**..** Data collected were subjected to analysis of variance and means were separated using LSD at 5% probability level.

Nutrient Uptake by Groundnut Varieties

In nutrient uptake determination, plant samples (haulm, kernel and shell) were analyzed for respective nutrient elements (nitrogen, phosphorus and potassium). After the nutrient element analysis, the result so obtained in mg/g were divided by 1000 and multiplied by 100 to get the nutrient content in percentage (%). The nutrient content in percentage was then multiplied by the respective corresponding dry matter yield (haulm, kernel or shell) of the sample analyzed and divided by 100 thus nutrient uptake kg/ha calculated (Ranjit *et al.,* 2007).

$$\text{Nutrient uptake (kg/ha)} = \frac{\text{Nutrient content (\%) x Dry matter (kg/ha)}}{100}$$

III. Results and Discussions

At Yola, it was observed that uptake of nitrogen in shell was higher in control than in phosphorus applied plots. This is in agreement with the findings of Balasubramanian *et al.,* (1980) who reported that concentration of Nitrogen in all plant parts except kernels were higher in control than in fertilized treatments. Uptake of nitrogen by haulm, kernel and shell at both locations with respect to phosphorus application levels increases with increase in phosphorus levels though not linearly. Similarly Hossain *et al.,* (2007) from their work on the effect of nitrogen and phosphorus fertilizer on N/P uptake and yield performance of groundnut reported that uptake of nitrogen and phosphorus by leaf and stem at different growth stages and also by seed were influenced by applied nitrogen and phosphorus fertilizer. Nitrogen uptake with respect to phosphorus application by haulm at Yola, haulm and shell at Mubi were all highly Significant. This is in line with the findings of Gabasawa *et al.* (2009) which indicated that phosphorus level is significantly affected by haulm yields. The effect of phosphorus application on phosphorus uptake is significant ($P<0.05$) at both locations with respect to phosphorus levels except Mubi shell this indicates that uptake of phosphorus by different plant parts was influenced by applied phosphorus. This conforms to earlier findings of Hossain *et al.*, (2007) who reported that uptake of phosphorus by leaf and stem was influenced by applied fertilizer. Atayese (2007) similarly reported that phosphorus uptake by leaf was influenced by phosphorus application. Babalola *et al.,* (2004) reported that groundnut response to phosphorus application was influenced by varietal differences thereby suggesting that each variety may differ in its response to different rates of applied phosphorus. Factors such as varietal efficiencies inherently possessed by the variety in terms of Phosphorus utilization can increase nutrient availability thereby boosting uptake. Sandras (2005) also reported that Nutrient availability as affected by soils and fertilizer rate is a major source of variation in yield and uptake of nutrient. Nutrient requirements of a crop and uptake pattern also vary according to growth and yield performance of varieties and season (Hossain *et al.*, 2007).

The uptake pattern of haulm at both locations showed that nitrogen and phosphorus uptake has been influenced by application of phosphorus. Hossain *et al.,* (2007) reported that uptake of nitrogen and phosphorus by leaf and stem at different growth stages was influenced by applied nitrogen and phosphorus. Bhadoria *et al.*, (2001) reported that plant species and cultivars differ greatly in their response to low phosphorus supply in soil and some plants can grow well under such conditions because they are able to take up enough phosphorus for optimum growth and they attributed this high uptake efficiency to a high influx e.g. in spinach, rape and groundnut or to a large root/shoot ratio e.g. in ryegrass and wheat. Bhadoria *et al.,* (2004) reported that under field conditions in early growth stages, groundnut was not limited by low phosphorus soil. Increased root production is a well known acclimation of phosphorus deficient plants to improve phosphorus uptake. Bhadoria *et al.,* (2004) further enumerated that at early growth stages groundnut was very phosphorus efficient mainly because of a high phosphorus uptake rate which declines later in the growing period with a concomitant decrease in Phosphorus efficiency. This therefore suggests that phosphorus influx differed greatly between species as well as with the stage of growth of particular specie.

The uptake of Phosphorus with respect to phosphorus application rates increased with increasing rate of phosphorus at both Yola and Mubi. Balasubramanian *et al.*, (1980) reported that Phosphorus uptake increased significantly. Hossain *et al.*, (2007) also reported from their research that Phosphorus uptake by leaf, roots and seeds followed a similar pattern to that obtained for Nitrogen uptake. Singh *et al.* (2003) reported that at low and medium Phosphorus levels soil solution concentration is more important in determining Phosphorus uptake than the ability of the roots to absorb phosphorus. Potassium uptake with respect to phosphorus application was highly significant ($P< 0.001$) in Yola at kernel and shell while at Mubi it was not significant. In the present study at Yola, the potassium uptake of kernels with respect to phosphorus application was highly significant ($P< 0.001$). Balasubramanian and Singh (1990) reported that potassium uptake in kernel is greatly influenced by Phosphorus level and that content of potassium in kernel significantly increased with Phosphorus level. However Hall *et al.*, (1990) and Del Pozo *et al.*, (2000) both reported that high production value of seed contribute to the low yield per unit nutrient uptake in oil seeds and legumes in comparison to cereals.

IV. Recommendations

Studies have indicated that varietal differences, soil type, climate, type of fertilizer applied, sowing date, fertilizer application rate and/or time of fertilizer application all contribute to nutrient uptake in groundnut. Uptake trends of the varieties studied indicate that at both locations groundnut variety Ex-Dakar had better ability for nitrogen, phosphorus and potassium uptake at the application of 16 Kg P/ha at Yola and at 24 Kg P/ha at Mubi.

Table *1*: Nitrogen Uptake (kg N/ha) by Haulm, Kernel and Shell of Varieties of Groundnut at Different Phosphorus Levels at Yola and Mubi

	LOCATIONS							
	Yola				Mubi			
Fertilizer P(kg/ha)	Haulm	Kernel	Shell	Total	Haulm	Kernel	Shell	Total
0	8.35	106.0	0.83	115.2	14.1	88.1	0.51	102.7
8	19.19	120.0	0.72	140.0	26.4	116.1	0.88	143.4
16	15.52	126.0	0.61	142.1	22.1	94.2	0.56	116.9
24	12.56	83.0	0.64	96.2	24.50	93.50	0.70	118.7
Mean	13.91	109.0	0.70	123.6	21.8	98.00	0.67	120.4
LSD	3.93	NS	NS	NS	6.02	NS	0.16	NS
Varieties								
Samnut-10	13.60	92.0	0.69	106.3	20.30	104.4	0.73	125.4
Samnut-21	12.95	128.0	0.76	120.0	21.40	85.50	0.65	107.2
Ex-Dakar	15.17	106	0.66	143.8	23.60	104.1	0.63	128.3
Mean	13.91	109.0	0.70	123.6	21.80	98.00	0.67	120.5
LSD	NS	NS	NS	NS	NS	NS	NS	NS

NS Not Significant, ** Significant at 1% Level of Probability

Table 2: Phosphorus Uptake (kg P/ha) by Haulm, Kernel and Shell of Different Varieties and Different Phosphorus Levels at Yola and Mubi

	LOCATIONS							
	YOLA				MUBI			
Fertilizer P(kg/ha)	Haulm	Kernel	Shell	Total	Haulm	Kernel	Shell	Total
0	3.51	4.36	1.80	9.67	16.0	3.42	1.00	20.4
8	5.93	3.51	1.52	10.96	24.5	4.07	1.14	29.7
16	5.35	3.58	1.33	10.26	16.7	3.60	1.16	21.5
24	4.64	2.91	1.05	8.59	21.2	4.22	1.20	26.6
Mean	4.86	3.59	1.42	9.87	19.6	3.83	1.12	24.5
LSD	1.25	0.48	0.36	1.30	5.95	0.35	NS	5.91
Varieties								
Samnut-10	4.17	3.82	1.24	9.23	21.6	3.77	1.12	26.5
Samnut-21	5.39	3.05	1.54	9.98	17.5	3.66	1.13	22.2
Ex-Dakar	5.01	3.89	1.50	10.40	19.7	4.05	1.12	24.9
Mean	4.86	3.59	1.42	9.87	19.6	3.83	1.12	24.5
LSD	NS	0.41	NS	NS	NS	0.31	NS	NS

NS Not Significant, **Significant at 1% Level of Probability,* Significant at 5% Level of Probability

***Table 3*: Potassium Uptake (kg K/ha) of Haulm, Kernel and Shell of Groundnut Varieties at Different Phosphorus Levels at Yola and Mubi**

	LOCATIONS							
	YOLA				MUBI			
Fertilizer P(kg/ha)	Haulm	Kernel	Shell	Total	Haulm	Kernel	Shell	Total
0	56.5	6.43	2.85	65.7	69.5	3.47	2.05	75.0
8	49.7	4.55	2.71	56.9	83.0	3.55	2.17	88.7
16	49.5	4.07	2.23	55.8	83.7	3.28	1.88	88.9
24	44.8	3.12	2.04	49.9	87.4	3.49	1.80	92.7
Mean	50.1	4.54	2.46	57.1	80.9	3.45	1.98	86.3
LSD	NS	0.51	0.46	NS	NS	NS	NS	NS
Varieties								
Samnut-10	49.8	4.63	2.25	56.7	73.9	3.30	1.84	79.0
Samnut-21	50.6	4.33	2.40	57.3	86.6	3.35	1.87	91.8
Ex-Dakar	49.9	4.67	2.71	57.3	82.1	3.70	2.22	88.0
Mean	50.1	4.54	2.46	57.1	80.9	3.45	1.98	86.3
LSD	NS	NS	NS	NS	NS	NS	0.33	NS

NS Not Significant, **Significant at 1% Level of probability, *Significant at 5% Level of Probability

References

[1] Asibuo,J.Y., R. Akromah, Safo-Kantaka, O.Osei Adu-Dapaah, O.S. Hans Kofi and A. Agyeman,(2008)Chemical Composition of Groundnut, Arachis hypogaea L. Land Races Afr. J.Biotech., 7: 2203-2208

[2] Ayoola P.B. and A. Adeyeye (2010) Effect of heating on the Chemical Composition and Physico Chemical Properties of Arachis hypogaea (Groundnut) seed flour and oil Pakistan Journal of Nutrition 9(8): 751-754

[3] Babalola O.A and I.Y.Amapu (2006) Response of some cowpea genotypes to different rates of phosphorus in Samaru. Nigerian Journal of Soil Science 16:77-83

[4] Babalola O.A.Lagoke, S.T.O. and Sadou, M.K. (2004) Response of two groundnut varieties to N and P under different tillage methods in Abeokuta. Managing soil resources for food security and sustainable environment Proceedings of 29th annual conference of Soil Science Society of Nigeria 219-223

[5] Babalola, O.A., V.O.Chude., E.N.O.Iwuafor and J.K.Adu (2000) Incidence of Phosphate Solubilizing Microorganisms in an Alfisol in North Western Nigeria Nigerian Journal of Soil Research 1:23-28

[6] Babalola.O.A., Lagoke, S.T.O and O.N.Sulaiman (2009) Interaction between rates of phosphorus application and flat or ridge planting in groundnut (Arachis hypogeae L.) varieties Nigerian Journal of Soil Science 19(1) 60-69

[7] Bala HMB, Ogunlela VB, Kuchinda NC and Tanimu B. (2011). Response of two groundnut (Arachis hypogaea) varieties to sowing date and NPK fertilizer rate in a sami-arid environment: yield and yield attributes. Asian J. Crop Sci. 3(3):130-134.

[8] Balasubramanian V. and L. Singh (1990) Effects of phosphorus on Nitrogen Fixation Journal of Agricultural Research 6:115-120

[9] Balasubramanian V., L Singh & L. A. Nnadi (1980) Effect of long term fertilizer treatment on groundnut yield, nodulation and nutrient uptake at Samaru Nigeria. Plant and soil 55:171-180

[10] Balasubramanian V., L.Singh and L.A.Nnadi (1981a) Sorghum response to straight and compound fertilizer under continuous cultivation Samaru Journal of Agricultural Research 2:100-115

[11] Balasubramanian, V., L.Singh and L.A.Nnadi (1981b) Fertilization of Crops in Semi Arid Savanna soils of Nigeria 1 Groundnut response to straight and compound fertilization under continuous cultivation Samaru Journal of Agricultural Research 1:119 -128

[12] Benjamin, W (2003) Diagnostic Techniques for improving crop production CBS publisher and distributers New Delhi India p67

[13] Brady, N.C and R.W. Ray (1999) Nature and Properties of Soils. New Jersey Prentice Hall Inc.USA

[14] Daft, M.S. and A.A.ElGiahmi (1975). Effect of Glomus infection on tree legume In Sanders, F.E., B.Mosse and P.B.Tinker, (Eds.). Endomycorrhizae Academic press New York, pp 581-592

[15] Gabasawa A.I., A.A Yusuf., E.N.O Ewu Afor and B. Malgwi (2009). Biological nitrogen characteristics and yield of groundnut genotypes in an Alfisol of the northern guinea savanna of Nigeria .Proceeding of the 33rd annual conference of the SSSN march 9-13 2009 University of Ado Ekiti Nigeria

[16] Girdthai, T., Jogloy, S., Vorasoot, N., Akkasaeng, C., Wongkaew, S., Holbrook, C.C., Patanothai, A., (2010). Heritability of and genotypic correlations between, aflatoxin traits andphysiological traits for drought tolerance under end of season droughtin peanut (Arachishypogaea L.). Field Crops Res. 118, 169-176.

[17] Hague, I., L.A. Nnadi and M.A. Mohamed-Saleem (1978) Phosphorus management with special reference to forage legumes in sub-Saharan Africa ILCA, P.O. Box 5689, Addis Ababa, Ethiopia www.fao.org/wairdocs/ilri/x5488e/x5488e0a.htm

[18] Hausenbuiller, R.L. (1972) Soil Science Principles and Practice W.M.C. Brown Iowa USA p504

a. Hayman, D.S (1986) Mycorrhizal of nitrogen fixing legumes.MICREN J.Appl.Microbiol. Biotech 2:121-145

[19] Henry Tamba Nyuma (2016) Response of Three Groundnut (Arachis hypogaea L.) Genotypes to Calcium and Phosphatic Fertilizers a Dissertation Submitted in Partial Fulfilment of the Requirements for the degree of Master of Science in Crop Science Sokoine University of Agriculture. Morogoro, Tanzania.

[20] Hossain, M.A., A. Hamid and S. Nasreen (2007) Effect of Nitrogen and Phosphorus Fertilizer on N/P Uptake and Yield Performance of Groundnut (**Arachis hypogaea L.**) Journal of Agricultural Research 45:119-125

[21] Junjittakarna J., S. Pimratchb , S. Jogloya,, W. Htoona , N. Singkhama , N. Vorasoota , B. Toomsana , C.C. Holbrookc , A. Patanothai (2013) Nutrient uptake of peanut genotypes under different water regimes International Journal of Plant Production 7 (4),

[22] Kamara, A. Y., Ekeleme, F., Kwari, J. D., Omoigui, L. O. and Chikoye, D. (2011). Phosphorus effect on growth and yield of groundnut varieties in the tropical savanna of North Eastern Nigeria. Journal of Tropical Africa 49(2): 24 – 30.
[23] Kamara, E. G., Olympio, N. S and Asibuo, J. Y. (2011). Effect of calcium and phosphorus on the growth and yield of groundnut (Arachis hypogaea L.). International Research Journal of Agricultural Science and Soil Science 1(8): 326 – 331.
[24] Kwari, J. D. (2005). Soil Fertility Status in Some Communities of Southern Borno. PROSAB, Nigeria. 21pp.
[25] Lombin, G., L.Singh and J.Y.Yayock (1985) A Decade of Fertilizer Research. Nutrient cycling in Agroecosystems.6:157-170
[26] Ludwick Albert E. (1998) phosphorus fixation-the good and bad of it. Retrieved October 3,2010 from www.IPNI.com
[27] Meena RS, RS Yadav and VS Meena (2014) Response of groundnut (Arachis hypogaea L.) varieties to sowing dates and NP fertilizers under western dry zone of India. Bangladesh J. Bot. 43(2): 169-173,
[28] Nwokolo, E.O (1996) Peanut (**Arachis hypogaea L**.) in E.Nwokolo and J.Smartt (eds.) in Food and Feed from Legumes and Oil Seeds, London T.J Press
[29] Okolo T.O. and Utoh N.O(1999)groundnut seed multiplication and constraints FAOs Experience. In A.Aliyu and G.O. Nwafor (Eds.) Proceedings of the national workshop on groundnut rehabilitation in Nigeria. Kano Nigeria FAO/FDA 11-12 May 1999 pp 14-22
[30] Pimratch, S., Jogloy, S., Vorasoot, N., Toomsan, B., Kesmala, T., Patanothai, A., Holbrook, C.C., (2008). Effect of drought stress on traits related to N2 fixation in eleven peanut (Arachishypogeae L.) genotypes differing in degrees of resistance to drought. Asian J. Plant Sci. 7 (4), 334-342.
[31] Ranjit R., G.S. Dasog and P.L.Patil (2007) effect of lime ad phosphorus levels on nutrient uptake by groundnut genotypes in acid soils of coastal agro system of Karnataka. Karnataka Journal of Agric Science 20(3)631-633
[32] Reddy, T.Y., V.R.Reddy and V.Anbumozhi (2005) Physiological response of Groundnut (**Arachis hypogaea L**.) to Drought Stress and its Amelioration: A Review.Acta Agronomica Hungarica 51:205-227
[33] Ryan, J., M.Singh, M.Pala (2008) Long Term Cereal Based Rotation in the Mediterranean: Implications for Cropping Sustainability. Advances in Agronomy 97:273-319
[34] Singh A L and Chaudri Vidya (2007) Macronutrient requirement of groundnut: effects on uptake of macronutrients. Indian journal of Plant Physiology volume 12:72-77
[35] Singh, S., P.B.S.Bhadoria, and A.Rakhshit (2003) Simulation of Phosphorus Uptake by Peanut in Low Phosphorus Supplying Soil. Italian Journal of Agronomy 7:65-71
[36] Songsri, P., Jogloy, S., Kesmala, T., Vorasoot, N., Akkasaeng, C., Patanothai, A., Holbrook, C.C., (2008). Responses of reproductive characters of drought resistant peanut genotypes to drought. Asian J. Plant Sci. 7 (5), 427-439.
[37] Tarawali, A. and Quee, D. (2014). Performance of groundnut varieties in two agroecologies in Sierra Leone. African Journal of Agricultural Research 9(19): 1442 – 1448.
[38] Taru V.B., I.Z.Kyagya., I.S.Mshelia., E.F.Adebayo (2008) Economic Efficiency of resource use in groundnut production in Adamawa state of Nigeria world journal of Agricultural Sciences 4(S):896-900
[39] Uma, M. N. and Sathiyavani, G. (2012). Solubilization of phosphate by Bacillus Sps., from groundnut rhizosphere (Arachis hypogaea L.). Journal of Chemical and Pharmaceutical Research 4(8): 4007 – 4011.
[40] Uyovbisere U.B and G.Lombin (1991) Efficient Fertilizer use for increased crop production: The Sub Humid Savanna Experience. Fertilizer Research 29:81-94
[41] Uzoho, B.U and N.N Oti (2005) Estimation of phosphorus requirement of maize (**Zea mays**) in selected soils of south Eastern Nigeria using phosphorus sorption isotherm. Nigerian Agricultural Journal 36:157-168
[42] Waliyar, F., Traore', A., Fatondji, D., Ntare, B.R., (2003). Effect of irrigation interval, planting date and cultivar on Aspergillusflavus and aflatoxin contamination of peanut in a sandy soil of Niger. Peanut Sci. 30, 79-84.

Musa, A. M1. "Nitrogen, Phosphorus and Potassium Uptake by Some Varieties of Groundnut (Arachis Hypogaea L.) As Influenced By Phosphorus Application in Yola and Mubi, Adamawa State, Nigeria ." IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 10.7 (2017): 40-45.