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INFLUENCE OF TIME OF NITROGEN SECOND DOSE FERTILIZATION MAIZE (*Zea mays L.*) VARIETIES IN NORTHERN GUINEA SAVANNAH OF NIGERIA

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ABSTRACT
The field trial was carried out to evaluate the effect of timing nitrogen second dose fertilization on the grain yield and yield components of some improved maize varieties. The field experiments was conducted at the Institute for Agricultural Research IAR-ABU Research Farm Samaru – Zaria and Military Cantonment Farm Jaji – Nigeria. Treatments consist of three maize varieties (SAMMAZ 14, SAMMAZ 15 and SAMMAZ 16) and six timings of nitrogen second dose of fertilizer application. Data were recorded on grain yield, number of cobs /plant, number of grain /row, cob(ear) diameter, cob(ear) weight and 100 grain weight. Treatments were laid out in a randomized complete block design (RCBD) with three replications. SAMMAZ 16 produced significantly higher grain yield and recorded superior yield characters over SAMMAZ 14 and 15. The results further showed that time of nitrogen second dose application 6 WAS outperformed other timings evaluated at both location. The study identified. SAMMAZ 16 and time 6 WAS appeared to be the option for increased maize grain yield in the study area.

Keyword: Maize, grain yield, fertilizer application timing, yield components, savanna ecology

INTRODUCTION

Maize (*Zea mays* L.) is an important staple crop especially in the savannah ecological zone of Nigeria where production is on the increase (Ado *et al.,* 2007). Owing to the development of varieties suitable for the different ecologies as well as wide adoption and adaptation by farmers (Ahmed *et al.,* 2014). Although maize can be cultivated on different soils but performs better on fertile, sandy loam soils that is well drained, (Brunson and Smith, 1955). Nitrogen has been identified as the most limiting factor for higher growth and grain yield of the crop (Tisadale and Nelson, 1975; Hay and Walker, 1989). Fertilizers (nutritients) for maize cultivation must be applied at times and levels/rates required (needed) for best possible growth of the crop in view of crop requirements as well as agro-climatic consideration. Higher fertilizer rates (over application beyond required rates) could cause lodging risk, encourage disease and commonly reduced the nitrogen use efficiency (Karim and Ramassamy, 2000;Halvorsson *et al.,* 2005). On the other hand, low, minimal or no application of fertilizer can obstruct crop growth bringing lower or no yields at all in the short term while in long term it endangers suitability for maize production. The decline in organic matter content of the soil and low chemical fertilizer application rate has a major role in reducing soil fertility (Kumwenda *et al.,* 1996). Timing of nitrogen fertilizer application is critical and is regarded as the most important decision for high yielding hybrid maize production (Walsh, 2006). Careful consideration must be made between N supply and demand and met in maize cultivation which enhances N uptake rates and increase N use efficiency and subsiquently reducing N losses (Rizwan *et al.,* 2003).

Fast developmental phase during maize growth starts from V6 growth stage during which highest N uptake takes place, therefore, maize responds to the belated N application (Binder *et al.,*2000). Application of nitrogen from V8 to V10 growth stages of maize could be the appropriate time of N supply to respond to its high demand, Hassan *et al.,* (2010). Schmidt *et al.,* (2002) and Muthukumar *et al.,* (2005) advocated that Nitrogen application during late vegetative growth stage is a means of increasing nitrogen efficiency. The time of N fertilizer topdressing (second dose fertilization) is of paramount importance to maize crop because if it is missed, it could lead to low or no yield at all. The timing could be missed through non availability of the fertilizer to the farmers for purchase or non availability of labour to apply it as at when due e.t.c. Therefore the aim of this study was to evaluate the effect of varying the timing of nitrogen fertilizer topdressing on the grain yield and some yield components of three maize varieties in the Nigeria savannah.

MATERIALS AND METHODS

Field experiments were conducted during the cropping season of 2018 at two location simultaneously namely, Research farm of the Institute for Agricultural Research Ahmadu Bello University, Zaria (latitude '$11^0$11'N, long $07^0$38'E, 686m above sea level) and Jaji military cantonment farm (latitude 10^0, 49'25"N, longitude $07^0$34'11''E, 600m above sea level) located at km 30 Kaduna – Zaria Road, both in Northern Guinea Savannah agro-ecological zone of Nigeria. The treatments consisted of three maize varieties (SAMMAZ 14, SAMMAZ 15 and SAMMAZ 16) and six time of Nitrogen fertilizer second dose application at 4, 5, 6, 7, 8, and 9 weeks after sowing (WAS). Treatments combination were laid out in a randomized complete block design (RCBD) and replicated three times. After land preparation, two seeds were sown per hole and later tinned to one seedling par hole at 2 WAS at a spacing of 25cm by 75cm in all location. Fertilizer at the rate of 120kgN, -60kg P_2O_5 and 60Kg K_2O was applied in two split doses, the first dose (-75%N, 100% P_2O_5 and 100% K_2O) was applied at 1(one) WAS while the second dose 25% N (Urea) which was part of the treatment was varied from 4, 5, 6, 7, 8 and 9 WAS by side placement at 5cm away from the base of the stand. Manual weeding was carried out using hand held hoe at 6 and 10 WAS then followed by earthing up after each weeding. There was no incidence of pests and diseases observed at both locations. Harvesting was carried out at full maturity. Data were recorded on grain yield and some yield parameters including number of cobs, number of grain per cob, cob diameter, cob weight and 100 grain weight. Data collected were subjected to analysis of variance and the means separated were separated using Duncan multiple rang test (DMRT) at 5% level of probability using SAS statistical package (2005).

Table 1: Physical and chemical properties of soils (0 – 30 cm depth) taken from the experimental location at Samaru and Jaji during 2018 cropping season

	Location		
Soil Characteristics	Samaru	Jaji	
Particle size distribution gkg^{-1}			
Sand	580	410	410
Silt	340	460	460
Clay	80	130	130
Textural class	Sandy loam	Loam	Loamy soil
Chemical composition			
pH in water (1:2.5)	6.05	6.15	6.15
pH in 0.01M$CaCl_2$ (1:2.5)	5.60	5.78	5.78
Organic carbon (g kg^{-1})	1.04	1.19	1.19
Total nitrogen (g kg^{-1})	0.27	0.30	0.30
Available phosphorus (mg kg^{-1})	6.00	9.29	9.29
Exchangeable bases (cmol kg^{-1})			
Calcium (Ca)	2.61	3.91	3.91
Magnesium (Mg)	0.41	0.71	0.71
Potassium (K)	0.09	0.13	0.13
Sodium (Na)	0.17	0.26	0.26
Cation Exchange Capacity (C.E.C)	3.21	4.90	4.90

Source: Soil Analytical Laboratory, Department of Agronomy, ABU Zaria.

RESULTS

Physical and Chemical Properties of the Soil

Details of physical and chemical properties of the soil taken from the experimental sites (Samaru and Jaji) for analysis during 2018 rainy season are shown in Table 1.The soil textural classes were found to be sandy loam and loamy soil for Samaru and Jaji respectively. Soils from both locations were also found to be low in organic and inorganic mineral nutrients i.e. organic carbon (1.04% for Samaru soil and 1.19% for Jaji soil),while the total N content of soils from Samaru and Jaji were 0.27% and 0.30% respectively. Available phosphorus content from both Samaru and Jaji soils were found to be 6.00 mg kg^{-1} and 9.29 mg kg^{-1} respectively while the exchangeable cations were also low as is the characteristics of most savannah soils (Uruk, 2015), with calcium(Ca) being 2.61 meq/100g and 3.91, magnesium(Mg) content are 0.41 meq/100g(Samaru) and 0.71meq/100g(Jaji), potassium(K) content for Samaru was 0.09 meq/100g while that of Jaji was 0.13 meq/100g and the sodium(Na) content for Samaru was 0.17 meq/100g while that of Jaji was 0.26 meq/100g. The cation exchange capacity of Jaji soil had a higher value at 4.90 than that of Samaru with a value of 3.21.

The results of the study showes that the number of cobs per plant, number of grain per row and cob diameter of maize were significantly affected by the effect of variety (Table 2). There was no significant difference between SAMMAZ 14 and SAMMAZ 16 on number of cobs per plant in both locations but both varieties produced higher number of cobs per plant than SAMMAZ 15. The time of N fertilizer second dose application at both locations was significant ($P \leq 0.05$) on number of cobs per plant where application of second dose of nitrogen at 6 WAS produced significantly higher number of cobs per plant in both locations. The interaction between maize variety and time of nitrogen second dose fertilization was not significant on number of cobs per plant. Table 2 shows that SAMMAZ 14 and 16 had statistically similar number of grains per row and SAMMAZ 15 produced the lowest number of grains per row at Samaru while at Jaji the variety effect was not significant ($P \leq 0.05$) on number of grains per row. Time of application of second dose of N fertilizer was significant ($P \leq 0.05$) on number of grain per row in both locations where application of second dose of nitrogen at 6 WAS produced significantly higher number of grains per row but at per with application of second dose of nitrogen at 7 and 8 WAS in Samaru, while application at 4 WAS recorded the least number of grain per row (Table 2). The interaction between maize variety and time of nitrogen second dose fertilization was not significant on number of grains per row. The variety effect was significant ($P \leq 0.05$) on cob diameter where SAMMAZ 14 and SAMMAZ 16 were statistically similar but both varieties produced significantly bigger cob diameter than SAMMAZ 15 in both locations (Table 2). Application of second dose of nitrogen at 6WAS produced significantly higher cob diameter than other timing regimes in Jaji but at Samaru, there was no significant difference among the various timing regimes except at 4 WAS where cob diameter was significantly lower than any other timing regime of applying second dose of nitrogen fertilizer. The interaction between maize variety and time of nitrogen second dose fertilization was not significant on maize cob diameter.

Table 3 shows cob weight, 100-grain weight and grain yield of maize varieties grown under different timings of N fertilizer second dose application at both locations. SAMMAZ 16 recorded the heaviest cob weight (kg) per plot which was statistically similar with that of SAMMAZ 14 but significantly heavier than that of SAMMAZ 15. At Jaji however, SAMMAZ 16 recorded the heaviest cob weight per plot which was significantly heavier than that recorded by SAMMAZ 14 and SAMMAZ 15 which recorded the lightest cob weight (kg) per plot. At both locations, the time of N fertilizer second dose application at both location was significant ($P \leq 0.05$) on cob weight per plot where application of second dose of nitrogen at 6 WAS produced heaviest cob weight per plot which was significantly different from any other time of application in both locations (Table 3). The interaction between maize variety and time of nitrogen second dose fertilization was not significant on cob weight per plot. Table 3 also showed the varietal response in terms of 100 grain weight that was significant at Samaru but not at Jaji. At Samaru SAMMAZ 14 was statistically similar with SAMMAZ 16 on 100 grain weight but both varieties produced significantly heavier 100 grain weight than SAMMAZ 15. Time of application ofsecond dose of N fertilizer was significant ($P \leq 0.05$) on 100 grain weight in both locations where application of second dose of nitrogen at 6 WAS produced heaviest 100 grain weight which was significantly different from any other time of application in both locations but at per with application of second dose of nitrogen at 5WAS in Samaru (Table 3). The interaction between maize variety and time of second dose fertilization was not significant on 100 grain weight. There was no significant difference between SAMMAZ14 and SAMMAZ 16 on grain yield (kg) per hectare in both locations, but both varieties produced higher grain yield (kg) per hectare than SAMMAZ 15. Application of second dose of nitrogen at 6 WAS produced heaviest grain yield (kg) per hectare which was significantly different from any other time of application in both locations but did not differ significantly from application of second dose of nitrogen at 5 and 7 WAS in Samaru (Table

3). The interaction between maize variety and time of nitrogen second dose fertilization was not significant on grain yield (kg) per hectare.

Table 2: Number of Cobs per plant, grain per row and cob diameter per (cm) response of maize varieties grown under different timings of N fertilizer second dose application at Samaru and Jaji during 2018 wet season.

Treatment	Number of Cobs/Plant		Number of Grain/row		Cob Diameter(cm)	
	Samaru	Jaji	Samaru	Jaji	Samaru	Jaji
Variety (v)						
SAMMAZ 14	1.806a	1.433ab	36.14ab	36.68	4.84a	4.42a
SAMMAZ 15	1.500b	1.400b	35.16b	36.56	4.59b	4.19b
SAMMAZ 16	1.911a	1.488a	36.67a	37.92	4.98a	4.60a
SE ±	0.0964	0.0402	0.406	0.507	0.053	0.063
Significance	*	*	*	NS	**	*
Time of Utilization Second Dose (T)						
4 WAS	1.067c	1.044d	33.49c	30.78e	4.50b	3.99c
5 WAS	1.911b	1.563b	37.14a	39.65b	4.94a	4.34b
6 WAS	2.611a	1.877a	37.59a	43.21a	4.94a	4.84a
7 WAS	1.811b	1.515b	36.38ab	38.59b	4.85a	4.36b
8 WAS	1.744b	1.400b	35.84ab	36.46c	4.82a	4.19bc
9 WAS	1.288c	1.333c	35.50b	33.47d	4.76a	4.06c
SE ±	0.1364	0.0569	0.573	0.717	0.076	0.90
Significance	**	**	*	**	*	**
Interaction						
VXT	NS	NS	NS	NS	NS	NS

Means followed by same letters (s) within the treatment group and location were statistically the same using DMRT at 5% level of significance. NS- not significant

Table 3: Cob weight (g), 100 grain weight (g) and grain yield (kg) per plot of maize varieties grown under different timings of N fertilizer second dose application at Samaru and Jaji during 2018 wet season.

Treatment	Cob Weight (kg)/plot		100 grain weight (g)		Grain Yield (kg)/ha	
	Samaru	Jaji	Samaru	Jaji	Samaru	Jaji
Variety (v)						
SAMMAZ 14	7.17ab	4.18b	38.63a	25.49	3730.9a	2274.1ab
SAMMAZ 15	6.58b	3.47c	35.48b	24.76	3243.2b	1784.3b
SAMMAZ 16	7.86a	4.48a	38.89a	25.98	3887.4a	2587.2a
SE ±	0.335	0.087	0.001	0.001	97.96	84.11
Significance	*	**	*	NS	*	**
Time of Utilization Second Dose (T)						
4 WAS	4.14c	2.76c	30.32d	22.28d	2647.3e	1518.5d
5 WAS	8.58b	4.49b	41.28ab	26.39b	4198.3a	2427.8b
6 WAS	10.30a	5.19a	43.93a	29.82a	4352.3a	2799.6a
7 WAS	7.93b	4.16bc	39.76b	26.67b	4036.6ab	2351.8b
8 WAS	7.70b	4.03c	35.65c	24.56bc	3872.3bc	2105.6bc
9 WAS	4.76c	3.48d	34.46c	23.69cd	3333.4d	1907.4c
SE ±	0.473	0.124	0.002	0.001	138.54	118.95
Significance	*	**	*	**	*	**
Interaction						
VXT	NS	NS	NS	NS	NS	NS

Means followed by same letters (s) within the treatment group and location were statistically the same using DMRT at 5% level of significance. NS- not significant

DISCUSSION

The weather (rainfall, temperature, humidity and sunshine hours) as well as the soil type including it's fertility level at both locations play an important role in explaining the varied responses observed in terms of yield components like number of cobs per plant, number of grains per cob, cob diameter, cob weight (kg) per plot, 100 grain weight (g) and grain yield (kg) /ha at both Samaru and Jaji. This could probably explain why SAMMAZ 16 produced the highest number of cobs per plant, highest number of grains per row, wider cob diameter, heavier cob weight (kg) per plot, heavier 100 grain weight (g) and highest grain yield (kg) /ha than other varieties (SAMMAZ 14 and SAMMAZ 15) evaluated at Samaru than Jaji probably due to higher amount of rainfall (moisture) recorded at Samaru (Appendix I and II) . SAMMAZ 16 as a late maturing variety, took a longer time to grow due to its genetic makeup thereby expressing its full growth potential as a result of its inherent growth characteristics which led to an increase in number of cobs per plant, more number of grains per cob, higher cob diameter, heavier cob weight (kg) per plot, heavier 100 grain weight (g), thus highest grain yield (kg) /ha (Hassan, 2011). . Many researchers like Nazir *et al.,* 2010 have shown that there is a highly significant variability in plaint height, number of leaves and total dry matter production in various maize varieties genotype In terms of the length of growing season among maize varieties.

Application at 6 WAS coincide with the most appropriate time N fertilizer is needed by the growing crop, as it was the period of robust vegetative growth leading to reproductive growth (post an-thesis) stage as described by Valero *et al.,* (2005). It is also at this stage where the roots, rootlets development of the plant is enhanced for anchorage and water/nutrients uptake for photosynthesis.

Hafiz *et al.,* (2011) further reported that application at 6 WAS was for further development of roots and other photosynthetic apparatuses first prior to commencement of reproductive growth stage leading to higher and longer accumulation of higher pre an-thesis assimilates stored within the plant which can be shifted or translocated into higher dry matter yield and grain yield during grain filling stage. Application prior to 6 WAS may be ascribed to luxuriant consumption of Nitrogen during vegetation growth, which may prolong this growth stage against easily commencement of reproduction growth stage (Song *et al.,* 2010). While Application beyond 6 WAS may not be effective as it was applied after the period of need as the effective period of fertilizer use may have passed at this time, application of N fertilizer may be too late for further development of appropriate photosynthetic apparatuses for the plant to attain full growth development (Wang *et al.,* 2011).

CONCLUSION

Based on the findings of this study, it can be concluded that SAMMAZ 16 is the best variety among the tested varieties and application of second dose of N fertilizer at 6 WAS is the best time to apply the second dose of nitrogen fertilizer in the study area. The study has indicated that varieties and time of fertilizer second dose application are among important agronomic practices that enhance performance of maize crop in term of yield and yield components.

REFERENCES

Ado, S.G., Showemimo, F.A., Alabi, S.O., Badu Aparaku, B., Menker, A., Usman, I.S. and Abdullahi, U.S. (2007). Maize Research at I.R.R. Samaru. Pp. 107-177. Badu-Aparaku, B., Fakorede, M.A.B., Lum, A.F., Menkir, A. and Ouedraogo, M. (eds) 2007. Demand-driven technologies for sustaibable maize production in West and Central Africa. *Proceedings of the fifth biennial regional maize workshop,* IITA, Cotonou, Benin, 3-6 May 2005. WECA MAN/IITA, Ibadan, Nigeria, Pp. 515.

Ahmed, D.A., Mohammed, I.B., Miko, S. and Yusuf, S.R. (2014). Grain Yield and Yield Components of Maize (*Zea mays L.*) varieties grown under different levels of organic and inorganic fertilizers: *Biological and Enviornmental Sciences Journal for the Tropic,* 11(3)LISSN0794-9057.

Binder, D.L., Sander, D.H. and Waltss, D.T. (2000). Maize response to time of Nitrogen application as affected by level of Nitrogen deficiency. *Agronomic Journal of Science,* 92:1228-1236.

Brunson, A.M. and Smith, G.M. (1955). Effect of Nitrogen on and Plant Population on the Yield Attributes of Maize. *Indian Journal of Agricultural Research,* 10(20):77-86.

Duncan, D.B. (1955). Multiple Range and Multiple 'F' test. *Biometric,* 11:1-42.

Hafiz M.H Ashfaq .W Javaid A., (2011). Maize response to time and rate of Nitrogen Application Pakistan journal of Botanical season. 43(4): 1935 – 1942 2011.

Hassan N Khan and Baloch, M.S. (2011). Screening Maize Verities for green for grain at Dera Ismail Khan.J.*Animal and plant sci*., 21(3): 626-628.

Halvorson, A.D., Schweissing, F.C., Bartolo, M.E. and C.A. Revle (2005). Corn response to Nitrogen Fertilization in a soil with high residual nitrogen. *Agronomic Journal of Science,* 97:1222-1229.

Hay, R.K.M. and Walker, A.J. (1989). An Introduction to the Physiology of Crop Yield. Harlow: Longman. Pp. 292.

Karim, A.A. and Ramasamy, C. (2000). Expanding Frontiers of Agriculture. Contemporary Issues, Kalyain Publishers, Ludhiana, India.

Kumwenda, J.D.T., Waddington, S.R., Snapp, S.S., Jones, R.B. and Blackie, M.J. (1996). Soil fertility Management research for the maize cropping systems of Small holders in Southern Africa. *A Review of Natural Resources Crops Paper. 96 – 02. Mexico City. International Maize and Wheat Improvement Center* (CIMMYT).

Mohammad, S.A., Prasanma, B.M. and Sing, N.N. (2002). Sequential Path model for determining interrelationship among grain yield and relaters character sin Maize. *Crop Science Journal,* 43:1690=1697.

Muthukumar, V.B., Velayudham, K. and Thavaprakaash, N. (2005). Growth and yield of baby corn (*Zea mays L.*) as influenced by plant growth regulators and different time of nitrogen application. *Research Journal of Agriculture and Biological Science*, 1(4):3003-307.

Nazir H Zaman Q Amjad m Ed Aziz NA (2010). Response of Maize verities Under Agric Ecologixal Condition of Bera Ismail Khan J, Agric res 48 (1) 59-63.

Rizwan, M., Maqsood, M., Rafiq, M., Saeed, M. and Ali, Z. (2003). Maize (*Zea mays L.*) response to split application of nitrogen. *International Journal of Agricultural and Biological Science,* 5(1):19-21.

Schmidt, J.P., Dwjoia, A.J., Feguson, R.B., Taylor, R.K., Young, R.K. and Halvin, J.L. (2002). Corn yield response to Nitrogen at Multiple location in field. *Agronomic Journal of Science,* 94:798-806.

Song JM, Li HS, Dai S, Liu AF Cheng Dg, Liu J,J Zhao ZD (2010). Yield component analysis of jimai 22 with super high yield potential and wide adaptation. *Journal. Nuclear, Agricultural science,24(6):1280-1285*

Tidadale, S.I. and Nelson, W.L. (1975). Soil Fertility and Fertilizers: 3rd Edition, Macmillan Publishing Company, Pp. 65-108.

Valero J.A Juan, Matro, M., Ramirez A.A. Martin Benito J.M.T and Advarez J.F.O., (2005). Growth and Nitrogen use efficiency of irrigated maize in a semi arid region as affected by nitrogen fertilizer *Spermol Journal.de Agricultures*. 134-144.

Wang, X., Chang, J., Qin, G.,Zhang, S., Cheng, X and Li,C. (2011). Analysis of yield components of elite maize variety Xundan 20 with super high yield potential. *African. Journal. Agric Res*earch.,6(24):5490-5495.

Walsh, O.S (2006). Effect of delayed nitrogen fertilization on corn grainy ields. M.Sc. Thesis. Graduate College Oklahoma State University, Oklahoma.

Appendix I: Meteorological data showing monthly and mean annual rainfall, monthly air temperature, relative humidity and sunshine hours in 2016 wet season at Samaru.

Month	Rainfall (mm)	Temperature (^{0}C)		Relative humidity (%)	Average monthly Sunshine hours(from 6am-6pm)
		Max.	Min.		
January	0.00	31.1	14.31	20.11	124.2
February	0.00	33.2	16.68	22.06	116.1
March	24.34	35.19	18.13	46.51	123.8
April	15.16	36.27	21.53	52.92	118.5
May	132.21	32.35	23.5	64.82	120.3
June	249.93	30.63	20.13	74.20	113.8
July	307.06	28.63	19.79	66.21	102.5
August	349.90	27.67	19.50	68.52	89.5
September	282.81	29.62	19.45	69.31	110.8
October	16.97	31.23	18.23	54.45	123.5
November	0.00	30.83	12.80	20.83	9.30
December	0.00	29.10	14.58	20.94	8.86
Mean	134.25	31.44	19.06	53.88	114.2

Source: Meteorological Unit of Institute for Agricultural Research (IAR), Ahmadu Bello

. University, Samaru, Zaria

Appendix II: Meteorological data showing monthly and mean annual rainfall, monthly air temperature, relative humidity and sunshine hours in 2016 wet season at Jaji.

Month	Rainfall (mm)	Temperature (^{0}C)		Relative humidity (%)	Average monthly Sunshine hours(from 6am-6pm)
		Max.	Min.		
January	0.00	30.44	18.93	23.43	124.1
February	0.00	34.89	17.76	27.32	114.5
March	95.11	36.84	22.23	47.03	122.4
April	29.40	36.67	23.10	54.80	117.5
May	24.40	33.94	22.58	68.39	120.1
June	215.80	30.23	21.33	79.73	97.3
July	298.80	29.42	21.06	66.74	71.6
August	304.20	28.16	20.32	72.83	66.4
September	208.41	30.04	21.44	70.34	92.5
October	54.40	32.81	21.52	58.68	121.4
November	0.00	30.53	18.23	28.83	10.51
December	0.00	26.97	14.42	28.61	9.98
Mean	129.01	32.17	21.23	56.04	104.6

Source: Meteorological Unit of Jaji military sub aerodrome,Jaji-Kaduna.