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Evaluation of Maxicrop foliar fertilizer on the performance of Sesame (*Sesamum indicum* L.) in Badeggi North Central, Nigeria.

Usman, A., Gbanguba, U.A., Ismaila, A. and Umar, A.
National Cereals Research Institute, Badeggi, P.M.B. 8, Bida-Niger State

E-mail: alyusman2013@gmail.com

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Abstract

Sesame is an important annual plant belonging to padaliceae family. The crop species has a long history of cultivation, mostly for its yield of oil. In Nigeria, it is cultivated mostly by small holder farmers and not considered as an important crop until recently when its economic benefits were realized and the demand for the crop increased worldwide. A field study was therefore carried out at the experimental upland site of the National Cereals Research Institute, Badeggi, Nigeria ($09^0$3'56"N and $06^0$5'57"E) during the wet cropping season. Treatments used for the experiment were application of maxicrop foliar fertilizer nutrients at the rate of $1ha^{-1}$, applied in four split doses at an interval of 2 weeks each in combination with various rates of NPK fertilizer applied at 3 weeks after planting. The test crop for the experiment was sesame varieties NCRIBEN 01M, NCRIBEN 04E and E8. The experimental design used was a randomized complete block design (RCBD) replicated 3 times. The plot size used for the experiment was 3 m x 5 m. The result of this study indicated that the productivity of sesame was enhanced when maxicrop was applied in combination with NPK fertilizer, hence the use of maxicrop on sesame, can be recommended as complimentary to the application of NPK fertilizer.

Keywords: A Maxicrop, Foliar application, NPK fertilizer, Sesame varieties and Weeks after planting

Introduction

Sesame (*Sesamum indicum L.*) is an oilseed crop generally cultivated on small holdings by resource-poor farmers in the tropics. The crop was first grown in the north central Nigeria. This follows the mandate given to West Africa Oilseed Mission to find out the possibility for the production of groundnut and other oilseed crops (Idowu, 2002).. The traditional agro-ecozone of sesame cultivation is between latitude 6^o and 10^oN (Agboola, 1979), which falls within the guinea savanna where the annual rainfall is usually below 1000mm. However, sesame had been successfully cultivated in areas with annual rainfall above 1000mm and its yields are comparable both in quality to those recorded in the traditional growing areas (Ogunremi, 1985; Ogunremi and Ogunboded 1986).

Although, the crop was not given adequate cultural management practice and recognition as an important oilseed crop initially, it has started to receive wide acceptance in recent times among farmers. This is because of the economic value of its oil in the international market. The crop is now grown mainly for its seeds which contain 50–52% oil, 17–19% protein and 16–18% carbohydrate (Ustimenko-Bakumovsky, 1983), are used mainly for cooking purposes, salad oils and margarine. The oil contains about 47% oleic and 39% linoleic acid and is also used in producing soaps, paints, perfumes, pharmaceutical and some insecticides (Oplinger *et al.,* 1990).

For high productivity of crop, there is need for regular supply of essential elements to develop high photosynthetic capacity and maintain the proper nutrient elements in the leaves (Lawlor, 1995). Micronutrient effects has however been reported by many workers. For instance, Rehm and Alber 2006 observed higher productivity of crops with application of micronutrients. Similarly, the effect of foliar spray of ferrous sulphate was observed by Singh, 2004 to be more effective on Wheat. However, the soil and foliar application of Mn significantly increased the yields to some extend. Soil application of Mn (40 to 50 Kg ha^{-1}) is uneconomical than its foliar spray due to more reversion of soil applied Mn with higher oxide in alkaline soils. Therefore, this study was conducted to determine efficacy of complimenting maxicrop (growth stimulant) with NPK fertilizer on the performance of sesame.

Materials and Methods

The trial was carried out in 2016 cropping season at upland research field of National Cereals Research Institute, Badeggi ($09^0$3'56"N and $06^0$5'57"E). The treatments used for the experiment were application of maxicrop at the rate of 1l/ha, applied on four split doses at an interval of 2 weeks each in combination with various rates of NPK fertilizer applied at 3 weeks after planting. The test crop for the experiment were NCRIBEN 01M, NCRIBEN 04E and E8 varieties of sesame. The treatment combinations are as follow:-

1. Application of maxicrop alone to NCRIBEN 01M
2. Application of maxicrop alone to NCRIBEN 04E
3. Application of maxicrop alone to E8
4. Application of maxicrop + NPK 30:15:15 to NCRIBEN 01M
5. Application of maxicrop + NPK 30:15:15 to NCRIBEN 04E
6. Application of maxicrop + NPK 30:15:15 to E8
7. Application of maxicrop + NPK 60:30:30 to NCRIBEN 01M
8. Application of maxicrop + NPK 60:30:30 to NCRIBEN 04E
9. Application of maxicrop + NPK 60:30:30 to E8
10. Application of maxicrop + NPK 120:60:60 to NCRIBEN 01M
11. Application of maxicrop + NPK 120:60:60 to NCRIBEN 04E
12. Application of maxicrop + NPK 120:60:60 to E8

The trial was laid out in a Randomized Complete Block Design (RCBD) replicated 3 times. The plot size was 3 m x 5 m. Soil sample of the experimental site was collected prior to planting for physiochemical analysis. Also sample of maxicrop was analyzed for its chemical composition. Data collected include lodging rate, branch per plant, root length, root girth and straw weight; others are days to 50% flowering, days to maturity, plant height, number of capsules per plant grain yield. All data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Test (DMRT).

Results and Discussion

The result of the physic4ochemical properties for the experimental site is shown in table 1. The soils are predominantly sandy (89.98%) and slightly acidic with pH, 6.7. moderate in N content (0.19%) and P (12 ppm) and high in K (0.32). which is commonly found in soils of the savanna because of intensive land use and inherent parent material (Dudal, 2002). The chemical composition of maxicrop showed that it is slightly acidic and high in moisture content (88.25%). N and K contents are high and low in P (Table 2).

The effect of maxicrop and NPK fertilizer on plant lodging, branch per plant and days to 50% flowering of Sesame varieties was significant (Table 3). Application of maxicrop alone or in combination with NPK fertilizer to NCRIBEN 01M variety resulted in significantly lodging. However, significantly higher lodging was obtained with

NCRIBEN04E under same treatments. Similarly, the combination of maxicrop with NPK resulted in production of higher number of branches per plant across the varieties. This is an indication that Sesame could grow profusely when maxicrop is applied in combination with NPK fertilizer. This result is in consonant with report of El-Habbasha *et al*, (2007) who observed that seed yield, number of capsules/ plant, 1000-seed weight and seed oil content were increased due to the application of chemical fertilization (NPK) and bio-organic manure in different combinations.

A similar finding was reported by Eidediyi *et al.* 2017, using Neem seed cake in combination with NPK on sesame. Hamideldin and Hussein (2014) recorded increase in the growth and yield of Bemiseed with application of Boron. Application of maxicrop alone on NCRIBEN 01M and NCRIBEN 04E resulted in significantly lesser number of days to 50% flowering. Equally, double recommended rate of NPK with maxicrop across the varieties significantly delayed flowering of Sesame which resulted in more days for the vegetative growth. This shows that with the delays in the production phases, more vigorous plants are likely produced and this enhance the overall yields of Sesame. Application of maxicrop alone to all varieties resulted in lesser number of days to 50% flowering and consequently resulted in lower grains compared to other treatments. The plants are less vigorous and hence the productive outputs are equally low.

Conclusion

The results of this study indicate that application of maxicrop can only be effective in Sesame, when it is used in combination with NPK fertilizer. Therefore, maxicrop use can be recommended as complimentary to NPK fertilizer for use in Sesame.

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Conflict of Interests

The authors declare no conflict of interests

Tables, Figures and Charts

Table 1: Initial Physico-chemical properties of the soils of experimental site and chemical composition of Maxicrop

Soil characteristics, 2013	
Physical	
Sand%	89.96
Silt%	4.28
Clay%	5.76
Textural class	Sandy
Chemical	
pH (H_2O	6.70
Organic carbon %	0.47
Organic matter %	0.83
Total N%	0.19
Available P (ppm)	12.0
Exchangeable bases (cmolKg-1)	
Na	0.21
Ca	1.20
Mg	4.86
K	0.32
Exchangeable Acidity (cmolKg-1)	0.07
CEC (cmolKg-1)	6.73

Table 2: Chemical content of Maxicrop

Parameters	Value
pH	6.75
Moisture %	88.27
Total solid %	11.73
N%	2.16
P%	2.35
K (ppm)	1,780
Na (ppm)	7,500

Table 3: Effect of Maxicrop plus NPK application on Lodging rate, Branch/plant, Root length, Root girth and Straw weight

Treatments	Days to 50% Flowering	Days to maturity	Plant height (cm)	No of capsules/plant	Grain (kg/ha)
NCRIBEN 01M (Maxicrop alone)	55.0^{d}	93.3^{c}	126.6$^{a\ b}$	57.0^{d}	123.4^{f}
NCRIBEN 04E (Maxicrop alone)	55.0^{d}	96.0^{c}	125.6$^{a\ b}$	27.0^{e}	119.5^{f}
E8 (Maxicrop alone)	58.0^{c}	96.0^{c}	131.0^{a}	27.0^{e}	121.2^{f}
NCRIBEN 01M (Maxicrop + ½ Rec. NPK)	57.0^{c}	99.3^{c}	126.3$^{a\ b}$	48.0^{d}	190.7^{d}
NCRIBEN 04E (Maxicrop + ½ Rec. NPK)	58.0^{c}	101.0^{c}	117.3^{c}	39.0^{e}	188.4^{d}
E8 (Maxicrop + ½ Rec. NPK)	58.0^{c}	101.0^{c}	129.3^{a}	35.0^{e}	182.3^{d}
NCRIBEN 01M (Maxicrop + Rec. NPK)	64.0^{b}	108.0^{b}	127.6$^{a\ b}$	89.0^{b}	249.6^{b}
NCRIBEN 04E (Maxicrop + Rec. NPK)	63.0^{b}	100.0^{c}	125.3$^{a\ b}$	47.0^{d}	120.0^{b}
E8 (Maxicrop + Rec. NPK)	63.0^{b}	109.0^{b}	120.0^{b}	63.0^{c}	196.3^{d}
NCRIBEN 01M (Maxicrop +Double Rec. NPK)	70.0^{a}	117.0^{a}	131.6^{a}	98.0^{a}	226.9^{a}
NCRIBEN 04E (Maxicrop +Double Rec. NPK)	70.0^{a}	106.0^{b}	124.3^{b}	88.0^{b}	222.0^{c}
E8 (Maxicrop +Double Rec. NPK)	69.0^{a}	101.0^{c}	114.6^{c}	88.0^{b}	222.7^{c}
NCRIBEN 01M (Rec. NPK)	64.0^{b}	96.0^{c}	134.0^{a}	70.0^{c}	185.2^{d}
NCRIBEN 04E (Rec. NPK)	62.0^{b}	95.0^{c}	114.3^{c}	43.0^{d}	140.6^{c}
E8 (Rec. NPK)	60.0^{c}	97.0^{c}	129.3^{a}	47.0^{d}	122.1f
SE±	1.6	3.4	9.4	6.9	6.1
CV%	4.5	5.9	20.7	13.1	13.1

Means followed by the same letter (s) within the same column are not significantly different at 5% level of probability (DMRT)

Table 4: effect of maxicrop plus NPK application on Days to 50% flowering Days to maturity, plant height, number of capsules/plant and grain yield.

Treatments	Lodging	Branch/plant	Root length (cm)	Root girth (cm)	Straw weight (kg/ha)
NCRIBEN 01M (Maxicrop alone)	1.3[c]	9.0[b c]	10.6	1.7	1106.1
NCRIBEN 04E (Maxicrop alone)	3.3[a]	7.0[c]	9.6	2.4	949.8
E8 (Maxicrop alone)	2.3[b]	8.0[c]	12.3	1.1	1182.2
NCRIBEN 01M (Maxicrop + ½ Rec. NPK)	1.0[c]	11.0[a]	10	1.1	1166.6
NCRIBEN 04E (Maxicrop + ½ Rec. NPK)	3.3[a]	11.0[a]	10	2	995.3
E8 (Maxicrop + ½ Rec. NPK)	1.6[c]	11.0[a]	10.6	1.8	1018.8
NCRIBEN 01M (Maxicrop + Rec. NPK)	1.0[c]	11.0[a]	10.6	1.4	1174.9
NCRIBEN 04E (Maxicrop + Rec. NPK)	2.6[b]	11.0[a]	11.3	1.4	1123.9
E8 (Maxicrop + Rec. NPK)	2.6[b]	10.0[a b]	11	1.8	1125.2
NCRIBEN 01M (Maxicrop +Double Rec. NPK)	1.0[c]	14.0[a]	11	1.7	1180.5
NCRIBEN 04E (Maxicrop +Double Rec. NPK)	2.3[b]	12.0[a]	10.3	2.1	1165.5
E8 (Maxicrop +Double Rec. NPK)	2.6[b]	11.0[a]	10.6	1.2	832.2
NCRIBEN 01M (Rec. NPK)	1.3[c]	9.0b[c]	11	1.8	1162.7
NCRIBEN 04E (Rec. NPK)	3.3[a]	8.0[c]	10	1.9	915.6
E8 (Rec. NPK)	2.3[b]	8.0[c]	10.3	1.8	1093.7
SE±	0.4	0.8	N.S	N.S	N.S
CV%	34.5	13.9	21.7	37.4	19

Means followed by the same letter (s) within the same column are not significantly different at 5% level of probability (DMRT)

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