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PLANT HEIGHT AND FRUIT YIELD OF OKRA AS AFFECTED BY FIELD APPLICATION OF FERTILIZER AND BENLATE IN BIDA, NIGERIA

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ABSTRACT

A factorial experiment involving variety, fertilizer application and fungicide treatment in randomised complete block design was carried out at the Biological garden of the Federal Polytechnic, Bida in the planting seasons of 1999 and 2000 to determine the effects of NPK fertilizer and field benlate application on the growth (height) and fruit yield of four okra varieties. Three seeds/hole were planted on manually prepared ridges at a spacing of 0.30m X 1.00m. Fertilizer was applied as 200Kg/ha NPK (20-10-10) at two weeks after planting (WAP) and 50Kg/ha Urea (46-0-0) top-dressed at 50% flowering. BENLATE at the rate of 20g/20l (w/v) of water was applied at 5WAP and then repeated forth nightly until the experiment was terminated. By the 6,8 and 10 weeks after planting (WAP). the height of ten tagged plants/plot were determined. The numbers of fruits harvested from these tagged plants were also recorded. The results showed that plant height was positively affected by field application of either or both fertilizer and benlate over the control plants. Also, plants treated with both fertilizer and BENLATE had a tendency for more continuous growth and significantly higher fruit yield than those treated differently. This brings higher economic returns to the farmer.

INTRODUCTION

Okra is a widely grown fruit vegetable. It is grown on about 2 million hectares annually in Nigeria (FMAWRRD, 1989). It is one of the leading fruits and vegetables in the Nigerian fresh fruit market on the basis of land area, production volume and value (Taylor, 1996) and it features daily in the diets of most Nigerians. The young shoots and leaves are eaten or used as fodder for sheep and goats, and the stems also contain fibre of considerable strength, which may be used for domestic purposes such as in making fish lines, traps and hammocks (Irvine, 1969).

Okra is an erect, annual crop species growing up to 2m in height. The first pods are ready for harvest in about two months after planting, but plants continue to bloom and set if all pods are harvested at the appropriate time. To enhance production, application of 60Kg/haN, 20Kg/haP and 20Kg/haK have been suggested adequate for okra production (NIHORT, 1976-1986; Adelana, 1985; Ayodele, 1993).

Okra is known to be susceptible to a wide range of diseases and pests, which result in considerable losses at the field and after harvest. In wet weather, fruits can be attacked by various

pathogens (James, 1988) hence the need for pre-harvest fungicidal sprays. Ugoji (1993) showed various fungi colonizing the rhizosphere and rhizoplane of okra.

Most post harvest diseases originate in the field where pathogens attack growing and mature produce. Part of the strategies suggested for post harvest loss prevention by James (1988) include the use of an integrated crop management system involving pre- and post-harvest chemical sprays using BENLATE[1] (Benomyl), to reduce spoilage of fruits after harvest.

There are few reports on effects of fertilizers (chemical and organic) on fruit and seed yields of okra but not on growth parameters. No report on the effect of field fungicidal sprays on yield or as part of the integrated control programmes of disease organisms in okra has been found. This study therefore was to investigate the effect of field application of fertilizer and benlate on the growth and fruit yield of okra.

MATERIALS AND ETHODS

The factorial experiment involved variety (4 levels); fertilizer application (2 levels - absent or present), benlate treatment (2 levels - absent or present) and three replications in a randomised complete block design on $9m^2$ plot sizes. Seeds of four okra varieties-Jokoso, LD88/1-8-13-2, LD88/1-8-26-2, and NHAe 47-4 obtained from the National Institute for Horticultural Research (NIHORT), Ibadan were soaked in water for 24hrs and planted 0.30m apart on manually prepared ridges (1.00m apart) in the biological garden of the Science Laboratory Technology Department of the Federal Polytechnic, Bida at the rate of 3seeds/hole in the planting seasons of 1999 and 2000 respectively beginning from June of each year. At germination, plants were sprayed with CYMBUSH (Cypermethrine) EC insecticide at the rate of 5ml/10l of water for the control of flea beetles and other leaf-eating insects. This was repeated weekly for another 4weeks.

Fertilizer at the rate of 200Kg/ha NPK (20:10:10) was applied by continuous banding on one side (NIHORT, 1986) to the plants at two weeks after planting. The second dose was applied at 50% flowering as a top dressing of urea (46:0:0) at the rate of 50Kg/ha. BENLATE (50% wettable powder) at the rate of 20g/20ml (w/v) of water was sprayed on the okra plants starting from the 5^{th} WAP. This also was repeated forth nightly till the end of the experiment.

The experimental plots were kept weed free all through the experiment by manual weeding and by hand pulling of weeds. The first major weeding was at 3WAP while the second was at 3 –4 weeks later (Ogazi *et al.*, 1997). Hand pulling of weeds was on a continuous basis.

The effect of the treatments on plant growth (height) was determined by plant height measurements of 10 randomly tagged plants/plot with the aid of a tape rule by the 6^{th}, 8^{th} and 10^{th} WAP. The effects of the treatments on fruit yield was determined by recording the numbers of matured harvested fruits from the 10 randomly tagged plants/plot. Analysis of variance (ANOVA) was carried out using the MINITAB statistical package on the measured (collated) data. The Least Significant Difference (LSD) method was employed to separate between the means.

RESULTS AND ISCUSSION

Height results are presented in Tables 1- 6 while yield results are presented in Tables 2,3 and 7.

Table 1 shows the result of the analysis of variance (ANOVA) for effect of fertilizer and BENLATE on okra height at 6,8 and 10 WAP. Significant differences were observed between the varieties, treatments, WAP, and in the interactions between variety and WAP on one hand and also treatments and WAP on the other hand.

Table 2 shows that LD88/1-8-26-2 was significantly taller than the other varieties whose height were not significantly different from one another.

Table 3 shows no significant difference in height between plants treated with only fertilizer and those treated with both fertilizer and benlate. Both were significantly taller than the control plants and those treated with only benlate. The later were not significantly taller than one another.

[1] Registered trademark of E.I Du Pont de Nemours & Co. (Inc.)

Table 1. ANOVA for okra height at 6, 8, & 10 WAP

Source	DF	SS	MS	F
Variety {a}	3	12265	4088.2	19.15**
Treatment {b}	3	17275	5758.3	26.98**
WAP {c}	2	72556	36278.1	169.95**
a X b	9	3397	377.5	1.77
a X c	6	3992	665.3	3.12**
b X c	6	5419	903.1	4.23**
a X b X c	18	831	46.2	0.22
Error	96	20493	213.5	
Total	143	136228	952.6	

Table 2. Plant height and fruit number as affected by variety

Variety	Height (cm)	Fruit number
Jokoso	41.089B	24.667A
LD88/1-8-13-2	43.236B	23.917A
LD88/1-8-26-2	61.897A	22.580A
NHAe47-4	38.494B	19.333B

Figures along the same column with different letters are significantly different. (P=5%) N =36(Pant height), 12(Fruit number).

Table 3 Plant height and fruit number as affected by treatments

Treatment	Height (cm)	Fruit number
Control	35.450B	19.167C
Only benlate	35.006B	22.917B
Only fertilizer	57.253A	21.833B
Both fertilizer and benlate	57.008A	26.583A

Figures along the same column with different letters are significantly different. (P=5%) N =36(Pant height), 12(Fruit number).

Table 4. Plant height as affected by WAP

WAP	Plant height
6	20.619C
8	42.656B
10	75.262A

Figures with different letters are significantly different. (P=5%) N =48

Table 4 shows significant differences in plant height by the 6th, 8th and 10th WAP. Plant height significantly increased as WAP increased.

The effect of the interaction between variety and WAP on height is shown in Table 5. No significant difference in plant height was observed by the 6WAP. By the 8th and 10th WAP, LD88/1-8-26-2 was significantly taller than the other varieties. By the 10th WAP, LD88/1-8-13-2 was significantly taller than NHAe 47-4 but was not significantly taller than Jokoso.

Fig. 1 shows that the growth rate of LD88/1-8-26-2 was very high compared with that of the other varieties between the 6th and 8th WAP. While the slow growth rate of NHAe 47-4 may be genetically determined, those of Jokoso and LD88/1-8-13-2 may have resulted from delayed germination. LD88/1-8-26-2 and NHAe 47-4 germinated within 3-5 days of planting while Jokoso and LD88/1-8-13-2 took between 10-14 days to germinate (reasons for late germination not clear). Thus, the faster germinating varieties would have started growing before the late germinating varieties emerged.

Table 5. Plant height (cm) as affected by variety and WAP

Variety	Weeks after planting (WAP)		
	6	8	10
Jokoso	17.642E	35.725D	69.900BC
LD88/1-8-13-2	17.867E	37.958D	73.883B
LD88/1-8-26-2	26.442DE	60.175C	99.175A
NHAe47-4	20.525E	36.867D	58.092C

Figures along the same row or column with different letters are significantly different. (P=5%) N =12.

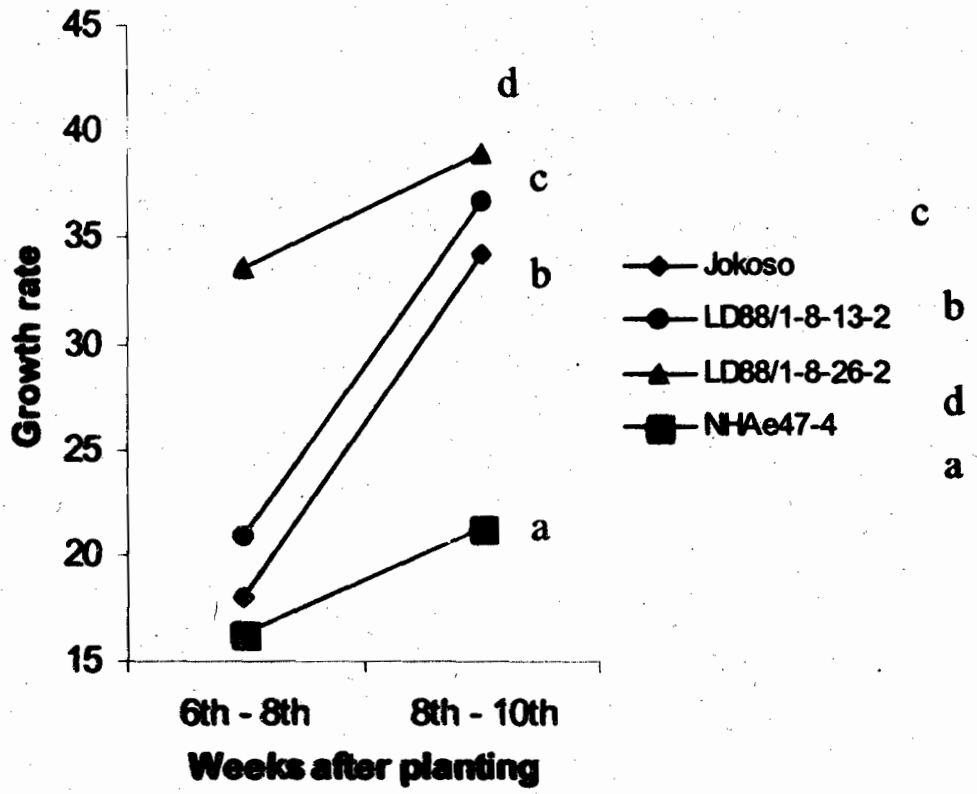

Fig. 1. Plant growth rate as affected by variety

The effect of the interaction between treatments and WAP on okra plant height is shown in Table 6. The heights of plants from the control and only benlate treated plants were significantly shorter than those from only fertilizer and both fertilizer and benlate treated plants by the 8th and 10th WAP.

Although there was no significant difference in the height of the plants from the different treatments at 6WAP, the height attained by plants treated with only fertilizer or both fertilizer and benlate by the 6th WAP was not significantly different from that attained by plants treated with only benlate and those from the control plants by the 8th WAP. Similarly, the height attained by

plants treated with only fertilizer, and both fertilizer and benlate by the 8th WAP was not significantly different from that attained by plants treated with only benlate and those from the control plants by the 10th WAP. The effect of benlate on okra plant growth becomes much more evident as the number of applications increase. The growth rate of okra plants as affected by treatments are shown in Fig. 2.

Evidently, only fertilizer and both fertilizer and benlate treated plants had a faster rate of growth than the control and only benlate treated plants. Between the 6 - 8 and 8 - 10 WAP, the rate of growth of only fertilizer treated plants was comparable with those of both fertilizer and benlate treated plants. Likewise, the growth of only benlate treated plants was comparable with those of the control plants. However, the effect of benlate on the growth of the plants is much more evident by the 10th WAP (after three applications). The rate of growth of plants with BENLATE treatments shows increasing trend over the others.

Table 6. Plant height (cm) as affected by treatments and WAP

Treatments	Weeks after planting (WAP)		
	6	8	10
Control	16.492D	33.125C	56.733B
Only benlate	17.100D	31.375C	56.542B
Only fertilizer	25.292CD	54.283B	92.183A
Both fertilizer and benlate	23.592CD	51.842B	95.592A

Figures along the same row or column with different letters are significantly different. (P=5%) N =12.

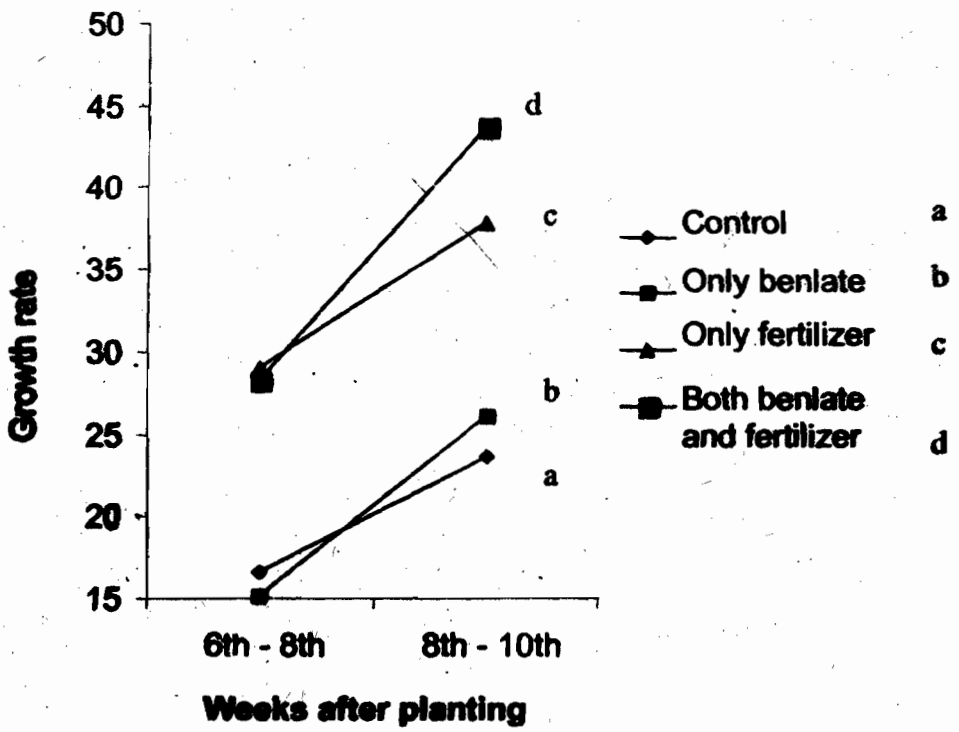

Fig.2. Plant growth rates as affected by treatments

The relationship between variety, treatment and fruit yield is shown in the ANOVA result in Table 7. Both the okra varieties and the treatments applied significantly affected fruit yield but the interaction between them was not significant.

The treatment means (Table 3) show that plants treated with both fertilizer and benlate produced a significantly higher number of harvestable fruits than plants treated differently. This shows that field application of both fertilizer and benlate is profitable for increased fruit yield. No significant difference was observed between the number of fruits produced by plants treated with only benlate and those treated with only fertilizer, although, both produced a significantly higher number of fruits than the control plants.

Table 7. ANOVA for fruit number/plot

Source	DF	SS	MS	F
Treatment (a)	3	340.08	113.361	12.37**
Variety (b)	3	200.08	66.694	7.28**
a X b	9	87.75	9.750	1.06
Error	32	293.33	9.167	
Total	47	921.25	19.601	

Fertilizer has been shown to enhance okra fruit production (NIHORT, 1976-86; Adelana, 1985; Ayodele, 1993). The applied benlate may have controlled some of the field fungi (James, 1988; Ugoji, 1993) resulting in increased height and yield of only benlate treated plants over those of the control. The higher number of fruits will give a higher economic return since sale of okra fruits in most Nigerian markets is by 'bulk' and not by weight.

The effect of variety on fruit yield is shown in Table 2. Varieties Jokoso, LD88/1-8-13-2 and LD88/1-8-26-2 produced higher fruit number than variety NHAe 47-4. The higher fruit yielding varieties will also likely give higher economic returns.

The increased growth rate shown by Jokoso and LD88/1-8-13-2 between the 8-10WAP would have made them have a comparable growth with LD88/1-8-26-2 by and by. This may probably have resulted in the non-significant difference in the fruit number/plot produced by these three varieties (Table 2). NHAe 47-4 with a slower growth rate would probably have been significantly shorter than the other varieties by the end of the experiment and this would have resulted in its significantly low number of fruits produced/plot.

CONCLUSION

This study has shown that the height and yield attainable by okra plants is affected by treatments applied. It has also demonstrated that only fertilizer treatment has more positive effect on the growth of okra plants than only BENLATE treatment but may not result in a significant difference in the number of fruits produced. It has also shown that okra plants treated with both fertilizer and BENLATE show a more continuous rate of growth than those treated differently and will therefore likely continue to produce fruits longer than plants treated differently under normal agronomic conditions (this is evident from the significantly higher number of fruits produced). This will result to greater economic returns for the farmer. The taller height of the plants so treated will also make available more leaves and stem fibre for the other uses (Irvine, 1969).

REFERENCES

Adelana, B.O. (1985). Effects of N, P and K fertilizers on the yield of okra in south Western Nigeria Samaru J. Agric. Res. 3(2): 67 – 72.

Ayodele, O.J. (1993). Yield responses of okra (A. esculentus {L.} Moench) to N, P and K fertilization NIHORT Research Bulletin No. 13.

FMAWRRD (Federal Ministry of Agriculture, Water resources and Rural Development) (1989). Fertilizer use and management practices for crops in Nigeria. Series N0. 2. W. O. Enwezor et al. (eds.) Fertilizer procurement and distribution division, Lagos.

Irvine, F.R. (1969). Vegetables. In: West African crops. Oxford University Press.

James, A.T. (1988). Post harvest biodeterioration of okra (A.esculentus {L.} Moench. Ph.D Thesis, University of Ibadan, Nigeria.

NIHORT (National Institute for Horticultural Research)(1876 – 1986). Advances in fruit and vegetable research at NIHORT. A commemorative publication to mark the 10th anniversary of the National Horticultural Research Institute (NIHORT), Ibadan.

Ogazi, P.O., U.A. Hassan, and A.A. Ogunwusi (1997). Boosting the supply of Agricultural raw materials for industrial use: The RMRDC experience. Raw mzterials Research and development council, Abuja, Nigeria. National Library of Nigeria Cataloguing in Publication Data.

Taylor, O.A. (1996). Preservation, storage, processing and marketing of horticultural produce in Nigeria. Proc. 14th HORTSON Conference, Ago-Iwoye, 1-4 April 1996, 9-13.

Ugoji, E.O. (1993). Fungi in the rhizoplane and rhizosphere of Abelmoschus esculentus. Nig. J. Botany. 6: 61 – 69.