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IRRIGATION LEVELS AND FERTILIZER DOSE IN DRIP IRRIGATED OKRA CROP

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ABSTRACT
Experiments in the field were conducted during the 2012/2013 dry season farming at the Kaduna Polytechnic Demonstration Farm, Nariya, Kaduna which aimed at knowing the optimum irrigation level and doses of fertilizer. The layout chosen for this experiment was randomized block design including three applications. The fertigation treatments applied were 60% of recommended dose of fertilizer (F_1), 80% of recommended dose of fertilizer (F_2) and 100% of recommended dose of fertilizer (F_3) in main plots. Three irrigation levels based on crop evapotranspiration were 0.6Etc (I_1), 0.8Etc (I_2) and 1.0Etc (I_3). Okra yield was maximum in I_2F_2 treatment (204kg/ha) with an increased yield of 27.45% over traditional method. The result revealed that there was significant effect of irrigation and fertilizer treatment as well as its combination on yield but the effect was not significant on plant height.

Keyword: Drip irrigation, okra, fertigation

INTRODUCTION
Drip irrigation with fertigation offers the possibility of precisely placing irrigation water and nutrients to the plant root zone at the timing and frequency needed to enhanced the agricultural production, water use efficiency and nutrient use efficiency. Wetting pattern near the crop and the soil water spatial distribution, matric potentials and concentration of fertilizer are dependent mainly on hydraulic properties of soil, emitter release rate, spacing, arrangement, water irrigation amount and frequency, plant water up take rate and root distributor design (Gardenes et al., 2005). An effectively designed drip fertigation

system provides waters and nutrients at a rate and frequency, that optimizes crop water and nutrients up takes also reducing leaching of nutrients and chemicals from the root zone in agricultural fields (Gardenes et al., 2005).

Okra (Abelmosclus esculentus) is also known Kubewa, bamia, ladies fingers, gumho e.t.c. The seed pods turn fibrous and woody quickly, so the fruit most be harvested in between the first week of the pollination of fruit for eating. The fruit to be consumed as vegetable picked immature. It is the vegetable with high nutritive value and is well adapted to tropical conditions. Aromatic eligible oil and proteins of high biological value can be extracted from okra fruit (Cardoso and Berni, 2012).

Keeping in view the importance of water and available nitrogen for plant growth, the present surely was planned to study the optimum irrigation level and fertilizer dose in drip irrigated okra crop.

MATERIALS AND METHOD

The study was carried out at the Kaduna polytechnic school farm nariya which is on latitude 10^{o} 16, N and longitude 7^{o} 21 E at an altitude of 600m above the mean sea level, dairy the dry season, January to April 2012. The region falls within the Savanna root with dry, sub-humid with severe deficit in rainfall for October to May each year and a surplus from June to September with an annual raw fuel of 1200mn. The average incoming solar radiation, range from 12.3ms/m^2/day in December to 15ms/m^2/day in March, (Olorunaiye, 2009). Drip irrigation method with fertigation ensures an efficient and cost-effective method for irrigation and nutrient application to crops (Bar-Yosef, 1999). Fertigation along with irrigation aids the application of fertilizers which are readily soluble with other chemicals, efficiently and more uniformly (Patel and Kajput, 2000; Narda and Chawla, 2002). The range in solar radiation implies that light are temperature do not greatly limit potential crop production at any time of the year. The mean daily temperature from November to mid February is severally low an range from 19^0 to 25^0c, while for the remaining months of the year, the mean daily temperature ranges between 25^0c and 32^0c. This temperature regime throughout the year is suitable for growing most crops under rain-fed agriculture and subtropical crop such as wheat, tomatoes, onion and others during the irrigation season of November to May (olorumaiyie, 2009). The experiment was laid in a randomize complete block design. Irrigation plans were decided based on crop evepotranspirations. The crop evepotransipiration was calculated by the multiplications of the potential evapotranspiration and crops coefficient values. The potential

evapotranspiration was calculated by using Penman Montheith method. Water was applied every alternative days different irrigation treatments used were;

60% of crop evaportranspiration (I_1)
80% „ „ „ „ „ (I_2)
100% „ „ „ „ „ (I_3)

The treatment in this study consisted of three fertilizer doses based on recommended fertilizer (92kg/ha) are three irrigation level based on crop evapotranspiration. The fertilizer was applied in 17 equal splits and interval. Different fertigation treatments used were:

60% of recommended fertilizer of N (F_1)
80% „ „ „ „ „ N (F_2)
100% „ „ „ „ „ N (F_3)

The number of plants in different treatment was counted at regular interval that is 40, 80 and 120 days after sowing (DAS). The height of selected plants was measures with the help of measuring scale. The height was observed from the base to the growing tip are average value for each was calculated. Total weight of harvested fruits from each treatment during each picking was noted till the fruits harvest and the total yield of fruits per hectare under different treatment was computed.

RESULT AND DISCUSSION

Crop performance parameter for different irrigation treatments included plant height and okra yield. Plant height as observe at 40 DAS under drip fertigation treatment (Table 1) showed that maximum average plant height was obtained in I_2 F_2 treatment (46.3cm) followed by I_3 F_2 (43.0cm) treatment which was statistically at par with other drip fertigation combination treatment, whereas minimum plant height was observed in I_1 F_1 treatment (18.1m). considering only the effect of fertilizer levels, F_2 treatment was best followed by F_3 and F_1. F_2 treatment was statistically at par with F_3 treatment, but both were significantly better that F_1 treatment. Also, considering irrigation level only, l_3 was the best followed by I_2 and I_1 treatment. Plant height under control treatment was 34.9cm

Table1: effect of different drip treatment on plant height of okra crop

Treatment	Plant height (%)		
	40DAS	80DAS	120DAS
I1 F1	18.1	47.2	89.7
I1 F2	35.4	55.4	96.5
I1 F3	29.5	56.0	95.9

I2 F1	25.7	51.8	81.8
I2 F2	46.3	56.5	93.5
I2 F3	40..2	54.7	94.2
I3 F1	38.6	56.4	91.9
I3 F2	43.0	58.4	93.3
I3 F3	45.5	56.8	93.7
Control	34.9	44.3	70.8
C.D (p=o.o5)	2.8	6.3	3.0

Plant height as observed at 80 DAS under drip fertigation treatments showed that maximum average plant height was obtained in I_3 F_3 treatment (56.8cm) followed by I_1 F_3 (56.ocm) treatment which was statistically at par with all other drips fertigation combination treatment, whereas minimum plant height was observed in I_1 F_1 treatment (47.2cm). Considering only the effect of fertilizer level, F_3 treatment was best followed by F_2 and F_1. F_3 treatment was statistically better than F_1 treatment. Also, considering irrigation level only, I_1 was the best followed by I_2 and I_3. I_1 treatment was statistically at par with I_2 and I_3 treatments. plant height under control treatment was 44.3cm.

Plant height as observed at 120 DAS under drip fertigation treatment showed the maximum average plant height was obtained in I_1 F_3 treatment (95.9cm) followed by I_3 F_2 (93.3cm) Statistically at payr with I_1 F_1 and I_1 F_3 treatment, whereas minimum plant height was observed in I_2 F_1 treatment(81.8cm). considering only the effect fertilizer level, F_3 treatment was the best followed by F_2 treatment, but both were significantly better than F_1 treatment. Also, considering irrigation levels only, I_1 was the best followed by I_3 and I_2. I_1 treatment was statistically at par with I_3 and I_2 treatment. Plant height under control treatment was 70.8%. The variation in result has due to the climato logical factors mainly the participation and evaporation. The result showed the same trend as reported by Norda and Lubana (2002), singh and Rayput (2007) and Al-harbi et al. (2008).

Crop yield obtained under combination of three different fertilizer levels and three drip irrigation levels and presented in Table 2. Under drip fertigation treatments, average maximum yield obtained was in I_2 F_2 treatment (204kg/ha) followed by I_3 F_2 (199kg/ha) treatment. Minimum okra yield was obtained in I_1 f_1 treatment (148kg/ha). Considering only the effect of fertilizer levels, F_2 treatment was best followed by F_3 and F_1. Both the treatment F_2 and F_3 were significantly better than F_1. Also, considering irrigation levels only, I_2 was best

followed by I_3 and I_1. I_2 treatment was statistically at par with I_3 treatment, but significantly better that I_1, treatment under control treatment average okra yield was 159kg/ha. The best drip fertigation treatment (I_2F_2) which was (204kg/ha). In terms of okra yield showed 27.45 % increased yield in comparison to control. Split application of nutrients, by drip fertigation as compared to traditional furrow method may have resulted in reduced nutrients wastage and hence, leading to better yield in drip fertigation method. Systematic and frequent use in drip irrigation resulted in maintaining optimum soil moisture condition in the plant root zone leading to higher water nutrient availability to the plant (Rekha et al., 2005). It is clear from the statistically analysis that the difference levels of fertilizers, irrigation are their combination had significant effect on the okra yield. The similar trend of increase in yield was reported by sunilkumar and Jaikumar (2002), serve et al., 2002), Mishara et al., 2009), Konyeha nd Alatise (2013).

Table 2: Okra yield under treatments

Treatment	Okra yield (kg/ha)
I_1 F_1`	147.7
I_1 F_2	167.3
I_1 F_3	171.6
I_2 F_1	153.1
I_2 F_3	204
I_2 F_2	187.2
I_3 F_1	190.8
I_3 F_2	199
I_3 F_3	189.8
Control	159
C.D (p=0.05)	148.4

CONCLUSION

The maximum plant height was observed under the treatment I_1 F_3 which was 95.5 cm on 120 DAS and minimum was 18.1cm for I_1 F_1 on 40 DAS. Traditional method gave a height of 38.24, 44.26 and 74.2 on 40, 80 and 120 DAS, respectively. There was significant effect of irrigation and fertigation but combination had non-significant effect plant height. It was observed that for all the irrigation treatment that with an increase in fertilizer amount resulted in increased plant height. The rate of increases in plant height was observed to be

less during initial months and increases with the growing period. There was significant effect of irrigation, fertigation and combination from the yield of the okra. Okra yield was maximum (204kglha) in I_2 F_2 treatment and minimum (147.7kglha) in I_1 F_1 treatment. There was an increase of 27.45% yield of I_2F_2 treatment over the traditional method which have yield of 159kglha.

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