Pak. J. Agri. Sci. Vol. 38(1-2), *2001*

EFFECT OF DIFFERENT SOWING DATES AND VARIOUS DOSES OF FERTILIZERS ON JUVENILITY AND PRODUCTIVITY OF OKRA

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Seeds of okra cv. Pusa Sawani were sown in the field on various dates i,e. April 15, April 25 and May 5, using different levels of N and P fertilizers. Maximum germination percentage was observed when crop was sown on either April 25 or May 5. Plant height, number of days to flower and length of green pod were not affected by the sowing dates. Number of leaves per plant, number of pods per plant and green pod yield were higher when crop was sown on April 15 or May 5. Germination percentage, green pod length and yield were not influenced by different levels of fertilizers used. Maximum plant height, number of leaves per plant, number of days to flower and number of pods per plant were obtained with the highest fertilizer dose (150 kg N + 80 kg Pps ha'I). Germination percentage, number of days to flower and length of green pods were not influenced by the interaction between sowing time and fertilizer dose. Maximum plant height, number of leaves per plant, number of pods per plant and green pod yield were recorded when the crop was sown on May 5 and given the highest dose of fertilizers (150 kg N + 80 kg Pps ha"). Key words: *Abelmoschus esculentus,* juvenility and productivity of okra, sowing dates

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is a popular home garden vegetable and is commercially grown in many parts of the world. In Pakistan, it is grown throughout the country.Though climatic conditions are favourable for getting maximum yield, average yield in the country is much lower (7.88 t ha") compared to that of several other countries. Proper sowing time and fertilizer application seem to play an important role in the yield of this crop. Singh et al. (1988) compared four sowing dates (June 20 to August 4) and four plant spacings. Maximum seed yield (1844.12 kg ha:') was obtained when crop was grown on June 20 at a spacing of 45 x 30 cm. Seeds of okra cv. Pusa Sawani were sown by Bhuibhar et al. (1989) during the Kharif season on July 4, July 19 and August 3. Plants from the earliest sowing produced the highest yields and quality green pods and seeds. Lenka et al. (1989) conducted a field on trial on okra cv. Parbhanikranti by applying 4 levels of N (0, 50, 75, and 100 kg ha"), 2 levels of Pps (30 and 60 kg ha:') and ~O at a constant rate of 40 kg ha", N and P significantly increased plant height, yield and its attributes. N at 100 kg ha·' and Pps at 30 kg ha" gave a satisfactory seed yield. Arora et al. (1991) compared growth and yield of a new okra cv. Punjab Padmani with that of Pusa Sawani grown under variable N (0, 30,60 and 90 kg ha") and P (0, 30 and 60 kg ha:') applications. Plant height, number of fruits, fruit size and total green fruit yield were significantly improved by application of 90 kg N ha" and 60 kg P ha", A significant increase in marketable yield for both cultivars was also obtained with an increase in N application from 0 to 90 kg ha:' and P from 0 to 60 kg ha': Hassan (1992) observed the effect of different dates of sowing (i,e. Feb. 12, Feb. 26 and March 12) on the development and early productivity of okra. Mean values of the treatments indicated that the crop sown on March 12 attained significantly the highest position followed by that of February 26. Naik and Srinivas (1992) applied N at 50, 100, 150 or 200 kg ha-I, P at 30, 60 or 90 kg of Pps ha'ı and K at 40 kg ~O ha" to okra cv. Pusa Sawani grown on a sandy loam soil with low available N and P. The highest seed yields were obtained with 200 kg N ha" and 90 kg Pps ha", Other parameters (fruit length, number of fruits per plant, number of seeds per fruit and 1000-seed weight) were significantly high with the highest rate of fertilizer application. Anjum and Amjad (1999) applied various doses of N, P and K fertilizers to okra cv. Pusa Sawani. Seed germination was not affected by the fertilizer application while plant height, number of leaves per plant, number o{ pods per plant, pod length and green pod yield were the highest at the highest dose of fertilizer (125 kg N + 100 kg P_2O_5 + 80 kg ~O 'ha'I). Hence, to boost up the productivity of okra and extend the period of its availability in market, determination of proper sowing time and application of optimum dose of fertilizers is essential: The present study was thus conducted to find out the effect of different sowing dates and various doses of N and P fertilizers on juvenility and productivity of okra.

MATERIALS AND METHODS

This study was conducted at the Vegetable Research Area, Department of Horticulture, University of Agriculture, Faisalabad. The physico-chemical characteristics of the soil used for this study, as determined by the method of U.S.

Salinity Lab. Staff (1954) are given in Table 1, Okra cv. Pusa Sawani was sown in the field on April 15 (S.), April 25 (S2) and May 5 (S3)' under different levels of N and P fertilizers. The sources of nitrogen and phosphorus were urea and single super phosphate respectively. These fertilizers were combined in different proportions and the doses used were: F_1 = control (0 kg N ha:', 0 kg *Pps* ha"), F_2 = 100 kg N + 60 kg *Pps* ha:' and F_3 = 150 kg N + 80 kg *Pps* ha,l. The first dose of nitrogen was applied at the time of sowing the crop while the other was applied at the time of appearance of flowers. The phosphorus was applied as a whole at the time of sowing. The experiment was laid out in a split plot design with three replications, keeping the fertilizer levels in main plots and sowing dates in subplots. The soil was prepared well before sowing. Seeds were sown on both sides of beds prepared 60 cm apart keeping plant to plant distance of 30 cm. The field was irrigated immediately after sowing and subsequent irrigations were applied at fortnight intervals. The crop was kept free from weeds during the entire growth period through hoeing manually.

After recording the seed germination percentage, ten plants were tagged in each plot randomly to record the data on plant height (cm), number of leaves per plant, number of days required to flower, number of pods per plant, green pod length (cm), green pod yield per plant (g) and per hectare (t). The data collected were analysed statistically using the Fisher's analysis of variance technique and the treatment means were compared using least significant difference test (LSD) at 5% probability (petersen, 1994).

RESULTS AND DISCUSSION

Germination Percentage: Maximum germination was recorded when crop was sown on April 25 or May 5, showing statistically an alike behaviour on both the dates, while significantly minimum germination was rec-ordedwhen crop was sown on April 15 (Table 2). This could be due to the effect of prevailing environmental conditions especially temperature and humidity on seed germination. Fertilizer treatments and their interaction with sowing dates had no significant effect on seed germination (Tables 3 and 4).

Plant Height: Plant height was not affected significantly by the time of sowing and it was almost the same at each of the sowing date (Table 2). However, plant height was significantly affected by various fertilizer doses and their interaction with sowing dates. Maximum plant height was attained when the highest fertilizer (150 kg N + 80 kg *Pps* ha:') dose was applied. This was followed by 100 kg N + 60 kg *Pps* ha", both the treatments showed statistically similar results (Table 3). Increase in plant height has also been reported by several workers (Lenka et al., 1989; Arora et al., 1991; Anjum and Amjad, 1999). As far as the interaction was concerned, crop sown either on April 15 or May 5 and fertilized at the highest fertilizer level resulted in maximum plant height. However, minimum plant height was recorded when crop was sown on May 5 and received no fertilizer (Table 4). The results reflected the natural phenomena that fertilizers especially nitrogenous affect the plant growth regardless of sowing time. This could be the reason that when higher dose of fertilizers was applied, it increased height of the plants.

Number of Leaves per Plant: Maximum number of leaves was recorded when crop was sown on April 15 or May 5. Minimum number of leaves was recorded when crop was sown on April 25 (Table 2). Significantly more number of leaves was also recorded on the plants receiving fertilizer compared to those plants given no fertilizer (Table 3). In case of interaction, more leaves were produced on plants sown on May 5 and received the highest dose of fertilizers (Table 4). This combination showed results that were significantly different from all other treatments, followed by those of the crop sown either on April 15 or May 5 and received fertilizers (F_3 and F_2). These results explain that fertilizer application enhances the plant growth as shown by increased number ofleaves per plant compared to control,

Number of Days to Flower: Time required to flowering was not affected by the sowing dates (Table 2). However, maximum number of days was required to flower when the highest fertilizer dose (F3) was used, followed by the next lower dose of fertilizer (F2)' This could be due to nitrogen, which increased vegetative growth of the plants resulting in delayed flowering. Minimum number of days was required to flower where no fertilizer was applied probably due to the nutrient stress resulting in early flowering (Table 3). The interaction between sowing time and fertilizer doses was also non-significant (Table 4).

Number of Pods per Plant: Maximum number of pods per plant was harvested when crop was either sown on April 15 or May 5, while minimum number of pods was recorded when crop was sown on April 25 and it differed significantly from those of other sowing dates (Table 2). All the fertilizer treatments differed significantly from each other. Maximum number of pods was also harvested when the highest dose of fertilizer was applied, while the number was minimum when no fertilizer (control) was applied (Table 3). Number of fruits would depend on intensity of growth of the plants. Higher doses of fertilizer should ordinarily enhance the plant growth an consequently affect the number of pods. Precisely this has been observed in the present study as higher dose of fertilizer expressed superiority over lower dose and control. Interaction between sowing dates and fertilizer doses indicated that the crop sown on May 5 and given the highest dose of fertilizers resulted in maximum number of pods per plant (Table 4). Availability of nutrients makes the plant to bear more number of flowers and reduces

chances of flower drop resulting in more number of fruits per plant. The results of the present study conform to those of Arora et al. (1991), Naik and Srinivas (1992) and Anjum and Amjad (1999) who reported higher number of pods per plant with higher fertilizer dose.

Green Pod Length: It was neither statistically affected by sowing dates nor by fertilizer doses and their interaction (Tables 2, 3 and 4). This was probably because the pods were harvested at edible maturity which was almost the same in all the cases. Green pod yields were higher when crop was sown either on April .15 or May 5. Both the sowing dates behaved statistically alike for the yield parameter. Minimum yields were recorded when crop was sown on April 25. These results are at par with those of April 15 sowing (Table 2). This could be due to the effect of prevailing environmental conditions on flowering, pollination and subsequent pod development. Differences in yield was also reported by several workers due to different times of sowings (Singh et al., 1988; Bhuibhar et al., 1989; Hassan, 1992). This was interesting to note that green pod yield was not affected by the fertilizer application (Table 3). Under the circumstances it was difficult to explain why the yield was not influenced by the application of fertilizers. However, the results regarding interaction between sowing dates and fertilizer doses were significant (Table 4). The highest green pod yield, which significantly differed from all other combinations, was obtained when crop was sown on May 5 and received the highest dose of fertilizers. This was followed by the crop sown on April 15 using the same dose of fertilizers, while all other combinations showed statistically the same trend.

Table 1. Physico-chemical characteristics of soil used for the study

Characteristics	Unit	Quantity
Sand	%	52.5
Silt	%	20.9
Clay	%	26.6
Textural class	-	Sandy clay loam
pH	-	7.8
TSS	%	0.21
Organic matter	%	0.69
Total nitrogen	%	0.051
Available phosphorus	ppm	5.0
Available potassium	ppm	178

Table 2. Effect of different sowing dates on growth and yield of okra cv, Pusa Sawani

Parameters	S_1	S_2	S_3
Germination (%)	73.76b*	76.41a	76.00a
Plant height (cm)	125.87a	124.73a	126.51a
No. of leaves plant^{-1}	32.26a	30.85b	32.41a
No. of days to flower	55.70a	55.30a	56.28a
No. of pods plant^{-1}	26.04a	25.22b	26.48a
Green pod length (cm)	12.11a	11.66a	12.30a
Pod yield plant^{-1} (g)	326.23ab	314.00b	334.60a
Pod yield ha^{-1} (t)	12.56ab	12.11b	12.88a

* Means with different letters in a row are statistically significant at 5% probability (LSD test).

Table 3. Effect of various fertilizer doses on growth and yield of okra cv, Pusa Sawani

Parameters	F_1	F_2	F_3
Gennination (%)	73.97a*	76.48a	76.33a
Plant height (cm)	122.71b	126.34ab	128.07a
No. of leaves plant^{-1}	30.07b	32.41a	33.04a
No. of days to flower	54.26b	55.74ab	57.26a
No. of pods plant^{-1}	24.81c	25.89b	27.04a
Green pod length (cm)	11.81a	11.71a	12.57a
Pod yield plant^{-1} (g)	315.88a	316.89a	342.71a
Pod yield ha^{-1} (t)	12.16a	12.20a	13.19a

* Means with different letters in a row are statistically significant at 5% probability (LSD test).

Table 4. Effect of different sowing dates add various fertilizer doses (interaction) on growth and yield of okra cv. Pusa Sawani

Parameters	F_1			F_2			F_3		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
Germination (%)	74.53a*	74.07a	73.22a	72.45a	78.93a	78.01a	74.30a	76.22a	78.47a
Plant height (cm)	122.5300	125.1300	12o.47e	125.57bcd	124.8700	128.6Oabc	129.50ab	124.2Ode	130.503
No. of leaves plant'	30.3300	30.55c	29.33d	32.89b	3Ulc	32.22b	33.56b	30.89c	34.67a
No. of days to flower	54.78a	53.78a	54.22a	56.00a	55.Ha	56.Ha	56.33a	57.00a	58.44a
No. of pods planr' ·	24.7800	25. 44cde	24.22e	25.8900	25.44cde	26.33bc	27.44b	24.7800	28.29a
Green pod length (cm)	11.62a	11.94a	11.88a	12.04a	11.51a	11.57a	12.70a	11.54a	13.46a
Pod yield plant"^{1} (g)	313.93c	320.53c	313.17c	319.8Oc	312.33c	318.53c	344.97b	310.93c	372.27a
Pod yield.ha^{-1} (t)	12.09c	12.34c	l2.05c	12.31c	12.02c	12.26c	13.28b	11.97c	14.33a

* Means with different letters in a row are statistically significant at 5% probability (LSD test).

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