DISCUSSION
CHAPTER V

DISCUSSION

Okra is an annual vegetable and it is one of the important vegetable crops of the sub tropics. It is extensively grown throughout India for its tender, green and delicious fruits. The most important factor affecting crop production is the quality of seeds. The use of good quality of seed is indispensable for the successful production of any crop.

Genetic factor of any crop is governed by their genetic configuration and it shows its capability by interacting with environment. The growth of plant and quality seed production is strongly influenced by genetic factors and environmental conditions. Maximum yield of any crop is the result of optimum plant population. Under condition of sufficient soil moisture and nutrient, higher population is necessary to utilize other growth factors efficiently. Once soil moisture and nutrients are adequately available then yield of crop is affected by solar radiation. The level of plant population should be such that maximum solar radiation is intercepted.

5.1 Effect of spacing

Establishment of optimum plant population is essential to get maximum seed yield. The full yield potential of individual plant is activated when sown at wider spacing. When sown densely, competition among plants is more for growth resulting in reduced size and lower yield of the plant. On the other hand yield per
plant decreased gradually as plant population per unit area increased. However, the yield per unit area increased due to maximum utilization of cultivated area with plant population.

In the present investigation, three spacings (i.e. 45×25 cm, 60×15 cm and 60×25 cm) were tested for seed production of okra crop. The results are discussed under the following points.

5.1.1 Growth Characters

During the year 2004 among the three spacings, S3 (60×25 cm) was produced taller plant and it was at par with S1 (45×25 cm) while minimum plant height was observed with closest spacing i.e. S2 (60×15 cm). However, it showed non-significant difference during 2005, but on the bases of mean it is seemed that wider spacing had taller plants and it is may be due to optimum space for growth and development of individual plant.

Number of branches per plant was not affected significantly by various plant spacing although as per mean bases wider spacing had more number of branches per plant and it may be due to plant at wider spacing found sufficient soil moisture, nutrient and interception of optimum solar radiation so it had luxuries vegetative growth and development compared with closer spacing. Similar results were reported by Muhammad et al. (2002) and Yadav and Dhankar (1999) who observed the maximum plant height and number of branches per plant of okra with wider spacing.
5.1.2 Flowering

Days required for fifty per cent flowering were also not affected significantly by the various plant spacing, although on mean bases, it was maximum with wider spacing and minimum with closer spacing. Similar results have also been reported by Muhammad et al. (2002) and Birbal et al. (1995) who reported that various spacings did not change days required to 50 per cent flowering significantly.

5.1.3 Yield and yield-attributes

Under the present investigation, there was a marked effect of plant spacing on various yield-attributing characters. The length of fruit (18.57cm and 17.33cm), numbers of seeds per fruit (57.26 and 56.14), weight of seed per fruit (3.38g and 3.35g) during 2004 and 2005 respectively, were found significantly higher under wider spacing S3 (60×25cm). Similarly, maximum seed yield per hectare (15.74q and 15.07q during the year 2004 and 2005, respectively) was recorded with wider plant spacing S3 (60×25 cm) while, lower seed yield was recorded with closer plant spacing i.e. S2 (60×15 cm) (13.67q and 12.50q during the year 2004 and 2005, respectively). It is may be due to the optimum plant population under wider plant spacing which facilitate optimum utilization of available soil moisture, nutrient and intercepted maximum solar radiation ultimately maximum seed yield. Similar results were reported by many workers (Sarnaik et al. 1986; Singh et al. 1986; Singh 1990; Bisen et al. 1994; Birbal et al. 1995; Yadav and Dhankar 1999; Fondo et al. 1999; Muhammad et al. 2002 and Saijan et al. 2004) who found
higher fruit length, more number of fruits per plant and maximum seed yield by adoption of wider spacing.

5.1.4 Quality Characters

The quality characters were expressed in terms of 1000 seed weight and percentage viability of seed. The weight of thousand seed was recorded to obtain an idea about the effect of various plant spacing on seed boldness. Similarly, seed viability showed effect of various spacing on germination per cent.

It was found that both the characters were higher with adoption of wider plant spacing i.e. S₃ (60×25 cm), which was significantly superior over S₂ (60×15 cm) spacing and it may be due to more synthesis of food and translocation to seed which made them plump and bold under wider spacing S₃ (60×25 cm) than closer spacing (60×15 cm). The result are in conformity with the findings of Palanisamy et al. (1986), Muhammad et al. (2002) and Sajjan et al. (2004) they reported that the 1000 seed weight and viability were higher under wider spacing.

5.2 Effect of Nitrogen

Nitrogen compounds constitute 40 to 50 per cent of the dry matter of protoplasm. Due to this reason, nitrogen is required in large quantities. Proteins, chlorophyll, amino acids, amides and alkaloids are the compounds of nitrogen, which are involved in the growth processes of plants.

The seed yield of any variety depends upon their nitrogen sink capacity and ability of the variety to utilize available nitrogen. So, selection of appropriate
variety is very important to get maximum seed yield of okra. Gowda et al. (2002) reported that the variety Varsha has capability to uptake maximum nutrient which accumulation in leaves and fruits. The experimental findings in terms of growth, flowering, yield and quality as influenced by different levels of nitrogen have been discussed in the following subheads:

5.2.1 Growth characters

Those characters which indicate growth of any plant are termed as growth characters. Under the present investigation, two important growth parameters were studied i.e. height of the plants (at first flowering and at final stage) and number of branches per plant (at 60 days and at 90 days interval). The result revealed that growth parameters were significantly influenced by nitrogen levels from $N_1$ (40 kg/hectare) to $N_5$ (160 kg/hectare). A significant improvement was observed with increasing rate of nitrogen for both the character during both the years. This may be due to more uptake of nitrogen, which synthesizes more protein and protoplasm. Thus, the growth characters were found dominant, where higher amount of nitrogen was applied. The view is similar to findings of many former workers (Singh et al., 1998; Paliwal et al., 1999) who found more plant height and higher number of branches per plant with 120 kg nitrogen application. Similarly, Majanbu et al. (1986) observed maximum improvement on growth characters with higher dose of nitrogenous fertilizers. Samaik et al. (1986a), Fayaz (1999) and Yadav et al. (2004) found maximum plant height with 120 kg of nitrogen per hectare.
5.2.2 Flowering

Flowering is the most important character, which determines the duration as well as yield of crop. By the critical observation, it has been found that the days taken for 50 per cent flowering was delayed 11 to 12 days with highest level of nitrogen in both the years and maximum delay in flowering was observed with higher amount of nitrogen application i.e. 160 kg/ha. Delayed flowering with higher supply of nitrogen may be due to profuse and prolonged vegetative growth of the plant. The results are in close conformity with the findings of Birbal et al. (1995) and Singh et al. (1998).

5.2.3 Yield and yield attributes

Higher length of fruit (20.99 cm and 20.07 cm during the year 2004 and 2005, respectively) was found with higher application of nitrogen and it may be due to the fact that the increased dose of nitrogen increases protein synthesis and movement of photosynthates from leaves and thereby increasing photosynthetic efficiency to the developing fruits which ultimately promoted fruits to attain optimum size. The results are in close conformity with the findings of Bisen et al. (1994), Kurup et al. (1997), Ali (1999) and Muhammad et al. (2002) found increase in length of fruit of okra with application of 100 kg nitrogen. Singh (1995) and Paliwal et al. (1999) also observed that fruit length was increased significantly with 160 kg/ha nitrogen.

Number of fruits (39.81 and 38.81 during the year 2004 and 2005, respectively) was also increased with higher levels of nitrogen. It may be due to
good height and more number of branches in the plants which receiving higher dose of nitrogen. Similar results were also reported by many workers (Majanbu et al., 1985; Somkuwar et al., 1997; Singh et al., 1998; Fayaz et al., 1999 and Paliwal et al., 1999).

In the present investigation, the number of seeds per fruit (59.18 and 58.17 during the year 2004 and 2005, respectively) were also increased significantly with increase level of nitrogen. The weight of seeds per fruit (3.55g and 3.51g during the year 2004 and 2005, respectively) was increased significantly with the increase in the level of nitrogen during both the year. The weight of seeds per fruit is positively correlated with number of seeds per fruit that obviously depends upon the length of fruit. Similar results were found by Majunbu et al. (1985) Bhat and Dhar (1999), Muhammad et al. (2002) who found that number and weight of seeds increased with increasing rate of nitrogen.

Findings revealed that the application of nitrogen was found to have profound effect on the seed yield of okra during both the years. As the amount of nitrogen was increased, the seed yield per hectare was stepped up significantly. During the year 2004, successive increase on seed yield was noted by N2 (80 kg N/ha), N3 (120 kg N/ha) and N4 (160 kg N/ha) than N1 (40 kg N/ha). The per cent increase over N1 was 22.47%, 49.73% and 52.72% under N2, N3, and N4, respectively. The increase of nitrogen from 120 to 160 kg/ha showed statistically similar effect on seed yield for the year 2004 experiment (18.38q with 120 kg N/ha and 19.48q with 160 kg N/ha). But during 2005, seed yield increased with
the application of nitrogen at the rate of 160 kg/ha as compared to 120 kg nitrogen/ha (17.55q with 120 kg N/ha and 18.94q with 160 kg N/ha).

Similar results were also obtained by Samaik et al. (1986a), Somkuwer et al. (1997), Singh (1995), Bhat and Dhar (1999), Paliwal et al. (1999), Sajjan et al. (2004) and Yadav et al. (2004) who found maximum yield by the application of 120 and 160 kg/ha nitrogen.

5.2.4 Quality Characters

The quality characters were expressed in terms of 1000 seed weight (Test weight) and percentage viability of seeds. These characters were studied with first five fruit. It is interesting to note that both the quality characters influenced significantly by nitrogen levels from 40 to 120 kg/ha during both the years, further increase on nitrogen amount seemed to differ non-significantly and produce statistically similar thousand seed weight and seed viability during both the year of study. It is also mentioned in previous discussion that 120 kg/ha of nitrogen showed better growth which, synthesis more food materials, its translocation to the seeds, making them bolder and thus increasing the weight and viability of seeds. Due to less supply of food, the seeds shriveled and undersized with lower level of nitrogen. Mishra and Pandey (1987), Bhat and Dhar (1999) and Sajjan et al. (2004) also found higher seed quality character of okra seed with 150 kg nitrogen/hectare application.
5.3 Spacing \times Nitrogen

The interaction between different spacing and nitrogen levels showed appropriate combination for optimum growth and yield of okra. It was found that proper combination of nutrition and spacing affects overall growth of plant by effecting nutrient uptake by plant (Pandey and Dubey, 1997).

5.3.1 Growth Characters

The interaction effect of spacing with nitrogen were found to be significant for plant height in the year, 2004 while it was non-significantly during 2005. By the critical observation of the data, it was found that maximum plant height at both the interval (i.e. at first flowering and at final stage) was recorded under the treatment $S_3N_4$, while minimum plant height was recorded under $S_2N_1$ in both the years.

Number of branches per plant differed significantly and found to be maximum under the treatment combination of $S_3N_4$, while minimum was noted under $S_2N_1$. The reason for maximum growth i.e. plant height and number of branches was recorded under $S_3N_4$ may be due to good space with abundant supply of nitrogen, which encouraged faster vegetative growth of the plant. The results are in conformity with the findings of Birbal et al. (1995) and Hossain et al. (2003) who reported higher plant height and number of branches per plant at wider spacing with higher dose of nitrogen. Where as, on the contrary, Rampal et al. (2005) found that combination of various spacing and nitrogen levels did not affect significantly plant height and number of branches per plant.
5.3.2 Flowering

Days taken to fifty per cent flowering was not significantly affected by different plant spacing and nitrogen level combination. Although maximum days were taken to fifty per cent flowering by $S_3N_4$, while minimum days were taken under $S_2N_1$ for both the year of study. The similar findings were also found by Muhammad et al. (2002).

5.3.3 Yield and yield-attributes

Significantly higher fruit length (21.98cm and 20.87cm during the year 2004 and 2005, respectively), number of fruits per plant (50.11 and 50.72 during the year 2004 and 2005, respectively) were found under $S_3N_4$.

In case of seed weight per fruit, it was found significantly similar under treatment $S_3N_3$ (3.75g and 3.72g) and $S_3N_4$ (3.75g and 3.69g) during the year 2004 and 2005, respectively.

The total seed yield per hectare was found higher under treatment $S_3N_4$ (20.11q and 19.59q) which was at par with $S_3N_3$ (19.87q and 17.11q) during the year 2004 and 2005. It is may be due to that sufficient space and appropriate nitrogen level, the plant had uptake maximum nutrient, moisture and intercepted maximum solar radiation for proper growth and development of plant as well as fruits. The results are conformity with the findings of Samaik et al. (1986), Naik and Singh (1999), Birbal et al. (1995), and Hossain et al. (2004).
5.3.4 Quality Characters

The quality characters of okra seeds i.e. 1000 seed weight and viability of seeds were not significantly influenced by various combinations of spacing and nitrogen levels. Although, maximum thousand seed weight and viability were obtained with wider spacing and higher nitrogen levels. These results are in close agreement with those reported by Singh and Singh (1999) and Sajjan et al. (2004).

5.4 Economics

The economics study of okra seed production was done with the gross return, net return and net return per rupee invested. Among the spacings, S₃ (60×25 cm) found superior over other plant spacings and produced maximum gross return of Rs 94440 and Rs 90420, net return of Rs 64493.60 and Rs 60473.60 and net return per rupee invested (Rs 3.15 and Rs 3.02) during 2004 and 2005 respectively. While minimum economical treatment was S₂ (60×15 cm). The reason for best performance of S₃ is result of maximum seed yield by adoption of this treatment and also the similar cost of cultivation as S₂ needed.

In case nitrogen levels N₄ i.e.160 kg N/ha was most effective among all the nitrogen levels to improve all the economical parameters i.e. gross return (Rs 116880 and Rs 113640), net return (Rs 86282.60 and Rs 83042.60) and net return per rupee invested (Rs 3.82 and Rs 3.71). The higher economical return under the treatment N₄ was due to maximum seed yield with this treatment with reasonable improvement on cost of cultivation. Whereas minimum economical return was found with the treatment N₁ i.e.40 kg N/ha.
Whereas, treatment combinations S₃ N₄ was best for maximizing gross return (Rs 120660 and Rs 117540) and net return (Rs 90062.60 and Rs 86942.60). While, net return per rupee invested was maximum with S₃ N₃ (Rs 3.95 and Rs 3.85) followed by S₃ N₄ (Rs 3.94 and Rs 3.84) during the year 2004 and 2005 respectively. Similar, result was also reported by Singh (1995) that higher net return with 120 kg/ha nitrogen application.