SUMMARY, CONCLUSION AND SUGGESTION FOR FUTURE RESEARCH WORK
CHAPTER VI

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In India, looking to the population explosion and limited land resources there is need to maximise vegetable production per unit area. The further land expansion for vegetable is not possible, although it shrinks day by day due to tremendous population pressure so solution to feed the bursting population is only comes from genetic packet i.e. seed, because by only good quality seed we can achieve desired massive production target. In India availability of quality seeds is so poor particularly in case of okra, so attention is very much needed towards quality seed production for okra.

Chhattisgarh has favorable agro climatic condition for seed production of okra, but appropriate seed production technology for our region is still in grotto. In seed production technology planting density and amount of nitrogen application is most important factor, so it is very essential to optimize plant density and nitrogen level to get maximum seed production with best quality of seed from per unit area of land. Keeping the above facts in view, a field experiment on “Studies on response of different planting densities and nitrogen levels on seed yield of okra (Abelmoschus esculentus (L.) Moench)” was conducted during the year 2004 and 2005. The soil of the experimental field was classified as Alfisols and texturally known as clay-loam and locally known as “Dorsa”. The experiment was laid out in a Factorial Randomized Block Design with three replications. The two factors,
three plant spacings and four nitrogen levels were taken for the task. The results obtained by the experiment have summarized in the following heads:

6.1 Effect of spacing

In okra plant geometry or plant spacing is one of the important factor to determine quality as well as quantity of seed produce. Establishment of optimum plant pupation is essential to get maximum seed yield. In the present investigation three spacings (i.e. 45×25 em, 60×15 cm and 60×25 cm) were tested for seed production capability for okra crop. The experimental findings in terms of growth, yield and quality as influence by different spacings have been summarized in the following points:

6.1.1 Growth Characters

Growth characters are those character which indicates growth of the any plant. Under the present investigation two important growth parameters were studied. First height of the plant (at first flowering and at final stage), second character studied was number of branches per plant (at 60 days and at 90 days interval). Among the three spacings $S_3$ (60×25 cm) showed significantly taller plant and it was at par with $S_1$ (45×25 cm) while smaller plant was observed with closest spacing i.e. $S_2$ (60×15 cm) during 2004 study. While it was showed non-significant difference during 2005, however the wider spacing had taller plant as previous year study showed. Another growth parameter i.e. number of branches per plant was not effected significantly by various plant spacing although wider spacing had more number of branches per plant.
6.1.2 Flowering

Days require for fifty present flowering was not significantly affected by the various spacings. Although, it was higher with wider spacing and lower with closer spacing.

6.1.3 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, number of fruit, weight of seed per fruit all were found significantly higher by adoption of wider spacing. Similarly, higher seed yield was associated with wider plant spacing S₃ (60×25 cm) while lower with closer plant spacing i.e. S₂ (60×15 cm).

6.1.4 Quality Character

The quality character express in terms of 1000 seed weight and percentage viability of seed. It is found that both the character was higher with adoption of wider plant spacing i.e. S₃ (60×25 cm), which was significantly superior over S₂ (60×15 cm) spacing.

6.2 Effect of Nitrogen

Nitrogen is the chief constituent among the several important elements occurring in the plants. Nitrogen compounds constitute 40 to 50 percent of the dry matter of protoplasm, due to this reason, nitrogen is required in large quantity. Proteins, chlorophyll, amino acids, amides and alkaloids are the compounds of nitrogen, which are involved in the growth process of plants. The experimental
findings in terms of growth, yield and quality as influence by different levels of nitrogen have been summarized in the following points:

6.2.1 Growth characters

The growth parameters (plant height and number of branches per plant) were significantly influenced by nitrogen levels from N<sub>1</sub> (40 kg/hectare) to N<sub>4</sub> (160 kg/ hectare). It was observed that significant improvement with increasing rate of nitrogen for both the character during both the years.

6.2.2 Flowering

Flowering is the most important character, which determines the duration as well as yield of crop. By the critical observation it has been seem that the days taken for 50 percent flowering was delayed 12.05 days and 11.58 days with the highest level of nitrogen in the year 2004 and 2005 respectively. Maximum delay in flowering was observed with higher amount of nitrogen application i.e. 160 kg / ha.

6.2.3 Yield and yield attributes

Higher length of fruit was found with more application of nitrogen. Numbers of mature fruit per plant was also increased with successive improvement over levels of nitrogen. The weight of seed per fruit was also increased significantly with the increase in the level of nitrogen during both the year of study. In the present investigation the number of seeds per fruit also increased significantly with increase in the level of nitrogen. 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 over N1. The successive increase of yield was 22.47%, 49.73% and 52.72% in 2004 over N1 (40 kg.) by N2 (80 kg), N3 (120 kg), N4 (160 kg) nitrogen per hectare respectively. The increase of nitrogen from 120 kg/ha to 160 kg/ha was showed statistically similar effect on seed yield for year 2004 study. During 2005 there was improvement on seed yield was found with application of nitrogen at the rate of 160 kg/ha as compare to 120 kg nitrogen/ha.

6.2.4 Quality Character

The quality characters expressed in term of 1000 seed weight and percentage of viable seeds. It is interesting to see that both the quality characters influenced significantly by nitrogen levels from 40 to 120 kg/ha. (N1 to N3) during both the years. Further increase in nitrogen quantity from 120 to 160 kg/ha did not result any significant change in above mentioned quality characters.

6.3 Spacing × Nitrogen

The interaction between different spacing and nitrogen levels shows appropriate combination for optimum growth and yield of okra.

6.3.1 Growth Characters

The interaction effect of spacing and nitrogen was significantly affected for plant height for 2004. While, it was effected non-significantly during 2005 study. By the critical observation of the data it is found that maximum plant height at
both the internal (i.e. at first flowering and at final stage) for both the year of study was under the treatment $S_3N_4$, while minimum for $S_2N_1$. Another growth character number of branches per plant differs significantly and found maximum number of branches under the treatment combination $S_3N_4$ while minimum under $S_2N_1$.

6.3.2 Flowering

Days taken to fifty percent flowering was not significantly effected by different plant spacing and nitrogen level combination although maximum days taken by $S_3N_4$ while minimum for $S_2N_1$ for both year of study.

6.3.3 Yield and yield attributes

Significantly higher fruit length, number of fruits per plant, found with $S_3N_4$. Weight of seed per fruit higher under treatment $S_3N_3$ which was at par with $S_3N_4$. Seed yield found higher under the treatment $S_3N_4$, which was at par with $S_3N_3$.

6.3.4 Quality Character

The quality characters of okra seeds (i.e. 1000 seed weight and viability of seeds) were not significantly influenced by various spacing and nitrogen doses combination. Although maximum thousand seed weight and viability were obtained with wider spacing and higher nitrogen dose combination ($S_3N_4$).
6.4 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, \( S_3 \) (60×25 cm) found superior over other plant spacings and minimum economical treatment was \( S_2 \) (60×15 cm). In case nitrogen levels \( N_4 \) i.e.160 kg N/ha was most effective among all the nitrogen levels to improve all the economical parameters i.e. gross return, net return and net return per rupee invested and minimum economical return was found with the treatment \( N_1 \) i.e.40 kg N/ha. The treatment combinations \( S_3 N_4 \) was best for maximizing gross return and net return while, net return per rupee invested was maximum with \( S_3 N_3 \) during both the year of study.

CONCLUSION

The study reveals that in Alfixoil of Chhattisgarh plains for okra 60 × 25 cm plant spacing was found most suitable for higher seed yield (23.6 q/ha and 22.61 q/ha), maximum net return (Rs.64493.60/ha and Rs.60473.60/ha) and net return per rupee invested(Rs.3.15 and Rs.3.02) during the year 2004 and 2005 respectively.

The next best treatment in term of productivity (14.76 q/ha and 13.75 q/ha seed yield) and net returns (Rs 52073/ha and Rs 45053.60/ha) and net return per rupee invested (Rs 2.74 and Rs 2.50) was found with the adoption of 45 × 25 cm plant spacing during the year 2004 and 2005 respectively.
Among the nitrogen levels 160 kg N/ha was the best for highest seed yield of 19.48 q/ha and 18.94 q/ha, maximum net return (Rs 86282.60/ha and Rs 83042.60/ha) and net return per rupee invested (Rs 3.87 and Rs 3.71). The treatment 120 kg N/ha was closely followed with seed production of 18.32 q/ha and 17.55 q/ha, net return (Rs.79756.60/ha and Rs.75136.60/ha) and net return per rupee invested (Rs.3.64 and Rs.3.49) during the year 2004 and 2005 respectively.

The treatment combination of two best treatments of plant spacing and nitrogen level ($S_3 N_4$) was good combination and produced seed yield (20.11 q/ha and 19.59 q/ha) net return (Rs.90062.60/ha and Rs.86942.60/ha) and net return per rupee invested (Rs.3.94 and Rs.3.84) during the year 2004 and 2005 respectively.

$S_3 N_3$ was another important treatment combination produced seed yield (19.87 q/ha and 19.37 q/ha), net return (Rs.89056.60/ha and Rs.86056.60/ha) and net return per rupee invested (Rs.3.95 and Rs.3.85) during the year 2004 and 2005 respectively.

In this way there was improvement on the seed yield per hectare by manipulation on plant density was (7.38% and 13.15%, over $S_2$ by adoption of $S_1$ and $S_3$ plant spacing respectively during the year 2004) and during the year 2005(9.02% and 17.05%, over $S_2$ by adoption of $S_1$ and $S_3$ plant spacing respectively). Similarly by improvement on nitrogen levels the seed yield was improved during the year 2004 (22.47%, 49.73% and 52.72%, yield improved over $N_1$ by adoption of $N_2$, $N_3$ and $N_4$ nitrogen level respectively) and during
2005 (16.95%, 47.52% and 51.37%, yield improved over N_1 by adoption of N_4, N_3 and N_2 nitrogen level respectively).

SUGGESTION FOR FUTURE RESEARCH WORK

Looking to the superior performance of 60 x 25 cm plant spacing and 120 to 160 kg N/ha application, further refinement is needed in the following direction to generate some more scientific information and justification of there effect, to popularized the appropriate agro-technique.

1. Seed yield and quality of produce were higher with adoption of 60 x 25 cm plant spacing some closer as well as wider spacing will be try.

2. Seed yield was found to be the optimum level with higher nitrogen levels some nearer nitrogen doses would be try. Foliar spry of nitrogen, foliar spry mixed with micronutrients and growth promoting hormones would also be try.

3. The experiment was performed during kharif season, other session and part of kharif months would be try to find out appropriate time for okra seed production.

4. Similar experiment would be conducted at different location with different varieties to improve the precision and validity of results.