CHAPTER-VI

SUMMARY

&

CONCLUSION
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SUMMARY AND CONCLUSION

Linseed (*Linum usitatissimum* L.) is considered to be an important industrial oil crop in the country. In the present era of intensive cropping emergence of high yielding varieties coupled with maximum application of nitrogen resulted imbalance use of fertilizer which ultimately deteriorated the soil condition. These conditions have became the challenge for sustainable agriculture. In Madhya Pradesh still the 72.3% area is unirrigated and under low moisture, high temperature and poor management conditions, this crop has shown promise as far as yield and economical return is concerned. The linseed oil as source of paints and varnish in industries contributes to around 32% of total technical oil pool. However, its contribution to oilseed kitty rarely goes beyond 2 percent. The general productivity is less then 300-350 kg/ha, which is far lower than the average yield's obtained by other major linseed producers of the world. In the light of the facts we can say that yield is a complex character and highly influenced by the environment, but it can be manipulated through the improvement of component characters with the help of biometrical approaches. Since this process is laborious and time consuming, it would be known from proposed study that which chemical (growth promoter or inhibitor) with optimum threshold dose may be appropriate to achieve good yield response under the existing agroclimatic conditions of Vindhyan Plateau of Madhya Pradesh.

Keeping the facts mentioned above in view, there is an urgent need to search not only agro-techniques, but certain synthetic growth regulating substances also, to achieve maximum harvest of linseed in the state. Concentrating above points in view, the present investigation entitled "INFLUENCE OF SYNTHETIC GROWTH REGULATORS ON PLANT ARCHITECT, GROWTH AND SEED PRODUCTIVITY OF LINSEED (*Linum usitatissimum* L.)" was undertaken.
Recently several synthetic growth regulators have been formulated which can be applied exogenously at appropriate rate and growth stages of the crop. They may lead to desirable changes in growth and development of the plant by changing the endogenous hormonal level in the plant. Only five types of growth regulators viz. Auxins, Gibberelline, Cytokinins, Ethylene and inhibitors have been known so far which affect at cell-gene level in the plant. These regulators affects the phenology of the plant. Growth regulators when applied exogenously they modify the internal balance of hormones and may lead to desirable change in plant morphology and physiological processes which break the yield barriers in this crop.

For obtaining the specific target i.e. increase of per unit area production of linseed, it is essential to identify growth stages during vegetative phase which needs modification, proper growth regulators, concentration, mode and number of application.

The experiments on field were conducted at J.N.K.V.V., Regional Agricultural Research Station, Sagar during rabi season of 1996-97. And 1997-98. The experimental field was well levelled and homogenous in fertility. The soil of the experimental field fall under the order “vertisols” which is characterised by deep and wide cracks during summer and swelling characteristics under wet conditions.

The experimental field was comprised of clay-loam (vertisol) soil having PH 6.8 to 7.5, electrical conductivity 0.30 and 0.26 mhoes/cm, organic carbon 0.65 and 0.56%; available N, P₂O₅ and K₂O, 425.5 and 410.80 kg; 8.5 and 8.9 kg and 560.01 and 490.20 kg/ha respectively in both the seasons. The total rainfall received during the crop season (October to March) was 32.2 mm and 278.4 mm in 1996-97 at 1997-98 respectively.

The treatments comprised of (I) 2, 3, 5-Tri-iodobenzoic, acid with concentration of 20, 40 and 60 ppm. (ii) Naphthalene acetic acid (NAA) with
concentration of 20, 40 and 60 ppm (iii) Triacantanol with concentration of 2, 5 and 10 ppm. (iv) chlormequat (ccc) with concentration of 250, 500 and 1000 ppm (v) control with distilled water spray (vi) control with no water spray. The stages of foliar spray were (a) at 20 days and (b) 40 days after sowing, Similarly under control the single and double water spray were implemented during study.

The twenty seven treatment combinations thus formed, were laid out in Randomised Complete Block Design with three replications. The plot size was maintained as 5 m X 3 m with row to row distance of 30 cm keeping the seed rate 30 kg./ha. The experiment was planted on 23\textsuperscript{rd} Oct. 1996 and 29\textsuperscript{th} Oct. 1997. The recommended dose of 40 kg nitrogen along with 20 kg P\textsubscript{2}O\textsubscript{5}/ha was applied to all the plots as basal in 30 cm aprat open furrow at the time of sowing. Linseed variety kiran was used as seed for sowing purpose.

The crop was grown as per recommended package of practices. No serious weed infestation was observed during the cropping period, hence weeding operation was not followed during this period. The crop was raised exclusively under rainfed condition during both the years. The crop was harvested during second week of march in both the years and finally, treatmentwise, yields were recorded. Different observations on various parameters were recorded and computed periodically and ultimately at harvest in both the years and data were tabulated and analysed statistically.

**Salient Findings**

**A. Effect of synthetic growth regulators.**

The consistency in results for leaf area index, leaf area ratio and leaf area duration at the stage of 80 days after sowing has been observed and double spray of all the concentrations of four chemicals resulted higher LAI, LAR and LAD as compared to single spray. However, the treatments TRIA 2 ppm, TRIA 5 ppm and TRIA 10 ppm (all double spray) were observed the best
among the group. The clear cut differences in above mentioned characters reveals the fact that the green portion of tissues in leaves remains higher where the values of LAI and LAR were high. It will give the higher rate of photosynthesis resulting translocation of more photosynthates from source to sink as these parameters are the ratio of leaf area to per unit dry matter produced. Accordingly, every successive period will already add dry matter many times. It may appear non relevant but it expresses relative efficiency of area to produce unit dry weight. It is apparent that duration of leaf area was maximum for TRIA 10 ppm as compared to any combinations of NAA, CCC and TIBA. This increase in leaf area duration may further increase the age of crop resulting higher yield. The LAD is ability of a crop to produce and maintain photosynthetically active leaf area which is mainly governed by genetic architecture and is censored by prevailing aerial and edaphic ambient environment.

The maximum biomass duration was observed at the stage of 60-80 DAS indicating the full growth of plant canopy at this stage. The increased biomass duration reflects the increased phosynthetic area. It has direct assimilation of more dry matter followed by further translocation to sink. It may lead to stay green habit of the plant, however in majority of the cases it is governed by minor genes.

Since no significant difference in double spray of CCC 500 ppm and CCC 1000 ppm was observed, the economically viable dose of 500 ppm (DS) may be used for obtaining maximum yield. This chemical is well known growth retardant which in turn would have increased the other yield contributing parameters. For biological yield double spray of TRIA 10 ppm and double spray of NAA 60 ppm, double spray of CCC 1000 ppm and double spray of NAA 60 ppm occupied place in first non significant group. Similarly CCC 500 ppm (DS) and CCC 1000 ppm (DS) resulted higher magnitude of harvest index. Thus the double spray of CCC 1000 ppm was found to be best for seed yield, biological yield and harvest index.
TRIA 10 ppm showed maximum 1000 grain weight and straw yield both. Since yield is cumulative effect of environment and other qualitative parameters. Only TGW (1000 grain weight) cannot determine the total produce of crop. Other parameters must be given due concentration and manipulation with the help of favourable synthetic growth regulator.

These results will be helpful in manipulating the crop by means of standardising the doses to optimum level, which can yield higher straw coupled with good grain recovery. The highest number of seeds per capsule was observed in TIBA 40 ppm (DS) followed by TRIA 5 ppm (DS), TRIA 10 ppm (DS), NAA 60 ppm (DS) and NAA 40 ppm (DS). These results did not show significant difference, however the best combination was observed to be TIBA 40 ppm (DS).

It is evident that under exclusively rainfed condition the long duration varieties are higher yielder as compared to short duration. However it is vice versa in case of irrigated condition. Treatments CCC 500 ppm and CCC1000 ppm, when sprayed twice increased the duration of the crop giving higher seed yield.

CCC is an important growth regulator and considered to be growth retardant. The vegetative growth of the plant has no value if it is not qualified in terms of yield. The double spray of CCC 500 ppm and CCC 1000 ppm has given the best result for plant height, number of primary and secondary branches. It has reduced the plant height to desired level resulting increase number of primary and secondary branches which provided more space for formation and development of more number of capsules. It is also observed that the number of capsules also increased significantly correlating its importance with higher yield. Thus the double spray of growth retardant with the doses of CCC 500 ppm and CCC 1000 ppm was found better for yield and important attributing characters.
The study of relative growth rate and net assimilation rate indicated that the spray of growth retardant CCC even at the lower dose is beneficial. The single spray of CCC 250 ppm gave the higher value of these characters. However, meagre deviation was observed for crop growth rate. The double spray of TRIA 10 ppm was recorded to be the best treatment. However, these values were also associated in same direction with other physiological parameters.

The most important qualitative parameters i.e. Oil yield kg/ha has significantly increased with the use of important growth retardant CCC. The double spray of CCC 1000 ppm recorded maximum Oil harvest indicating its importance in net economic return.

(B) Association and Regression Analysis

The correlation and regression coefficient between seed yield and yield attributing components and also with physiological components were studied by considering seed yield as dependent variable. Seed yield showed positive and highly significant association with days to flowering, days to maturity, number of secondary branches, number of primary branches/plant, harvest index, 1000-grain weight, seeds per capsule, capsule per plant, straw yield, Oil yield and biological yield kg/ha. The character plant height showed negative and significant association with seed yield. Regression analysis indicated that oil percent followed by 1000-grain weight, primary branches/plant, seeds/capsule, secondary branches/plant, harvest index, days to flowering and days to maturity contributed directly towards seed yield. On the other hand plant height exhibited direct negative contribution towards seed yield.

Correlation coefficient of seed yield with functional parameters revealed that it was positively and significantly correlated with LAI, biomass/plant at all the growth stages, LAR at 40 DAS, LAD at 40-60 DAS and 60-80 DAS, BMD at 40-60 and 60-80 DAS, CGR at 40-60 DAS and NAR 40-60
DAS. Net assimilation rate at 60-80 DAS had significantly negative association while CGR at 60-80 DAS showed negative but non significant association. Regression analysis highlighted that LAI 40 DAS, LAI 60 DAS, LAI 80 DAS, Biomass 40 DAS, biomass 60 DAS, biomass 80 DAS, LAD 40-60 DAS, LAD 60-80 DAS, BMD 40-60 DAS, BMD 60-80 DAS, CGR 40-60 DAS and NAR at 40-60 DAS exhibited direct positive and significant influence on seed yield.

(C) Economic Analysis

The effect of synthetic growth regulators on linseed yield as evident from the pooled data, there was consistent increase in seed yield with the increase of concentration in single as well as in double dose of different synthetic growth regulators in the present study. Though, the increase is not significant after first two concentration in single and double dose both for all the regulators, and more so it was reflected in the cost : benefit ratio also.

While comparing the overall gain in seed yield, net return and C:B ratio, 500 ppm concentration of CCC in double dose was found best with 633 kg/ha; Rs 4160.20/ha and 1:1.86 as seed yield, net return and cost:benefit ratio respectively.

Conclusion

Almost all the treatments showed consistency in its performance with various concentrations in regard to different parameters with minor deviation. The treatments showed its superiority for quantitative parameters, did not proved excellence for functional characters.

For functional parameters the double spray of triacontanol 10 ppm proved to be the best and it has significantly increased certain physiological components like leaf area index, leaf area ratio and leaf area duration indicating more assimilation of photosynthates.
The yield and important yield attributes were highly influenced by chlormequat (CCC) 500 ppm double spray and CCC 1000 ppm double spray. Numerically best results were observed with CCC 1000 ppm in almost all the cases but it was all the time statistically at par with CCC 500 ppm. Therefore, CCC 500 ppm (DS) was found to be economically viable to achieve the threshold level of yield and other advantageous components including oil. Although TRIA 10 ppm was efficient to increase the functional components but it was also most of the time at par with CCC 500 ppm which was beneficial for yield related parameters otherwise.

The concentration of 500 ppm CCC in repeated spray was found best with 633 kg/ha; Rs. 4160.20/ha and 1.1.86 as seed yield, net return and cost : benefit ratio respectively. Therefore, growth retarding synthetic regulator CCC 500 ppm (double spray) is recommended for harvesting the maximum advantage in all respect in linseed crop under rainfed situation.

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