DISCUSSION
CHAPTER-V
DISCUSSION

Cultivation of linseed is very common in Bundelkhand region of Uttar Pradesh and to improve the production and productivity of this crop, four high yielding varieties are introduced in the region. In order to find out the suitability of high yielding linseed varieties for this region, performance of each variety under different conditions is to be studied. With this view experiment was conducted for two years with Shubhra, Neelum, Sweta and Laxmi-27 varieties of linseed, under three dates of sowing (10 October, 25 October and 10 November) and three levels of irrigation (one at 30 days after sowing, 2 at 30 and 60 days after sowing and 3 irrigations at 30, 60 and 75 days after sowing).

On the basis of the findings, attempt has been made in the chapter to explain the possible reasons of variability obtained due to different treatments. The results have been discussed in the light of the literature available for the different parameters in the study.

Effect of date of sowing:

Effect of date of sowing on the plant population though had no significant difference in both the years and in the pooled data. However in first year ($D_2$) 25 October sowing recorded higher plant population in first year and in the pooled data and in $2^{nd}$ year the plant population was almost similar in the three dates of sowing. Prevalence of higher mean and maximum temperature coupled with
favourable relative humidity and other environmental conditions prevailing during these dates of sowing in both the years almost similar type of plant population. Similar observations were reported by Sen and Chakravarty (1994) and Tomar (1997) due to temperature and main environmental factor governing all elementary physiological process of plant. Fresh weight of linseed plants 30 days after sowing were not significantly different, however, crop sown on 25 October had higher fresh weight in both the years and in the pooled data due to reasons given above. Fresh weight recorded at 60, 90 days after sowing and at harvest was found significantly higher in D₂ (25 October sowing) followed by D₁ (10 October sowing). Both the dates had significantly higher fresh weight of plants than D₃ (10 November sowing). This may be attributed basically to the reason that crop sown on 10 October and 25 October received optimum environmental conditions for higher fresh weight, while delay in sowing (10 November) could not get favourable environmental conditions, hence the fresh weight of plants at all the above stages of record. Similar views were also reported by Lander (1934), Smith (1946) and Mullar (1952). According to them temperature controls the growth period of the oilseed crops considerably according to the duration of the crop.

Dry weight of plant was recorded at 30, 60, 90 days after sowing and at harvest in both the years and then data of both the years were pooled. In this parameter also D₂ sowing date had
produced significantly more dry weight than D₃ (10 October sowing) and D₃ (10 November) sowing date at all the stages of record. Both D₂ and D₁ more duration for accumulating the weight. Moreover one more number of irrigation helped to gather more photosynthates in the plant. Mullar (1962), Henry and Danlay(1988), Singh(1991) Yadav and Yadav(1997) had also reported similar views.

The height of main shoot recorded at 30, 60 and 90 days after sowing was significantly affected due to date of sowing. In both the years and in the pooled data of two years at each stage the higher height was noticed in D₂ (25 October sowing). It was significantly superior to D₃ but was at par with D₁. This may be due to the fact that the crop sown in D₂ and D₁ dates(10 October and 25 October) got sufficient more time than D₃ sowing date (10 November) for proper vegetative growth and development as reported by Sen Chakravarty(1944), Mullar(1952), Majumdar(1962), Tomar(1998) and Singh et al.(2001).

Number of primary branches, secondary branches and tertiary branches parameters are very important for linseed yield. In both the years and in the pooled data of two years, date of sowing recorded distinct influence on growth and development of the above mentioned three parameters. In D₂ date of sowing(25 October sowing) significantly produced higher number of primary, secondary and tertiary branches in the crop than D₁ and D₃ dates of
sowing. However $D_1$ date of sowing had also recorded significantly higher number of these parameters than $D_3$ (10 November sowing). Low temperature in November sown crop at early stage resulted in low dry matter accumulation which delayed and reduced number of these parameters while October sown crop coincided with congenial temperature which had affected all elementary physiological process in the plant resulted in more number of primary, secondary and tertiary branches/plant as supported by SenGupta and Chakravarty (1944), Mullar (1952), Garg (1961), Lahiri (1964), Critchfield (1966) and Saini (1972), Kumar and Shastry (1984).

Among the yield attributing characters in linseed, number of seeds and weight of capsules/plant and number of seeds and weight of seeds/capsule and weight of seeds/plant are the most responsive yield components. The capsules which produce seeds in linseed are produced in cycles because linseed has distinct flowering period separated by brief resting period date of sowing of linseed plant is important in determining the number of cycles and number of flowers produced in each cycle (Yarmanos and Worker, 1964). The crop sown in $D_1$ and $D_2$ that is on 10 October and 25 October might have more cycles due to the long duration by early sowing than $D_3$ (10 November sowing) recorded significantly higher number of above yield attributes. Crop sown on $D_1$ and $D_2$ dates of October clubbed with suitable irrigation levels enhanced parameters i.e. number and weight of capsules, number and weight of
seeds/capsule and number of seeds/plant. This may also be attributed basically to the reason that crop sown 10 and 25 October each years also received optimum environmental conditions required for better crop growth and above yield attributing parameters. These finding are in agreement with those of Sethi and Sharma(1952), Garg(1961), Lahiri(1964), Aulak and Bahal(1989), Shrivastava(1990), Rajput et al.(1991), Mahapatra(1993), Rathore(1995) and Phalwan and Kapre(2002).

Date of sowing recorded distinct influence on biomass, seed and stover yield (q/ha). D$_2$ produced significantly more (biomass, seed and stover yield) than D$_1$ which had also significantly higher values of these than D$_3$(10 November sowing). This may be the result of increase in dry matter and yield attributes of linseed crop sown in 10 and 25 October. Low temperature at vegetative and flowering stages might have caused slow growth and delayed phonological stages in November sown crop. This also resulted in poor development of all yield attributes of linseed crop. Hence November sown crop gave lower biomass, seed and stover yield of linseed. Saini(1972), Rai and Kumar(1978), Saran and Giri(1987), Rajput et al.(1991), Rathore(1995) have also expressed similar views. The above findings are also in agreement with opinions of various scientist working at Kanpur, Palampur, Raipur and Nagpur during 1997-1999 as mentioned in Annual Report of AICORPO of 1997-98 and 1999-2000.
Evaluation of nutritional modifications in linseed grain, in addition to quantitative achievements (yield attributes and yield of seed and stover) is a necessary adjunct in relevance to the present investigation. There was a significantly difference in percent oil content in linseed seed due to date of sowing. In both the years the percent oil content was significantly higher in D\textsubscript{2} (25 October sowing) than D\textsubscript{1} (10 October sowing) which was also significantly superior than D\textsubscript{3} (10 November). Similarly trend was also noticed in the mean of two years. Lender (1934), Smith (1949), Majumdar (1962), Bisnoi and Singh (1979), Kumar and Shastry (1984), Ghosh and Chatterjee (1988) and Payasi \textit{et al.}(1999)

Percent protein content in linseed was also significantly affected due to date of sowing. In both the years the protein content was also significantly affected and higher in D\textsubscript{2}(25 October sowing) than D\textsubscript{1}(10 October sowing). Similar trend was also found in the mean of two years. This may be due to the long duration that crop plant got in early sowing, and prevailing weather conditions. Along with these conditions, protein synthesis in plants continued for more time in early sown crop in D\textsubscript{1} and D\textsubscript{2} than D\textsubscript{3} sowing. These findings are supported by Majumdar(1962), Singh and Singh(1985), Ghosh and Chatterjee(1988) and Tomar(1998).
Effect of varieties:

Out of 29 parameters studied in the present investigation, significant differences were observed in almost all the parameters among varieties. This indicated that a good amount of variability is present in the genotypes of linseed included in this investigation. It shows that genotypes differed significantly in expressing their yield potential and yield components. Thus the performance of these genotypes with respect to yield attributes, yield, percent oil content and protein content is also different in Bundelkhand region of Uttar pradesh under similar set of environment conditions leader (1934), Smith (1949), Sethi and Sharma Garg (1961), Chauhan (1963), Tiwari et al. (1988) and Singh (1988) have also remarked similar views. Fresh weight of plants at 30, 60 and 90 days after sowing and at harvest was significantly higher in V$_2$ followed by V$_3$ and in some cases V$_1$ than other varieties in both the years and I the mean of two years. Similarly the dry weight of plan at 30, 60, 90 days after sowing and at harvest were significantly in V$_2$ (Neelum) followed by V$_3$ (Sweta) in both the years and in the mean of two years. Fresh weight and dry weight per plat in a crop depends upon their capacity to produce more photosynthesis and also to gain weight through better adoption of environment condition, uptake of nutrients from the soil. Due to these conditions, the fresh weight and dry weight / plant is related in linseed crop also. Similar views
were given by Jeshwani (1984). Height of main shoot at 30, 60, 90 days after sowing and at harvest were found significantly higher in V₂ (Neelum followed by V₁ (Shubhra) in both the year ad in the years and in the mean of two years. Both the above parameters were better in these varieties may be due to the genetic constitution and favorable environmental conditions prevailing during cultivation. Sen and Chakravarty (1944), Sethi ad Sharma (1952), Sigh (1988), Sharma (1999) ad Ram (1993) have also similar views about improved ad high yielding varieties over local traditional varieties.

Difference in number of primary, secondary and tertiary branches amongst the four varieties including in the investigation was present in both the years and in the mean of the two year. These three types of branches were significantly higher in V₂ (Neelum) and V₄ (Laxmi-27) in both the years and the mean of two years. The probable reason for the difference in primary, secondary branches and tertiary branches two above two varieties may be due to genetical quality and adoption under environmental conditions prevailing during the experimental period in southern western region of Bundelkhand of Uttar Pradesh. These findings are also in agreement with those of Jeshwani (1984), Ojha (1985), Singh (1989) and Sharma (1999).

There was significant difference in number and weight of capsule/plant, number of seed and weight of seeds/capsule and
weight of seed / capsule and biomass / ha in both the years and in the mean of the two years. Number and weight of capsules per plant, number and weight of seeds per capsule were significantly higher in V₂ (Neelum) followed by V₄ (Laxmi-27) and V₃ (Sweta) in both the years and in the mean of two years. Similar trend in biomass was also seen in both the years and mean of two years. These parameters may be due to inherent quality of varieties, uptake of nutrients and better utilization of environmental conditions. Both V₂ and V₄ surpassed in the above parameters than V₁ (Shubhra) and V₃ (Sweta). Tiwari et al. (1988), Ojha (1985), and Sharma (1999) expressed similar views.

Maturity of plants, 50 percent flowering and seed yield per plant (g), seed and stover yield quintal / hectare differences among varieties were found significant in both the years and in the mean of two years. These parameters were significantly higher in V₂ and V₄ (Neelum and Laxmi-27). These types of yield depend upon nutrient uptake, environment factors, comparative more number of primary and secondary branches number of capsule / plant and seeds / capsule in V₂ (Neelum) and V₄ (Laxmi-27) varieties. Therefore the differences of yield / plant q / ha and stover yield q / ha is due to these above mentioned factors as reported by Jeswani (1984), ram (1993) and as per annual report of AICORP 1994-95 and 1995-96.
Percent oil content in different varieties also varied in the trial. In both the years significantly higher percent oil content was found in V₄ which was at par with V₁ (Shubhra) and V₃ (Sweta) and minimum was found in V₂ (Neelum), oil yield quintal/hectare was found higher in V₂ (Neelum) and V₄ (Laxmi-27) than V₁ (Shubhra) and V₃ (Sweta) due to yield of seed q/ha. Both percent oil content and oil yield q/ha may also be due to accumulation of more oil synthesizing constituents in these two varieties. Hence these varieties had more oil q/ha. Saran and Giri (1987), Singh et al. (1994) had also expressed similar views.

**Percent protein content:**

There was significant variation in percent protein content in the varieties in both the years and also the difference was found significant in the mean of two years. Significant higher protein content was found in V₂ (Neelum) than all other varieties. It is interesting to note that this variety had the lowest oil percent but the protein content is maximum. Protein synthesis is intimately connected with activities of the nucleic acid system and accumulation of certain amino acids and formation of proteinous substances in a variety. Therefore, higher protein content in Neelum may be due to above factors, which may be more active in this variety as compared to the other varieties. Similar views were also expressed by Singh (1968), Rao (1982), Gupta (1987), Ghosh and Chatterjee (1988), Maiti and Chattopadhyaya (1988).
Effect of Irrigation:

Plant population is the number of plats required per unit area to achieve the highest yield. It depend on the nature of the crop and on its environment. This number cannot be too small, or it can be too large. Maximum exploitation of the factors needed for growth is achieved only when the plant population exercises maximum pressure on all the production factors provided there is no moisture stress to the crop. In this trial the plant population in both the years was not affected significantly due to number of irrigation. However in both the years, thought the difference in plant population was not significant even then two irrigation given 30 and 60 days after sowing had the maximum number of plant population. Howard and Khan (1924), Sethi and Sharma (1952), Garg (1961), Guan and Zhangto (1987), Singh (1989), Josder / et al. (1979) have also advocated the need of two irrigations in the crop.

Fresh ad dry weight of plants were also affected due to irrigation numbers. Fresh weight at 30 days after sowing was significantly affected in 2nd year only. However higher fresh weight was found in 2 irrigation (at 30 and 60 days after sowing ) followed by 3 irrigation (at 30, 60 and 90 days sowing ) both years and I the mean of two years.

Fresh weight was significantly affected at 60 and 90 DAS and at harvest. 2 irrigation produced significantly higher fresh weight followed by 3 irrigations than one irrigation.
The dry weight of plants and higher of main shoot at 30, 60, 90 and at harvest was significantly higher in \( I_2 \) followed by \( I_3 \) than \( I_1 \) level of irrigation. This may be due to the beneficial utilization of the amount of water available to the crop with irrigations than three irrigations where it would have been more, while in one irrigation it would have been less than the required amount of water. Sigh (1988), Sharma (1990), Ghalok et al. (1990), Katole ad Sharma (1991) have expressed similar views about number of irrigations.

Number of primary, secondary branches / plants, number and weight of capsules / plants, number and weight of seeds / capsule and weight of seeds / plants are important parameters of yield of seed and stover in linseed. These were also affected significantly due to the number of irrigations given to the linseed crop. \( I_2 \) (2 irrigations at 30 and 60 days after sowing) was found significantly superior followed by \( I_3 \) (3 irrigations at 30, 60 and 75 days after sowing) than \( I_1 \) (1 irrigation at 30 days after sowing) for producing higher value of the above parameters. This might be due to more available water through irrigation for the crop which has used water most efficiently in the favorable environment conditions available to the crop. It is further pointed out that there might have not been much fluctuation of moisture in the root zone in the range between soil saturation and permanent wilting points. Therefore, severe water stress might have not been experienced at any stage of
the development of above mentioned yield attributes. Jorder et al. (1979), Yusuf et al. (1981), Bhardwaj (1983), Prasad and Eshanullah (1986), Sharma (1990), Shrivastava (1990), Singh et al. (1991) and mentioned in Annual Report of AICORPO 1994-95, due to irrigation improvement in the above yield attributes improved the yield of the crop.

Total biomass in the crop (grain+stover) q/ha, seed yield and stover yield q/ha were found significantly higher in I2 level of irrigation followed by I3. Both these levels produced higher yield of seed and stover/ha than I1. This may be due to better growth and development of the yield attributes like primary branches, secondary branches, number and weight of capsules and number and weight of seeds per capsule and seed weight per plant. Thus the I2 and I3 irrigation levels affected all the above yield attributes with the concomitant effect on seed and stover yield of the crop. These findings were in agreement with those of Howard and Khan (1924), Smith (1946), Jorder et al. (1979), Bhardwaj (1983), Shrivastava (1990) and with the results of AICORPO of 194-95 and 1998-99 (AICORPO- Annual Report of 1994-95 & 1998-99). Oil content and oil yield q/ha and protein percent content in linseed were not affected significantly in both the years and in the mean of 2 years indicating that irrigation levels have not affected oil content percent, oil yield q/ha and protein percent content significantly, however, I2 level of irrigation had more oil percent
and protein percent content in linseed. These results are not in agreement with that of Zaman and Das (1991).

**Interaction effect:**

The interaction effect DxV on fresh weight of plant at 90 days after sowing was found significant in both the years and in the pooled data of 2 years (Table-11(c)). At 90 days after sowing the linseed plants accumulated quiet a good amount of fresh weight. At this stage D₂V₂ (25th October sowing and variety Neelum) combination produced the maximum fresh weight amongst other dates of sowing and varieties showing that Neelum variety performed better than other varieties when it was sown at 25 October due to favourable environmental factors of growth. Hence resulted maximum fresh weight of plant. As the interaction of DxV was significant at 90 days after sowing in both the years and in the pooled data, so at plant harvest stage also same trend continued and at this stage also V₂ and D₂ surpassed all other combinations showing that Neelum when sown at 25 October produced the highest fresh weight of plants.

Interaction effect of VxI (Variety x irrigation levels) was also found significant at harvest but only in the year 1998. Here also V₂ (Neelum) recorded significantly higher fresh weight of plant at harvest stage that all other combinations of VxI, sowing that Neelum did well at 2 irrigations that 1 and 3 irrigations even when
the production conditions given were similar except irrigation level due to the reasons already given above.

Interaction effect of dates of sowing and variety on dry weight of plant was also found significant in both the years and in the pulled data at 30 days after sowing. Like interaction of VxD in fresh weight of plants, the dry weight of plants at 30 days after sowing was found significantly higher value in V2D2 (Neelum sown at 25 October). The reason for this may be the same as given in fresh weight of plant interaction.

Interaction effect of dates of sowing and varieties on dry weight of plants at harvest stage was also significantly higher in D2xV2 combination (25 October sowing x Neelum variety). In both the years and in the mean of 2 years indicating that dry weight of plant was highly affected by this combination at the harvest stage too due to better utilization of all the factors of production and due to favourable weather conditions.

Interaction effect of dates and varieties were found significant in both the years and in the mean of two years on 50 percent flowering of the crop. In this interaction D1 (10 October sowing) interacted with V2 (Neelum) and produced significantly higher number of 50 per cent flowering indicating that due to early sowing (10 October) V2 (Neelum) produced more 50 percent flowers than other DxV combinations under same set of production factors of the linseed crop.
Interaction effect of DxV on height of main shoot at 30 days after sowing was found significantly higher in D₁xV₂ (10 October sowing x Neelum) than other dates of sowing and varieties. In both the years and in the mean two years. This might be due to the fact that V₂ got more days in D₁ (10 October sowing) to get height than other dates of sowing and in other varieties. But in case of this interaction of DxV, at 60 days after sowing D₂xV₂ had recorded more height of main shoot due to better development of main shoot under favorable weather conditions particularly temperature and humidity in later days. The effect of interaction was found significant in both the years and in the pooled data due to these reasons.

Interaction effect of DxV on number of primary branches was found significant in both the years and in the pooled data in D₂ (25 October sowing) and V₂ (Neelum) due to better development of growth and formation of primary branches in this combination than other DxV combination for this parameter.

DₓI interaction was found significant on number of primary branches in 1998-99 year only I₂ (2 irrigations) x D₂ (25 October sowing) produced the significantly higher number of primary branches than other DₓI combinations. This may be due to the reasons given above in DXV interaction.

Interaction between date of sowing and varieties was also found significant and D₂xV₂ (25 October sowing and Neelum
variety) recorded the highest number of secondary branches/plant in both the years and in the pooled data. This may be due to the best availability growth factors in Neelum variety when sown at 25 October. Interaction effect of date of sowing and irrigation was found significant only in the year 1999 and D₂xI₂ (25th October sowing with 2 irrigations) produced higher number of secondary branches. This may be due to favourable growth and development of secondary branches in this combination. Similarly V₂xV₁ had also recorded higher number of secondary branches only in the year 1999 due to the reasons given above in I₂ and V₂ combinations than other combinations of irrigation x variety.

Interaction effect of date and variety was also found significant in both the years and in the mean of two years on number of tertiary branches/plant. V₂xD₂ recorded the higher number of tertiary branches/plant due to reasons given above.

Interaction effect of date of sowing and variety was also found significant on number of capsules/plant in both the years and in the pooled data. Here in this interaction also V₂ (Neelum) at D₂ (25th October sowing) produced the maximum number of capsules/plant due to favourable weather conditions in D₂ and due to better development of capsules/plant in the genetically good variety Neelum. Due to similar reasons interaction effect of DₓV was also found significant in both the years and in the pooled data.
and \( D_2 \times V_2 \) combination recorded higher weight of capsules/plant higher than all other combinations.

The interaction effect of \( D \times V \) was also found significant in case of number of seeds/capsule in 198 only. \( D_2 \times V_2 \) (25\textsuperscript{th} October sowing x Neelum variety) recorded the higher weight of capsules than all other \( D \times V \) combinations. The reasons for this interaction is also the same as mentioned above. Effect of this interaction was also found significant in case of weight of seed/capsule in the year 1999 only due to the better growth, development and accumulation of dry matter in seeds in this combination of date of sowing and variety.

Interaction of \( D \times V \) on weight of capsules (mg) was also found significant in both the years and in the mean of two years. \( D_2 \times V_2 \) (25\textsuperscript{th} October sowing date x Neelum variety) combination produced significantly higher weight than all other combinations in both the years. \( D_1 \times V_2 \) and \( D_3 \times V_2 \) were next combinations with higher weight of capsules. But these combinations were at par. This indicated that \( V_2 \) (Neelum) produce almost similar weight of capsules when sown either at 10 October or 10 November each year. This may be due to the better growth, development and formation of capsules in \( V_2 \) at \( D_2 \) sowing each year. Similar views were also given in the Annual Report of AICORPO of 1998-99 from the results of trials conducted at Raipur and Kanpur.
Interaction of DxI (date of sowing and irrigation) were also found significant only in the year 1998 with D₂X₁₂ combination producing significantly higher weight of capsules with 2 irrigations and by sowing on 25th October due to higher weight production of capsules in this combination, due to favourable growing and development conditions of the crop.

Interaction of effect of variety and irrigation was also found significantly in both the years and in the pooled data of two years. V₂ (Neelum variety) with I₂ (two irrigations) recorded the significantly highest weight of capsule in both the years and in the pooled data. However this variety is followed by V₄ (Laxmi-27) and I₂ irrigation level significantly with higher weight of capsules than V₁ and V₃ (Shubhra and Sweta) varieties. This indicates that under Bundelkhand condition these two varieties with two irrigations produce higher capsule weight due to favourable ecological and varietal inherent characters.

Date of sowing and varieties combinations had also affected the weight of seeds/plant. Both V₂ (Neelum) and V₄ (Laxmi-27) recorded significantly higher weight of seeds/plant in both the years and in the pooled data than other varieties but V₂ (Neelum) tops in seed weight/plant. Both V₂ and V₄ had produced higher seed weight significantly than V₁ and V₃ both in D₂ followed by D₁ dates in both the years and in the mean of two years. This might be due to better growth development and accumulation of dry matter.
in these varieties than other remaining varieties, resulting in higher seed weight/plant. Genetical capabilities of these varieties at D₂ (25th October sowing) coupled with favourable conditions might have produced higher seed weight in these two varieties.

Date of sowing and varietal combinations had also affected the total produce in both the years and in the pooled data. In all the DₓV combinations significantly higher total produce was recorded by D₂ₓV₂ followed by D₂ₓV₄ in both the years this may be due to the reason already given above.

Variety x irrigation interaction was found affecting the total yield significantly only in the year 1998 and V₂ (Neelum) and followed by V₄ (Laxmi-27) has recorded higher total yield at I₂ (2 irrigations 30 & 60 days after sowing) due to better yield capacity of V₂ and V₄ at 2 irrigations and 1 irrigation which were significantly better than I₃ (3 irrigation). This may be due to better performance of V₂ and V₄ at I₂ and I₁ levels of irrigation.

Seed yield q/ha with dates of sowing interaction effect was found significant in both the years and in the pooled data. Though V₂ and V₄ difference in yield was also significant in both the years at D₂ and D₁ dates of sowing, but the combinations of both the varieties at D₂ and D₁ dates was found significantly better than other varieties combination with dates of sowing. This indicated that higher grain yield in these two varieties at D₂ and D₁ dates of sowing might be due to better utilization of all the factors of
production than other dates of sowing x variety combinations in both the years. Both these varieties performed better at D2 and D1 dates of sowing owing to their higher yield capacity than the varieties.

Higher seed yield q/ha is the better utilization of all the factor of production, especially soil fertility and irrigation facilities. These two varieties (V2 and V4) at I2 and I1 irrigation levels have significantly produced higher seed yield q/ha in the year 1998 only. V2xI2 and V4xI2 interactions resulted significantly in higher seed yield q/ha than other combinations showed these V2 and V4 varieties utilized maximum all the factors of production resulting higher seed yield q/ha in one year only.

Interaction effect of DxV on stover yield was also found significant in both the years and in the pooled data like the grain yield V2xD2 and V4D2 combinations produced significant higher stover yield in both the years and in the pooled data like grain yield q/ha due to the reasons mentioned in thje seed yield q/ha above.

Interaction effect of date of sowing and varieties on oil yield q/ha was also founds significant in both the years and in the pooled data. In both the years and in the mean of two years V2 and V4 (Neelum and Laxmi-27) with D2 and D1 dates of sowing combinations had recorded significantly higher yield of oil q/ha. This may be due to fact that yield of seeds q/ha was also higher in these two varieties at D2 and D1 irrigation levels which multiplied
with per cent oil content of \( V_2D_2, V_2D_1 \) and \( V_4D_2, V_4D_2 \) produced
the maximum oil yield \( q/ha \) in these combinations of varieties and
date of sowing.

Interaction effect of variety x irrigation level of oil yield
quintal/hectare was found significant only in the year 1998. \( V_2 \)
(Neelum) and \( V_4 \) (Laxmi-27) recorded higher yield of oil \( q/ha \) at \( D_2 \)
(2 irrigations at 30 and 60 DAS) \( D_1 \) (1 irrigation 30 DAS)
combinations due to higher yield seed \( q/ha \) in these combination
when multiplied with percent oil yield \( q/ha \) resulted in higher oil
yield \( q/ha \).