SUMMARY AND CONCLUSIONS
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For the present study *Spinacia oleracea* L. was selected to observe the metabolic changes and physiological processes due to light and temperature, which is a cool season vegetable crop native of Central Asia cultivated widely in warmer during winter season. The basis for the approach in the present study has been described in the introduction part.

Vernalization treatment was given to imbibed seeds and seedlings (24 h old) for a particular period i.e. 4 weeks in case of imbibed seeds and 3, 4 and 5 weeks in case of seedlings afterwards these treated seedlings and imbibed seeds and seedlings of morphologically same size grown in dark at 20°C temperature (29 ± 2°C) were transplanted in earthenware pots and were subjected to different photoperiods (light treatment) to study the flowering behaviour. In case of seedlings metabolic and hormonal changes were studied during vernalization at weekly intervals for 5 weeks. The influence of vernalization and photoperiod on the metabolic status of leaves (inductive process) and shoot apex (evocation process) were investigated. The influence of these two factors on growth indices and yield components were also noted down. External application of GA3 proved to be unsuccessful to substitute the cold requirement in the present experimental plant.

Various biochemical and histochemical techniques and statistical methods were employed in the present study. Following conclusions were drawn from the results obtained in the present experiment.
Conclusions:

1. Vernalization caused early flowering irrespective of the photoperiods it received after the chilling treatments. Early transplanted control plants flowered earlier under LD and ED and produced pods. Under SD, plants took about 6 weeks i.e., 144 days that too only a few plants flowered which did not produce pods and died due to high temperature whereas late transplanted control plants flowered in all 3 photoperiods and produced pods. Thus it may be observed that this plant is a qualitative cold requiring and quantitative long day plant as during late sowing, plants were under natural LD and low winter temperatures.

2. Developmental stages at which seedlings received vernalization had some effect. Vernalized indented seeds took more days to flower compared to seedling vernalized plants.

3. Vernalization treatment given to seedlings of about 3 weeks was found to be stable in nature, since the vernalized seedlings transplanted in October took same number of days as that of plants which transplanted in November to initiate flowering, even though the day temperature was quite high during October.

4. Protein initially declined and maintained at almost the same level up to 3rd week after that it increased slightly in vernalized seedlings. Contents of ILA, reducing sugars and amino acids were also increased with the advancement of
treatment. This might have enabled the plants to accelerate
growth and developmental process of seedlings when
transplanted in pots.

5. Contents of protein, reducing sugar and HIA were at a
high level in top two leaves of control plants just before
flowering indicating a ready or trigger state for induction.

6. Elevated levels of protein, HIA, total nucleic acids were
observed in shoot apices of vernalized plants during the
transition stages. These metabolites are associated with
the process of flowering.

7. Vernalization caused considerable decrease in phenol content
which may be due to the inhibitor level of phenol which
causes the increase in hormonal level. However, only quali-
tative study will give a clear picture of the role of
phenol in the process of vernalization.

8. Aminoacids and phenols were at lower level in top two
leaves of control plants just before flowering.

9. Endogenous GA like and cytokinins like substances might
have some effects on flowering of vernalized plants.
Vernalized seedlings had more endogenous hormones at
particular R position.

10. External application of GA3 did not show any effect on
flowering, but only caused a slight elongation of stem.
11. Higher root assimilation rate in vernalized plants resulted in increased plant and seed weight plant. Net assimilation rate is an important factor in the process of development.

12. Leaf weight ratio was negatively correlated with the age of the plant whereas LAH was positively correlated.

13. It was observed that the longer the vegetative period the higher the dry matter production. Early transplanted control plants produced more dry matter compared to vernalized and late transplanted control plants.

14. Vernalization and photoperiodic treatment are important factors in the development of storage organ (root) in the present experimental plant. In vernalized plants and late transplanted control plants which experienced natural chilling at the early stages, roots were poorly developed. LD conditions during September to October were found to be suitable for the development of roots followed by LD and SD conditions.