

Many plants do not come to flower before they experience a low temperature. These plants remain vegetative during the warm season, receive low temperature during winter, grow further and then bear flowers and fruits. Requirement of low temperature prevents precocious reproductive development in autumn.

It allows the plant to reach vegetative maturity before reproduction can occur. The condition occurs in winter varieties of some annual food plants (e.g., Wheat, Barley, and Rye), some biennial (e.g., Cabbage, Sugar beet, Carrot) and perennial plants (e.g., Chrysanthemum).

The annual winter plants also possess spring varieties. The spring varieties are planted in spring. They come to flower and bear fruits prior to end of growing season.

If the winter varieties are sown similarly, they fail to flower and produce fruits before the end of growing season. They are planted in autumn, form seedlings in which form they cover winter. The seedlings resume growth in spring. They bear flowers and fruits in summer.

It was found by Lysenko (1928), a Russian worker that the cold requiring annual and biennial plants can be made to flower in one growing season by providing low temperature treatment to young plants or moistened seeds.

He called the effect of this chilling treatment as vernalization. Vernalization is, therefore, a process of shortening of the juvenile or vegetative phase and hastening flowering by a previous cold treatment (Fig. 15.33).

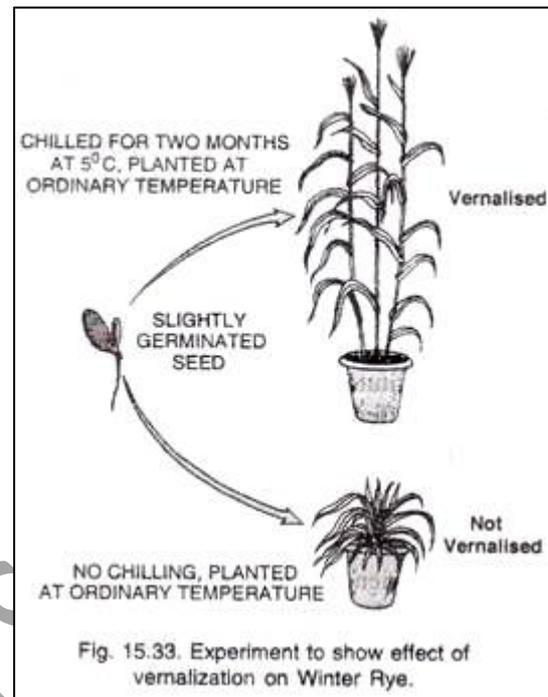


Fig. 15.33. Experiment to show effect of vernalization on Winter Rye.

Site for Vernalization:

The stimulus of vernalization is perceived only by the meristematic cells, e.g., shoot tip, embryo tips, root apex, developing leaves, etc..

Requirements of Vernalization:

(i) Low Temperature:

Low temperature required for vernalization is usually 0°—5°. It is 3°—17° in case of biennial Henbane (*Hyoscyamus niger*). Low temperature treatment should not be immediately followed by very high temperature (about 40°C) otherwise the effect of vernalization is lost. The phenomenon is called de-vernalization.

(ii) Period of Low Temperature Treatment:

It varies from a few hours to a few days.

(iii) Actively Dividing Cells:

Vernalization does not occur in dry seeds. The seeds must be germinated so that they contain an active embryo. For this the seeds are moistened before exposing them to low temperature. In whole plants, an active meristem is required.

(iv) Water:

Proper protoplasmic hydration is must for perceiving the stimulus of vernalization.

(v) Aerobic Respiration and

(vi) Proper Nourishment.

Mechanism of Vernalization:

The stimulus received by the actively dividing cells of shoot or embryo tip travels to all parts of the plant and prepare it to flower. The stimulus has been named as vernalin. It can be passed from one plant to another through grafting in case of Henbane but not in others. However, the chemical has not been separated. In some plants cold treatment can be replaced by gibberellins.

Vernalization prepares the plant to flower. The induction of flowering depends upon the presence of other favourable conditions. Photoperiodism, however, not only prepares the plant to flower but also brings about flowering. Thus, Henbane is a long-day plant which also requires cold treatment. Unless and until both are provided the plant will not come to flower (Fig. 15.34).

Importance of Vernalization:

- (i) Vernalization can help in shortening the juvenile or vegetative period of plant and bring about early flowering. It is not only applicable to temperate plants but also to some tropical plants, e.g., Wheat, Rice, Millets, Cotton,
- (ii) It increases yield, resistance to cold and diseases, and
- (iii) Kernel wrinkles of Triticale can be removed by vernalization.

Application of Vernalization:

The shortening of vegetative period by vernalization in winter cereals enables to have the yield in the first year and helps them to escape drought in the regions having late summer drought.

Late varieties of wheat and oat can be cultivated in northern latitudes with short summer as vernalization helps fruiting in the short summer. Vernalization also increases yield of crop plants, removes wrinkleness of the grains and also enables to obtain flowering out of season.

In India several crops have been vernalized with varied success. For instance, in rice, late Professor S. M. Sircar induced some delayed flowering following vernalization. Earlier Kar and Adhikary observed that pre-sowing and high temperature induced early flowering in some varieties.

Pre-sowing cold treatment of *Corchorus capsularis* seeds caused delayed seed germination but produced high chlorophyll contents in the leaves and more healthy plants. When the seeds were subjected to prolonged low temperature it caused early flowering and also fruiting. -

Some interesting results have been obtained on vernalization of gram, pea, mustard and linseed at different centres. The treatments were either given to the seeds, just emerged seedlings or even sprouted seeds.

The role of vernalization in reducing kernel shrivelling in triticale, a new synthetic genus and a polyploidy hybrid produced by cross breeding wheat and rye, has been shown. The basic mechanisms which regulate the kernel development were correlated with the vernalization response.

The lowering of α -amylase activity with high accumulation of endosperm starch leading to the reduction in kernel shrivelling could be obliterated through vernalization.

