

## Vernalization :

Temperature provides another environmental effect on the seasonal changes of plant body. A large no. of plants can be induced or promoted to flower by low temp ( $3^{\circ}\text{C}$ ) followed by exposure to long days i.e 15 hours at an optimum temp. This promotive effect of low temp on flowering is termed as vernalization.

The term is also applied to the treatment of seeds & other plant organs at relatively high temp. The term vernalization was first coined by a Russian scientist Dyzenko (1928). He demonstrated that the winter varieties of wheat, Rye & barley could be planted in the Spring to yield the crop at the same time. Vernalization actually includes the induction of flowering in species which require low temp. (cabbage, beet etc). As well as hastening of flowering which is promoted by low temp. (winter grass, radish) etc.

In some species both the seeds and the plant organs are capable of responding to vernalization. Many consider that the rapid growth of the plant may give an antagonistic effect on the flowering response & acc. to them the low temp. treatment may be simply a suppression of growth. The vernalization effect can be best visualised by examining the effect of chilling in winter Rye (*Secale cereale*). It has 2 strains - Spring and Winter <sup>strains</sup> strains. The Spring strain is annual, flowering & fruiting in one growing season.



The winter strain is a biennial, strain vegetative in the 1st growing season & flowering & fruiting in the next season. However, when the winter strain is vernalized it can be planted in spring and induced to flower in 1 season & in this manner resemble to Spring strain. After a prolonged treatment at cold temp. it respond to a proper photoperiodic treatment & flowering is initiated. Thus, vernalization changes biennial into an annual. It should be realized that in flyc, vernalization is not an absolute requirement of flowering, it just shortens the time to flower. However, in many other biennial its requirement is absolute & they cannot flower without vernalization.

### Sites of Vernalization:

In the seedlings and in mature plants the shoot apex seems to be the site of vernalization. This has been shown with localized low temp. treatment of diff. plant parts in celery, sugar beet, chrysanthemum. Grafting exp. have also demonstrated that the shoot tips receives the vernalization stimulus & the stimulus is transmitted to the other parts of the plants. Once, the tip is vernalized, the condition is transmitted to all other tissues formed subsequently so that all other lateral tips are also vernalized. If the vernalized tip is removed, the 2<sup>o</sup> & the 3<sup>o</sup> lateral are developed which are in

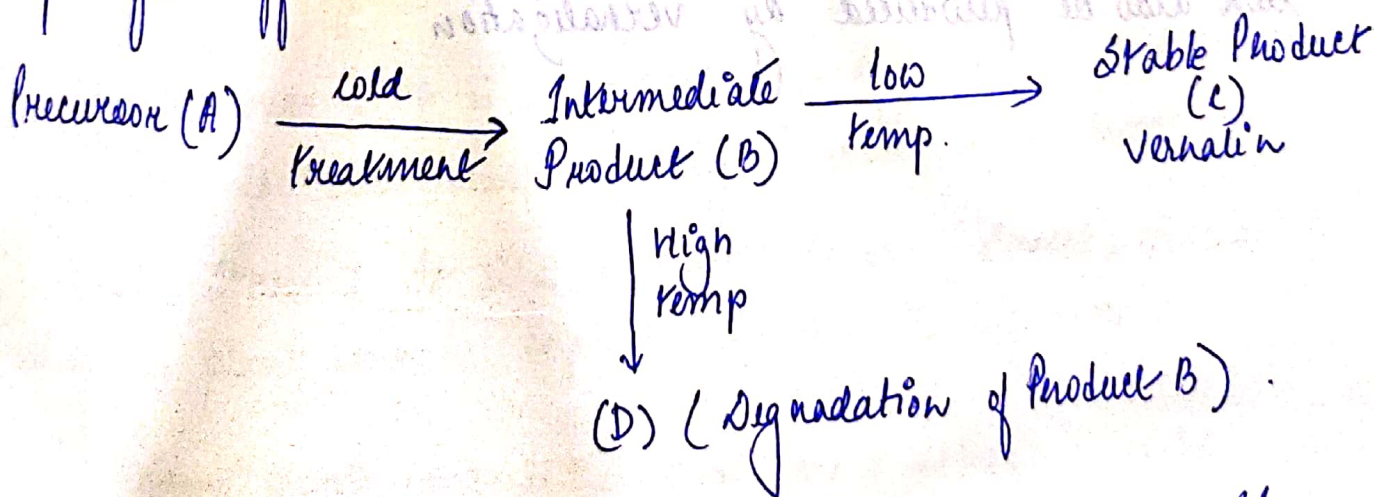


the vernalized state. In Lunaria biennis however, it has been found that the young leaves are also capable of being vernalized. But older leaves which have ceased growth do not respond. In plants which can be vernalized at seed stage, the plumule is the receptive tissue.

### Mechanism of Vernalization:

The mechanism of vernalization is based on imp. consideration. It has been observed that high temp. following the low temp. nullifies the flowering effect. This suggests that the products of cold treatment may be metabolized away if the low temp. is immediately followed by high temp.

A very simple hypothesis postulates the occurrence of 2 sep. processes competing for a common substrate each having its own temp. opt. coefficient.



It is obvious from the above scheme that if the cold treatment is continued without high temp., the intermediate product B starts accumulating which is then converted to stable product, vernalin. But if high temp. acts upon the



intermediate product B, then it will be degraded and as a result flowering does not occur.

Lang et al (1957) demonstrated that the application of gibberellins can replace cold treatment for vernalization of many plants.

### Significance of Vernalization:

Vernalization has got an immense role in agriculture. Countries like Russia has been successfully applying <sup>this process</sup> to shorten the vegetative period of plant species and to make them early flowering. The main advantage is that the plant can complete its life cycle (with the formation of flower & seed) before the onset of winter season which would normally fail to produce flower and seeds.

Other advantages of this process are to increase cold & drought resistance in plants. Some disease resistance plants can also be produced by vernalization.