Frost Tolerance and Frost Damage

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Frost can occur in any month; however, frost occurring in the spring and late August or early September can be critical. The temperature at which freezing injury occurs varies with the plant's stage of growth, soil moisture content and the length of time the temperature remains below freezing. Damage occurs when ice crystals form within the plant or the plant actually freezes, causing cell walls to rupture.

A severe drop in temperature that lasts only a very short time may not damage canola plants, while a light frost of a several degrees below freezing that lasts all night may cause severe damage. The amount of frost injury will depend on soil moisture conditions, the rate at which thawing occurs, the growth stage of the plants and the amount of cold temperature hardening the plant is exposed to prior to freezing temperatures.

Canola seedlings usually will recover from a light spring frost that does not damage the growing point of the plant. If a heavy frost does blacken the leaves, take no action for at least four to seven days.

The extent of the injury can be determined in a week or less following the frost. If you see any green at the growing point in the center of the frozen leaf rosette, the plant will recover and yields will be higher than if the field is torn up, reworked and reseeded.

Early seeded canola, after several days of near-freezing temperatures, will undergo a gradual hardening process that will allow the plants to withstand freezing temperatures without serious damage. A number of chemical changes occur, resulting in a higher concentration of soluble substances in the cell sap. Research in Canada has shown that early seeded canola that had undergone hardening could withstand 18 to 20 F temperatures, while later-sown canola that did not undergo hardening was killed by temperatures of 25 to 26 F. In North Dakota, canola seedlings have withstood temperatures as low as 22 to 23 F with only limited frost damage or stand reduction.

In evaluating frosted seedling fields, one must consider the percentage of plants killed, the percentage recovered and the time of year. The surviving plants also should be somewhat evenly distributed in a field when allowing the stand to remain for production and yield. Even if two-thirds of the seedlings in a reasonable stand are frost-killed, the field usually will produce more when left than if reseeded. The surviving plants will take advantage of the reduced competition for light, moisture and nutrients, and they will grow larger, producing more branches, pods and seeds per pod, thereby

compensating for the lost plants. The surviving plants will require five to eight days longer to mature, but a reseeded crop will require an even longer period to reach maturity.

Frost at flowering will delay maturity but results in only minor yield reductions. Frost after flowering, however, can result in significant yield reductions and grade loss. Frost during flowering usually causes flower abortion. Researchers have observed that only plants with open flowers at the time of the frost were affected. Pods lower down on the stems and unopened buds continued to develop normally. Several days after the frost injury, gaps of aborted pods were evident on the stems. The injury was quite evident; all open flowers at the time of the frost showed the damage.

The amount of fall frost damage to canola depends on the stage of maturity. A 27 F frost is enough to kill immature seeds containing 50 to 60 percent moisture, while those ready to swath at about 35 percent moisture normally will escape damage. Thus, having uniform stands that ripen uniformly early is important. Uneven stands, with a significant portion of late, immature seeds, may produce seeds of lower quality because the damaged seeds will retain their green color, which will reduce the grade.