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To the casual observer, seed production in grasses consists of the appearance of heads, the dispersal of pollen and the maturation of seed. But these are only the more advanced stages in seed development. A full understanding of the complete process is basic to the successful management of grasses for seed production. In view of the importance of the grass seed industry in northwestern Canada, we at the CDA Research Station, Beaverlodge, Alta., are conducting experiments to determine the various factors that influence all stages of the phasic development of grasses.

It has long been known that a feature common to all perennial grasses is the sequence of stages through which an individual tiller passes in producing a seed head. Each tiller originates as a minute enlargement on the crown of the plant but soon becomes a vegetative shoot with leaves and roots. Under favorable conditions the growing point, after producing several leaves, undergoes chemical change (induction) in preparation for flowering. The next stage (initiation) is the morphological transformation of the growing point from the vegetative (Fig. 1) to the floral state (Figs. 2, 3 & 4) with the rudimentary floral parts appearing as small protuberances. Only then does heading and development of seed occur.

Although grass species follow the same sequence of phasic development, the environments required to promote the successive stages differ considerably. The stages at which the plants are receptive to these stimuli also vary. For example, the induction of creeping red fescue is completed in late autumn, but only in those tillers with one full season of uninhibited growth. Because of this, spring seedings made without a companion crop usually produce seed the following year, while those sown with such a crop or alone in mid-summer do not. Floral initiation occurs in the spring shortly after the spring thaw, some 5 to 10 days prior to that of most other species. By controlling the environment, we found that creeping red fescue requires a period of long days and low temperatures for floral initiation. If spring temperatures rise too rapidly in relation to lengthening daylight, floral initiation does not take place. For this stage of flowering, northwestern Canada provides the required spring climate.

Intermediate wheatgrass also is autumn induced, but a week or two earlier than creeping red fescue, indicating that this species does not require such low temperatures and short days as does fescue. Intermediate wheatgrass is somewhat unique in that induction can be acquired also by moistened seeds (seed vernalization) and by very young tillers. Therefore, it is not uncommon to find tillers in the early autumn with initiated floral parts. However, tillers initiated in the autumn are killed during the winter and the seed crop is from induced tillers that undergo initiation in the early spring.

Russian wild-rye differs from most other cultivated species in that seed is produced by tillers which pass

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factors

Fig. 1—The growing point of a creeping red fescue tiller in a vegetative stage

Figs. 2, 3 & 4—The growing points of creeping red fescue tillers in successive stages of floral initiation prior to stem elongation

through the floral initiation stage in the early autumn of the previous season. We also noted that initiation occurred only in those tillers that had previously overwintered in the vegetative stage. This explains why new seedings of Russian wild-rye do not produce seed until after the second winter.

These precise species differences dictate the management practices that must be followed for commercial seed production. For example, grasses in which young tillers invariably undergo autumn induction can be seeded in the spring with a companion crop or alone in midsummer. Time of applying fertilizer is also important. We have found that floral initiation has very specific requirements for nitrogen, so seed growers should apply supplemental nitrogen just prior to this stage. For those grasses, such as creeping red fescue, that initiate heads in the early spring, late autumn fertilizing is most effective. For those that initiate floral parts later than creeping red fescue, such as bromegrass, intermediate wheat grass and timothy, fertilizing may be delayed until the early spring. For Russian wild-rye, fertilizing immediately after seed harvest is best.

This knowledge can reduce by two-thirds the time required to produce seed from the initial crosses in a grass breeding program. At Beaverlodge we determined the light and temperature requirements for each stage for creeping red fescue, bromegrass and intermediate wheatgrass. These grasses, under controlled climates, can be grown through one complete life cycle in 8 months as compared to 24 months for fieldgrown plants.

Fig. 5—Harvesting a portion of the 20-million pound crop of creeping red fescue seed produced annually in Canada's Peace River region

affecting grass seed yields

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