AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

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Growing Forage Legumes for Seed

Legumes have a wide area of adaptation when grown for forage, soil improvement and conservation, but their potential for producing seed profitably is restricted to regions with specific soil and climatic conditions. Before growing legumes for seed production in a given area, check, local recommendations on the seed-producing capability of legume species and cultivars.

A number of prerequisites have to be met for the optimum production of legume seed stands. Some of these conditions are outlined below.

Inoculation, seeding and stand establishment

Soil tests are required for accurate assessment of soil nutrient availability. Liming is essential on soils with a pH below 5.0. Lime makes the soil less acid and promotes the nitrogen fixing activity of nodule bacteria. Optimum nitrogen fixing activity occurs at the following pH levels: 5.8 for cicer milk vetch; 6.4 for bird's-foot trefoil, alsike clover and red clover; 6.5 for alfalfa, sweetclover and white clover and finally, 7.1 for sainfoin. All the important nutrients should be replenished on the basis of a soil test.

Legumes should be seeded as early in the spring as possible

Legumes should be seeded as early in the spring as possible into a warm, moist firm seed bed at a depth of 1 to 2 cm. Seeding rates for legume seed stands are lower than those used for herbage stands. For example, seeding rates for small seeded legumes, such as alfalfa and the clovers, vary between 1 and 5 kg/ha, while those for large seeded legumes such as sainfoin, vary between 7 and 10 kg/ ha.

Legumes do not depend entirely on nitrogen fertilizer available from the soil. They are capable of converting nitrogen from the air into a form that is available for their growth. To do this conversion, they require certain bacteria known as *Rhizobium*. These *Rhizobium* grow and multiply on the roots and form nodules. It is in these nodules that free nitrogen from the air is converted into a form that can be used by the plant.

To ensure that enough *Rhizobium* are available in the soil, the seed should be inoculated just prior to seeding. The inoculum is a culture of living *Rhizobium* bacteria and should be applied to the seed with a sticking agent. Pre-inoculated seed should be kept in a cool, dark place. Exposure to sunlight or fertilizers will kill the *Rhizobium* bacteria.

For successful inoculation, the correct type of bacteria should be used. For example, alfalfa bacteria are not effective on red clover.

Legumes can be divided into the following groups, often referred to as 'cross-inoculation' groups. The crops in each cross-inoculation group are nodulated by the same bacteria:

- alfalfa, white and yellow sweet-clover
- alsike clover, red clover and white clover
- bird's-foot trefoil
- sainfoin

There is no simple soil test to detect the presence or absence of the required bacteria. However, inoculation is essential if one or more of the following conditions apply:

- on acid soils that have been limed as a prerequisite for growing legumes
- on recently cleared or broken soils or soils where legumes have not been recently grown
- on soils where previous crops of legumes have not been successful
- on soil with poor drainage

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Weed control

Weeds reduce seed yields, lower the grade of seed and increase processing costs, so weed control is important. Aggressive annual weeds can reduce the vigor of the legume crop during the year of establishment, resulting in poor establishment and reduced yields in subsequent years.

To reduce losses from annual weeds, use pedigreed seed (check your seed test certificate), and plant only on clean land. If the land is infested with weeds, it should be cleaned up by cultivation or other means before seeding. Herbicides can be useful in controlling weeds in seedling stands. Current recommendations for herbicide use are contained in provincial bulletins.

In vigorous established legume seed stands, annual weeds should not be a problem since the crop can compete successfully with weeds. However, persistent perennial weeds can become a problem. When these weeds occur in patches, such areas should be isolated from the rest of the field and destroyed by cultural means or recommended herbicides.

Control of diseases and injurious insects

Diseases are caused by fungi, bacteria, viruses, mycoplasmas, nematodes, mineral deficiencies and excesses. Of these, the fungi are the most important in causing losses, as they attack foliage, roots and crowns. Preventing or minimizing disease is more economical than curing it. Losses caused by most diseases can be reduced by proper management to maintain a vigorous stand. Use pedigreed seed of recommended cultivars, rotate with non-legume crops and use resistant cultivars where available. If serious diseases develop, get a professional diagnosis.

Lygus bugs, plant bugs and aphids can cause severe injury and reduce seed yields by destroying buds and by causing flower drop and seed blast. Other injurious insects are thrips, leaf hoppers, weevils and beetles. Seed producers should make sweeps prior to blooming, preferably in the early to mid-bud stage. If insect populations warrant it, apply the recommended insecticide.

Some insecticides are extremely toxic or may persist on sprayed foliage for extended periods. Small residues of these long-lasting insecticides can effectively decimate useful pollinating insects and bees. Spraying should be done before pollinators are introduced into the crop and before bloom to avoid injury to introduced and native pollinators. Refer to the annual Alberta Agriculture publication *Crop Protection*, Agdex 606-1, for the proper use and application of insecticides.

Pollination

To make legume seed production an economically viable venture, it is essential to introduce bees to pollinate the crop. Seed yields are increased appreciably, e.g. up to five-fold in alfalfa, with the use of leafcutting bees.

Legumes have to be cross pollinated to produce seed, and bees are required to do the job. Cross pollination is the transfer of pollen from the anthers (male organ) of one plant to the stigma (female organ) of another plant. Cross pollination must occur for seed set because legumes are predominantly self sterile, i.e. the pollen is unable to successfully fertilize the ovules of the plant on which it is produced.

Bees forage for nectar and pollen. In legumes, the flower parts (anthers, stigma, etc.) are enclosed within the petals. Nectar is produced at the bottom of the flower. Bees force the flower open and in the process of foraging, cover their bodies with pollen, which is transferred from one flower to the next, thus effecting cross pollination.

There are three main types of bees that pollinate legumes – honey bees, leafcutting bees and bumblebees.

Honey bees are effective pollinators of a number of legume crops. Two economically important products are obtained by using honey bees to pollinate legume crops – legume seed and honey. Stocking rates commonly used are 2 to 5 colonies per hectare for sweetclover, white clover, and bird's-foot trefoil; 2 to 8 colonies per hectare for alsike clover; 3 to 15 colonies per hectare for red clover and sainfoin. In fields less than 8 ha in size, or when competing crops are in the vicinity, the higher stocking rates are usually required. Honey bees are of little value as pollinators of alfalfa in most seed producing areas in Canada. They prefer to 'rob' nectar from the side of the flower and in most instances, do not collect pollen or pollinate the crop.

Megachile rotundata (F.), the **leafcutting bee** introduced to North America from Europe, is the preferred pollinator of alfalfa. A stocking rate of 50,000 cells per hectare is recommended. This bee overwinters as a prepupa in a cocoon or cell wrapped in leaf material, and on an average, there is a 1.5 to 3-fold increase in cells during the growing season. Leafcutting bee cells, like alfalfa seed, are an item of both domestic and international trade. In some fields, particularly those surrounded by bush, some native species of leafcutting bees are found. They pollinate alfalfa but because of fluctuations in numbers, are not reliable pollinators.

Bumble bees are excellent pollinators of legumes. Colonies of native bumble bees can be built up by providing nesting areas and spring flowering plants that start to bloom before legumes. Bumble bees often

establish colonies in the surrounding bush in abandoned nests of small mammals or birds. Some species choose underground sites, while others prefer sites that are on the surface but concealed in a depression or under a tuft of grass. However, for consistent and reliable seed yields, honey bees or leafcutting bees must be introduced to seed fields during the blooming period.

Harvesting

Most legume seed stands can be swathed when a large proportion of heads are ripe and dark brown to black. The swaths should be left to dry and can be threshed 7 to 10 days later. The seed will still cure and ripen in the swath. If the weather is wet, a side delivery rake can be used to turn the swath for drying with minimal seed loss.

Another alternative is to chemically defoliate the crop and straight combine the crop 10 to 14 days later. Defoliation may be more practical where weeds are a problem or where there is late growth in the crop. While seed can ripen in the swath, no change in seed maturity occurs after the use of a defoliant. Therefore, defoliants should be applied after most of the seed heads are mature. A severe killing frost acts as a defoliant.

Use a slow forward speed when combining as overloading the machine can cause serious seed losses. Wind adjustment, type and speed of reel, ground speed and cylinder speed are important in combining. Follow the manufacturer's instructions and take samples of chaff from behind the combine at intervals to determine seed losses. Then just combine speed and settings accordingly.

Seed should be dried if the moisture content is too high for storage (in excess of 13 to 14 per cent). Seed cleaning is required to bring seed up to specified standards of purity. Specialized equipment found in forage cleaning plants is used for this processing.

Post-harvest management of fields

In the fall, a very shallow cultivation will destroy weeds, incorporate straw and loosen soil for better moisture penetration. Herbicides for weed control can also be applied in the fall for most legume stands. Check local recommendations.

Pedigreed seed production

Seed that has pedigreed status meets the grade requirements (for genetic identity, purity, germination, etc.) of the *Canada Seeds Act*. For forage legumes, there are four classes of pedigreed seed – breeder, foundation, registered and certified. Foundation and certified classes are the predominant seeds of commerce. Certified seed is recommended for general farm use. It is the last pedigreed generation at which seed may be sold under a cultivar name. Therefore, if you wish to produce certified seed, i.e. seed of a named cultivar, you must plant registered or foundation seed. If you plant certified seed of a named cultivar and produce seed from it, that seed cannot be sold under a cultivar name.

The regulations and procedures for production of all classes of pedigreed seed are prepared by the Canadian Seed Growers' Association (CSGA). The CSGA is designated by the *Canada Seeds Act* as the official agency responsible for prescribing standards and issuing crop certificates for Canadian produced pedigreed seed. Specific requirements have to be met to produce pedigreed seed – e.g. isolation distances, previous cropping history of land, etc. Contact the CSGA to obtain detailed information on pedigreed seed production.

Contract production of seed of foreign cultivars

A limited opportunity exists for producing seed of some foreign cultivars. The seed is grown under contract for a particular member country of the Organization for Economic Cooperation and Development (OECD). Such contracts are negotiated between the individual producer and the seed firm responsible for delivery of the seed to the country involved. A number of countries participate in this scheme. Prospective producers should make all arrangements and contracts with the seed firm concerned prior to going into production of foreign unregistered cultivars.

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