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Legume Seed Production In Ontario

by
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Prior to the mid-forties, legume seed production was a well-established enterprise on many Ontario farms. Today, it is of very minor importance. Legume crops are left for seed only when conditions appear favorable, and when they are not required as more profitable feed crops for the ever-increasing livestock population. Consequently, the modest production of legume seed in this province fluctuates considerably from year to year. The principal supply for our domestic requirements comes from the specialized grower in the more favorable climate areas of the American West.

The western grower, particularly in the United States, has increased seed production considerably over the past decade by practicing important improvements resulting from research. He produces seed of improved varieties in demand in the east for one generation without altering them with respect to winterhardiness. Seed production with these growers is a specialized business. It is their main operation and not secondary to their feed crops.

In Ontario, legume seed production is very uncertain. Furthermore, it appears that seed production will continue to be erratic in the forseeable future, in most of the legume crops grown. In most cases, low yields seem to be associated with the lack of sufficient pollinators to set a crop of seed effectively. Although the by-products of the legume seed crop may be useful to some classes of livestock, the seed must be the profitable part of the crop.

Today, the demand is for pedigreed seed of a useful variety. The production of this class of seed requires special attention and, hence, added costs. But the uncertainty of good legume seed yields makes this enterprise a questionable part of a farm business. **Therefore, it is most important that this publication is not interpreted to recommend that Ontario farmers should undertake legume seed production for a stable portion of their livelihood.**

REQUIREMENTS FOR SEED PRODUCTION

There are many requirements for successful seed production of forage legumes. None is more important than the desire of the grower to produce a quality product of a pedigreed variety. Ontario has the rainfall and soil to produce excellent quality seed. By permitting the first crop to bloom when weather conditions are generally more favorable, and by encouraging pollinators, a farmer may normally expect higher yields. The factors discussed here have proven to be most important. But chance also plays a role. If the weather at blossom time is sunny and warm, pollinators will be more active and yields correspondingly increased. Similar weather at harvest time improves the threshability. Consequently, a few days of favorable weather often makes the difference between a good and a poor seed crop.

Honeybees are effective pollinators of most forage legumes.

Grower

The seed grower should produce high yields of good quality, genetically pure seed for a profitable crop. To do this, he must pay strict attention to his crop in order

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to protect it from weeds and other species; rogue it for off-type plants to obtain genetic purity; isolate it from other varieties to keep foreign cross-pollination to a minimum; and in some cases improve the likelihood of good yields by providing pollinating insects to cross-pollinate his crop. **He must grow a pedigreed variety for which there is an assured demand, specifically for seed and not primarily for forage.** Unless the grower is prepared to meet these minimum requirements, he will not find pedigreed legume seed production very rewarding.

Field

The field to be seeded must be clean. Unless it is free from weeds and other crop plants, the seed crop is doomed to failure. A planned crop rotation will help ensure a clean field before the seed crop is sown. Rotations help put the soil in a better condition and give the grower a chance to control difficult weeds. Indeed, small patches of weeds such as Canada thistle or couch grass should be killed by a timely application of a suitable herbicide in the year prior to making the seeding.

Seed fields must be clean and well isolated to produce quality pedigreed seed.

The field to be planted should be free of volunteer plants of the same or other crops. It must be well isolated from fields of the same species. Regulations concerning land requirements and previous cropping history should be carefully considered. The information shown in Table 1 points out some of these requirements for pedigreed seed crops.

Table 1. Minimum land and isolation requirements for forage legumes*

Variable	Foundation	Registered	Certified
	No. of years free of same kind of crop		
Land Requirement	5	3	2
Isolation Distance	Yards from same kind of crop		
5 acres or less	300	150	50
Exceeding 5 acres	200	100	50

*From Circular No. 6, Canadian Seed Growers' Association. Subject to change.

Seeding

Legumes should be seeded on a clean field, worked to a fine, firm seedbed, and covered with a packer or light harrow to the preferred depth of one-half inch. The seed should be inoculated with the proper inoculum just prior to seeding. This provides the legume bacteria for good nitrogen fixation.

Early spring seeding will establish the best stands by permitting the plants to become well established before hot weather arrives. If it is necessary to seed during the summer, such seedings should be early enough to permit eight weeks of growth before the first killing frost is expected.

Stands may be established with or without a companion crop. If one is used, it is suitable only for spring seedings. Oats is recommended at a seeding rate not to exceed 1½ bushels per acre. Superior stands are established where no companion crop is employed, providing weeds are controlled. Consult Ontario Department of Agriculture and Food Publication 75, **Guide to Chemical Weed Control,** for weed control recommendations in forage legumes.

In Ontario, most of the legume seed has been produced in the past from stands established primarily for hay. This practice has dictated the seeding rate and solid stand culture. **If the crop is to be grown primarily for seed production, the seeding rate should be cut in half.** Thin stands produce profusely blooming plants with large flowers and an open type of growth which appears to be attractive to bees. Where low seeding rates are used, however, chemical weed control is essential.

Row seedings have been shown in extensive studies to provide higher seed yields for a longer period of time than solid seedings. The method demands weed control and, in some cases, modifications to seeding and harvesting equipment. Rows are easily seeded by plugging the drill runs for the desired spacing. Row widths of 28 to 35 inches are recommended.

In the past, row seedings have not been popular due to the necessity of cultivation to prohibit weed and seedling growth. Today, a timely fall application of the herbicide simazine at 1 pound active per acre will eliminate new weed and legume seedlings. The herbicide must be applied each fall commencing in the seedling year. The application should be made sufficiently early to kill seedlings as they germinate. At Guelph, good control has been obtained from applying no later than October 1.

Fertilizer

In most areas commercial fertilizer is essential for good establishment, vigorous growth and a profitable seed yield. A late summer or early spring application is recommended. **The rate of application should be based on a soil test.** Legumes are heavy feeders of phosphorus and potassium, and fertilizers containing a high percentage of these elements are often recommended. Farmyard manure should not be used because weed seeds are frequently associated with it.

Roguing

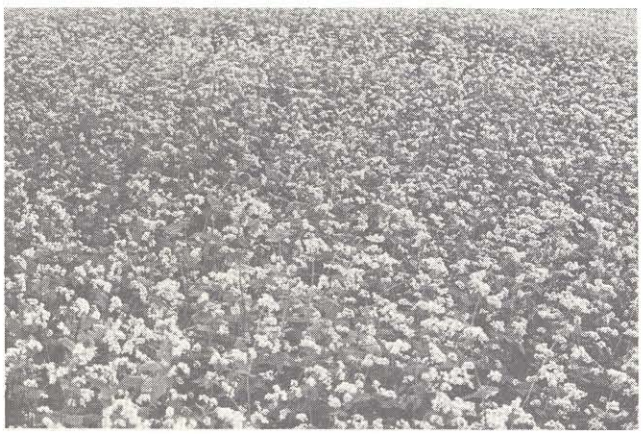
Roguing, the removal of foreign plants from the field, is an essential phase of pedigreed seed production. **It is rewarding because it improves the appearance and because clean seed commands a premium price.** It should be done at a time when other species, weeds, and off-type plants are easily spotted. Rogues should be pulled and removed from the field. Weeds should be controlled by chemicals or pulled before they produce seed. All roguing must be completed before field inspection. A good grower will rogue his field two or three times each year.

Pollination

Satisfactory legume seed production depends upon blossom visits by bees for the transfer of pollen from one plant to another. This enables fertilization and seed formation to occur.

Wild bees, including bumblebees, are very effective pollinators, but their numbers fluctuate from season to season and they are poorly distributed throughout the province. To date, the usefulness of the small alfalfa leaf cutter bee *(Megachile rotundata F.)* for pollination of legume seed crops in Ontario has not been demonstrated beyond question. Although this bee can be readily cultured by man, it appears that at least in the Guelph area, temperatures are often too low for their efficient activity. For this same reason they have not increased in numbers to any extent. Additional information is unlikely to change the picture in the future.

Honeybees are just as effective pollinators as wild bees of most forage legumes. Present in sufficient numbers, they can give a satisfactory seed set particularly with the clovers and bird's-foot trefoil. In Ontario, they are relatively ineffective pollinators of alfalfa.



Buckwheat, sweet clover and other plants often out-compete legume seed crops for pollinating insects.

Placing one or two colonies of honeybees per acre within legume fields may increase the seed yield but it does not guarantee a seed crop for the following reasons. First, in most areas the legume crop is in competition with other cultivated plants and attractive weeds as a pollen source for foraging honeybees. Second, for maximum bee activity, sunny, hot days are essential during the flowering period. Ontario's summer weather is variable and no guarantee of these ideal conditions can be given. However, July provides the maximum probability of these ideal conditions and management should be such that the bloom period occurs during that month.

Harvest

Direct combining, swathing or windrowing and the pickup combine have replaced the more efficient threshing machine for hulling legume seed crops. Although direct combining is used quite widely with red clover, more seed is saved with most legume crops by swathing or windrowing and the pickup combine.

Legume crops should be swathed or windrowed when covered with dew.

All forage legumes show considerable variation in time of ripening. For best results, swathing or windrowing should be carried out when most of the heads or pods have turned brown. It should be done when dew is present and the crop should be handled as little as possible to minimize shattering losses.

During favorable weather sufficient drying of windrowed or swathed material will occur usually in 3 to 7 days, depending upon the species and the amount of growth. When combining, the pickup should be run at a speed that will not tear the windrow apart since this increases seed losses considerably. The combine should be operated carefully to keep harvest losses low. Travel at the correct forward speed. Make careful adjustments to the cylinder clearance, cylinder speed and air blast. **For complete instructions always consult the operator's manual.**

Seed harvested when the crop is tough may contain too much moisture or crop refuse for safe storage. Spread such seed 3 to 4 inches deep on a tight floor and stir by raking every day until completely dry. Rough cleaning immediately following combing may eliminate the necessity of drying and improve the quality of the seed greatly.

Defoliating legume crops with chemicals has not been universally effective. It may be detrimental if the weather does not remain bright and sunny from the time the chemical is applied until the crop is combined. With some crops, however, defoliation appears to be quite promis-

ing. At present, insufficient information is available to recommend preharvest sprays in Ontario.

When harvesting any forage legume seed crop, check the following points:

- Consult your operator's manual.
- Check the cylinder for concave and shelling plate clearance. Usually a clearance of 3/16 to 3/8 inch is required for alfalfa and trefoil, 3/32 to 3/16 inch for red clover, with a cylinder speed of 1400 to 1600 rpm.
- The chaffer must be adjusted to let the seed and seed pods through for cleaning or rethreshing.
- The air is probably the most critical adjustment of all. The air blast must be such as to keep the sieves from loading up with chaff, but seed must not be blown over.
- The ground speed should be moderate. Overloading causes seed to be carried out with the straw.
- Save all the seed. If necessary do the fine cleaning job in the storage area.

ALFALFA SEED PRODUCTION

The annual demand and favorable retail price for alfalfa seed creates considerable incentive on the part of Ontario farmers to produce alfalfa seed. At one time, high yields of seed of this crop were obtained in some areas of this province. Today, however, only an occasional field in a rare year produces a satisfactory crop.

Alfalfa sets seed occasionally around the perimeter of the field. Observe carefully the amount of podding out in the field before harvesting.

Alfalfa seed yields have ranged from 0 to an occasional 120 pounds per acre, with the very rare exception of 200 to 400 pounds. The odds against a successful seed crop are too great, however, to recommend that farmers try to produce alfalfa seed in Ontario. **Since there does not appear to be any immediate answer to the alfalfa seed setting problem, the crop will continue to be worth far more for hay or pasture than for seed.**

The alfalfa flower on the right has been tripped and is capable of setting seed. At full bloom, three or more tripped flowers should be present in each bunch of flowers for a minimum seed crop.

Why can't Ontario grow seed? The complete answer is not known but observations have clearly shown that very few flowers are cross-pollinated in seed fields. Alfalfa must be cross-pollinated to set seed, a job well done by wild pollinators that probably once abounded in rail and stump fences, bush and waste areas. Today, when the only pollinator of any consequence is the honeybee, seed production is extremely low. Actually, the honeybee could be a satisfactory pollinator but the tripping mechanism of the flower plus competing plants that produce a profuse amount of pollen make this bee very reluctant to work alfalfa for pollen. To obtain the alfalfa pollen, the honeybee must trip the bloom. This tripping process releases the sexual column of the flower which strikes the bee under the head. Honeybees soon learn to avoid the tripping mechanism by working the flowers for nectar from the side. As nectar collectors, they trip and pollinate less than one percent of the flowers visited. **Consequently, honeybees may be numerous in an alfalfa field without pollination being effected.**

Thin seedings at 6 to 8 pounds, preferably in pure stands, are likely to produce the best seed yield. Where stands are thin, the crop is open, the flowers are profuse, and the bloom is more attractive to and more easily worked by bees. Pollinators do not like to work alfalfa plants intermixed with grass and their numbers have been observed to be much lower in grassy alfalfa stands.

Some alfalfa pods must be present at the last sign of flowers for a profitable crop.

Seed production has been higher in most years where the first crop has been left to seed. If the seed crop is to be taken from the second cutting, remove the first growth as early as possible, preferably by the first week in June. This permits the second growth to flower during the generally brighter and hotter days of late July when bee activity is likely to be at its peak.

Table 2. Effect of first growth date of cutting on second growth alfalfa seed yield in pounds per acre at Guelph

Date cut	Height when cut	Year 1	Year 2	Year 3	Year 4
Not cut	—	222	77	60	39
May 13	7″	32	57	19	0
May 20	12″	9	34	0	0
May 27	18″	5	18	0	0
June 3	25″	5	20	0	0
June 17	33″	7	11	13	0

The crop is best harvested by swathing or windrowing when two-thirds of the pods are brown or black. The harvest method to use, however, is dependent upon grower preference, the weather and the equipment available. Whatever the method, it is most important that the combine be properly adjusted to eliminate seed losses. A little time used at the beginning of the harvest may pay rich dividends in pounds of seed saved.

BIRD'S-FOOT TREFOIL SEED PRODUCTION

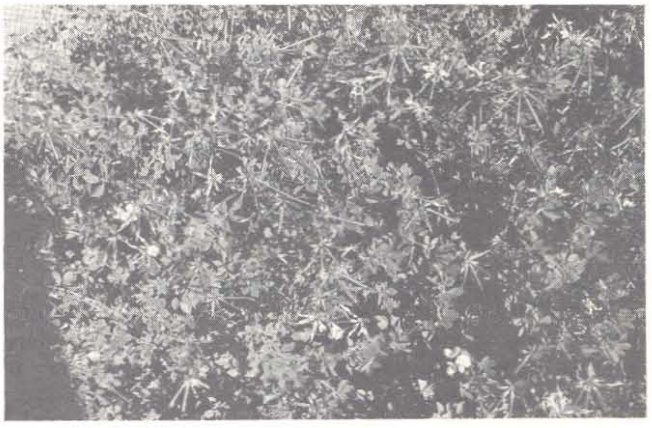
Many farmers in Ontario have had good success in producing bird's-foot trefoil seed. Seed yields have run as high as 300 to 400 pounds per acre, but most yields average about 120 pounds.

Good stands are the first essential step to a successful seed crop. The recipe for establishing trefoil is to spring seed at 5 to 7 pounds of inoculated seed per acre, preferably without a companion crop, united with good weed control. This will ensure a satisfactory stand capable of producing high seed yields. Superior yields, however, are obtained from 3-foot row seedings made at 2 pounds per acre. The management practices outlined on page 2 are an essential part of this method.

The first crop is preferred over other crops for seed because the early flowers set more pod clusters, each of which contains more seed. This adds up to more seed per acre. If grazing or cutting must be done, do it early in the season. The greater the delay of harvesting the first crop for feed, the larger the reduction in the yield of seed that follows.

Bird's-foot trefoil should be grown in pure stands. The addition of grass often presents some pollination difficulties, reduces seed yield, and may provide cleaning problems. Volunteer red clover produces a considerable cleaning problem and it and other species should be eradicated from seed fields. Control of such plants is often best obtained by timely sprays in the year of seeding coupled with roguing and annual applications of simazine. Specific up-to-date recommendations for chemical weed control are available in Ontario Department of Agriculture and Food Publication 75.

Trefoil is attractive to honeybees and wild bees, both of which are effective pollinators. Generally, it is not necessary to place honeybees in a seed field if colonies are available nearby. Natural pollinators do a satisfactory job of setting a seed crop throughout most of Ontario. However, occasionally other bloom, particularly sweet clover, may attract pollinators from trefoil.



Pods, at various stages of maturity, as well as flowers, are present on bird's-foot trefoil at harvest time.

Successful seed production in bird's-foot trefoil often depends upon the timing of the harvest. Trefoil does not flower uniformly. Flowers, as well as green, brown, black and shattered pods are present on a crop at the same time. This makes it difficult to decide just when to harvest. Furthermore, the big harvest problem is that the pods break open and scatter seed soon after they are ripe. Consequently, harvesting must occur when the majority of the pods — 60 to 70% — range from a light to dark brown color.

To harvest, the crop is best windrowed with a roll-bar or pea swather on a mower. This places the pods located at the top of the crop in the center of the windrow and

exposes the tougher stems to the elements. Swathers may be used but care must be taken to combine within a couple of days of good weather or the exposed pods will shatter. In either case, the windrow or swath should be light to facilitate drying and cut when tough, preferably covered with a heavy dew. Careful observations will dictate when combining of this material should take place. This is usually well in advance of the complete drying of the stems.

Swathed bird's-foot trefoil must be combined as soon as the pods have dried.

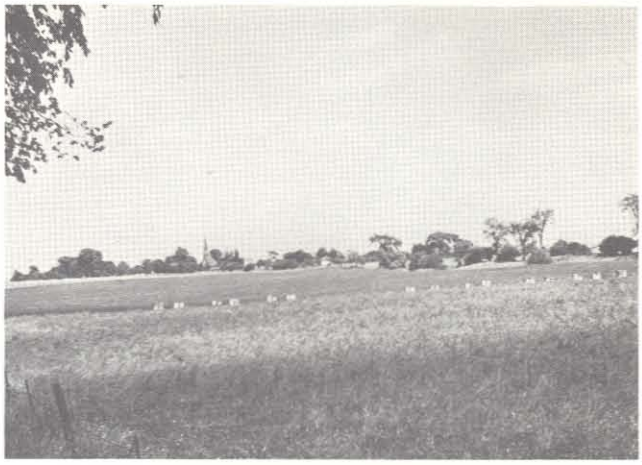
Direct combining may reduce field losses in very favorable years. It is a slow and exacting job but may be useful for a small acreage. In all cases, in trefoil harvesting, the same care is required in adjustment of the combine as with other legume species.

Since all of the harvested seed is not fully ripe at harvest, it is important that the crop be dried immediately to avoid heating. A rough cleaning to remove coarse and green material will hasten drying. In any case, the seed should be spread out on a dry floor to a depth of 3 to 4 inches and turned daily until drying is complete.

RED CLOVER SEED PRODUCTION

Red clover has been grown for seed in Ontario longer than any other legume crop. Most of the seed is produced from meadows that are seeded primarily for hay. This fact probably accounts for the great variation in total amount of seed produced from year to year as well as the low yields of 50 to 100 pounds of seed generally obtained. Only on rare occasions have yields as high as 400 pounds been reported.

Red clover grows best on moist, well-drained soils. Spring seedings are preferred at a light seeding rate of 5 to 7 pounds per acre. If the crop is to be grown primarily for seed, it should be seeded in pure stands. The seed grower, who can supply the necessary management and desires the highest yield, should grow the crop in 3-foot rows seeded at 2 pounds per acre. Because many farmers wish to grow this crop for seed from the second cutting regardless of the probability of lower seed yields, 2 to 4 pounds of timothy may be added under such circumstances.



Placing honeybee colonies within a red clover seed field may increase seed yields.

Like other forage legumes, red clover must be cross-pollinated in order to produce seed. This task is performed by bees, particularly honeybees. Although bumblebees are very efficient pollinators, generally their numbers are too low to set a high yielding seed crop. Honeybees can do an effective pollination job, provided they are not attracted away from the field by other sources of bloom. One to three colonies per acre placed within the red clover field should improve the seed set.

Bumblebees and honeybees are effective pollinators of red clover.

Highest seed yields have been obtained where the first crop has been left for seed. Delaying the harvest of the first crop for feed has decreased the seed yield of the second crop at Guelph. Yield reduction appeared to be associated with lack of moisture, delayed flowering, fewer and less profuse blooms. It also extends the harvest period to the late summer - early fall when less favorable weather conditions often prevail and the longer dew retention is not as conducive to easy threshing.

Table 3. Effect of first growth date of cutting on second growth red clover seed yield in pounds per acre at Guelph

Date cut	Stage when cut	Year 1	Year 2	Year 3
Not cut	—	192	130	74
June 15	early bloom	99	69	61
June 25	full bloom	40	22	55

Red clover seed should be harvested when 90 percent of the heads have turned deep brown to black. Generally, the crop is handled by swathing or windrowing with a mower equipped with a roll-bar or pea swather. Cutting should take place in the morning when the crop is tough. Light windrows or swaths dry faster and thresh easier than heavy ones. The pickup combine should thresh the crop when it is completely dry since hulling is difficult when the crop is tough. Careful combine adjustment and proper forward speed will reduce harvest losses. Direct combining can be carried out on very ripe crops when the upper portion of the stems is brown and dry. This method does not work well where an excessive amount of green material is present. It is useful, however, in those years when the harvest weather is very unfavorable.