Legume Seed Production[1]

by J. A. Munro[2]

There are three important factors required in the production of a legume seed crop,—whether it be alfalfa or any of the clovers. First of all, it is essential that conditions are right for a vigorous stand of plants; second, freedom from pests, and third, enough pollinating insects at blossoming time to insure a satisfactory seed set. They are all necessary, and like a chain, the whole is no stronger than its weakest link. If any one of these conditions is inadequate or lacking, it will result in lowered yield of seed.

It is only in the past few years that new insecticides have been found to meet the need of controlling the more important insects affecting legume crops. Prior to the introduction of DDT there was no satisfactory insecticide to combat such pests as lygus bugs,—possibly the most serious enemy of alfalfa seed production. More recently chlordane and toxaphene have come into valuable use for controlling grasshoppers, crickets and other insects in a more satisfactory way than the old-time arsenical baits.

The new insecticides are being used because of their greater effectiveness and convenience of application. They have the combined qualities of prolonged effectiveness while serving as all-around stomach poison, contact insecticide, and in some instances fumigant.

Fortunately the newer insecticides are less of a menace to bees than the obsolete arsenicals. For years the arsenicals caused heavy loss to beekeeping in potato and cotton growing areas, but since the newer insecticides came into use the reports of bee poisoning have greatly lessened. The last serious loss recorded in North Dakota, as a result of bee poisoning by arsenicals, occurred in 1943 to bee yards close to large potato fields in northeastern North Dakota. Colonies were seriously depleted of their bees and a survey conducted then by this station revealed an estimated loss of $25,000 to beekeeping.

An insecticide must return "dividends"; that is, it must control the pest and result in increasing the yield enough to more than offset the cost of materials and application. Munro (1948) cites as a good example the results obtained from spraying alfalfa in 1947 with two pounds of DDT per acre to control lygus bugs. The sprayed portion yielded 140 pounds of alfalfa seed per acre while the unsprayed portion yielded only 18 pounds per acre. The application was made at a cost of less than $5 per acre, yet it represented a profit to the grower of about $50 increase in seed production per acre.

The chief insect pests of alfalfa in this area are lygus bugs, grasshoppers and crickets. The main enemy of sweet clover is the sweet clover weevil. Of these insects, the lygus bugs are possibly

[1]Paper given at second annual conference on Aerial Crop Dusting and Spraying, NDAC, Fargo, North Dakota, April 10-11, 1950.
[2]Entomologist

the most damaging to alfalfa seed production and the most likely to escape notice. They are small, inconspicuous bugs which are seldom noticed unless a sweep net is used. Every seed producer should have one of these nets on hand to use in determining whether or not control for lygus bugs is necessary. If an average of one or more lygus bugs are captured per sweep by the standard 12 inch diameter collecting net, prior to blossoming time, the application of a DDT spray or dust is well justified. The main advantage of a spray is that it can be applied over a wider range of weather conditions than the dusts.

Grasshoppers and crickets are more readily seen than the lygus bugs. They can be controlled with applications of chlordane or toxaphene. Early treatment must be observed, especially for grasshoppers. If control is done promptly, it reflects greatest saving of crops and economy of materials and less acreage to treat.

The sweet clover weevil is controlled satisfactorily in established plantings with the application of about 20 lbs. of a five per cent dust per acre in spring,—usually late April or the first week of May. The application made at this time is not a residue problem because there is ample time for residues to be removed by weathering agencies. So far, insecticidal applications have not been successful in protecting the new seedings. Best results here have been obtained from delaying the seedings until about June 15 to 20.

There is an ideal time to control insects and yet protect the pollinators. For alfalfa the application of any insecticide,—whether it be DDT, chlordane or toxaphene, preferably should be before the bloom begins to appear.

By applying the insecticide then, the injurious insects are destroyed without endangering bees and other pollinators. The pollinators, it should be borne in mind, do not visit the fields until the plants are in bloom and then they confine their visits largely to the interior of the blossoms. Hence, if sprays or dusts are applied previous to the bloom there is no danger to the beneficial insects. Under emergency situations, when for some reason the insecticide must be applied to the bloom, then it will cause less damage to the pollinators if applied at night or in early morning when these insects are not present.

It should also be borne in mind that the type of insecticide used has an important bearing. Todd et al (1949) states that the field bees were the affected part of the colony and most of the mortality occurred within two days after applications. Parathion killed about 40 per cent of the field bees, DDT 28 per cent, chlordane 23 per cent and toxaphene an average of 5 per cent. This would suggest the use of toxaphene instead of chlordane for control of grasshoppers in fields which are in bloom.

Regarding the effect of pollinating insects on sweet clover seed production in North Dakota, Munro (1939) observed that sweet clover which was open to insect pollination produced 22 times more

seed than sweet clover which was screened to exclude these insects. Under the usual field conditions where the plants are exposed to wild bees and other pollinators, the presence of honeybees at the rate of about one hive per acre has resulted in a two to three-fold increase in sweet clover seed production.

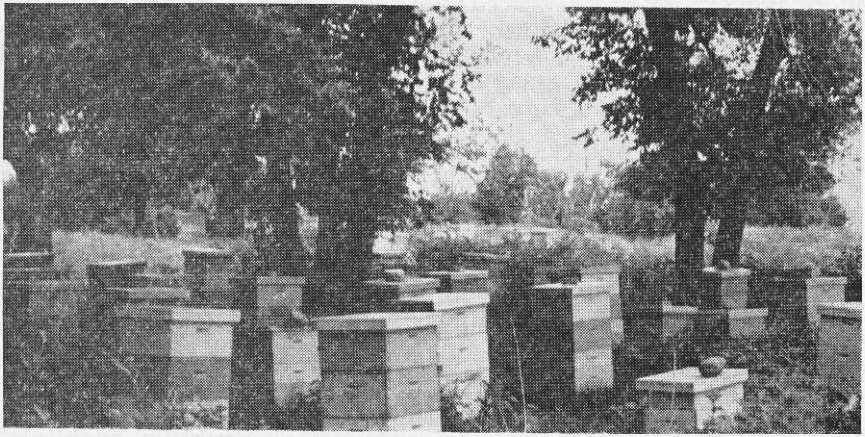

Fig. 1. On most North Dakota farms, such as this one, there is a waste corner in a field, a small grove, some kind of patch where several bee hives can be placed without interfering with tillage, planting and harvesting operations. Yet these hives can greatly increase pollination of legumes and at the same time store a sweet delicacy which will be added to the family larder.

Grout (1950) states that honeybees are responsible for approximately 80 per cent of pollination of various seed and fruit crops. Bees are especially desirable over other pollinators because their numbers can be regulated. Grout quotes James I. Hambleton, apiculturist, U. S. Department of Agriculture, having reported that in Utah and California in 1949, five colonies of bees per acre of alfalfa resulted in yields of 1000 pounds of seed where formerly seed yields ranged from 265 to 300 pounds per acre, but that this concentration of bees was too great to pay the beekeeper in the amount of honey produced. Grout cites many other examples of increased yields due to pollination. J. R. Anderson of the North Dakota Department of Agriculture, reported severe loss of "field" bees in several commercial apiaries in 1949 following the aerial application of insecticides used in grasshopper control. His observations were confirmed by the owners of the apiaries. E. L. Kirkpatrick of Fargo reported to the writer that in 1949 he observed about 20 per cent loss of his field bees directly following an aerial application of 20 pounds of five per cent chlordane dust per acre to a nearby field of alfalfa in bloom.

Eckert (1948) states that DDT acts as both stomach and contact poison but is not nearly as injurious as arsenicals. Regarding the phosphates, TEPP and parathion, he says they are toxic to bees in minute quantities, but lose their toxicity in a short time. DDD is least toxic. Chlordane, he says, is highly toxic as a stomach poison,

contact and fumigant. None of these insecticides had a repellent effect against the bees when dissolved in sugar syrup or sprayed over a surface over which the bees walked.

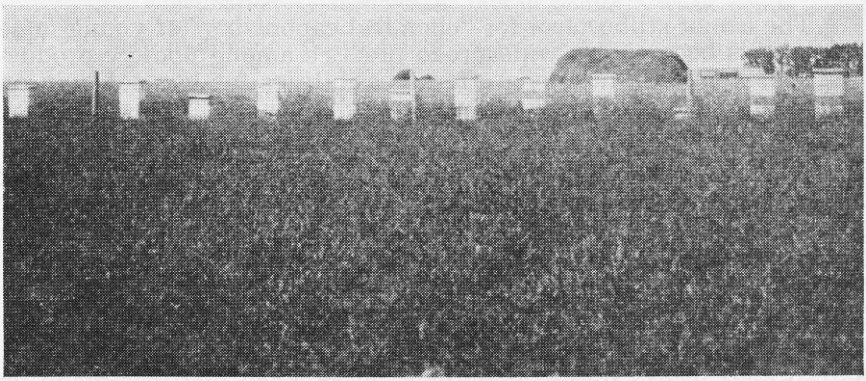

Fig. 2. Here the farmer placed a row of hives right across the center of the field, so that his insect helpers would be in the midst of their outdoor workroom.

Smith and others (1948) report that dusting DDT on alfalfa in bloom caused a decline in bee population, but that the increased nectar as a result of controlling lygus bugs more than compensated in yield of honey for the loss of the bees. He pointed out that dusting of alfalfa in bloom should be restricted to the minimum and then only in the evening or early morning when the bees are not in the field. Hafliger (1949) says that benzene hexachloride appears to be 200 times and parathion 300 to 500 times more toxic than DDT suspensions. Shaw and others (1949) testing benzene hexachloride, parathion and DDT, report that benzene hexachloride was very toxic to bees. DDT was very toxic in laboratory experiments but not so under field conditions. Parathion was very toxic under both laboratory and field conditions whether applied as a spray or dust.

SELECTED REFERENCES

Munro, J. A. 1939 Bees and Sweet Clover. Farm, Stock and Home, July 29, 1939.

Munro, J. A. 1948 Spraying Alfalfa With DDT to Control Lygus Bugs. N. Dak. Bimon. Bull. 10 (3):114.

Smith, R. F., MacSwain, J. W., Linsley, E. G., Platt, F. R. 1948 The Effects of DDT Dusting on the Honeybee. Jour. of Ec. Ent. 41 (6):960.

Hafliger, E. 1949 Comparative Toxicity of Various Insecticides to the Honeybee. Jour. of Ec. Ent. 42 (3):523.

Shaw, F. R. and Butler, G. D. 1949 The Effect of DDT, BHC and Parathion on the Honeybee. Jour. of Ec. Ent. 42 (5):855.

Todd, Frank E., Lieberman, F. V., Nye, W. P. and Knowlton, G. F. 1949 The Effect of Field Applications of Insecticides on Honey Bees. Repr. Agr. Chemicals, August, 1949.

Grout, Roy A. Pollination, An Agricultural Practice. American Bee Journal Publishing Company, Hamilton, Illinois.

Todd, Frank E., Lieberman, F. V., Nye, W. P. and Knowlton, G. F. 1949 The Effect of Field Applications of Insecticides on Honey Bees.. Agricultural Chemicals, August, 1949