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May 23, 1951

Recommendations for the Control of the Most
Important Insect Pests of Potatoes in South Dakota

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The important insect pests attacking potatoes in South Dakota must be controlled if a good or even a fair yield of potatoes is to be harvested. Many different species of insects attack growing potato plants in the state, but the insects of major importance do not form a long list. It is not necessary for the grower to be able to recognize the minor potato insects, but it is a distinct advantage to be able to recognize the major species. Further, it would be profitable if the potato grower would familiarize himself with the life cycle and seasonal history of each of the major insects attacking potatoes, and with the general appearance of the various stages in the life cycle of these pests. It is important to know where each stage of the insect is to be found, how the feeding stages obtain their food, and of what their food consists. It would also be profitable for the potato grower to know the number of generations that are produced by each of the major insect pests and the different kinds of food plants besides potatoes that are used. And finally, it is imperative that a grower be able to recognize the particular type of injury that is done by each of the important harmful insects.

The major insects attacking potatoes in South Dakota are the following:

Potato Leafhopper
Flea Beetles of Several Species
Colorado Potato Beetle
Blister Beetles of Several Species
Potato Aphids of Several Species

Wireworms and white grubs, at times, do considerable damage to potato tubers, but since these insects are not to be controlled through spraying or dusting, they are not covered in this pamphlet. The control of cutworms is likewise not discussed in this pamphlet.

Potato leafhoppers: The adult is a small pale green winged insect measuring about one-eighth inch long. With a hand lens, one can distinguish certain characteristic white spots on the head and body. The hind legs are long and enable the insect to jump. The head is provided with a beak through which the leafhopper obtains its food.

The adult leafhoppers lay their eggs in the stems and larger veins of the leaves in slits made by a sharp ovipositor found on the back end of the body of the females. These eggs are very small and measure only one twenty-fourth of an inch in length.

From the eggs hatch nymphs or young leafhoppers. These are like the adults but they lack wings and are much smaller than the adults.

The potato leafhopper does not overwinter in South Dakota, but each year invades the state from the south by flying -- aided by southerly winds.

At least two generations of these insects are produced in South Dakota per year, with the possibility of a partial third generation in some years.

The potato leafhopper has many food plants from which it may get its nourishment. Potatoes, beans, alfalfa, clover, apples, tomatoes and an exceedingly long list of weeds, all may be attacked.

The adult leafhoppers and their nymphs feed on potato leaves by inserting their sucking mouthparts into a leaf vein and sucking out sap. The insects feed on the under surface of the leaves and spend most of their time on that surface. When the insects feed, they inject into the leaf a toxic material which causes the so-called hopper burn. The leaf tissue that is affected ultimately turns brown and dies. In a severe infestation, the entire potato plant dies prematurely and looks as if it died from drought.

Flea beetles: Several different species of flea beetles attack potatoes in South Dakota, but the two most important species are the potato flea beetle and the tuber flea beetle. The potato flea beetle is statewide in distribution but more abundant eastward, while the tuber flea beetle occurs in western South Dakota and not in the eastern portion.

These two species of flea beetles are small black beetles measuring about one-sixteenth of an inch in length. They have jumping hind legs and with these they can hop to a considerable distance when they are disturbed, hence the name flea beetles.

The female adult flea beetles lay their minute white eggs in the soil close to the stems of their food plants. From the eggs hatch the grubs or larvae. These are worm-like in appearance and are whitish in color but have a brown or blackish head. When the grubs are fully grown, they measure from one-eighth or one-third inch in length. They now hollow out a chamber in the soil, form a flimsy cocoon about their body and inside of this, change to the pupa stage. The pupa after a period of about ten days give rise to a beetle, thus completing the life cycle.

The potato flea beetles or the potato tuber flea beetles produce two generations per year. About six to seven weeks are required to complete the development from egg to beetle.

The two potato pests under consideration overwinter as beetles usually under or in trash, under leaves or other materials lying on the ground, in piles of cull potatoes, or in the ground. In the spring when the temperature becomes favorable, the beetles come out of their hibernating quarters and seek out potatoes if they are available. If they are not, they may feed on tomatoes, ground cherries and weeds. When potatoes become available, the beetles migrate from weeds and even tomatoes to the potatoes.

Injury done by flea beetles to potatoes or tomatoes is very characteristic. Small irregular holes are eaten out of the leaf tissue and when the holes are abundant, it looks as if the leaf had been peppered with fine shot. If the damage is very

severe, the entire potato plant may be killed by the beetles.

The larvae or grubs of the potato flea beetle feed principally on the root hairs and smaller roots of the potato plants and while the injury thus produced must be quite important, it is not very noticeable.

The larvae or grubs of the potato tuber flea beetle feed to a considerable extent on the tubers or potatoes. They bore into the tubers a quarter inch or less and later this tunnel may become filled with a corky sliver-like growth. On the surface of such areas a pimple or depression may develop. Sometimes the larvae eat out shallow surface channels (called worm tracks) and should these be abundant and run together, blotches are formed that may look like scab.

Colorado Potato Beetle: The Colorado potato beetle is probably better known to potato growers than any other pests affecting potatoes. In some years the beetles become exceedingly abundant and do an immense amount of damage, while in other years they become so reduced in number as to be relatively unimportant.

The beetles are hard-shelled, measure about three-eighths inch in length and are yellow in color with ten black stripes running lengthwise over the wing covers. The eggs that are laid by the female beetles are yellow in color and are usually attached in clusters on the under surface of the leaves. The larvae that hatch from the eggs are soft-bodied, hump-backed grubs, reddish in color with four rows of black spots on the upper surface. The larvae, when full-grown, leave the plants, enter the ground and change to the pupa stage. Thus it is seen that there are four stages in the life cycle of this insect, adult or beetle, egg, larva or grub and pupa. The insect hibernates in the ground in the beetle stage.

The Colorado potato beetle produces one complete and a partial, second generation per year. The hibernating beetles come out of the ground in the spring, and if potatoes are available, feed and lay their eggs on the leaves. The larvae also feed on the leaves and since both beetles and larvae have chewing mouth-parts, they chew up the foliage so that the leaves become very ragged in appearance. If the larvae are abundant, the plants may become stripped of foliage. The larvae or grubs feed more heavily than do the beetles and, consequently, do more damage.

Not all the hibernating beetles emerge from the ground in the spring at the same time, but those that do may be responsible for a partial second generation. Those that emerge late in the spring have time only to be responsible for a single generation.

Blister Beetles: About forty-five species of blister beetles occur in South Dakota, but only about a dozen of these ever become serious pests of potatoes. These blister beetles vary from one-third of an inch to slightly more than one inch in length. The beetles affecting potatoes are nearly all elongated and narrow-bodied, with a head that is distinctly set off from the remainder of the body and with wing covers that are elongate and softer than the usual run of beetles. Most of the blister beetles affecting potatoes in South Dakota are good fliers. The coloration of the different species of blister beetles varies, some are pure black, others are gray, some are yellow or orange, some gray spotted with black, some gray lined with black, one is brown lined

with black, and one is a striking blue-green with a metallic lustre.

The species of blister beetles that are harmful to potatoes have an unusual life cycle. The beetles are vegetarians and feed principally on the leaves of the potato plants. The female beetles when sexually mature, mate and then lay their eggs in chambers which they hollow out in the ground. The eggs hatch into active grubs and these seek out grasshopper egg masses. When they find such a mass, they burrow into it and feed on the grasshopper eggs. The grubs undergo several molts, each time changing in appearance and becoming more and more degenerate so far as their sense organs and external body appendages are concerned. The grubs overwinter in the soil in an inactive stage, called the coarctate larva. In the following spring, the coarctate larva molts into another larval stage and this a short time later transforms into a pupa. The pupa, in turn, ultimately gives rise to a blister beetle.

Blister beetles produce but one generation per year. The adult beetles of the species that we are concerned with feed on potato foliage, while the grub stages feed on grasshopper eggs. In general, blister beetles are most harmful during grasshopper years. However, since blister beetles tend to be gregarious and feed in colonies on potato plants, they may do considerable damage locally, even though the area is not especially suffering from a grasshopper outbreak. A characteristic of blister beetles is that they may appear suddenly in large numbers in a potato field and just as suddenly disappear.

Potato Aphids: Potato aphids, also called plant lice, are not as damaging to potatoes in South Dakota as are the potato leafhopper or the flea beetles. Aphids usually feed on the under surface of leaves or on the tender terminal portion of stems. When the aphids are abundant, they may cause the leaves to curl, or to turn yellow and drop off. When the terminal growth of stems becomes heavily infested, those terminal ends may become stunted and rosetted. A second and, at times, even more serious injury that may be caused by aphids to potatoes is the transmission of certain virus diseases such as mosaic, spindle tuber and leaf roll.

Aphids or plant lice have sucking mouthparts and with these, they puncture the leaf or stem tissue and suck out the sap. Should the aphid be contaminated with a virus, it is readily understandable how such an aphid may inoculate a plant with the disease that is caused by that particular virus.

In South Dakota the potato crop may become infested by several species of aphids. These aphids may be winged or wingless, but they are always very small soft-bodied insects, usually pink or green in color and may be marked with black.

The life cycle and seasonal history of only one species of aphid, the potato aphid (Macrosiphum solanifolii Ashmead) will be given in this pamphlet. This aphid attacks many plants, potato being only one of the host plants. In South Dakota the aphid overwinters in the egg stage. These eggs are deposited chiefly on wild roses, but other plants may also be used for this purpose. In the spring the eggs hatch and the young lice, all females, move to the unfolding leaves to feed. Ultimately these lice, known as stem mother aphids, mature and they give birth to a second generation of plant lice. This second generation will consist of females only and when these are mature, they give birth to a third generation of female aphids. Some of the lice of the third generation may develop wings and a larger percentage of the fourth generation develop wings. Some of these

winged lice may find their way by flight to potatoes where they start an infestation. If possible, the wingless lice on roses may crawl to potatoes if potatoes are in the vicinity of the roses. Several generations of plant lice are then produced on the potatoes and all of these are females. Some of these aphids may be winged, others will be wingless. In this manner a large population of aphids may be built up on potatoes and the infestation may become wide spread. In the fall of the year, return migrants are produced and these fly back to roses and other perennial plants. The return migrants are females and these give birth to wingless egg-laying female lice. Winged males, that were produced by the last generation of lice on potatoes, now fly to the egg-laying females on roses and mate with these females. These female aphids then lay their eggs, gluing them to the bark of rose bushes and other perennial plants. These eggs overwinter.

CONTROL

DDT is an efficient and satisfactory insecticide to use for the control of all of the important harmful insects that attack potatoes in South Dakota. The insecticide may be used either as a dust or liquid spray. It is highly important that good coverage of the foliage be obtained and that both upper and lower surfaces of the leaves be coated with the dust or spray. When ground dusters or sprayers are used, it is recommended that the following formulas be followed:

A. Recommended DDT Dust	Rate of Application
3% DDT with sulphur, or pyrophyllite or talc as the filler	20 to 40 lbs. per acre, depending on size of plants

B. Recommended DDT Spray	Rate of Application
2 lbs. wettable 50% DDT to 100 gallons of water	75 to 175 gallons per acre, depending on size of plants and with 200 to 300 lbs. pressure

or

C. Recommended DDT Spray	Rate of Application
2 quarts emulsion 25% DDT to 100 gallons of water	75 to 175 gallons per acre, depending on size of plants and with 200 to 300 lbs. pressure

The first spray or dust should be applied to the potatoes as soon as the insects are noticed on the plants. When this will occur, will depend upon when the potatoes were planted. Usually three or four applications at 10 to 14 day intervals are sufficient to give control during the growing season.

Better control has usually been obtained with sprays than with dusts, and with the emulsion type of DDT than with the wettable powder. However, good control can be obtained with the dust or with the wettable powder. If dusting is to

be practiced, the applications are usually limited to early morning, late afternoon or night, because at such times it is usually not so windy.

Good control of potato insects have been obtained by applying the insecticide through the use of aircraft. If aircraft spray applications are to be made, it is recommended that the emulsion form of DDT be used, and that the amount of DDT that is to be applied per acre, follow the recommendations given in paragraph "C" of this pamphlet under "Recommended DDT Sprays". However, the total amount of spray, including water, that is to be applied per acre should range from 2 to 5 gallons. The control of potato-infesting aphids through application of DDT sprays by aircraft is usually not satisfactory towards the end of the growing season when the plants are large.

For information regarding agronomic practices that should be followed in growing and harvesting potatoes, the reader is referred to the Agronomy Department, South Dakota State College, Brookings, South Dakota.