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TILLAGE METHODS  
IN  
GRASSHOPPER CONTROL

by

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TILLAGE METHODS IN GRASSHOPPER CONTROL  
(A PROGRESS REPORT)

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WASHINGTON OFFICIALS URGE GREATLY INCREASED PRODUCTION  
FROM U. S. FARMS FOR 1943

-o- -o- -o-

AMERICA WILL FEED PEOPLES OF LANDS LIBERATED BY HER TROOPS

-o- -o- -o-

MORE SMALL GARDENS, HOME PROCESSING OF PRODUCTS RECOMMENDED

-o- -o- -o-

UNITED STATES HAS BEST FED TROOPS IN THE WORLD

-o- -o- -o-

What is the significance of these statements? What do they mean?

Boiled down to a few words they mean simply and forcefully this: We, the people of South Dakota, as well as of every other State, have a tremendous job ahead of us ---- the job of PRODUCTION ON THE HOME FRONT. What is more, we must go "over the top" on the food production front with reduced manpower. This means more hours of hard work so that we can keep our boys on the battle fronts well fed and hasten the time of their victorious homecoming. It means added effort on our part in order that we may by liberation check the pangs of hunger and starvation which tear at the bodies of little children and adults alike in Axis-devastated countries. We must crush the monsters which have arisen so horribly from the fog and mist of the twisted minds of the Axis militarists.

This is a part of the job ahead of us, and it seems to be a far cry from the lowly grasshopper. Now just where do grasshoppers fit into the picture?

The locally produced grasshoppers are the "saboteurs". Each blade of grass or leaf of any other plant is a part of an individual "factory", the plant itself, which is doing its utmost to produce vital food. Grasshoppers "sabotage" these plant factories by chewing off the leaves, cutting stems and dropping heads of grain to the ground, etc., thereby

reducing the total output of the plant factories.

As the season progresses, great flights of "two-striped and differential raiders" escorted by "lesser migratory squadrons" may stage "daylight raids" on the later maturing small grains and corn. To say that a field is "blitzed" is putting it mildly. When such raids occur the all-to-frequent tendency is for us to run for the "bomb shelter of despair" and just hope that the raid will not be too destructive. Instead of doing this, the individual who uses "the ammunition of poison bait" against the raiders will have more to show for his efforts when the harvest is gathered. He will then start to plan controls for next year, to do his utmost to prevent such depredations from again befalling his crops and his land.

In South Dakota alone, according to Mr. G. I. Gilbertson, South Dakota Extension Entomologist, grasshoppers have destroyed millions of dollars worth of cereal, forage and truck crops in each of the past several years. For the 5-year period of 1937-1941 grasshoppers took a yearly average of approximately  $8\frac{1}{2}$  millions of dollars worth of such crops. With this in mind, it is to be remembered that South Dakota is not the only Great Plains state with a grasshopper problem.

Let me quote from my second progress report, issued in December 1941:

In times of war, when farmers are being urged to produce as much food as possible, one cannot afford not to give due consideration to any factor which serves to reduce the yield of food products from a given area of land. Grasshoppers are "fifth columnists" to the farmer just as much as the individual who bombs a factory is to the manufacturer. In the case of damage done by grasshoppers the results are merely spread out over more territory, do not show up so suddenly, and are therefore not so glaring.

There are several ways by which damage done by grasshoppers can be materially reduced and it is the patriotic duty of each farmer to see that the damage is reduced as much as possible. Cooperation is essential because grasshoppers from the land of one non-cooperator will spread to the land of cooperators all around him. However, this important fact remains: the damage may be lessened proportionately because the cooperators have reduced the grasshopper populations upon their own land.

There are various tillage practices employed by farmers, which, if done at the proper time, comprise one of the most important means of reducing grasshopper populations. In the light of present knowledge the tillage controls should be followed the next spring by the timely use of poison bait in a "mopping up campaign". This procedure should insure the best possible results.

The following figures are the results of tillage tests conducted over a period of three years. In the case of tests conducted only one year the results have been obtained by using the figures for check areas covering the full three-year period. In the future some of these figures may need revision as a result of subsequent findings.

EXPERIMENTS IN THE WINNER-RELIANCE AREA: SOIL TYPE--BOYD CLAY

FALL TILLAGE - FIELD CONDITIONS

<u>Tillage Method</u>	<u>Average Percentage Control</u>
Moldboard plowing	83.50
Double discing	74.10
Single discing	58.76
One-way discing (wheat land plow)	54.76
Sub-surface cultivation (straight blade type)	50.00
Sub-surface cultivation (small sweep type or duckfoot)	46.45
Regular listing	40.24
Cut-away disc treatment	35.25

SPRING TILLAGE - FIELD CONDITIONS (BASIS 1 TEST ONLY)

<u>Tillage Method</u>	<u>Average Percentage Control</u>
Sub-surface cultivation (small sweep type or duckfoot)	85.66 *
Single discing	79.12 *
Regular listing	No control

\* It is the writer's belief that additional tests would bring down considerably the figures indicated by these single tests. These figures seem somewhat higher than could ordinarily be expected.

EXPERIMENTS IN THE HECLA AREA:  
SOIL TYPES - VALENTINE SAND AND BEARDEN SANDY LOAM

FALL TILLAGE - FIELD CONDITIONS

<u>Tillage Method</u>	<u>Average Percentage</u>	<u>Control</u>
Regular listing	(one test only)	100.00
Moldboard plowing		94.15
Tandem discing		93.30
One-way discing, plus drilling	(one test only)	93.11
Sub-surface cultivation (wide sweep type)	(one test only)	90.52
One-way discing (wheat land plow)		86.28
Sub-surface cultivation (small sweep type or duckfoot)		81.64
Plowing with moldboard removed		74.01
Double discing	(one test only)	54.44
Single discing		39.34
Sub-surface cultivation (straight blade type)		No control

DOES SPRING TILLAGE FOR GRASSHOPPER CONTROL PAY ?

The South Dakota Experiment Station has been primarily interested in the evaluation of fall tillage methods as they may affect grasshopper populations. However, it is only reasonable to expect that certain spring tillage methods will also give worthwhile results in grasshopper control.

The spring tillage tests conducted in the Winner area, as stated before, seem to indicate a higher percentage of control than ordinarily, or at least logically, can be expected.

If no fall tillage was used then it can be stated definitely that spring tillage of the proper type, and if done as early as possible,

will materially reduce the number of 'hoppers that would otherwise be produced from a given area.

The grasshoppers that do the most damage to small grain crops are usually locally produced, that is, from the margins or headlands and the edge of the field in a strip perhaps 150 feet wide. The width of the 'hopper producing strip around the edge of a field may vary considerably. In the case of the lesser migratory locust the eggs may be deposited over the entire field.

Quoting from Bulletin 309 of the North Dakota Experiment Station, spring tillage tests conducted by Munro and Telford indicate the following results:

<u>Tillage Treatment</u>	<u>Average Percentage Control</u>
Moldboard plowing	83
One way disk plowing	69
Double disking	40
Duckfoot cultivation	58

In the writer's opinion, these figures and those obtained in the Winner, So. Dak. tests, clearly indicate that spring tillage for grasshopper control DOES pay. The amount of benefit to the farmer, derived from such tillage, varies directly with the egg infestation, that is, the heavier the grasshopper egg infestation the more the tillage will pay.

#### HOW DOES TILLAGE AID IN GRASSHOPPER CONTROL ?

There are several ways in which tillage practices aid in reducing grasshopper populations.

Deep plowing (moldboard) is a good method to use where it can be done without creation of a soil erosion hazard. This serves to bury the eggs to such a depth that hatching, if it occurs at all, is greatly delayed. This, in turn, increases the time during which other factors (predators, parasites, adverse moisture conditions, etc.) may operate to destroy the eggs. If the eggs do hatch the young 'hoppers are buried so deeply that they frequently fail to reach the surface of the soil.

Other tillage methods bring about destruction of the eggs in other ways. One of the principal objectives in the use of tillage for grasshopper control is the stirring up of the surface two-inch layer of soil (that in which the eggs are deposited) so that the egg pods will be broken and the eggs exposed. This will allow the eggs to dry out to

such an extent that they ordinarily will not hatch. Such treatment also makes the eggs more readily available to predators (other insects, mites, rodents and birds, etc.).

Lastly, there is a certain amount of actual mechanical destruction of the eggs by the various implements used.

In addition to destruction of eggs there is still another way in which tillage can be used to advantage. This involves the use of tillage implements to concentrate egg deposition in areas in which the eggs may later be destroyed.

Tests have indicated that sub-surface cultivation and other types of treatment used as soon as possible after harvest, and before the grasshoppers start to lay their eggs, will make unfavorable areas for egg laying. The grasshoppers will avoid these areas and will then concentrate their eggs in the adjacent favorable untilled areas. The latter may then be treated after egg-laying has been completed. In this kind of a control procedure it is best to leave untilled strips in the field (strips 15 to 20 feet wide) at intervals of perhaps every 20 rods, where the eggs will be deposited. This method also ties in very closely with moisture conservation methods recommended by the Soil Conservation Service.

This method of concentration of eggs was used to advantage by Mr. Emmett Healey, of Chamberlain, So. Dak. In the untreated strips (in barley stubble) 162 soil samples of one-half square foot each were taken. These samples showed an average of 3.31 egg pods per square foot over the untreated areas. In the duckfoot treated areas between the untreated strips 28 samples of one-half square foot each were taken; the average of these samples showed only 0.2 of an egg pod per square foot. In this case the duckfoot treatment was given shortly after harvest.

#### SUGGESTIONS FOR THE USE OF TILLAGE METHODS IN GRASSHOPPER CONTROL

1. Plan ahead for control. Start thinking NOW about this year's grasshopper control. Use tillage this spring to control local 'hoppers. Start action this summer, after harvest, to control the grasshopper crop of 1944. It costs money to raise grasshoppers.
2. Spring tillage should be done as early as possible, with main attention being given to outer edges of fields and to headlands. Surface and sub-surface methods are good; disturb surface (egg containing) layer of soil.



3. Deep plowing is recommended unless a soil blowing hazard is thereby created.
4. Use a spring tooth harrow early this spring to reduce hatching of grasshoppers in alfalfa fields. The 1942 egg survey shows rather heavy egg infestation in alfalfa fields.
5. Use tillage following harvest to create unfavorable egg-laying conditions in fields. Leave strips, 15 to 20 feet wide, every 15 to 20 rods in the field to function as egg concentration areas. These should be tillage treated when grasshopper egg-laying has been completed, late in the fall.
6. Know the condition of your fields from the standpoint of grasshopper egg deposition. Inexpensive egg screens may be constructed from 1 x 4 boards and 1/4 inch mesh hardware cloth. Soil samples of approximately one-half square foot each, of the surface 2-inch layer, are placed in the screens and the egg pods are screened out.