INSECTICIDAL APPLICATIONS AND POTATO YIELDS IN NORTH DAKOTA FOR 1949[1]

by

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The cooperative NDAC Experiment Station and State Seed Department insecticidal plots (Fig. 1) were located at Northwood, N. D. on land furnished by Mr. Art Nelson. Certified Bliss Triumph seed was planted May 9 and 3-12-12 fertilizer was applied by a fertilizer attachment at the rate of approximately 407 lbs. per acre.

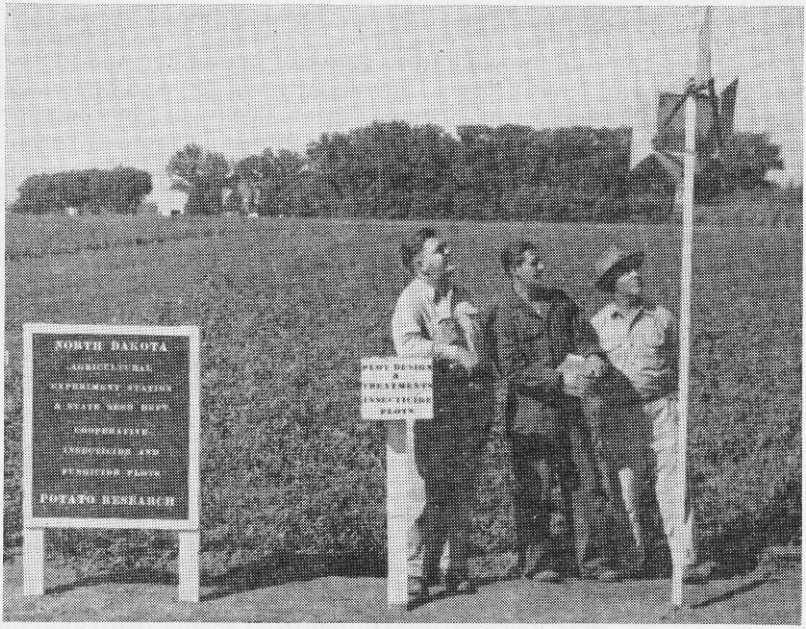

Fig. 1. Potato Insecticidal Plots at Northwood, N. Dakota. Mr. Art Nelson, Senior Author, and Mr. Bernard Legrid examining wind trap.

Following the appearance of early blight all plots and buffer rows received an application of Dithane spray July 30. A hard rain which followed washed off the fungicidal application and week-end weather conditions favored blight development. On August 1 early blight was severe throughout the northern end of the plots adjacent to a shelter belt. In order to prevent further spread of blight a thorough coverage of Dithane 3.9 per cent dust was promptly applied, and was followed by three successive applications of Dithane spray on August 9, 18 and 25 covering both the treated plots and buffer rows.

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I. Aphicidal Investigations

Due to the role of aphids in the transmission of potato virus diseases, especially the virus Y component of Rugose mosaic, the major emphasis of the 1949 research was on the application and evaluation of residual aphicides. The nine aphicidal treatments were replicated six times and arranged according to the triple lattice design. The 54 treated plots were 90 feet long and four rows wide with four untreated buffer rows on each side. The insecticidal treatments and adjusted mean yields are listed in Table 1.

Table 1. Insecticidal Treatments and Tuber Yield
(Based on six replicates)

Plot	Treatment	Adjusted Mean Yield Bushels Per Acre
	DUSTS: Applied at 20 lbs. per acre June 30 and July 12. Successive applications at 24 lbs. per acre on July 22, Aug. 2, 10, 19 and 29.	
1.	PARATHION 1%	309.9**
2.	DDT 5% with CP-5 STICKER	330.3**
3.	DDT—SULPHUR (4% DDT—80% Sulphur)	312.7**
4.	NICOTINE—ROTENONE—SULPHUR (2% nicotine, expressed as alkaloid, .5% rotenone, 1% other cube extractives, 25% sulphur)	283.3
	SPRAYS: Applied at 100 gals. per acre June 30 and July 12. Successive applications at 120 gals. per acre July 22, Aug. 2, 10, 19 and 29.	
5.	PARATHION 25% WETTABLE POWDER. 1 lb. of wettable powder per 100 gals. of water (¼-lb. actual toxicant)	337.0**
6.	LETHANE B-72 and 25% DDT EMULSION. Used at the rate of 3 lbs. of Lethane B-72 plus 1 quart 25% DDT emulsion per 100 gals. of water	326.6**
7.	LETHANE B-72 and DDD 25% EMULSION. Used at the rate of 3 lbs. of Lethane B-72 plus 1 quart 25% DDD emulsion per 100 gals. of water	300.0*
8.	PARATHION and DDT EMULSION. (Containing 1 lb. technical DDT and .3 lbs. of Parathion per gallon). Used at the rate of three quarts per 100 gals. of water	286.2
9.	CHECK. NO TREATMENT	283.1

*Indicates significant difference at 5% level as compared to Check Plot No. 9.
**Indicates highly significant difference at 1% level as compared to Check Plot No. 9.
The least significant difference between any two adjusted means at 5% level is 16.6 bu. and at the 1% level is 22.4 bu. per acre.

Sources of Insecticides

Agricultural Supply Company, Grand Forks, North Dakota
American Cyanamid Company, New York, New York
E. I. DuPont Company, Wilmington, Delaware
Mackwin Company (McConnon), Winona, Minnesota
Rohm and Haas Company, Philadelphia, Pennsylvania
Stauffer Chemical Company, Portland Oregon
Tobacco By-Products and Chemical Corporation, Louisville, Kentucky

Source of Fungicide

Agricultural Supply Company, Grand Forks, North Dakota

Yield data from the plots were referred to the Statistical Laboratory, Iowa State College. Concerning the plot design, J. G. Darroch, Research Associate, states that "The efficiency of the triple lattice relative to a randomized block indicates that six replicates as a triple lattice are as effective as eight replicates of a randomized block design in estimating

the same variance of a treated mean". Actual field yields and adjusted mean yields were almost identical, the greatest difference being .6 bushels per acre. This slight difference indicates an even stand and uniform soil conditions.

In order to evaluate the residual properties of the insecticides, aphid counts were taken on all plots at five day intervals, weather permitting, just prior to and five days after insecticidal applications. Eight randomized plants from each plot were thoroughly examined for aphids totaling 48 plants for each treatment. The total number of aphids found on each treatment are listed in Table 2.

Table 2. Abundance of Aphids on Insecticidal Plots

(48 plants from each treatment were examined every aphid count)

Plot numbers and treatments*	Dates of Aphid Counts													Total No. of Aphids
	July					Aug.						Sept.		
	6	12	18	22	27	1	6	10	18	24	29	2	7	
1														
Winged	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Wingless	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2														
Winged	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wingless	0	1	1	0	1	0	0	0	0	0	3	0	1	7
3														
Winged	2	0	0	0	0	0	0	0	0	0	1	0	1	4
Wingless	0	7	1	0	5	8	0	0	0	0	0	0	0	21
4														
Winged	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wingless	0	0	0	1	1	1	3	2	2	8	2	12	5	37
5														
Winged	0	1	0	0	0	0	0	0	0	1	0	0	1	3
Wingless	0	1	0	0	0	0	0	0	0	0	1	0	1	3
6														
Winged	0	0	0	0	0	0	0	0	0	3	0	0	0	3
Wingless	0	1	0	0	3	0	0	0	0	0	1	0	0	5
7														
Winged	0	0	0	0	0	0	0	0	0	2	0	0	2	4
Wingless	0	3	0	0	5	5	1	0	0	1	3	4	2	24
8														
Winged	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Wingless	0	1	2	2	0	3	1	0	0	0	0	0	0	9
9														
Winged	2	0	0	0	0	0	1	0	0	1	1	0	0	5
Wingless	0	1	2	2	0	3	1	0	0	1	1	0	15	26

*See Table I for details on treatments, dates and rates of applications of insecticides.

II. DDT three per cent vs. DDT five per cent Dusts

For three consecutive years DDT three per cent had outyielded DDT five per cent dusts by 28, 1.7, and 16.4 bushels per acre respectively. It was questioned whether the lower concentrations of DDT three per cent would keep the major potato insect pests sufficiently in check when the applications were on a larger scale and in solid blocks. Consequently 144 rows 100 feet long were selected for this experiment. The plots (No. 1, DDT three per cent and No. 2, DDT five per cent) were 24 rows wide and arranged as follows: 1-2-2-1-1-2. This design is one of

the possible random arrangements and allows a solid block of 48 rows and 24 rows for each treatment. There were no buffer (untreated) rows. These plots received insecticidal treatments at 20 pounds per acre on July 11 and successive applications at 24 pounds per acre on July 22, August 2, 19 and 29. The mean yields for the plots were as follows:

Treatment No. 1, DDT 3%	Treatment No. 2, DDT 5%
Mean yield 276.1 bushels per acre	Mean yield 261.1 bushels per acre

Aphid counts were taken nine times at intervals half way between and just prior to insecticidal applications. Sixteen plants were examined each time from every replicate totaling 48 plants for each treatment. The total number of aphids found for the entire season are as follows:

Treatment No. 1, DDT 3%	Treatment No. 2, DDT 5%
Winged aphids 2	Winged aphids 1
Wingless aphids 16	Wingless aphids 5

Summary of 1949 Treatments

The numbers of aphids present in 1949 were much lower than those present in 1948. In fact, the total number of aphids from 13 checks **on all plots** in 1949 were approximately the same as the single treatment showing the least aphids in 1948 with only eight weekly checks. A state-wide potato aphid survey (Post, McCalley and Nelson 1949) conducted by the North Dakota State Seed Department showed that the entire aphid population for 1949 was less than one per cent of the population for a similar survey conducted in 1948. This reduction might be attributed to a corresponding increase in numbers of ladybird beetles, aphis lions (larvae of lacewings) and other natural enemies. These aphid destroyers probably increased during the general outbreak of grain aphids and migrated to adjoining potato fields.

From the scarcity of aphids throughout the plots in 1949 it was difficult to evaluate an aphicide, although Parathion dusts and sprays have had the lowest aphid counts.

Five treatments (DDD 5% with CP-5 sticker, Parathion 25% Wettable Powder, Lethane B-72 and DDT Emulsion, DDT-Sulphur, and Parathion 1% Dust) showed highly significant yields at the one per cent level. Parathion sprays had the lowest aphid populations and among the highest yields both in 1948 and 1949. DDT five per cent with CP-5 sticker incorporated is believed to have higher dust deposit and longer dust retention under field conditions. This plot had one of the lowest aphid populations. Lethane B-72 and DDT emulsion had low aphid populations. Results obtained by this combination in other states showed that it had possibilities for reducing current-seasonal spread of aphid transmitted virus diseases. DDT-Sulphur dust has shown promising results as an aphicide in the Pacific Northwest. However, aphids were not sufficiently abundant to evaluate its properties as a residual aphicide under North Dakota conditions. Parathion one per cent dust had the lowest aphid populations in 1949. Due to the

toxicity of Parathion formulations, especially emulsions, the one per cent dust might have a place in certified potato production when used instead of or in combination with DDT. However, one would sacrifice the control of leafhoppers if Parathion were used exclusively.

One insecticide (Lethane B-72 and DDD Emulsion) showed significant yield at the five per cent level. DDD treatments had given high yields the previous three years and it was hoped that the Lethane B-72 and DDD combination might show promise as an aphicide. The populations of aphids on the plots receiving this treatment were not appreciably reduced over the check plots and the yield was not high enough to recommend its use to replace DDT.

For the fourth consecutive year DDT three per cent dusts outyielded DDT five per cent dusts. It is of interest to note that the average difference between these two treatments for 1946-48 and '49 was 15.4 bu. per acre and that the difference in 1949 was 15.0 bu. per acre. Aphids were more abundant on the DDT three per cent plots. It is questionable whether the certified grower would wish to sacrifice aphid control and possible disease increase for the increased yield over five per cent DDT. Further investigations with heavier aphid populations are necessary to determine the respective aphicidal qualities of three per cent and five per cent DDT. The aphid counts have been about the same on these plots during the years from 1947 to '49.

Based on the 1949 experience with early blight it is suggested that insecticidal plots receive regular fungicidal applications from early July until the end of the growing season. In the studies of these residual insecticides the plants should remain green and attractive to aphids otherwise they cannot be evaluated. In that section of the field attacked by blight the aphids were appreciably fewer in number until secondary green growth appeared later in the season.

Acknowledgements

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