EFFECT OF INSECTICIDES ON TUBER YIELD AND INSECT POPULATION[1]

by
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The field of Cobblers in which the experimental plots were located was planted at Northwood, N. Dak. June 10. It was dusted around the shelter belts on July 1 and on July 9 the field was dusted with DDT. The insecticidal treatments of the field prior to its being offered for the cooperative research explains the absence of Colorado potato beetles and flea beetles which would normally be more abundant on the check or untreated plots.

The sixteen treatments were replicated six times and arranged according to the triple lattice design (Post, Colberg and Munro-1948). The treated plots were 80 feet long and two rows wide with two untreated buffer rows on each side. The insecticidal treatments and yields are listed in Table 1. For the prevention of blight damage in the insecticidal plots Dithane was applied to the plots on August 6, 19 and 25 with the exception of Plot 8, which was treated with CR-1639, an experimental insecticide and fungicide.

Figure 1.—A square mile of potatoes in a field belonging to John Scott of Gilby.

[1]Progress report on Bankhead-Jones Project No. 8—III "A study of insects which affect potato production," N. D. State Seed Department Cooperating.
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Table 1.—Insecticidal Treatments and Tuber Yield

Plot	Treatment	Adjusted Mean Yield Bushels Per Acre**
1	Check, no treatment	273.4
	(x) SPRAYS: Applied at 100 gal. per acre (1 lb. actual toxicant) July 10, 23, Aug. 5 and 125 gal. per acre. (1-¼ lb. actual toxicant) Aug. 19 and Sept. 1.	
	Wettable Powders	
2	DDT 50%	289.8
3	DDT 50% or Vapotone, 25%, Vapotone July 10, Aug. 5 and 18, DDT July 23 and Sept. 1	280.8
4	DDT 50% or Toxaphene 41%, Toxaphene July 10, Aug. 5 and 18, DDT July 23 and Sept. 1	280.1
5	Parathion 25% (Thiophos)	295.7*
	Emulsions	
6	DDT 25%	277.8
7	DDD 25%	294.9
8	(x) CR-1639 25% (Dinitrocaprylphonol crotonate) (x) Except Plot 8 where ½ lb. actual toxicant applied July 10, Aug. 5 and 25, and 5/8 lb. Aug. 19 and Sept. 1	257.8
	DUSTS: Applied 20 lbs. per acre July 10, Aug. 5 and 25. 25 lbs. per acre Aug. 19 and Sept. 1	
9	DDT 5%	269.6
10	DDT 3%	286.0
11	Parathion 1% (Thiophos)	266.3
12	Parathion 2% (Thiophos)	280.9
13	Toxaphene 10% (Chlorinated camphene)	296.3*
14	Marlate 5% (Methoxy DDT)	285.7
15	DDD 5%	279.4
16	Toxaphene 10% or DDT 5%, Toxaphene July 10, Aug. 5 and 13. DDT July 23 and Sept. 1.	280.8

*Indicated significant difference at 5% level as compared to Check Plot No. 1.
**The least significant difference between any two adjusted means at 5% level was 22.0 bus. and at the 1% level, 29.2 bus. per acre.

Source of Insecticides

Agricultural Supply Company, Grand Forks, N. Dak., Plots 9, 10 and 16.

American Cyanamid Company, New York, N. Y., Plots 5, 11 and 12.

California Spray Chemical Corporation, Richmond, Calif. Plot 3.

E. I. DuPont and Co., Wilmington, Del., Plots 2, 3, 4 and 14.

Occident Elevator Company, Billings, Montana, Plots 4 and 13.

Rohm and Haas Company, Philadelphia, Pa., Plots 6, 7, 8 and 15.

Eight insect counts were taken on all plots at weekly intervals from July 16 to September 9. The specimens were collected by 25 sweeps with a standard 12″ insect net except aphids. Eight plants of each replicate were examined for aphids totaling 48 plants each week for all treatments. The insect populations are listed in Tables 2A and 2B.

Table 2A.—Effect of Insecticidal Sprays Upon Insect Populations (See text for sampling procedure).

Plot numbers and treatments†	Colo. Potato Beetle (Larvae)	Potato Flea Beetle	Potato Leaf-hoppers	6-spotted Leaf-hoppers	Winged Aphids	Wingless Aphids
1. Check	3	923	137	241	65	640
Wettable Powders						
2. 50% DDT	2	510	74	251	59	388
3. 50% DDT or 25% Vapotone	1	849	131	248	70	416
4. 50% DDT or 41% Toxaphene	0	700	122	323	70	353
5. 25% Parathion Emulsions	1	390	87	291	71	77
6. 25% DDT	1	582	90	288	56	254
7. 25% DDD	0	708	89	248	56	254
8. 25% C R 1639	1	672	145	378	46	446

†See Table 1 for details of dates and rates of application of sprays.

Table 2B—Effect of Insecticidal Dusts Upon Insect Populations (See text for sampling procedure).

Plot Numbers and Treatments†	Colo. Potato Beetle (Larvae)	Potato Flea Beetle	Potato Leaf-hoppers	6-spotted Leaf-hoppers	Winged Aphids	Wingless Aphids
1. Check	3	923	137	241	65	640
9. 5% DDT	0	699	147	225	53	535
10. 3% DDT	1	592	110	252	57	478
11. 1% Parathion	11	700	133	271	51	309
12. 2% Parathion	1	609	143	254	93	260
13. 1% Toxaphene	0	434	107	360	67	314
14. 5% Marlate	0	479	92	231	44	669
15. 5% DDD	1	642	74	230	83	493
16. 10% Toxaphene or 5% DDT	0	578	127	323	54	400

†See Table 1 for details of dates and rates of application of insecticidal dusts.

Summary of 1948 Treatments

Two plots showed significantly higher yields as compared to Check Plot No. 1 receiving no treatment. Plot No. 5, Thiophos 25% Wettable Powder and Plot No. 13, Toxaphene 10% were significant at the 5% level. No treatments were highly significant at the 1% level. Plot No. 7, DDD 25% emulsion, was third highest in tuber yield but lacked .5 bushels yield to attain significance at the 5% level.

DDT 3% dust outyielded DDT 5% dust by 16.4 bushels. In both 1946 and 1947 DDT 3% had an increase in yield over DDT 5% by 28 and 1.7 bushels respectively. The same results for three consecutive years substantiated the opinion expressed in 1946 that the stronger concentrations of DDT might retard tuber yield.

The lowest yielding plot was No. 8, CR-1639, a new experimental insecticide and fungicide. Dithane was not applied to this plot and it is of interest to note that the plot receiving no zinc (incorporated in Dithane) had the lowest yield.

For the third consecutive year DDD treatments have been among the highest yielding plots. However, due to the higher cost differential of DDD, growers will continue to prefer DDT as a potato insecticide. Due to DDD's low toxicity to warm blooded animals it is of interest to growers of leafy and head vegetables where DDT residue might be of concern.

All insecticidal treatments kept the major potato pests in check. The lowest aphid population was on Plot No. 5, Thiophos 25% Wettable Powder. However, the reduction in aphids was not sufficient to justify its recommendation as an aphicide.

Toxaphene 10% dust, Plot No. 13, did not have a reduced tuber yield. In 1947 it was one of the poorer yielding plots. This year's results were not in accordance with other states where it was found that Toxaphene plots had decreased yields and were much lower than DDT plots.

In the 1947 insect population counts Toxaphene and Vapotone showed promise of being potato aphicides. Consequently Plots 3, 4 and 16 had applications of these aphicides substituted for DDT in three applications. Aphids were not appreciably fewer in number on these plots than on the straight DDT applications.

The search for an effective and residual aphicide continues. DDT will control potato pests and keep aphids in check. However, due to the role of aphids in the transmission of virus diseases the major emphasis of this station will be on the development of a residual aphicide and its application for the control of aphids.

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Literature Cited

Post, Richard L., Colberg, Wayne J., and Munro, J. A. Effect of Insecticides on Tuber Yield. N. Dak. Agr. Expt. Sta. Bim. Bull. 10 (3): 98-100. 1948.