Insect Control and Yields from Insecticidal Plots - 1950[1]

By R. L. Post[2], Russell W. McCalley[3], and J. A. Munro[4]

The cooperative North Dakota Agricultural Experiment Station and State Seed Department insecticidal plots were located at Northwood, N. D. on land furnished by Mr. Arthur Nelson. Certified "B" size Bliss Triumph potato seed was planted June 9 and 8-8-8 fertilizer was applied by a fertilizer attachment at 490 pounds per acre. For the control of fungus diseases all plots and buffer rows received applications of Dithane sprays on July 20, August 1, 10 and 21.

Table I. INSECTICIDAL TREATMENTS AND TUBER YIELD
(Based on six replicates)

Plot	Treatment	Adjusted Mean Bu. Per Acre
1	CHECK No Treatment	323.4
	DUSTS: Applied at 10 day intervals. 20 lbs. per acre July 15. Successive applications at 24 lbs. per acre on July 25, August 4, 15, 25 and September 5.	
2	DDT 5%—compounded with special tobacco material carrier	347.9
3	Toxaphene 10%	345.5
4	DDT 2%—methylated naphthalene 3%	337.4
5	Aldrin 2½%	347.6
	SPRAYS: Applied at 10 day intervals.* (except Plot 8) at 100 gallons per acre July 15. Successive applications at 117 gallons per acre July 25, August 4, 15, 25 and September 5.	
6	Dilan a 25% emulsifiable concentrate containing 2 lbs of nitro-paraffin derivatives per gallon. Applied at 1 pint per 100 gallons of water except September 5 when used at 2 quarts per 100 gallons of water	344.9
7	Genitol EM 25-3 emulsifiable concentrate containing DDT 25% and Parathion 3%. Applied at 1 pint per 100 gallons of water	339.7
8	C1014—octa-methyl-pyrophosphoramide (a systemic insecticide). 20% water dispersible concentrate containing 1 lb. actual toxicant per quart. *Applied at 2 quarts per 100 gallons of water July 15, 25, August 15 and September 5	314.2
9	Lindane—20% emulsifiable concentrate. (highly refined gamma isomer of Benzene hexachloride). Applied July 15 and 25 at 1 pint per 100 gallons of water. Successive applications at 1½ pints per 100 gallons of water	325.6

The least significant difference between any two adjusted means at the 5% level is 31.14 bushels.

[1]Progress report on Bankhead Jones Project No. 8-III "A Study of Insects Which Affect Potato Production", N. D. State Seed Department cooperating.
[2]Associate Entomologist, NDAC Experiment Station and State Seed Department.
[3]Assistant Entomologist, State Seed Department.
[4]Entomologist, NDAC Experiment Station.

Due to the role of aphids in the transmission of potato virus diseases, major emphasis of the 1950 research was on application and evaluation of residual aphicides (aphid killers). The aphicidal plots were replicated six times and arranged according to the triple lattice design.

The insecticidal treatments and adjusted mean yields are listed in Table 1.

In order to evaluate the residual properties of the insecticides, aphid counts were taken in all plots at approximately five day intervals, just prior to and five days after applications.

Eight randomized plants from each plot were thoroughly examined for aphids totaling 48 plants for each treatment. The 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 completely examined every aphid count)

Plot numbers and treatments*	July			August						Sept.	Total No. of Aphids
	19	24	38	3	9	15	21	25	31	5	
1. Check-no treatment											
Winged	0	0	0	2	2	15	10	13	28	69	139
Wingless	0	0	0	6	105	635	2063	1383	4216	5560	13968
2. DDT-Tobacco											
Winged	0	0	2	1	5	17	16	6	36	35	118
Wingless	0	0	0	0	0	21	2	3	42	312	380
3. Toxaphene											
Winged	0	0	0	0	4	7	12	7	33	23	86
Wingless	1	7	0	7	9	86	53	62	171	645	1035
4. DDT-M. Napth.											
Winged	0	0	0	0	1	16	13	7	36	29	102
Wingless	1	0	0	2	24	41	36	35	130	478	747
5. Aldrin											
Winged	0	0	0	3	5	20	21	26	34	64	173
Wingless	0	0	7-	4	87	754	1787	1787	3839	4780	13045
6. Dilan											
Winged	0	0	1	1	1	20	10	21	46	42	142
Wingless	0	0	1	10	65	290	804	362	750	1987	4269
7. Genitol											
Winged	0	0	0	0	3	10	7	22	41	32	115
Wingless	0	0	0	5	2	43	21	16	39	340	466
8. Systemic											
Winged	0	0	1	2	3	13	7	11	16	32	85
Wingless	0	0	0	1	4	15	5	6	60	168	259
9. Lindane											
Winged	0	0	0	0	2	21	7	9	33	28	100
Wingless	0	0	0	2	3	119	57	92	211	607	1091

*See Table 1 for details on treatments, dates and rates of applications of insecticides.

Five insect counts were taken at 10 day intervals from July 25 to September 5 (10 days following and just prior to insecticidal application). The specimens were collected by 25 sweeps with a standard 12 inch insect net.

Specimens were collected from each plot and the total numbers listed in Table 3.

Table 3. TOTAL NUMBER OF INSECTS COLLECTED FROM INSECTICIDAL PLOTS[1]
(6 replicates of each treatment swept July 25, August 3, 15, 25 and September 5)

Plot	Potato Leafhoppers	6-Spotted Leafhoppers	Winged Aphids	Wingless Aphids	Ladybird Beetles	Flea Beetles
1—Check	217	170	39	346	8	941
2—DDT-Tobacco	42	118	36	49	1	233
3—Toxaphene	116	161	26	132	3	185
4—DDT-M. Napth.	64	157	36	78	2	420
5—Aldrin	196	131	46	249	7	280
6—Dilan	56	114	34	95	3	230
7—Genitol	77	210	46	48	3	606
8—Systematic	176	158	49	46	1	1626
9—Lindane	216	198	66	99	0	613

[1] See Table 1 for details on treatments, dates and rates of applications of insecticides.

SUMMARY OF INSECTICIDAL PLOTS

Yield data from the plots were referred to the statistical laboratory, Iowa State College. With a least significant difference value of 31.14 bu. at the 5 per cent level there were no treatments showing significant difference as compared to check plot No. 1.

Aphids were 159 times more abundant in 1950 than in 1948 and eight times more abundant than in 1949 at the insecticidal plots located at Northwood.

Plot 2 consisting of a 5% DDT dust compounded from the 50% DDT concentrate and a special tobacco material carrier, which had incorporated in it 20% of mineral extender, had the lowest potato leafhopper counts as well as the lowest aphid and fleabeetle populations. It was the highest yielding plot.

Plot 3, Toxaphene 10%, although not an aphicide, was selected because of its use on grasshoppers invading potatoes and because there were conflicting reports on reduced yields as a result of toxaphene treatments. There is also the theory that toxaphene does not kill the parasites and predators of aphids, and that there is a consequent reduction of aphids in fields where this chemical is used. This plot had the lowest fleabeetle counts, a good yield, but no appreciable decrease in aphids.

Plot 4, DDT 2% Methylated naphthalene 3%, showed a low potato leafhopper count but fair control of aphids. However, there is no advantage of this combination over DDT 3% and 5% dusts.

Plot 5, Aldrin 2½%, resulted in effective control of cotton aphids on cucurbits in Ohio and of the same species on melons in California in 1949 yet it proved ineffective for the control of aphids on potatoes in North Dakota.

Plot 6, Dilan, although this material shows promise as having residual value for potato beetles and leafhoppers, is ineffective for aphid control by the certified grower. On the last application it was applied at two quarts per 100 gallons of water, but the aphid counts were 4 winged and 460 wingless as compared to 4 of winged and 30 wingless on the check plot on September 11th. Lady bird beetles and other aphid parasites were more abundant in the check plot on September 11th.

Plot 7, Genitol, a parathion-DDT formulation, was among the three insecticides showing marked aphid reduction. It is an economical formulation for potatoes. It has a low concentration of a highly poisonous organic phosphate but every precaution must be taken by growers to avoid undue exposure to it.

Plot 8, systemic (octa-methyl-pyrophosphoramide). Systemics are water soluble compounds which are taken up by the plant and transmitted by traveling in the plant system. This treatment had the lowest aphid count but a higher number of flea beetles than the check plot No. 1. It also was the lowest yielding plot. Analysis[1] revealed 1.6 parts per million of the octa-methyl-pyrophosphoramide in the tubers following foliage applications listed in Table 1. Until the danger of accumulating residual organic phosphates in the tubers has been ascertained it cannot be recommended except as a combination with DDT for valuable tuber units or small increase plots which will *not* be used as food.

Plot 9, Lindane, this highly refined gamma isomer of Benzene hexachloride cannot be recommended because it imparts an objectionable taste to tubers. In taste tests 13 of 14 testers reported objectionable flavors to tubers following foliage treatments listed in Table 1.

CONCLUSIONS

Growers of table stock are still advised to use DDT spray or dust for all potato insects. Such treatment holds aphids in check but does not eliminate them.

Growers of certified potatoes should check their fields for the presence of aphids following local migrations which vary from August 1 to 20. The certified grower who desires practical elimination of disease-transmitting aphids may use Parathion or Parathion-DDT combinations. When using organic phosphates such as Parathion, every precaution must be observed to avoid undue exposure to it.

Systemic insecticides, which give best aphid control, cannot be recommended except for tuber unit or valuable seed increase plots until the danger of their accumulating as residual organic phosphates in the tubers has been ascertained. Moreover, they give poor control of Coleoptera (beetles) and Lepidoptera (butterflies and moths). When used they should be in combination with DDT to control fleabeetles.

[1] Analysis by Analytical Laboratory, Dow Chemical Co., Midland, Michigan.

Sources of Insecticides

Agsco Chemicals Incorporated, Grand Forks, N. D.
California Spray Chemical Company, Janesville, Wis., Branch Office.
Commercial Solvents Corporation, New York City, N. Y.
Dow Chemical Company, Midland, Mich.
General Chemical Division, Allied Chemical & Dye Corp., New York City, N. Y.
Julius Hyman & Company, Denver, Colo.
Rohm & Haas Company, Philadelphia, Pa.
Tobacco By-Products and Chemical Corp., Richmond, Va.

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