Systemic Insecticides in Commercial Potato Production

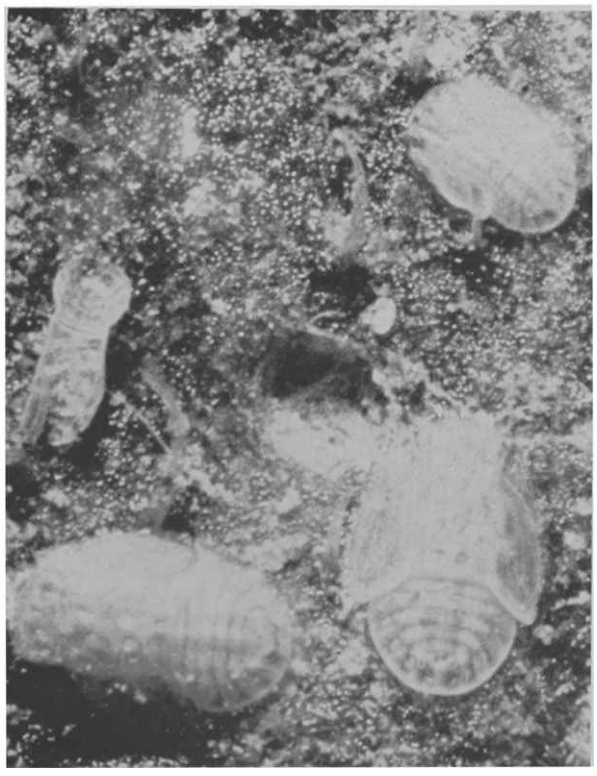
Paul D. Gerhardt and Don L. Turley

Potato growers in Arizona are more fortunate than those in other areas of the United States because they do not have to contend with two of the most serious potato insect pests, the Colorado potato beetle and the potato tuber moth.

In Arizona the insect of most concern is the potato psyllid. Other insects which are problems in potato production are aphids — but chiefly the green peach aphid, leafhoppers, and grain thrips. All of these are classified as sucking insects. The potato psyllid is most serious because the feeding nymphs transmit the psyllid yellows disease.

Psyllid yellows-infected plants usually set more tubers than normal, but fail to mature them. The plants become yellow with a purple tinge. The top growth is reduced and gnarled. The result is reduced yield. In the recent past, several phosphate type systemic insecticides have been particularly effective against these sucking insects. A more recent innovation is the granular formulation of these insecticides.

BELOW, SECOND and third instar potato psyllid nymphs. Magnified 20 times natural size.

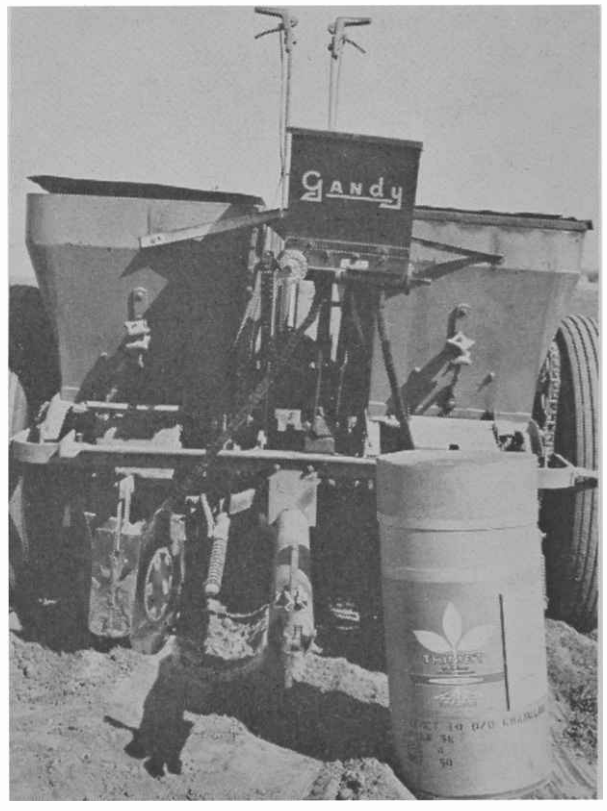


Two Granules Effective

Since 1959, studies have been made using these insecticide granules for potato insect control in Arizona. The two insecticides that have been most effective are phorate (Thimet) and Di-syston, each used as 10 per cent granules. These insecticides are generally applied through a dry insecticide applicator mounted on a potato planter. In this manner, granular insecticides may be applied in one or both of the fertilizer bands during the planting operation.

The granules may be introduced through the fertilizer tube or directly into the fertilizer shoe. It is important that the tube connecting the applicator to the fertilizer shoe be maintained straight enough to minimize flow stoppage, which would cause faulty application and areas of untreated soil. The placement of the granules should be in the fertilizer band, 3 to 4 inches to the side and approximately an inch below the seed pieces. Granules placed deeper or further from seed pieces will be less effective. Proper safety precautions must be taken when these insecticides are handled.

SHOWN BELOW IS the dry insecticide applicator used to apply granular systemic insecticides, mounted on a two-row potato planter.



Dr. Gerhardt is an associate entomologist and Mr. Turley is an assistant in entomology, both working at the Mesa Branch Experiment Station.

Because it is necessary for the roots to take up the insecticide so it can be moved into leaves and stems of the plant, the material must be dissolved in the soil solution. To accomplish this, the potato fields should be irrigated within a week or two after the stand is established. This is essential for effectively protecting the young plants early in the growth period, particularly when severe psyllid infestations are suspected or indicated. Such conditions were experienced during 1962.

Look For Freckled Leaves

When phorate is taken in by the roots and translocated into the leaves and stems, its metabolites tend to accumulate in the tips and margins of the leaves. When this happens these areas will generally turn brown and become necrotic. There also may be small, brown, necrotic spots throughout the leaf blades. The presence of these spots, brown tips, or necrotic leaf margins is a visible sign that the phorate has been taken into the plant in amounts adequate for insect control. Such leaf injury is minor and will not affect plant growth or yields materially when phorate is used as recommended. Similar symptoms are found in plants treated with Di-syston although not as pronounced as in phorate.

Lack of control of potato psyllids and aphids is illustrated in Tables I and III.

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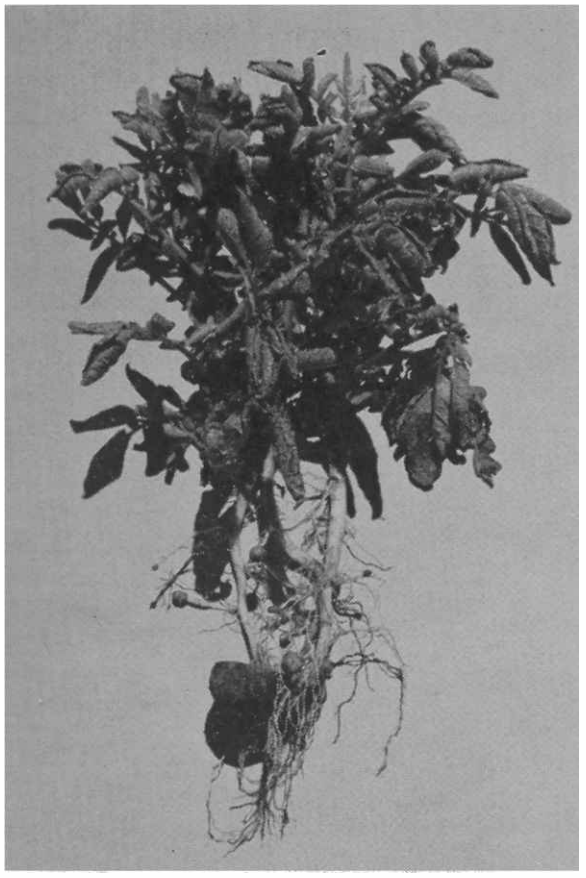
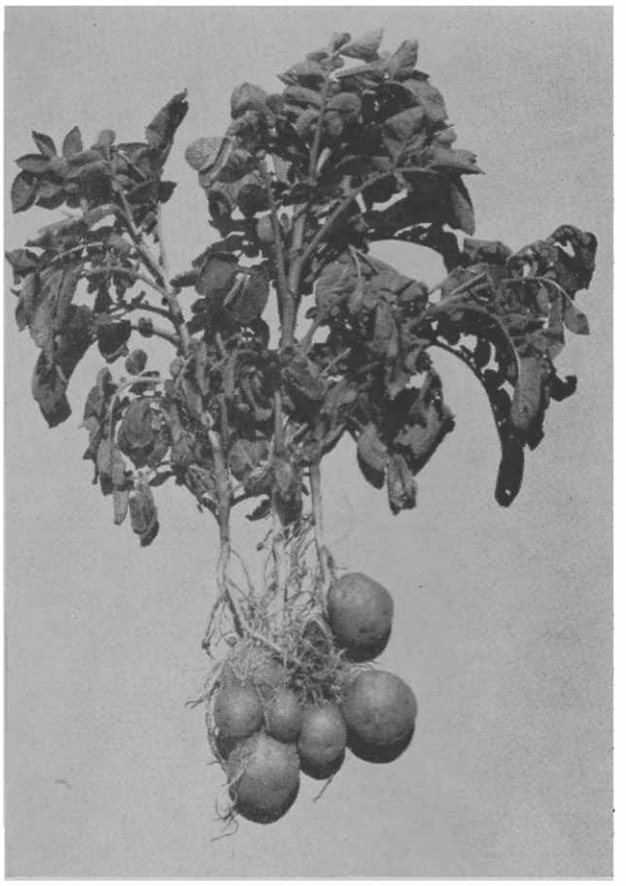
Table I. — Effects of phorate on the control of green peach aphid and potato psyllid in Pontiac Potatoes; Mesa Branch Station, 1960.

Sampling Dates	Insects per 25 Leaves: Untreated Green Peach Aphids	Untreated Potato Psyllids	Treated[1] Green Peach Aphids	Treated[1] Potato Psyllids
March 24	2829	0	2473	0
April 6[2]	64	0	45	0
April 15	134	0	14	0
April 26	55	55	1.3	0
May 6	8	65	0	0
May 13	3	6	0	0
May 25	0.3	0.5	0	0

[1]Phorate (10 per cent granules) applied at planting time, February 16, 1960.
[2]First irrigation applied prior to second sampling date.





AT LEFT IS AN untreated potato plant showing psyllid yellows symptoms. At right a normal plant from a treated plot. Compare tuber set and size.

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Dramatic results are shown in Table I where an application of 20 pounds of 10 per cent granular phorate per acre was applied at planting time. As many as 65 psyllid nymphs per 25 leaves were found on the untreated plants, while throughout the growing season no psyllid nymphs were found on the phorate-treated plants.

In Table II, yield data are shown from these same plots. The untreated plots yielded only 86.5 hundred pound sacks per acre of U. S. No. 1-A potatoes compared with 230 of the hundred pound sacks in the phorate treated plots. The reduced yield of untreated plots resulted from psyllid yellows transmitted through the feeding psyllid nymphs.

New Interest in Chippers

In the past, red potatoes have been the most common commercial variety in Arizona. With the increased demand for and interest in processing, the Kennebec, a white-skinned variety, became the number one potato in 1962.

Comparative data for granular phorate and Di-syston are given in Table III. These materials were applied at planting time to the Kennebec variety. Application was made as described earlier. From this table, it is obvious that all rates of application of either phorate or Di-syston reduced the number of psyllids compared with the untreated plots. In the untreated plots, on one sampling date, up to 1008 psyllid nymphs were found per 25 leaves compared with 62 per 25 leaves where the 10-pound rate was used.

Table II.—Effects of phorate on yield of potatoes, Mesa Branch Station, 1960; variety, Red Pontiac.

U. S. Grade	Yields in 100-lb. Sacks per Acre: Untreated Sacks	Untreated Per cent	Phorate Treated Sacks	Phorate Treated Per cent
No. 1-Jumbo	0.6	0.3	75.3	22.2
No. 1-A	86.5	45.1	230.6	67.9
No. 1-B	91.6	47.8	15.3	4.5
No. 2	4.9	2.5	8.8	2.6
Culls	8.2	4.3	9.8	2.9
Total	191.8		339.8	

In comparing phorate and Di-syston, the 20 and 15-pound rates of these materials gave excellent control of aphids and psyllids. Most effective was the 20-pound rate of phorate, which gave nearly perfect control of psyllids and good control of aphids. The 10-pound rate of either material was not adequate for best control.

20-Pound Rate Best

Yield data from these plots are given in Table IV. Highest total yields were generally obtained where the 20-pound per acre rate was used. Although the 10-pound rate of phorate produced the largest number of sacks per acre of No. 1-A potatoes, the total yield was less. The 10-pound rate also gave poor psyllid nymph control. Where Di-syston was used, the 10-pound rate produced fewer No. 1-A potatoes than did the 15 and 20-pound rates.

In general, results from three years of study with granular systemic insecticides for controlling potato insects, particularly psyllids, show that a 20-pound rate per acre of 10 per cent granular phorate or Di-syston will give season-long control when the materials are properly applied.

Other insecticides will also control

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Table III. — Effects of granular phorate and Di-syston on the control of insects with Kennebec potatoes, 1962[1]

INSECTS PER 25 LEAVES

Sampling Date	10% Phorate Granular 20 lbs./A. Aphids	Psyllids	15 lbs./A. Aphids	Psyllids	10 lbs./A. Aphids	Psyllids	10% Di-syston Granular 20 lbs./A. Aphids	Psyllids	15 lbs./A. Aphids	Psyllids	10 lbs./A. Aphids	Psyllids	Untreated Aphids	Psyllids
Mar. 31	2	0	3	1 A[2]	11	1 A	9	0	2	0	10	1 A	5	1 A
Apr.	34	0	56	0	120	5	45	1	70	2 A	8	1 A	283	16
Apr. 14	29	0	101	3	312	45	44	5	62	14	18	33	1135	518
Apr. 19	5	1	49	0	485	86	15	0	18	3	62	6	3170	722
Apr. 28	6	0	19	0	406	62	3	0	8	3	54	1	4878	1008
May 3	19	0	24	0	688	47	3	0	5	3	33	6	3341	737
May 10	28	0	28	0	170	5	3	0	32	1	17	0	0	39
May 16	32	0	91	0	103	2	10	1	22	0	3	12	3	48

[1]Planted February 6, 1962.
[2]A: adult psyllids.

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psyllids, aphids, and thrips on potatoes. Acceptable materials are sulfur, as a dust; parathion two per cent, plus sulfur, as a dust; and Thiodan, three per cent as a dust or spray (two quarts per acre). Repeated applications may be necessary where these pesticides are used. On the other hand, properly applied granular systemic insecticides need be applied only once, at planting time.

The authors would like to acknowledge the valuable assistance given by insecticide companies in providing insecticides, farmers for providing land and other facilities, and to The University of Arizona Mesa Branch Station personnel for their help in accomplishing cultural procedures and harvesting. Without this assistance, these studies would not have been possible.

Table IV. — Effects of granular phorate and Di-syston on potato yields, 1962.

	100-POUND SACKS PER ACRE						
U. S.	*10% Phorate Granular*			*10% Di-syston Granular*			*Untreated*
Grade	*10 lbs./A*	*15 lbs./A*	*20 lbs./A*	*10 lbs./A*	*15 lbs./A*	*20 lbs./A*	
No. 1-Jumbo	13	26	30	13	29	22	0
No. 1-A	173	158	164	124	186	217	3
No. 2	105	140	150	67	150	107	12
No. 1-B	30	15	15	27	19	15	57
Culls	5	7	10	5	3	2	1
Total	326	346	369	326	387	363	73

Harvested: June 6, 1962.

Prof. Thornber, Former Agric. Dean, Dies at 90

Professor Emeritus John J. Thornber, long a distinguished botanist at The University of Arizona, died Nov. 22 at his Tucson home at the age of 90.

Professor Thornber joined The U of A faculty in 1901 and served as professor of botany until 1921. In that year he became dean of The UA College of Agriculture and continued to direct the college until 1928.

Dr. Richard A. Harvill, president of The U of A, said, "Professor Thornber served The University of Arizona long and well in a number of professional roles. He was unexcelled in knowledge and understanding of the plants and plant ecology of Arizona and the Southwest. The very extensive herbarium collections at the university are largely the results of his interest and efforts."

Prof. Thornber was born in Illinois and was 11 when his parents moved to South Dakota. He attended South Dakota Agricultural College and later received the M.S. degree from the University of Nebraska.

The U of A awarded him its 75th Anniversary Medallion of Merit Nov. 24, 1959, in recognition of his "outstanding service to the state and to the development of the university's teaching and research programs." During his long period of service with The U of A, Prof. Thornber devoted a large part of his time to the study of Arizona flora and built up a herbarium of more than 100,000 plant specimens at the university.

He was the author of "The Grazing Ranges of Arizona," a widely-known bulletin issued by The U of A Agricultural Experiment Station. It was the first comprehensive publication on grazing range management in the state and had unusually wide distribution. He was the author of many other professional publications and co-author, with Margaret Armstrong, of the "Field Book of Western Wildflowers."

For many years Prof. Thornber was active in introducing into the Southwest plants from other countries. It was once estimated that at least 75 per cent of the ornamental plantings on The U of A campus were acquired through his efforts.

In 1911-12, Prof. Thornber was granted a leave by The U of A to study at the Smithsonian Institution and the Asa Gray Herbarium. Upon his return to Arizona he continued study of the depleted grazing ranges in the Southwest. He addressed the National Livestock Association several times on the subject.

Prof. Thornber is survived by his son, John S. Thornber of San Diego; a sister, Miss Jessie Thornberg of Moscow, Idaho; and three brothers. They are Edward Thornber, Eugene, Ore.; Adam Thornber, Mt. Vernon, Wash.; and Harvey Thornber of Hamilton, Mont.

Arizona farmers, ranchmen and homemakers may have their names placed on the mailing list to receive **Progressive Agriculture** at no cost by sending a request to the College of Agriculture, University of Arizona, Tucson, Arizona.

U. S. Agricultural Exports Declining

Elmer L. Menzie and Jimmye S. Hillman

The United States has been and is a major exporter of agricultural products. Fiscal year 1961-62 exports amounted to $5,130 million.

However, the value of agricultural exports relative to the exports of all products has been declining, and currently makes up between 20 and 25 per cent of the total (see chart). Agricultural exports account for approximately 12 per cent of the gross farm income, or about 10 per cent of farm product utilization.

Other measures of the value of agricultural exports demonstrate the importance more dramatically. For instance, exports take from a third to half of all cotton produced and in the past have amounted to over 65 per cent. In recent years wheat exports absorbed about a third of the U. S. crop, but in 1957 were over 50 per cent. Tobacco, barley and rice exports have amounted to 20 to 30 per cent of production. These are major products in U. S. agriculture, contributing the largest share of total income.

Many Resources Employed

On the basis of acreage harvested, the U. S. Department of Agriculture estimated that 17.2 per cent was used for export production in 1960. Production of these exports requires numerous other resources such as labor, machinery, petroleum, chemicals and services. The use of these resources in turn creates employment for their production, all of which makes an important contribution to the economic welfare of the nation.

While the export of agricultural products has been large, and valuable both to agriculture and the economy in general, it has not been sustained without cost. Government action has been required,

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The authors are assistant professor and professor of Agricultural Economics, respectively.