SEED TREATMENTS: A NEW OPTION FOR INTEGRATED PEST MANAGEMENT OF POTATO LEAFROLL VIRUS, APHIDS, AND COLORADO POTATO BEETLE.[1]

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Several times in the past eight years we have explored the possibility of using imidacloprid as a potato seed treatment for control of aphid and Colorado potato beetle (CPB). Combining the insect and disease control in a seed treatment is very logical. The entry of an additional insecticide into the possible niche has renewed interest in this approach. This research reports the results of two trials conducted in 1998 to evaluate the potential of the technique.

METHODS AND MATERIALS

An efficacy trial was conducted comparing 16 experimental treatments (including seed treatments), 3 standards and an unprotected check for control of aphid and CPB. A second trial specific for seed treatments compared 2 seed treatments with 2 standards and an unprotected check. Treatments for the two experiments included:

Efficacy Trial	Seed Treatment Trial
Unprotected check	Unprotected check
Permethrin (0.1 # ai/a)	Admire 16 oz/a
Aldicarb (3# ai/a)	Aldicarb (3# ai/a)
Admire (20 oz/a)	Gaucho (high)
Adage (low)	Gaucho (low)
Adage (moderate)	
Adage (high)	**(Rates for seed treatments remain**
Gaucho (high)	**confidential at this time)**

Each trial was conducted as a 4 replication randomized complete block experiment. Insect counts were made using a 26" x 26" beating cloth. Alate (winged) and apterous (wingless) aphids and CPB adults, 1st and 2nd instar larvae (combined) and 3rd and 4th instar larvae (combined) were

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[1]Sponsored by the Oregon and Washington Potato Commissions.

counted. Populations of insects were observed twice weekly in the efficacy trial and once weekly in the seed treatment trial.

Standard insecticide treatments were applied using either a continuous belt granule applicator or sprayed as a 7" band in the furrow at the depth of the seed piece. Soil applied treatments were made to the efficacy trial April 23 and to the seed treatment trial May 20. Permethrin, in the efficacy trial, was broadcast sprayed over the plots using Delevan raindrop nozzles at 40# pressure over the row on at a weekly interval. The efficacy trial was planted April 24 & 25 with potato seed spaced 9.5" apart in 34" rows. Plots were eight rows by 24' with the center 14 foot of the middle two rows unplanted. Data was gathered in row 3 and 6, along the unplanted area of the middle rows. The seed treatment trial was planted May 25 with the same spacing and row spacings. Plots were 4 rows by 30'. Data was taken along the center 20' of the outer two rows. The efficacy trial was irrigated by center pivot with spinner sprinklers on drops. The seed treatment trial was sprinkler irrigated using hand lines. Irrigation applied for both trials followed a schedule provided by the Northwest Irrigation Network. Both trials were planted with certified "Russet Burbank" seed. Agronomic practices were as near as possible to those practiced in Columbia Basin for commercial potato production.

RESULTS

Evaluation of insecticides for aphid and Colorado potato beetle (CPB) were difficult in 1998. Populations of both aphid and CPB were smaller than normal early in the season. Aphid populations became large only after the projects were completed. CPB populations remained very small during the normal first field generation and though they became larger during the second field generation, defoliation of checks occurred much later than normal. Both populations were distributed in a more clumped distribution than normally observed in our trials. Aphid population data is presented in table 1 for the efficacy trial and table 2 for the seed treatment trial. CPB population data is presented in table 3 for the efficacy trial and table 4 for the seed treatment trial.

Aphid populations on the unprotected plots of the efficacy study (table 1) were low during June in relationship to most years then nearly disappeared. The disappearance occurred because there were few winged aphids to re-infest the plots, predator populations built to a level where they controlled most of the aphids and eventually CPB defoliated the plots. Aphid population in the permethrin treated plots was also lower than normal (table 1). Permethrin effectively controls the aphid predator complex, thus causing aphid populations to increase. Aldicarb was already beginning to break for aphid when we started taking data, 48 days after application (table 1). Aldicarb provided inadequate control in this study by 56 days after application. Admire, the adage treatments and gaucho adequately controlled aphid until there were no winged aphid migrating into the plots to re-infest the plants (table 1). If re-infestation had occurred these products would have been ineffective at some point, probably 60 to 70 days after application.

Aphid populations in the seed treatment trial were never very high (table 2). Because of the late planting date (planting time applications) all of the insecticides in this trial provided control till aphid flights had ceased and no winged aphid were available to infest the plots.

CPB populations provided a better measure of longevity of chemical control than did aphid. In the efficacy trial the adage and gaucho seed treatments provided longer periods of control than did aldicarb, and shorter periods of control than did admire at 16 oz/acre (table 3). Adage provided 77 days of control at the low rate, 80 at the moderate rate and 90 at the high rate. Gaucho provided 83 days of control at the high rate. In the seed treatment trial, gaucho and admire at 16 oz/acre provided about 63 days of control (table 4).

DISCUSSION

Once they are registered for commercial use, seed treatments of gaucho, admire and adage will provide an opportunity to achieve early to mid-season aphid and CPB control without having to make a field application. There is some likelihood that gaucho and admire may be registered for the 1999 crop season and perhaps adage the following year. These products appear to have provided a longer period of control of CPB than aldicarb. Though not verifies by this years research, imidacloprid (the active ingredient of admire and gaucho) normally provides a longer period of control for aphid than beetle and we would expect the same for seed One aspect that remains to be researched is impact of these products applied as seed treatments on transmission of potato leafroll virus (PLRV) and expression of net-necrosis. We expect to concentrate research on this factor during 1999. At this point however, I suspect that PLRV suppression will be similar to that of admire when furrow applied at similar rates.

There are constraints to be considered. Using a seed treatment to control a disease attacking the seed piece is different from trying to control insects affecting foliage. Insect control is governed by concentration of the product in the plant. Applications must be made in a manner that assures an adequate concentration is coated on all seed pieces. If less product is applied to the seed pieces, or concentration varies widely between pieces, less control will result. This means that extreme care must be expended to assure adequate coating and that scouting must be conducted regularly to assure that control is still effective. We must also adequately protect the treated seed from exposure to moisture, excessive heat or direct sunlight between the time it is applied to the seed and the seed planted in the ground.

The use of seed treatment for early to mid-season aphid and beetle control in potato offers an attractive alternative to addition of chemical application equipment to the planter, or additional travel over the field to make a specific application. Considering the potential for the Food Quality Protection Act to reduce the number of insecticides currently available for potato, it is likely that we will have to utilize imidacloprid and related products. It is extremely important that we utilize these products as they are registered to insure that we have adequate knowledge of the practical aspects of their use before we must rely on them for quality potato production.

Table 1. Efficacy trial - population of green peach aphid apterae (wingless) per beating cloth sample - Oregon State University, Hermiston Agricultural Research & Extension Center, 1998.

	Check	Permeth-rin	Aldicarb	Admire	Adage (low)	Adage (mod)	Adage (high)	Gaucho
6/11	21.75	8.50	2.00	0.00	0.50	0.50	1.00	0.75
6/16	15.50	11.00	4.50	0.00	0.00	0.00	0.00	0.00
6/19	27.25	12.50	15.25	0.25	0.25	1.00	0.50	0.50
6/23	43.25	48.25	5.25	1.25	0.50	0.00	0.75	0.00
6/26	56.75	63.00	21.50	0.00	1.00	0.25	0.50	2.75
6/30	26.25	60.25	13.00	0.75	0.00	0.50	0.00	0.25
7/3	11.50	50.75	3.25	0.50	0.25	0.50	0.50	0.25
7/7	5.00	90.50	2.25	0.50	0.25	0.00	0.50	0.00
7/10	2.25	30.25	0.75	0.00	0.50	0.25	0.50	0.25
7/14	2.50	42.25	2.00	1.00	1.00	0.50	0.25	0.50
7/17	3.50	8.25	2.50	0.25	0.50	0.00	0.50	1.00
7/21	0.75	16.50	3.50	1.00	0.75	0.00	0.50	1.00
7/24	1.50	21.25	0.50	0.00	0.00	0.00	0.00	0.50
7/28	0.75	10.25	2.25	0.50	0.00	0.25	0.00	0.00
8/4	0.00	18.75	1.25	0.00	0.00	0.50	0.25	0.75
8/7	0.25	75.25	1.50	0.00	0.00	0.00	0.00	0.00
8/11	0.00	71.25	0.00	0.00	0.00	0.00	0.00	0.75
8/14	0.00	37.50	3.00	0.00	0.25	0.00	0.00	0.00
8/18	0.00	34.50	0.00	0.50	0.00	0.25	0.00	0.00
8/21	0.00	67.00	0.00	0.00	0.00	0.00	0.00	0.00
8/25	0.00	27.50	4.00	0.25	0.00	0.25	0.00	0.00
8/28	0.00	20.75	2.75	0.00	0.00	0.00	0.00	0.00

Table 2. Seed treatment trial - population of apteerous aphid per beating cloth sample, Oregon State University, Hermiston Agricultural Research & Extension Center, 1998.

	Check	Admire	Aldicarb	Gaucho (high)	Gaucho (low)
7/1	16.25	0.00	0.50	0.00	0.25
7/8	1.25	0.00	0.00	0.50	0.25
7/15	0.75	0.25	0.00	0.00	0.00
7/22	1.00	0.00	1.00	0.00	0.25
7/29	1.00	0.00	0.00	0.00	0.00
8/5	0.75	0.25	0.25	0.00	0.50
8/12	2.75	0.00	0.00	0.00	0.00
8/19	3.00	0.25	0.75	0.25	0.00
8/26	5.50	0.00	4.75	0.00	0.75

Table 3. Efficacy trial, population of Colorado potato beetle 1st & 2nd instar larvae per beating cloth sample - Oregon State University, Hermiston Agricultural Research & extension Center, 1998

	Check	Permeth-rin	Aldicarb	Admire	Adage (low)	Adage (mod)	Adage (high)	Gaucho
6/11	0.75	7.50	0.00	0.00	0.00	0.25	0.00	0.00
6/16	2.50	2.00	0.00	0.00	0.00	0.00	0.00	0.00
6/19	4.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00
6/23	4.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00
6/26	7.50	0.00	6.50	0.00	0.00	0.00	0.25	0.00
6/30	7.25	0.00	0.25	0.00	0.00	0.00	0.00	0.00
7/3	1.50	0.00	4.00	0.00	0.00	0.00	0.00	0.00
7/7	4.75	0.50	2.50	0.00	0.00	0.00	0.50	0.50
7/10	15.00	0.00	2.75	0.00	0.00	0.25	1.25	0.00
7/14	18.00	0.00	1.50	0.00	3.75	0.00	0.25	0.25
7/17	45.00	0.75	1.00	0.00	0.00	3.75	1.00	1.50
7/21	138.50	0.00	13.00	0.00	1.75	1.75	0.50	7.25
7/24	41.75	1.25	18.25	0.25	1.00	0.25	0.50	19.75
7/28	56.75	13.50	5.50	5.75	1.25	4.25	3.25	4.25
8/4	52.50	11.50	23.75	1.75	3.25	5.50	2.00	31.25
8/7	76.00	1.50	44.25	11.00	6.25	5.75	4.00	42.25
8/11	27.25	5.75	21.50	25.25	9.50	6.00	4.25	29.75
8/14	5.00	2.00	19.50	25.50	5.25	6.00	0.50	29.50
8/18	0.25	5.00	20.25	31.25	15.50	11.25	10.75	14.75
8/21	0.75	7.50	14.75	21.00	21.50	14.50	6.25	36.25
8/25	0.50	4.00	10.50	26.75	13.75	6.75	0.50	19.00
8/28	0.00	1.75	4.00	6.50	1.00	0.25	1.25	4.25

Table 4. Seed treatment trial - population of 1st & 2nd instar Colorado potato beetle larvae per beating cloth sample, Oregon State University, Hermiston Agricultural Research & Extension Center, 1998.

	Check	Admire	Aldicarb	Gaucho (high)	Gaucho (low)
7/1	7.25	0.00	0.00	0.00	0.00
7/8	8.00	0.00	0.00	0.00	0.00
7/15	21.50	0.00	0.00	0.00	0.25
7/22	35.00	0.00	0.25	0.00	1.75
7/29	29.50	0.00	2.50	5.50	4.50
8/5	13.00	2.75	1.00	9.00	4.75
8/12	17.75	1.25	8.50	11.25	20.75
8/19	42.00	5.50	30.00	34.50	53.00
8/26	16.00	14.50	23.25	34.50	41.50