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Pea Aphid Control in Lentils: Effects on Yield and Yield Components from Insecticide Application Timings and the Use of Foliar Nutrients

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ABSTRACT

Pea aphid (PA), *Acyrtosiphum pisum* (Harris) is a widespread insect pest of leguminous crops such as lentils (*Lens culnaria*). Insecticide control measures vary. Some producers do not apply insecticides since they do not consider aphids economic pests. Other producers will always spray to control aphids and many of these producers will include a foliar nutrient spray with insecticide sprays to maximize yields. This study was conducted to document the impact of aphids on lentil yield, yield components, and observe differences between insecticide timing and the use of foliar nutrient sprays. Field trials were established in Farmington, WA in 2001 with a commercial variety of lentils, Pardina (small brown cotyledon). Aphid populations were counted every five days after aphid appearance in each of the plots. Crop year 2001 was characterized by extremely low aphid infestations throughout the growing season. This was vividly shown when peak aphid counts did not exceed 30 PA per square foot in any of the 2001 plots in contrast to over 800 PA per square foot in a similar trial conducted in 2000. Early treatments with foliar insecticides showed suppression of PA build-up until lentils reached physiological maturity. In the absence of economic threshold levels of PA there were no significant differences among treatments in yield. 100-seed weight was not influenced by any insecticide treatment and treatments were not significantly different from the untreated check. In the absence of PA pressure there were no differences shown between early and late insecticide treatments. Foliar nutrient applications did not enhance aphid control, yield or 100-seed weight. The lack of response to foliar nutrients in a year with limited PA pressure suggests that their value may be limited. The most conclusive results from this study emphasized the importance of field scouting to determine PA threshold levels. Until PA populations reach threshold levels, there is no economic benefit to treat with insecticides as a preventive measure.

Since 1996 the USA Dry Pea and Lentil Commissions (WA, ID) have supported research to find alternative insecticides to *Dimethoate*, the industry standard insecticide for aphid control. This focus stemmed from provisions of the EPA Food Quality Protection Act (FQPA) that placed organophosphate insecticides such as *Dimethoate* on review lists that could eliminate usage based on

environmental hazards. Loss of the use of *Dimethoate* and the subsequent inability to control aphids in lentils would result in significant yield and quality reductions. Yield losses in excess of 30% and associated reduced seed size in excess of 26% have been attributed to aphid feeding in lentils (Burns and Bragg, 1999).

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Many newer classes of synthetic Pyrethroid insecticides have been developed that represent 'soft' chemistry in terms of low environmental and risk exposure. On-farm research trials have shown PA control equal to or better than *Dimethoate* using newer classes of insecticides (Burns and Bragg, 1998,1999, 2000). PA population development studies in green peas, *Pisum sativum*, have shown economic threshold varies from season to season (Maiteki & Lamb, 1985). This variation is also observed in lentils. Despite the fact that PA infestations occur timing of insecticide

applications vary annually based on estimates of economic injury levels among producers.

Many producers feel the addition of foliar nutrients with the insecticide application provides additional yield advantages. Alternatively, there is an opinion that the yield and quality benefit observed with the combination of insecticide and foliar nutrient applications is strictly of function of aphid control. The objective of this study was to determine the efficacy of newer classes of insecticides compared to *Dimethoate* at two different stages of growth with and without combinations of foliar nutrients

MATERIALS and METHODS

Field plots were established 6 May 2001 near Farmington, WA on the Bernt and Roger Lehn farm to evaluate efficacy of foliar insecticides to control PA in Pardina (Spanish brown) spring lentil. Pardina is a predominant small brown cotyledon lentil raised in the PNW.

Plots were established in a RCBD with four replicates having 5 x 16 ft. plots. Seeding was done with double-disc drill at 45 pounds of seed per acre on 6-inch centers. Four foliar insecticide treatments and an untreated check (UTC) were established. Foliar treatments were: Capture (*bifenthrin*) 0.04# ai/ac; Dimethoate (*dimethoate*) 0.5# ai/ac; Baythroid (*cyfluthrin*) 0.03# ai/ac with a wettable powder and EC formulation. Foliar treatments (early) were applied at approximately 10% bloom (7 July 2001) and (late) pod-set (31 July 2001). A foliar micronutrient (*Micro-mix*, Wilbur-Ellis, Co) was used as the foliar treatment (32 ounces/acre) and was mixed directly with the foliar insecticide treatments. A CO₂-powered backpack sprayer at 20-gpa/20 psi was used to

apply foliar treatments. All foliar spray mixes were buffered to pH 5.0.

Pea aphid population development was monitored every five days and rated by average counts of Pea Aphid (PA) /ft² sample per replicate for Pre-Count (PrCt), 14,19,24,28, and 33 Days After Treatment (DAT). Aphid populations did not appear until 14 days after the initial early treatment. Average aphids per plot were counted using a one-square foot yellow-colored clipboard that was placed at random on the ground between rows in each plot. Aphids were 'knocked' by hand off plants with four sequential 'beatings' per plot. The 'beating' technique does not cause any plant damage and aphids readily fall from plants. The yellow color provides excellent contrast to the light-green colored aphids.

Plots were hand-harvested at random on 10 Aug 2001 from each replicate to obtain 100-seed weight. All plots (80 sq ft) were harvested with a Hege 125 plot combine on 28 August 2001 to estimate yield.

RESULTS

APHIDS: Aphid pressure in crop year 2001 was negligible and resulted in basically no significant differences among variables measured. Foliar insecticide treatments showed a trend of reducing aphid numbers compared to untreated check; however, aphid economic threshold numbers for

injury were never reached throughout the course of the study resulting in minimal significant differences among treatments. Early treatments with Dimethoate and Capture resulted in the lowest number of total aphids counted per treatment. Treatments with the two formulations

of Baythroid. were not as effective as Dimethoate or Capture. There did not appear to be an advantage to waiting for a late treatment since all early treatments provided season-long suppression of PA until the plants reached physiological maturity. Foliar nutrient applications had no significant effect on aphid control and were comparable to insecticide treatments without the foliar nutrient. Observations of untreated check (UTC) treatments, with and without foliar nutrients, showed no effect from the foliar nutrient on PA.

YIELD: There were no significant differences among treatments in yield including treatments

that included early and late foliar nutrient applications (Table 1). These results are in contrast to previous years studies where considerable differences in yields were obtained among insecticide treatments.

100-SEED WEIGHT: 100-seed weight trends followed yield trends with essentially no significant differences among treatments (Table 1) The lack of significant differences in 100-seed weight can also be attributed to lack of economic threshold PA numbers throughout the 2001 growing season (Table 2).

Table 1. PARDINA LENTIL:
Average values for yield and 100-seed weight in Pardina lentil after treatment with insecticides and foliar nutrient solutions at two stages (early, late) of growth. (Farmington, WA, 2001)

(1) Numbers followed by the same letter in a column are not significantly different. (P=0.05)

Treatment	YIELD ⁽¹⁾ (lbs/ac)	100 SEED WT (grams)
Dimethoate (late)	2850 a	4.00 abc
Baythroid 2E + Foliar (early)	2790 a	4.00 abc
Baythroid 2E (early)	2790 a	3.98 abc
Baythroid 20WP (early)	2775 a	4.13 ab
Capture 2E + Foliar (late)	2732 a	4.05 ab
Dimethoate + Foliar (late)	2690 a	4.05 abc
Untreated Control+Foliar (late)	2683 a	4.03 abc
Baythroid 20WP (late)	2681 a	4.03 abc
Capture 2E + Foliar (early)	2676 a	4.13 ab
Baythroid 20WP + Foliar (early)	2666 a	4.13 abc
Capture 2E (early)	2594 a	4.08 abc
Untreated Control	2592 a	4.18 a
Baythroid 2E (late)	2592 a	3.98 abc
Untreated Control+Foliar (early)	2587 a	4.10 abc
Capture 2E (late)	2476 a	4.18 a
Baythroid 20WP + Foliar (late)	2463 a	3.90 c
Baythroid 2E + Foliar (late)	2382 a	4.13 ab
Dimethoate + Foliar (early)	2331 a	4.08 abc
Dimethoate (early)	2020 a	3.95 bc

Table 2: PARDINA LENTIL: Average number of Pea Aphid per square foot in Pardina lentil counted at five different dates after treatment with insecticides and foliar nutrient solutions at two stages of growth (early, late). Counting dates are referred to as Days After Treatment (DAT) for each observation. (Farmington, WA, 2001)

	EARLY TMT				LATE TMT		
	7-Jul-01	21-Jul-01	26-Jul-01	31-Jul-01	4-Aug-01	10-Aug-01	
	0 DAT	14 DAT	19 DAT	24 DAT	28 DAT	33 DAT	
	AVERAGE						TOTAL
Treatment	Aphid Number per Square Foot						
Dimethoate (early)	0	0	10	2	5	0	16
Dimethoate + Foliar (early)	0	0	1	3	3	0	6
Capture 2E (early)	0	0	2	0	3	13	18
Capture 2E + Foliar (early)	0	0	2	0	4	4	10
Baythroid 2E (early)	0	0	8	4	14	2	28
Baythroid 2E + Foliar (early)	0	0	1	1	16	12	28
Baythroid 20WP (early)	0	0	8	2	18	14	43
Baythroid 20WP + Foliar (early)	0	0	16	4	27	13	59
Untreated Control+Foliar (early)	0	0	8	8	30	7	52
Untreated Control	0	0	1	4	30	5	40
Dimethoate (late)	0	0	15	22	1	0	38
Dimethoate + Foliar (late)	0	0	10	16	0	0	26
Capture 2E (late)	0	0	8	18	28	0	54
Capture 2E + Foliar (late)	0	0	10	25	10	0	45
Baythroid 2E (late)	0	0	5	30	16	4	54
Baythroid 2E + Foliar (late)	0	0	14	28	5	6	52
Baythroid 20WP (late)	0	0	11	27	17	2	57
Baythroid 20WP + Foliar (late)	0	0	12	10	7	1	30
Untreated Control+Foliar (late)	0	0	20	14	20	5	59
LSD (P=0.05)	NA	NA	16.6	18.8	21.1	14.0	46.6

DISCUSSION

Aphid population development, yield and 100-seed weight impacts did not follow patterns similar to previous studies conducted from 1999-2000. Unseasonable weather patterns did not favor aphid population development resulting in essentially no aphid pressure on lentils during 2001. As a result there were limited to no significant differences in yield, aphid counts or 100-seed weight from any treatment. Aphid populations did not exhibit a typical geometric increase and subsequent peak between 3-4 weeks after initial infestations as had been observed in previous studies. Foliar nutrient applications do not appear to provide any yield or seed weight enhancement, even in the absence of aphids. The trend observed in foliar nutrient applications is consistent with a similar study conducted in 2000. It is important to recognize that this study only evaluated a single brand (Micro-mix) of foliar nutrient during the past two years, which may or may

not be representative of other products available on the market. Micro-mix was utilized since it was commercially available in the area the study was conducted.

In contrast to previous years these results indicate that it is critical to scout and evaluate lentil fields for the presence of aphids. More importantly it is critical that an economic threshold-level of aphid populations should be established before spraying with an insecticide. There is a tendency to spray for aphid in lentil as a preventive measure; however, as these results indicate, there were never high enough aphid populations to warrant the expense of an insecticide application. This may offer a possible explanation why there continues to be differences of opinion among growers as to the value of insecticide sprays on lentils. This would particularly be the case if seasonal conditions were not conducive to aphid build-up.

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