Review of Sunflower Foliar Insecticides

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INTRODUCTION

Cultivated sunflowers, *Helianthus annuus* L., are considered a high risk crop due to losses from insect pests, diseases, birds and weeds. NDSU Extension Service recommends that sunflower growers follow Integrated Pest Management (IPM) strategies to help mitigate yield losses from pests. For sunflower insect pests, IPM uses scouting and economic thresholds to make management decisions, and promotes judicious use of pesticides to minimize impacts on nontarget organisms, such as bees and other beneficial insects. Insecticides are used when pest densities exceed the economic threshold. In North Dakota, the NDSU extension survey on pesticide use in field crops found approximately 63% of the sunflower acreage received at least one insecticide application (Zollinger et al. 2014). Application of insecticide is one IPM strategy that is commonly used in combination with other strategies (host plant resistance, cultural control) for management of sunflower insect pests (Knodel et al. 2016).

Two of the major insect pests that attack the head and seeds of sunflower are the banded sunflower moth (BSM), *Cochylis hospes* Walsingham (Fig. 1), and the red sunflower seed weevil (RSSW), *Smicronyx fulvus* LeConte (Fig. 2). The objective of this poster is to provide an overview on the efficacy of different foliar-applied insecticides used in oilseed sunflowers for control of BSM and RSSW.

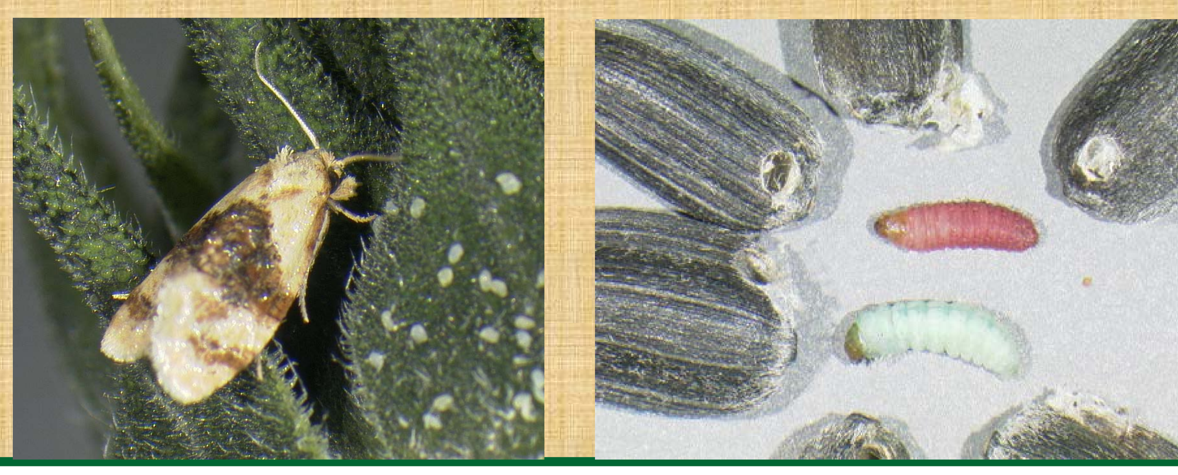

Figure 1. Adult banded sunflower moth (left, K. Mundal) and larvae and exit holes in seeds (right, NDSU Extension Entomology).

Figure 2. Adult red sunflower seed weevil (left, P. Beauzay, NDSU) and larvae in seed (right, NDSU Extension Entomology).

MATERIALS AND METHODS

Foliar insecticide efficacy trials for BSM were conducted from 2011-2016 at the NDSU Agronomy Farm near Casselton, ND and at a cooperator's field near Mapleton. The insecticide efficacy trial for RSSW was conducted at a cooperator's field near Flasher in Grant County in southwest ND in 2013. Trials were conducted in a randomized complete block design with four replicates. Insecticide tested are listed in Tables 1 and 2.

Each year, trials were planted with a 2-row vacuum precision planter as soon as possible after the soil temperature warmed to 50F. Plots were seeded at a rate of 22,500 seeds per acre using hybrids with maturity suitable for eastern North Dakota. Trial plots were 10 feet wide (4 30-inch rows) by 30 feet long with 7.5 foot alleys around each plot to facilitate foliar insecticide applications and prevent plot-to-plot spray drift.

Foliar insecticide applications were made with a tractor-mounted CO_2 sprayer using TeeJet 11015 flat fan nozzles at a spray pressure of 40 psi and a spray volume of 20.5 GPA (Fig. 3). Each year, applications were made at the R5.1 sunflower growth stage, which we consider to be the optimum application time for head-feeding sunflower insect pests.

At maturity, ten heads were randomly harvested from each plot and dried in a forced air drier for two to three days. Each head was manually threshed, and a subsample of 100 seeds from each head were analyzed for BSM and RSSW damage. The number of damaged seeds caused by each insect was counted and recorded. Proportion damaged seed data was analyzed using logistic regression in SAS PROC GLIMMIX.

For the purpose of this poster, efficacy of product and rate combinations tested are presented as *percent control relative to the untreated check*. For example, if the untreated check seed damage was 10% and the treatment seed damage was 2%, percent control would be 80%. For product / rate combinations that were tested in more than one year, the seed damage values were averaged across those years and percent control calculated from the averages.

Figure 3. Pat Beauzay spraying R5.1 sunflower field for sunflower insect pests. (J. Knodel)

RESULTS & DISCUSSION

Banded sunflower moth: Percent BSM damaged seed in the untreated checks ranged from a low of 7% in 2012 to a high of 18.1% in 2011, with an average of 10.2% across all years. Insecticide products that provided more than 70% control were considered good. The top three insecticides ranked from highest to lowest percent control were: Coragen (5 fl oz per acre), Mustang Maxx (4 fl oz per acre), and Cobalt Advanced (38 fl oz per acre). The lowest percent control recorded for BSM was a low rate of Asana at 5.8 fl oz per acre and Lorsban 4E at 16 fl oz per acre. All chemical classes or IRAC Groups provided some efficacy against BSM; however, the class organophosphates (IRAC 1B) had a lowest percent control, probably due to the short residual activity of organophosphates.

Economics: The diamides (IRAC Group 28) had the highest percent control, but also the highest input costs at $16.94 per acre for Prevathon at 14 fl oz per acre to $38.15 per acre for Coragen at 5 fl oz per acre.
For pyrethroids (IRAC Group 3A), the high rates provided higher efficacy than the lower rates. This class also had the best control for the insecticide costs. For example, Mustang Maxx at 4 fl oz per acre had 80 percent control for only $4.81 per acre. The lowest input costs were another pyrethroid, Delta Gold at 1 and 1.5 fl oz per acre for $1.77 and $2.66 per acre, respectively. The combination products, Cobalt Advanced and Stallion, with two different chemical classes provided 66.9 to 78 percent control, and prices ranged from $5.07 - $14.82 per acre depending on rate used.

Table 1. Insecticide efficacy trials conducted for BSM in oilseed sunflowers during 2011-2016.

Product	Rate fl oz/acre	AI(s)	IRAC Group(s)	Chemical Class*	% Control	Years Tested	Cost $ per acre
Coragen	5	chlorantraniliprole	28	D	82.9	1	$38.15
Mustang Maxx	4	zeta-cypermethrin	3A	P	80	1	$4.84
Cobalt Advanced	38	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	78	1	$14.82
Delta Gold	1.5	deltamethrin	3A	P	73.9	2	$2.66
Asana XL	9.6	esfenvalerate	3A	P	73.4	4	$4.61
Stallion	8.5	chlorpyrifos + zeta-cypermethrin	1B + 3A	OP + P	72.9	1	$5.95
Stallion	11.75	chlorpyrifos + zeta-cypermethrin	1B + 3A	OP + P	72.9	1	$8.23
Cobalt Advanced	13	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	71.7	3	$5.07
Warrior II	1.92	lambda-cyhalothrin	3A	P	70.7	2	$4.74
Prevathon	10	chlorantraniliprole	28	D	70	2	$12.10
Cobalt Advanced	16	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	69.2	4	$6.24
Delta Gold	1	deltamethrin	3A	P	68.9	2	$1.77
Cobalt Advanced	24	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	68.8	2	$9.36
Cobalt Advanced	19	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	66.9	1	$7.41
Prevathon	14	chlorantraniliprole	28	D	61.9	2	$16.94
Lorsban 4E	16	chlorpyrifos	1B	OP	52.7	1	$5.76
Asana XL	5.8	esfenvalerate	3A	P	45.6	1	$2.78

** D = diamides; P = pyrethroids; OP = organophosphates*

Red sunflower seed weevil: Percent RSSW damaged seed in the untreated check was 13.8% for the trial conducted in 2013 near Flasher. RSSW pressure was negligible for all years at Casselton. The top insecticide products tested for RSSW control included: Asana XL at 9.6 fl oz per acre, Cobalt Advanced at 19 fl oz per acre, and Prevathon at 14 fl oz per acre + Asana XL at 7.7 fl oz per acre with percent control at 92, 86.2, 76.8 and 71, respectively.
Prevathon alone does not have activity against RSSW regardless of the rate. As a result, Prevathon is not recommended for red sunflower seed weevil control.

Economics: The two rate of Asana XL, pyrethroid insecticide, had the lowest costs of $3.70 to $4.61 per acre, followed by Cobalt Advanced at $7.41, and then Prevathon + Asana XL at $20.64 per acre.

Table 2. Insecticide efficacy trials conducted for RSSW in oilseed sunflowers in 2013.

Product	Rate fl oz/acre	AI(s)	IRAC Group(s)	Chemical Class*	% Control	Cost $ per acre
Asana XL	9.6	esfenvalerate	3A	P	92.0	$4.61
Cobalt Advanced	19	chlorpyrifos + lambda-cyhalothrin	1B + 3A	OP + P	86.2	$7.41
Asana XL	7.7	esfenvalerate	3A	P	76.8	$3.70
Prevathon + Asana XL	14 + 7.7	chlorantraniliprole + esfenvalerate	28 + 3A	D + P	71.0	$20.64
Prevathon	20	chlorantraniliprole	28	D	32.6	$24.20
Prevathon	14	chlorantraniliprole	28	D	21.7	$16.94
Prevathon	10	chlorantraniliprole	28	D	6.5	$12.10

** D = diamides; P = pyrethroids; OP = organophosphates*

CONCLUSION

The currently registered insecticides that were evaluated for control of BSM and RSSW continue to provide effective control, and prevent economic losses to sunflowers. However, the newer classes of insecticides, diamides (IRAC Group 28), have a more narrow range of action compared to older classes of insecticides with broad spectrum activity, namely pyrethroids (IRAC Group 3A) and organophosphates (IRAC Group 1B). For example, Prevathon (IRAC Group 28) controlled BSM, but not RSSW. Knowledge on which insect pest is present and pest densities in fields are keys for future insect pest management in sunflower.

ACKNOWLEDGMENTS

Insecticides trials were supported by our industry partners including BASF USA, Dow AgroSciences, DuPont USA, FMC Corporation, Syngenta Crop Protection, Valent USA and WinField Solutions. The authors also thank the producers who accommodated the insecticide efficacy testing in their fields.

LITERATURE CITED

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Note: The NDSU Extension Service and the authors do not endorse any insecticide product or companies mentioned in this poster.