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A Weed Control Program for Establishing Lesquerella

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Broad spectrum weed control is essential for successful lesquerella [*Lesquerella fendleri* (Gray) Wats., Brassicaceae] production. Weeds must be controlled during establishment and throughout the growing season. Lesquerella seedlings grow slowly following germination and emergence, and cannot compete well with most broadleaf and grass weeds. Weed competition is particularly critical prior to closure of the lesquerella canopy, a point sometimes not reached until several months after planting (Roseberg 1996). Weed seedlings can emerge in early fall and interfere with lesquerella growth and establishment. This interference may reduce winter survival of the crop and reduce seed yield.

An herbicide program was developed for lesquerella production in Oregon: (1) preplant incorporated trifluralin, benefin, or ethalfluralin; (2) postemergence control of grass weeds—fluazifop-P or sethoxydim; (3) postemergence broadleaf weed control—clopyralid, oxyfluorfen, or pronamide; and (4) layby treatments of DCPA or pendimethalin following cultivation (Roseberg 1996).

Several herbicides are registered under Special Local Needs (24c) in Arizona and Texas for weed control in lesquerella when the lesquerella is in the 8 to 10 true-leaf-stage: trifluralin provides adequate preemergence control of annual grasses and broadleaf weeds, fluazifop controls annual and perennial grass weeds postemergence, and oxyfluorfen is used for postemergence control of annual broadleaf weeds (Foster et al. 2005). This program has worked well in establishing large blocks of lesquerella but the postemergence control of broadleaf weeds is still a major problem. Treatments that can be safely applied earlier in the growing season when lesquerella seedlings are smaller (4 to 6 true-leaf-stage) are necessary. Weed escapes from the preemergence treatment germinate along with lesquerella and must be treated when they are small to obtain effective control. Herbicides that offer a broader spectrum of control, and that are more cost effective than oxyfluorfen are also needed. The objective of this research was to determine the tolerance of lesquerella seedlings to alternative postemergence herbicides versus oxyfluorfen (0.6 kg ai/ha) registered under SLN.

METHODOLOGY

Our study was initiated Oct. 20, 2005 at the University of Arizona Maricopa Agricultural Center. Trifluralin (1.1 kg ai/ha) was applied preplant incorporated on an 8 ha block, and lesquerella seed of an advanced generation line (WCL-LO3) (Dierig et al. 2006) was planted on level basins with a Brillion seeder at 11 kg/ha and border irrigated.

Herbicide treatments consisted of plots 6 m long and 3 m wide arranged in a randomized complete block design with three replications. The following postemergence treatments were applied at 1/2×, 1×, and 2× rates on December 5, 2005 when the lesquerella seedlings were in the 4 to 6 true-leaf-stage: clopyralid (0.3, 0.6, 1.1 kg ai/ha); dicamba (0.1, 0.2, 0.3 kg ai/ha); metolachlor (2.0, 3.0, 4.0 kg ai/ha); oxyfluorfen (0.3, 0.6, 1.1 kg ai/ha); oxyfluorfen+clopyralid (0.2+0.2, 0.3+0.3, 0.6+0.6 kg ai/ha); and pyrithiobac (0.03, 0.07, 0.12 kg ai/ha). Treatments were applied using a CO_2-powered backpack sprayer with a four-nozzle boom (Teejet 8004 flat fan nozzles) delivering 225 L/ha at 187 kPa.

Lesquerella seedling density was determined prior to spraying in each plot by counting the seedlings in a 0.25 m^2 quadrant. Counts were made weekly for 90 days and plant mortality was determined by the percentage change in seedling numbers. Seed production was measured in June 2006 by harvesting a 6 × 2 m strip in each treatment with a Hege 180 combine. Data were subjected to analysis of variance and treatment means were separated according to Fisher's protected Least Significant Difference at the 5% level of significance.

RESULTS AND DISCUSSION

Plant mortality was 100% in all pyrithiobac treatments (Table 1). Mortality was only 3% in the 1× oxyfluorfen plots, and 0% in the clopyralid and oxyfluorfen+clopyralid treatments, respectively. Crop damage with cloypralid and oxyfluorfen in research plots in Oregon and Arizona was minimal except at rates of 1.1 kg ai/ha (Roseberg 1996; Foster et al. 2005). Although dicamba is a phenoxy herbicide like clopyralid, it caused severe plant chlorosis and 10% crop mortality.

Table 1. Lesquerella seedling mortality 90 days after treatment with postemergence herbicides and seed production following treatment with postemergence herbicides.

	Seedling mortality (%)			Seed yield (kg/ha)		
	Herbicide rate			Herbicide rate		
Treatment	1/2×	1×	2×	1/2×	1×	2×
Pyrithiobac	100a[z]	100a	100a	0e[z]	0c	0d
Oxyfluorfen	18b	3cd	8c	853bc	1,187a	1,213a
Clopyralid	0d	0d	20b	877ab	1,160a	698c
Oxyfluorfen+clopyralid	4c	0d	9c	731cd	1,197a	931ab
Metolochlor	0d	12b	1d	937a	873b	867b
Dicamba	7c	10b	6c	628d	868b	866b
Control	6c	6bc	6c	803bc	803b	803b

[z]Means within columns in each herbicide rate followed by the same letter are not different according to Fisher's protected Least Significant Difference (LSD) at the 5% level of significance.

Seed production averaged 868 kg/ha in the dicamba treatment and 873 kg/ha in the metolachlor treatment, and was not significantly different from the untreated control (Table 1). The oxyfluorfen (1,187 kg/ha), clopyralid (1,160 kg/ha), oxyfluorfen+clopyralid (1,197 kg/ha) yields were significantly greater than the control. Seed yield in research plots in Arizona have ranged from 1,020 to 1,200 kg/ha (Nelson et al. 1996).

Harvests in grower fields in 2004 in Arizona varied from 460 kg/ha at Peoria, 2,081 kg/ha at Stanfield, and 2,350 kg/ha at Maricopa (Foster et al. 2004). The low yield at Peoria was due to not treating weed escapes soon enough, which resulted in stand loss and problems at harvest. Ten years ago lesquerella seed yields in combine harvested grower fields averaged 900 to 1,000 kg/ha with an oil content of 20% to 24%. Results from the grower trials indicate that these traits have improved significantly through improved breeding lines and agronomic practices. A conservative estimate now is 1,344 kg seed/ha with 29% oil content. Advances are occurring rapidly, and within four years, seed yields are expected to reach 2,200 kg/ha with an oil content of 37%.

CONCLUSIONS

Oxyfluorfen is still the leading postemergence treatment for annual broadleaf weed control in lesquerella. The recommended treatment of 0.6 kg ai/ha would cost the grower about $56/ha, versus $98/ha for clopyralid and $77/ha for clopyralid+oxyfluorfen. The above treatments did not injure lesquerella seedlings in the 4 to 6 true-leaf-stage; therefore, these herbicides can be applied earlier in the growing season on smaller plants that previously thought.

The bottom line is that postemergence weed control is still a problem. Many weeds have the ability to escape preemergence or preplant incorporated applications, which can result in the loss of crop stand, reduced seed yield, and harvesting problems. Postemergence herbicides must be able to control other *Brassica* weeds closely related to lesquerella without significant crop injury. There are many new herbicides with new chemistries that must be screened for postemergence weed control in lesquerella.

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