Postemergence Herbicide Weed Control in Broccoli

Kai Umeda

Abstract

An exploratory field study provided results of postemergence herbicide weed control efficacy and broccoli tolerance. Pyridate (Tough®), clopyralid (Stinger®), and oxyfluorfen (Goal®) did not cause any crop stand reduction compared to bentazon (Basagran®) that completely reduced the broccoli stand. Tough and Goal at the lower rates tested caused marginally acceptable broccoli injury. Goal effectively controlled pigweed species (Amaranthus sp.), groundcherry (Physalis wrightii), and purslane (Portulaca oleracea). Tough gave good control of pigweed and purslane but not groundcherry. Stinger was safe on broccoli and marginally controlled groundcherry. In a second field study, Tough and Goal were evaluated for cheeseweed control. Goal marginally controlled cheeseweed at all rates tested and caused marginally acceptable injury at the two lowest rates. Tough was relatively safe at the lower rates but did not adequately control the cheeseweed.

Introduction

Broccoli (*Brassica oleracea)* and many related cruciferous crops are grown as a fall crop planted in the late summer in the desert Southwest US. The problem weed spectrum ranges from summer annuals to winter annuals in the same crop. Goal herbicide is registered for use when it is applied on the soil surface prior to transplanting broccoli only. It is not used when broccoli is direct seeded or applied to the foliage. Direct seeded broccoli stand is severely reduced by Goal when applied preemergence on the soil surface (Herbst and Derr 1990a). Foliar-treated broccoli exhibited phytotoxicity but did not affect yield and quality (Herbst and Derr 1990b). Different cultivars demonstrated relatively higher degree of tolerance to Goal and differences may have been attributed to "hardening" response to the temperature by developing waxiness of the leaves(Farnham and Harrison 1995). Under the high solar radiation and high temperatures during the fall growing season, broccoli may develop a thick, waxy cuticle on the leaves and provide safety from Goal herbicide applications. The objectives of the studies were to evaluate effective rates of Goal and other potential herbicides for weed control and determine if there is adequate safety in broccoli to postemergence applications.

Materials and Methods

Two small plot field studies were conducted within commercially grown broccoli fields in Aguila, AZ. In the first test, broccoli cv. Packman was direct seeded on 04 Aug 1995 into 80-inch beds with five seedlines per bed. The crop was sprinkler irrigated to germinate and establish the crop stand then subsurface drip irrigated. The test was a randomized complete block design with three replicates. Each treatment plot was a single bed measuring 25 feet in length. All treatments in both tests were applied with a hand-held boom having four flat fan 8002 nozzles spaced 20-inches apart and delivered in 22 to 25 gallons per acre of water pressurized with a CO_2 backpack sprayer at 45 psi. No adjuvants were added to any treatment in either test. Postemergence treatments were applied in the morning hours on 10 Aug with air temperature at 96°F, winds at less than 10 mph, and light cloudiness. The ground was moist following light rains from the previous night. The broccoli was at the cotyledon stage with the first true leaf beginning to emerge and weeds present were prostrate and tumble pigweeds (*Amaranthus blitoides* and *A. albus*), purslane (*Portulaca oleracea*), and

groundcherry (*Physalis wrightii)* at the 4- to 6-leaf stage of growth. In the second test, broccoli was direct seeded in late Nov with the same cultural practices. The test was established as a randomized complete block design with four replicates. Each treatment plot measured 6.7 feet wide and 20 feet long with the plots being sprayed across three 80-inch beds. Postemergence treatments were applied on 05 Dec during the morning hours with air temperature at 78°F, slight winds at less than 3 mph, and about 25% cloudiness. Cheeseweed (*Malva parviflora*) was the dominant weed species and was at the cotyledon stage of growth as was the broccoli. Weed control ratings and crop stand reduction and injury ratings were made at 7 days after treatment (DAT) in the first test and at 23 DAT in the second test.

Results and Discussion

In the first test, at 7 DAT, Basagran completely reduced the broccoli stand and was effective against pigweeds and purslane (Table 1). Basagran at 1.0 lb a.i./A was only moderately effective against groundcherry at 70%. Stinger was safe in broccoli with no injury observed and provided acceptable control of only groundcherry at 85% Tough at 0.5 lb a.i./A caused some acceptable injury (13%) on broccoli and gave good control of pigweeds and purslane. Tough at any rate tested did not provide control of groundcherry. Goal was marginally safe on broccoli showing 17% injury and gave near complete control of pigweeds, groundcherry, and purslane.

In the second test, Tough at the highest rate of 1.5 lb a.i./A caused 31% injury on the broccoli and only marginally acceptable cheeseweed control at 23 DAT (Table 2). Lower rates at less than 0.75 lb a.i./A were marginally safe on broccoli. Goal at rates ranging from 0.063 to 0.125 lb a.i./A gave marginally acceptable control on cheeseweed at about 85%. Goal at 0.094 lb a.i./A or less was relatively safer on the broccoli.

These exploratory field tests demonstrated that Stinger, Goal, and Tough were effective for controlling specific weeds in broccoli with varying degrees of safety. Goal was efficacious on a broader spectrum of weeds but caused injury to delay crop maturity but not necessarily yield or quality. In other testing, broccoli harvest was delayed three weeks when Goal was applied postemergence (Gill, A. 1996). Stinger and Tough appeared to have potential in be complimentary in controlling a broader spectrum of weeds than when applied individually. Further investigation is warranted to evaluate the efficacy and safety of these postemergence herbicides for use in cole crops.

Acknowledgements

I would like to thank Martori Farms for providing areas within their commercial broccoli fields to conduct these field tests.

Literature Cited

Farnham, M.W. and H.F. Harrison. 1995. Response of broccoli (*Brassica oleracea*) cultivars to post-transplant oxyfluorfen. Weed Technol. 9:385-391.

Gill, A. 1996. Personal communication. Martori Farms, Aguila, AZ.

Herbst, K.A. and J.F. Derr. 1990a. Effects of oxyfluorfen, pyridate, and BAS 514 applied postemergence on direct-seeded broccoli (*Brassica oleracea* var. *botrytis*). Weed Technol. 4:71-75.

Herbst, K.A. and J.F. Derr. 1990b. Direct-seeded broccoli (*Brassica oleracea* var. *botrytis*) response to oxyfluorfen and BAS 514 applied preemergence. Weed Technol. 4:356-359.

Table 1. Postemergence herbicide weed control in broccoli in Aguila, AZ. (Umeda).

Treatment	Rate	Broccoli		Weed Control		
	(lb a.i./A)	CSR	Injury	AMARSP	PHYWR	PORAL
		---------- percent (%) ----------				
Untreated check		0	0	0	0	0
Tough	0.500	0	13	99	17	90
Tough	1.000	0	27	98	33	86
Basagran	0.500	96	99	93	57	99
Basagran	1.000	99	99	98	70	99
Stinger	0.140	0	0	0	85	13
Stinger	0.280	0	0	0	85	20
Goal	0.125	0	17	99	99	99
Goal	0.250	0	28	99	99	99

Tough® = pyridate, Basagran® = bentazon, Stinger® = clopyralid, Goal® = oxyfluorfen
Applications made on 10 Aug and rated on 17 Aug 1995.
CSR = crop stand reduction
AMARSP = pigweeds (*Amaranthus* sp.), PHYWR = groundcherry (*Physalis wrightii*), PORAL = purslane (*Portulaca oleracea*)

Table 2. Postemergence herbicide weed control in broccoli in Aguila, AZ. (Umeda).

Treatment	Rate	Broccoli	Weed Control
	(lb a.i./A)	Injury	MALPA
		--- percent (%) ---	
Untreated check		0	0
Tough	0.500	5	53
Tough	0.750	16	76
Tough	1.000	21	78
Tough	1.500	31	83
Goal	0.063	16	84
Goal	0.094	19	85
Goal	0.125	33	84

Tough® = pyridate, Goal® = oxyfluorfen
Applications made on 05 Dec and ratings on 28 Dec 1995.
MALPA = cheeseweed (*Malva parviflora*)