TRANSITIONING FROM PREPLANT TO POSTEMERGENCE HERBICIDE USAGE IN CORN PRODUCTION

Kent Brittan and Mick Canevari[1]

ABSTRACT

Grass weed control in corn is a serious issue in the Sacramento and San Joaquin River delta region. Reliance on nicosulfuron based products to control barnyardgrass (*Echinochloa crus-galli*) and Johnsongrass (*Sorghum halepense*) has forced the transition to postemergence herbicide methodology and created a potential for herbicide resistance. This research evaluated current and new herbicides as to their effectiveness in controlling these two grass weeds and their possible role in a rotational program to avoid weed resistance. Good grass control was achieved with foramsulfuron (Option) combined with methylated seed oil as an adjuvant. Only fair grass control (65-85%) was obtained with Option when a crop oil concentrate was used as the adjuvant. Both Steadfast and Accent which are nicosulfuron based products provided good grass weed control. Glyphosate tolerant corn varieties are starting to appear and will also help control these weeds. It will be very important to rotate the use of these different herbicide chemistries to avoid herbicide resistance in these two weed species.

Key Words: corn, weed management, weed control, postemergence herbicide use, Johnsongrass control, barnyardgrass control.

INTRODUCTION

There are 450,000 acres in corn production in California with the majority of those acres,72%, in silage production. Grain corn comprises 28% with 1% for sweet corn, popcorn and ornamental production. Most grain corn production centers around the Sacramento-San Joaquin Delta area and up into Yolo County. Silage corn production occurs mainly in the south-central San Joaquin Valley, with an increase in acreage in the Sacramento Valley.

With the low prices for corn grain and silage, pest management issues are becoming increasingly problematic. Of these issues weed control is the most important and has the greatest lasting effect when not dealt with. Growing weed seed banks are posing a threat to the sustainability of corn grain production in California. Competition from weeds during the first 3 to 5 weeks following emergence can reduce stand and yield. Weeds are easiest to control before they grow beyond 6 to 8 inches high or 3-4 leaf stage when their leaf surfaces become harder to penetrate. Late-season weed infestations do not reduce yields nearly as much as early weed competition; however, weeds at this time can harbor insect pests such as thrips, which vector Fusarium ear rot, and armyworms, which can defoliate the crop. Weeds also reduce silage feed quality, raise grain moisture content, and add seed to the seed bank to infest subsequent crops.

[1] K. Brittan, UCCE Farm Advisor, Yolo, Solano and Sacramento Counties, 70 Cottonwood Street, Woodland, CA 95695; M. Canevari, UCCE Farm Advisor, San Joaquin County, Wilson Way, Stockton, CA 9; Email: klbrittan@ucdavis.edu; wmcanevari@ucdavis.edu **In:** Proceedings, California Alfalfa and Forage Symposium, 17-19 December, 2003, Monterey, CA, UC Cooperative Extension, University of California, Davis 95616. (See http://alfalfa.ucdavis.edu).

Weed species and cropping practices drive the choice of weed control strategies. In the southern San Joaquin Valley where annual weeds dominate the area, growers are shifting from atrazine to pendimethalin (Prowl) in their preemergence programs. Areas, like the delta where Johnsongrass is a problem, have transitioned to postemergence herbicide materials. There are currently two postemergence herbicide classes that contain materials that control Johnsongrass: the sulfonylureas which include nicosulfuron (Accent, etc) and foramsulfuron (Option); and the glycines which include glyphosate (Roundup, etc). Halosulfuron, which is a sulfonylurea, does not control barnyardgrass or Johnsongrass. Both of these classes are amino acid inhibitors, the sulfonylureas inhibit acetolactate synthase and the glycines EPSP synthase. Resistance in weeds to both classes has already occurred and management strategies have to be implemented to protect these tools.

There are several postemergence herbicide materials for broadleaf weed control. The University of California IPM Pest Management Guidelines for Corn, Susceptibility Of Weeds to Herbicide Control chart describes the level of control for most of the current registered herbicides in California. For a complete copy of the Guidelines please use the following web site: http://ipm.ucdavis.edu
This research evaluated new and current postemergence herbicide materials for their ability to control barnyardgrass and Johnsongrass. Included in this study was an evaluation of the effectiveness of certain adjuvants in combination with the herbicides tested.

PROCEDURES

A field trial was conducted in a grower's field on Tyler Island in the Sacramento-San Joaquin delta. Fourteen treatments were applied to plots of 200ft^2 (4-30" rows x 20' long) and replicated 4 times. Herbicide treatments were applied using a CO_2 pressurized backpack sprayer with a hand held 5ft boom that had 3 nozzles. The entire plot surface was covered in two passes. Table 1 describes the treatments tested and Table 2 the rates in which the materials were applied.

Table 1. Herbicide treatments.

Common Name	Active Ingredient	Company
Accent	nicosulfuron	Dupont
Buctril 480 EC	bromoxynil	Bayer CropScience
Distinct	diflufenzopyr + dicamba	BASF Corp
Option 35 WG	foramsulfuron	Bayer CropScience
Steadfast	nicosulfuron	Dupont
Yukon	halosulfuron-methyl + dicamba	Monsanto
Clarity	diglycolamine	BASF Corp
Cornbelt Crop Oil Concentrate	petroleum base oil , COC	adjuvant
Methylated Seed Oil Plus	seed oil extract, MSO	adjuvant
Non-ionic surfactant (NIS)		adjuvant
Ammonium sulfate	$(NH_4)_2SO_4$	adjuvant/fertilizer
UN-32	32% Nitrogen	adjuvant/fertilizer

Corn height at application of treatments was 7 to 8 inches tall, the 5th leaf stage. Barnyardgrass was 2 to 6 inches tall; seeding Johnsongrass was 6 to 8 inches tall; and the rhizome Johnsongrass was 1-9 inches tall. Redroot pigweed and velvetleaf were the only broadleaf weeds in abundance to evaluate.

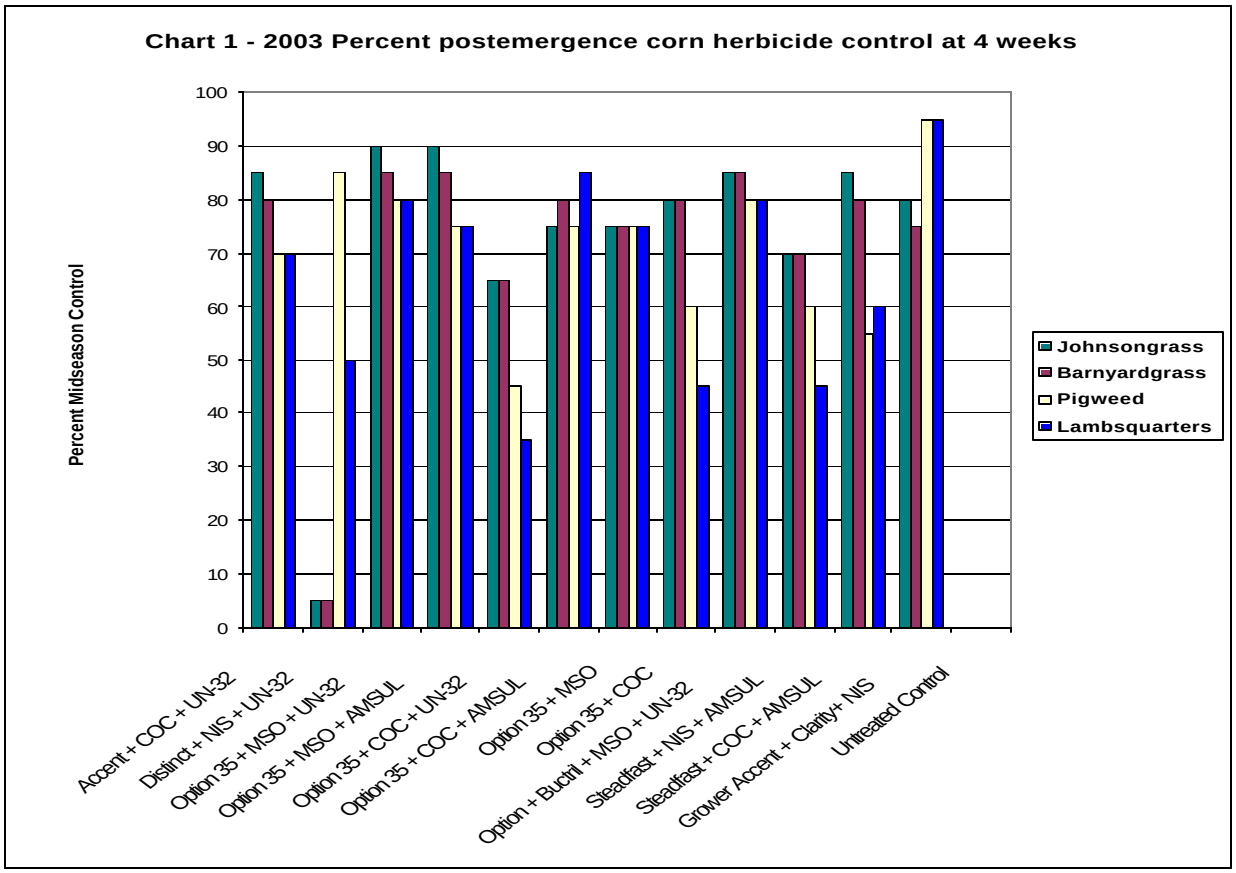
Table 2 Treatment Rates

1	0.67oz Accent/A + 2ptCOC/A + 2qt UN-32/A
2	6oz Distinct/A + 1qtNIS/100gal + 2qt UN-32/A
3	1.5 oz Option/A + 1.5ptMSO/A + 2qt UN-32/A
4	1.5 oz Option/A + 1.5ptMSO/A + 1.5 lbs$(NH_4)_2SO_4$/A
5	1.5 oz Option/A + 2qtCOC/A + 2qt UN-32/A
6	1.5 oz Option/A + 2qtCOC/A + 1.5 lbs$(NH_4)_2SO_4$/A
7	1.5 oz Option/A + 1.5ptMSO/A
8	1.5 oz Option/A + 2qtCOC/A
9	1.5 oz Option/A + 0.25qt Buctril/A + 1.5ptMSO/A + 2qt UN-32/A
10	0.75 oz Steadfast/A + 0.25% v/v NIS + 2 lbs$(NH_4)_2SO_4$/A
11	0.75 oz Steadfast/A + 1% v/v COC + 2 lbs$(NH_4)_2SO_4$/A
12	6 oz Yukon/A + 2qtNIC/100gal
13*	0.67oz Accent/A + 4 oz Clarity + 1% v/v No Foam A
14	Untreated Control

* Grower treatment control

RESULTS

Weed growth in the non-treated plots was tremendous. After 4 weeks it was impossible to walk into the control plots the barnyardgrass and Johnsongrass was so heavy. Broadleaf weed growth was uneven making evaluation variable. In the Yukon treatments there were so few broadleaf weeds to evaluate the results were too variable. The following Chart 1 displays the percent of weed control at four weeks post-application for 13 treatments.



DISCUSSION

Prior experimentation has shown that an adjuvant is important for good activity of nicosulfuron (Accent) and foramsulfuron (Option). This study shows there is a difference in the effectiveness of adjuvants. Sulfonylureas that were tested in the above study gave good barnyardgrass and Johnsongrass control depending on the adjuvants used. Mentholated seed oil (MSO), which gave the best results, is more expensive than the crop oil concentrate (COC) and nonionic surfactants so it probably will not be widely used. Option with COC and UN-32 does not look like a good combination, though without the UN-32 it works well. It looks like the grower could rotate between Option and Accent with Clarity or Yukon for both grass and broadleaf weeds. No single weed control regime is effective for all growing conditions. An integrated weed management program utilizes a combination of cultural, mechanical, and chemical methods for consistent, effective weed control. A vigorous, competitive crop produced through proper seedbed preparation, variety selection, seeding rates, fertilization, irrigation, cultivation, pest control and crop rotation is the best defense against weed infestations and competition. In California a well-managed corn crop is extremely competitive with most weeds. Good cultural practices combined with timely cultivations often control weeds sufficiently to maximize yields and profits.

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