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ONION HERBICIDE EVALUATIONS IN NORTH FLORIDA

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Abstract. Herbicides were applied at several rates to onions (*Allium cepa* L.) posttransplant in 1990-91 and 1991-92, early posttransplant in 1991-92 and sequentially at posttransplant and postemergence timings in 1993-94 to evaluate weed control and herbicide safety to onions. DCPA, pendimethalin, oxyfluorfen, methazole, and bensulide did not injure onions when applied posttransplant. Crop tolerance was also good with pendimethalin, oxyfluorfen, pyridate, bensulide, and MSDS applied early preemergence. Application of bromoxynil reduced vigor initially, but onions rapidly out grew the vigor reduction. Bromoxynil severely reduced vigor when applied late in the season with corresponding yield reduction. Oxyfluorfen and pyridate applied late in the season also caused visible phytotoxicity but yield was not affected.

Florida is not a major onion producing state (Fuller et al., 1990) and most of the onions produced in Florida are marketed locally. A high of 18,000 50-lb sacks of bulb onions were shipped out of the state in 1986-87 (Freie & Young, 1990) and a total of 3000 cwt was shipped in 1992-93 (Freie & Young 1994). New technology has reduced many risks in onion production and with the advent of an innovative marketing strategy, a total of 250 acres of bulb onions were grown for shipment in 1993-94.

Preemergence control of weeds in onions was limited to DCPA and oxyfluorfen in 1990. Herbicides labelled for postemergence weed control in 1991 included bromoxynil, oxyfluorfen and fluzifop (Stall, 1991). The use of herbicides along with mechanical cultivation allowed adequate weed control during the season (Hayslip et al. 1987). New production methodology using wider beds with multiple rows/bed as de-

scribed by Hensel and Shumaker (1992) has dramatically increased yields but has made the use of cultivation very difficult.

In 1990, several herbicides were in the final stages of receiving an EPA tolerance for use in onions. Of these, sethoxydim and pendimethalin have received labelling in 1991 and 1993, respectively. Bensulide has a tolerance for use in onions but has labelling for use only in Texas, New Mexico, Idaho, and Oregon. Grower interest, especially in Georgia, for methazole used early posttransplant led to screening tests for residue. Also interest in the herbicides pyridate and MCDS for postemergence control of late emerging winter annuals and clethodim and quizalofop-P-terfuryl for post-grass control has been generated by the industry. The purpose of these studies were to evaluate herbicides for efficacy and crop tolerance and to evaluate sequential applications of herbicides and the timings of these herbicides for season long control of weeds in onions grown in north Florida.

Materials and Methods

Three studies were conducted at the Hastings Research and Education Centers Yelvington Farm during the 1990-91, 1991 -92 and 1993-94 production seasons. The soil was an Ellezy fine sand (sandy, siliceous, hyperthermic Arenic Ochraqulf) with a pH ranging from 5.0 to 6.2. Onion sets were transplanted onto raised beds on 10 Dec. 1990, 2 Dec. 1991 and 30 Nov. 1993. Cultivars were Grano 1015Y in 1990 and 1991 and Sweet Dixie in 1993. Beds were 40 inches on center (20 inch tops) with two rows/bed in 1990. In 1991 and 1993 beds were 80 inches on center (60 inch tops) with six rows/bed as described by Hensel (1992). Rows were spaced 9.5 inches apart with onion sets 6 inches apart in row. Plot length was 20 ft in 1990, 5 ft in 1991 and 10 ft in 1993. Plots were arranged in a randomized complete block design, and treatments were replicated five times in 1990 and 1991 and four times in 1993.

Herbicide applications were made to onions at posttransplant (2 to 3 days after transplanting), early postemergence (1 month after transplanting), and 1 or 2 postemergence applications (2 to 3 months after transplanting). Herbicides were applied with a CO₂- powered backpack sprayer operated at 30 psi, calibrated to deliver 30 gpa.

The first two years, posttransplant treatments of oxyfluorfen at 0.125, 0.25 and 0.5 lb/acre, pendimethalin at 0.5, 0.75 and 1.0 lb/acre, methazole at 1.0, 1.25 and 1.5 lb/acre and DCPA at 10 lb/acre were evaluated.

Early postemergence treatments of oxyfluorfen at 0.125 and 0.25 lb/acre, MCDS at 10 and 15 gal/acre, bromoxynil at

Table 1. Weed control, onion vigor and yield of large onions as affected by posttransplant[†] application of herbicides, 1990-91 and 1991-92.

Herbicide	Rate (lb/acre)	Applic. timing	Ratings (%) [‡]						Yield (T/ acre)	
			10 Jan. 1991			28 Feb. 1992			Extra large	
			Onion vigor	CHEAL [*]	AMALI	Vigor	CHEAL	COPDI	1991	1992
Check			100	0	0	80	0	0	9.3	13.0
Oxyfluorfen	0.125	Posttr.	100	97	100	88	100	98	11.9	27.4
Oxyfluorfen	0.25	Posttr.	100	98	100	84	82	100	13.1	23
Oxyfluorfen	0.5	Posttr.	100	100	97	96	100	100	13.6	32.8
Pendimethalin	0.5	Posttr.	100	96	94	85	98	85	11.6	26.2
Pendimethalin	0.75	Posttr.	100	98	98	90	100	94	12.0	29.2
Pendimethalin	1.0	Posttr.	100	100	94	88	100	100	11.2	27.6
Methazole	1.0	Posttr.	100	94	94	82	94	98	11.1	23.6
Methazole	1.25	Posttr.	98	98	100	88	96	100	11.7	21.9
Methazole	1.5	Posttr.	100	100	100	92	100	100	12.3	28.4
DCPA	1.0	Posttr.	100	80	78	76	94	56	11.2	17.0
LSD (0.05)			NS	10	13	14	27	22	3.2	10.6

[†]Posttransplant to onions, preemergence to weeds.[‡]Ratings are 0=vigor or no weed control, and 100=no loss of vigor or complete weed control.^{*}(CHEAL) lambsquarter, (AMALI) livid Amaranth, (COPDI) swinecress.

0.25 and 0.375 lb/acre and pyridate at 0.9 lb/acre were applied and evaluated in 1991-92. Also four post-grass herbicides applied postemergence and at split-applications were evaluated that year. These herbicides were fluazifop applied at 0.18 lb/acre with a non-ionic adjuvant and sethoxydin at 0.18 lb/acre, clethodim at 0.094 lb/acre and quizalofop-P-terfuryl at 0.06 lb/acre. The last three materials were applied with a crop oil adjuvant.

During the 1993-94 season, posttransplant plus early postemergence or late postemergence treatments were evaluated. Treatments were oxyfluorfen applied late postemergence at 0.125 lb/acre following DCPA at 10 lb/acre, pendimethalin at 0.5 lb/acre, oxyfluorfen at 0.125 lb/acre or bensulide with and without crop oil at 6 lb/acre. Bromoxynil (0.375 lb/acre) and pyridate (0.9 lb/acre) also were applied late postemergence following DCPA. Bensulide (6 lb/acre) also was applied alone with and without a crop oil. Bensulide also was applied in sequential posttransplant plus an early postemergence at 4 lb/acre tank mixed with and without a crop oil adjuvant (Table 3). Pendimethalin was also applied posttransplant and early postemergence at 0.5 lb/acre.

Weed control and crop vigor were determined by visual ratings throughout each season on a scale of 0 to 100 where 0 equalled no weed control or no vigor (dead) and 100 equalled complete weed control and no loss of vigor. Phyto-

toxicity ratings were made in 1993. Phytotoxicity ratings were on a scale of 0 to 5 where 0 equals no visible damage, 1 equalled light yellowing and/or twisting, 2 equalled heavy yellowing, light spotting or tip burn, 3 equalled large spotting or tip burn, 4 equalled severe leaf damage, and 5 equalled plant death.

Major weeds rated during the three seasons were: lambsquarter (*Chenopodium album* L # CHEAL) (@ approved 5 letter code by Weed Science Society of America, 1984. Weed Science 32, Suppl. 2), livid amaranth (*Amaranthus lividus* L # AMALI), swinecress (*Coronopus didymus* (L.) Sm. # COPDI) and cudweed (*Gnaphalium purpureum* var. *falcatum* (Lam.) T. & G # GNAFA). Onions were harvested when the tops begin to fall and the bulbs were mature. Onion tops were rolled, onions were undercut, pulled, clipped, graded, and weighed on 9 May 1991, 5 May 1992, and 19 April 1994.

Results and Discussion

Onion vigor was not significantly reduced by application of posttransplant herbicides in 1990-91 and 1991-92 (Table 1). All herbicides controlled lambsquarter in 1991-92 but the control was significantly less with DCPA in 1990-91 as was the control of livid amaranth. DCPA did not adequately control swinecress in 1991-92. There was light weed pressure in 1990-91. Yields obtained with the oxyfluorfen applications of 0.25

Table 2. Weed control and onion vigor as affected by early postemergence application of herbicides, 1991-92.

Herbicide	Rate [‡]	Applic. timing	Ratings [‡]				
			16 Jan. 1992		28 Feb. 1992		
			Onion vigor	Vigor	CHEAL [*]	COPDI	GNAFA
Check			77	84	0	0	0
Oxyfluorfen	0.125	E Post	88	90	100	100	100
Oxyfluorfen	0.25	E Post	77	90	100	100	100
MCDS	10	E Post	73	94	82	100	100
MCDS	15	E Post	69	85	96	100	99
Bromoxynil	0.25	E Post	53	90	100	98	100
Bromoxynil	0.375	E Post	46	82	85	80	80
Pyridate	0.9	E Post	77	92	88	70	92
LSD (0.05)			11	14	19	22	23

[†]Ratings are 0=no vigor or no weed control, and 100=no loss of vigor or complete weed control.[‡]Rate is lb/acre except MCDS which is gallons/acre.^{*}(CHEAL) lambsquarter, (COPDI) swinecress, (GNAFA) cudweed.

Table 3. Weed control, crop phytotoxicity and yield as affected by posttransplant and postemergence herbicide applications, 1993-94.

Herbicide	Rate (lbs/A)	Applic. ^y timing	Ratings ^z			93-94 Yield (Tons/acre)
			22 March 1994			
			Phytotoxicity	GNAFA	CHEAL	
Check			0	0	0	28.7
DCPA	10	Posttr.	1.0	97.5	100	31.4
+ oxyfluorfen	0.125	Post				
DCPA	10	Posttr.	4.0	100	100	19.7
+ bromoxynil	0.375	Post				
DCPA	10	Posttr.	0.5	100	100	28.5
+ pyridate	0.9	Post				
Pendimethalin	0.5	Posttr.	0	100	100	30.4
+ pendimethalin	0.5	Post				
Pendimethalin	0.5	Posttr.	1.0	100	100	32.5
+ oxyfluorfen	0.125	Post				
Oxyfluorfen	0.125	Posttr.	1.0	100	100	30.6
+ oxyfluorfen	0.125	Post				
Bensulide	6	Posttr.	1.0	87.5	100	32.3
+ oxyfluorfen	0.125	Post				
Bensulide + oil	6	Posttr.	1.0	85.0	97.5	31.4
+ oxyfluorfen	0.125	Post				
Bensulide	4	Posttr.	0	55.0	100	28.2
+ bensulide	4	Post				
Bensulide + oil	4	Posttr.	0	62.5	100	28.7
bensulide + oil	4	Post				
Bensulide	6	Post	0	57	97.5	27.1
Bensulide + oil	6	Post	0	55	85	27.5
LSD (0.05)			0.2	6.6	11	3.4

^zRatings are 0=no weed control or no-phyto. 100=complete weed control, phytotoxicity ratings 1=slight spotting, 4=heavy burn, 5=kill.

^yTiming is (Posttr) posttransplant, (Post) postemergence to weeds and crop.

^x(GNAFA) cudweed, (CHEAL) lambsquarter.

and 0.5 lb/acre were the only treatments significantly different from the check. Significant differences for yield among treatments did occur in 1991-92. Yields with oxyfluorfen at 0.25 lb/acre, methazole at 1.25 lb/acre and DCPA were the only ones not significantly higher than the check.

Control of emerged weeds by herbicides applied early postemergence was evaluated in the 1991-92 season (Table 2). Vigor of the onions was only fair at the time of herbicide application due to cold, wet, weather conditions. Application of bromoxynil significantly reduced vigor of onions initially. Later ratings (28 Feb.) however, showed that the onions outgrew the initial injury. All herbicides provided good control of lambsquarter and cudweed. Pyridate provided only fair control of swinecress in the trial. There were no differences for yield among the treatments (data not shown).

Applications of the four post-grass herbicides, fluzafop, sethoxydim, clethodim and quizalofop-P-terfuryl, either once or in sequence did not visibly cause phytotoxicity, cause vigor reduction, nor were yields reduced due to herbicide application (data not shown). Sethoxydim and fluzafop now have labels for use in onions for control of grass weeds. Quizalofop-P-terfuryl is no longer being considered for use in the United States, but does have labels for use in South America and Europe.

During the 1993-94 season, herbicides were applied to onions in a sequential manner to evaluate their potential for season-long weed control (Table 3). Methazole was dropped from further consideration due to residue concerns. Bensulide was included in posttransplant and early postemergence applications. Post-grass herbicides were initially planned as treatments, but due to a lack of emerged grass in the plots, these herbicides were not applied. DCPA, pendimethalin, and oxyfluorfen applied posttransplant con-

trolled all weeds until late in the season. The bensulide treatments controlled lambsquarter season-long, but the control of cudweed was weak. Pendimethalin applied posttransplant followed by an application of pendimethalin early postemergence treatment controlled these two weeds season-long. Although it was late in the season, well past the label instruction's timing, oxyfluorfen, bromoxynil, and pyridate were still applied to evaluate injury. Phytotoxicity resulted from application of each chemical. The effects of pyridate on onions was a yellowing and light twisting of the leaves. Oxyfluorfen damage was manifested by small chlorotic then necrotic spots on the leaves. Bromoxynil severely damaged the onions. Leaves were burned down approximately 50% of their original height. Yield with this treatment was significantly reduced below that with all other herbicides.

Weeds can be controlled season-long in onions with the selection of the proper herbicides for the weed spectrum found in the fields. Care must be taken in the proper timing of applications, however.

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