Literature Cited

Code, G. R. and T. W. Donaldson. 1996. Effect of cultivation, sowing methods and herbicides on wild radish populations in wheat crops. Aust. J. of Exp. Agric. 36:437-42.

Florida Agricultural Statistics. 1997. Vegetable Summary. Fl. Agr. Stat. Serv. Orlando, FL. p. 5.

Hochmuth, George J. and Donald N. Maynard, eds. 1995. Vegetable Production Guide for Florida SP-170. University of Florida.

Miller, A. B. and H. J. Hopen. 1991. Critical weed-control period in seeded cabbage (*Brassica oleracea* var. *capitata*). Weed Tech. 5:852-857.

Reeves, T. G., G. R. Code and C. M. Piggin. 1981. Seed production and longevity, seasonal emergence, and phenology of wild radish (*Raphanus raphanistrum* L.). Aust. J. Exp. Agric. Anim. Husb., 21:524-530.

Proc. Fla. State Hort. Soc. 110:323-325. 1997.

WATERMELON TOLERANCE TO HALOSULFURON APPLIED PREEMERGENCE AND POSTEMERGENCE

RICHARD S. BUKER III AND W. M. STALL
Horticultural Sciences Department
University of Florida, IFAS
Gainesville, FL 32611-0690

S. M. OLSON
University of Florida
North Florida Research & Education Center
Route 3, box 4370
Quincy, FL 3251-9500

Additional index words. Yellow nutsedge (*Cyperus esculentus* L.).

Abstract. **Watermelon yield response to the application of the herbicide halosulfuron was evaluated over three seasons (1995-1997) for control of commonly occurring weeds. In the 1995 season, preemergence (PRE) and postemergence (POST) treatments were applied at 9, 18, 27, 36, 54, 72, and 108 g·ha^{-1} to watermelons. In 1996, PRE treatments were evaluated at 18, 27, 36, 72, 108, and 144 g·ha^{-1}, early postemergence (EPOST) and POST were evaluated at 18, 27, 36, 72, and 108 g·ha^{-1}. In 1997, POST treatments were applied at four timings with rates of 27 and 36 g·ha^{-1}. Watermelon exhibited excellent tolerance (observed melon vigor >80%) and little negative response (observed phytotoxicity <30%) to halosulfuron applied at any PRE rates. POST applications in all years showed decreased yields and tolerance to halosulfuron. In 1997, watermelon exhibited excellent tolerance, and comparable yields to that with the untreated watermelons from POST applications of 27 g·ha^{-1}, 35 days after emergence (DAE).**

Introduction

Watermelons (*Citrullus lanatus* L.) comprise a major portion of the Florida vegetable industry. In Florida they ranked 4th and 7th in terms of acreage and value respectively during the 1995-96 growing season (Fla. Agric. Stat. Serv., 1997). Nationally the Florida watermelon industry, ranked 3rd and 1st in terms of acreage and value respectively in 1996 (USDA Statistics, 1997).

Spring watermelon planting begins in south Florida in the middle of December and progresses northward until early April. The subtropical climate of Florida allows for the early planting of warm season crops. These conditions also allow for potential yield losses from increased pest, disease, and weed pressures. With the exception of "double cropping", watermelon fields are disked and cultivated prior to planting. Cultivating can create a competitive advantage for weeds that rapidly grow early in their life cycle. Florida vegetable fields are commonly infested with pigweed (*Amaranthus* spp.), nightshade (*Solanum* spp.), lambsquarter (*Chenopodium album* L.), goosegrass (*Eleusine indica* L.), and nutsedge (*Cyperus* spp.). Weeds compete with crops for light, nutrients, water, gases, and/or space. Cultural practices such as fertilizing, disease control, and harvesting can be hindered by weeds. Inefficiencies in cultural practices arise when the potential value of a chemical or service falls short of the value gained. Inefficiencies occur when weeds interfere with spray deposition, fertilizer placement, and harvesting. Watermelons compete poorly with weeds early in their life cycle, and total yield loss can occur if weeds are left uncontrolled (Stall, 1992). Compounding the problem of weed control is the low tolerance of watermelons to herbicides. Currently there are only eight herbicides labeled for use in watermelons, and five are for postemergence (POST) weed control (Stall, 1997). Of the five, three can be sprayed over the crop, but one of these, DCPA will be withdrawn from registration. Growers will only have two options for POST control of weeds in beds. All of the currently labeled herbicides provide poor control of yellow nutsedge (Stall, 1997).

Halosulfuron is a relatively new herbicide that is a member of the sulfonylurea family, which inhibits the enzyme acetolactate synthase. Halosulfuron applied preemergence (PRE) or POST has provided excellent (90% or greater) control of yellow nutsedge (*Cyperus esculentus* L.) (Vencill et al., 1995). The objective of this research was to establish watermelon tolerance to halosulfuron applied PRE and POST, under Florida conditions.

Florida Agricultural Experiment Station Journal Series No. N-01476.

Materials and Methods

In the spring of 1995, an experiment was conducted at the Suwannee Valley Research and Education Center (SVREC) on a Lakeland fine sand (sandy siliceous, thermic, coated, Typic Quartzipsamment) with a pH of 6.0. Beds were formed 2.25 m (7.5 ft.) center to center, and plots were 9 m (30 ft.) long. The experimental design was randomized complete block with 4 replications. The watermelon variety 'Starbrite' was planted manually 5.1 cm (2 inches) deep at a rate of 1 seed per 0.9 m (3 ft.). Bensulide was applied PRE at the rate of 4.48 kg·ha^{-1} (4 lb per acre) to all plots. Fertilization was provided according to recommendations from the University of Florida Institute of Food and Agricultural Sciences (IFAS) soil testing laboratory. Pest and disease control was provided according to Florida Cooperative Extension Service recommendations (Johnson, 1997). Supplemental irrigation was applied through drip tape as needed. In 1995, the halosulfuron treatments were 9, 18, 27, 36, 54, 72, and 108 g·ha^{-1} applied PRE or POST. PRE treatments were applied over the bed on 29 March. POST treatments were applied over the top of watermelons on 25 April, which was 27 days after emergence (DAE). Fruits were harvested once on 19 June. Data were analyzed using analysis of variance and treatment means were fit to a simple linear model. In the spring of 1996 and 1997 experiments were conducted at the University of Florida Horticultural Research Unit, Gainesville, Fla., on a Kanapaha sand (loamy, siliceous, hyperthermic, Grossarenic Paleuquult) with a pH of 5.8 in 1996 and 6.8 in 1997. In 1996, beds were formed 2.4 m (8 ft.) center to center, and plots were 7.5 m (25 ft.) long. The experimental design was a randomized complete block, with 3 replications. The watermelon variety 'Fiesta' was used for both years. Seeds were planted manually 5.1 cm (2 inches) deep, at a rate of 1 seed per 0.9 m (3 ft.). Bensulide was applied PRE at the rate of 4.48 kg·ha^{-1} (4 lb per acre) to all plots. Fertilization was provided according to recommendations from the University of Florida Institute of Food and Agricultural Research (IFAS) soil testing laboratory. Pest and disease control was provided according to Florida Cooperative Extension Service recommendations (Johnson, 1997). Supplemental irrigation was applied overhead in both years. In 1996 halosulfuron treatments were 18, 27, 36, 72, 108, and 144 g·ha^{-1} applied PRE. For the early post emergence (EPOST) and POST treatments the rates were 18, 27, 36, 72, and 108 g·ha^{-1}. PRE treatments were applied over the bed on 29 March. EPOST treatments were applied over the top of watermelons on 2 May, which was 33 DAE. POST treatments were applied over the top of watermelons on 13 May, which was 44 DAE. Fruits were harvested once on 8 July. Data were analyzed using analysis of variance and treatment means were fit to a simple linear regression model.

In 1997, soil was fumigated with a 98:2 methyl bromide:chloropicrin formulation during bed formation. Fumigation was applied in place of bensulide for weed control. Application was at a rate of 181 kg·ha^{-1} in conjunction with polyethylene mulch laid over beds, and removed before planting. Beds were formed 2.4 m (8 ft.) center to center, and plots were 5 m (16.67 ft.) long. The experimental design was a randomized complete block, with 3 replications. Seeds were planted by hand 5.1 cm (2 inches) deep, at a rate of 1 seed per m (3.33 ft.). In 1997, halosulfuron treatments were 27 and 36 g·ha^{-1} applied POST at 1, 3, 5, and 7 WAE. POST treatments were applied over the top of watermelons on 20 May (1 WAE), 2 June (3 WAE), 16 June (5 WAE), and 30 June (7 WAE). Fruit were harvested on 14 and 30 July Data were analyzed using analysis of variance and treatment means were fit to a simple linear regression model. Mean yields for 1995-1997 are expressed as percent control. All halosulfuron treatments previously described were applied using a CO_2 powered backpack sprayer, equipped with a two nozzle (LF4 110) boom delivering 280.62 L per ha (30 gpa) with a pressure of 207 kPa (30 psi).

Results and Discussion

The 1995 trial consisted of halosulfuron rates applied PRE and POST to watermelon. Analysis of variance indicated that rate and time were significant factors at $p < 0.05$ level. The interaction between rate and time was found to be significant at the $p < 0.05$ level, therefore it is conclusive that both rate and time are significant factors in reducing watermelon mean yields. Data were then separated by timing, that is PRE and POST were analyzed independently of each other. The halosulfuron rates of PRE treatments were non significant, whereas for POST treatments, rate was a significant factor in reducing yield, $p < 0.05$ level. For POST treatments, mean yield was affected linearly, as rates were increased, yield decreased (Fig. 1). The 1995 PRE and POST treatment differed in two areas. First watermelons in the PRE treatments exhibited excellent vigor (> 80% observed), as compared to POST (<25% observed). Overall, halosulfuron phytotoxicity, which shows up as shortened internodes and crinkling of leaf edges, did not appear to be as wide spread as in the POST treatments (Stall, 1995). Secondly, halosulfuron applied PRE provided good control of Florida pusley (*Richardia scabra* L.). POST applications of halosulfuron regardless of rate did not provide adequate control of Florida pusley (Stall 1995). Pressure from Florida pusley was not severe enough to disregard data.

In 1996, goosegrass (*Eleusine indica* L.) pressures in all EPOST and POST plots were severe. Bensulide was applied PRE to all treatment plots, but by the EPOST spray (2 April) goosegrass was established in all of the EPOST and POST plots. Watermelon plants at this time were still in the four to six leaf stage, and goosegrass populations were not adequately

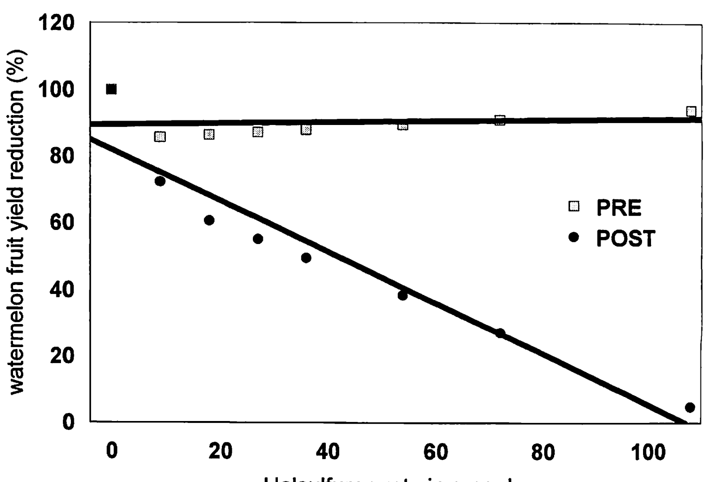

Figure 1. 1995 watermelon yield responses to halosulfuron rates applied preemergence and postemergence. The data were fit to the following equations for halosulfuron PRE $Y = 89.5 + 0.0176x$ and halosulfuron POST $Y = 82 - 0.766x$, where Y = yield and x = rate in g·ha^{-1}.

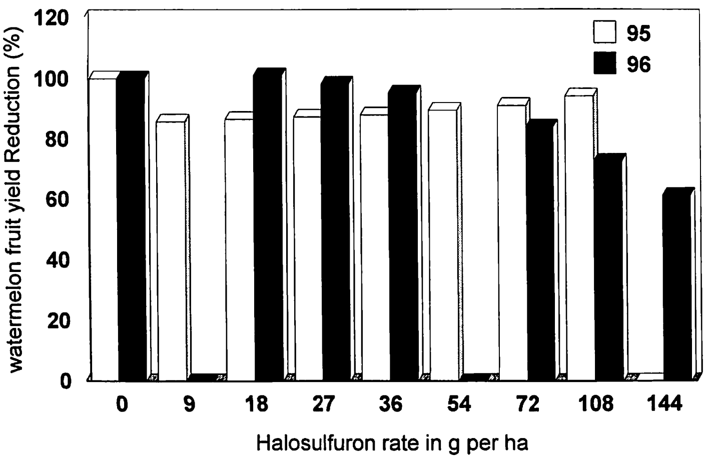

Figure 2. 1995 and 1996 watermelon yield responses to halosulfuron rates applied preemergence.

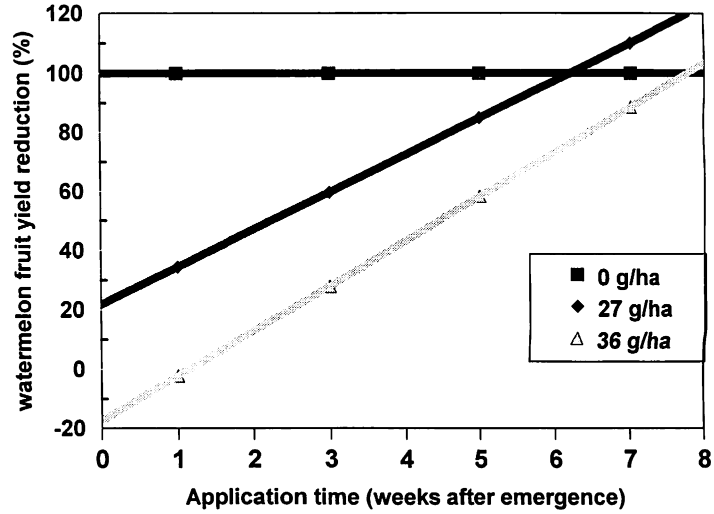

Figure 3. 1997 early watermelon yield responses as effected by time and rate of postemergence halosulfuron applications. Data were fit to the following equations Control Y = 100 + 0x, 27 g/ha Y = 21.8 + 1.8x, and for 36 g/ha Y = -17.3 + 2.16x, where Y = yield and x = rate in g·ha^{-1}.

controlled for the remainder of the season, consequently interference occurred with the watermelon for a substantial portion of the season. Distinguishing goosegrass competition from yield reductions due to halosulfuron injury was difficult. Therefore, all EPOST and POST applications were not included in data shown. The lowest rate used in 1995, 9 g·ha^{-1}, was dropped and a rate of 144 g·ha^{-1} was added in 1996. The higher rate was added to PRE treatments to determine if yield reductions would occur. PRE Data for 1995 and 1996 were analyzed by analysis of variance for interaction by year and rate. Year and year*rate interaction were not significant factors in effect on yield at the $p < 0.05$ level. Results similar to those of 1995 were obtained with PRE treatments in 1996 (Fig. 2). When comparing only 1996 PRE data (Fig. 2) a downward sloping trend in yield from the lower rates to the higher PRE rates (72, 108, and 144 g·ha^{-1}), was observed. The treatment mean yields were compared then by single degree orthogonal contrasts. It was found that the treatment mean yield with the rate of 144 g·ha^{-1} was the only rate significantly lower than 36 g·ha^{-1} (where mean yield starts to decrease) at the $p < 0.05$ level.

To alleviate the potential competition from non controlled weeds in treatments, the 1997 experiment was first fumigated with a 98:2 methyl bromide:chloropicrin formulation. A factorial rate by timing trial was set up for POST treatments only at 1, 3, 5, and 7 WAE. In this trial, rate and timing was not a significant factor in reduction of final yield at the $p < 0.05$ level, although rate and timing had significant effects on the dependent variable days to first harvest. The insignificance of the independent variables, rate and timing, on final yield did not correspond to the vigor and phytotoxicity observed in the field. As previously stated, multiple harvests were made in 1997, and data from the first harvest was then analyzed by analysis of variance. It was found that rate, time, and the rate*time interaction were significant factors in reducing first harvest watermelon yield at the $p < 0.05$ level. When 36 g·ha^{-1} was applied at 1 WAE no yield was obtained at the early harvest (Fig. 3), and final yield was significantly lower than 0 g·ha^{-1} or 27 g·ha^{-1} (data not shown). This suggested that an application of halosulfuron at 36 g·ha^{-1} at 1 WAE is too injurious for watermelons to recover, in terms of days to harvest and final yield. Single degree orthogonal contrasts were then used to compare treatment means from the first harvest, of halosulfuron applied at 5 WAE, and it was found that there was no significant difference between 0 g·ha^{-1} and 27 g·ha^{-1}, while 0 g·ha^{-1} and 36 g·ha^{-1} differed significantly. This trial and other unpublished data indicate that watermelon treated 5 WAE and later have no negative response to halosulfuron rates of 27 g·ha^{-1} when considering total yield and days to harvest. Initially it appears that halosulfuron can be used for PRE and POST weed control if timed correctly.

The critical period is the time that a weed must be controlled to prevent yield losses. Currently experiments are under way to determine the critical period of weed control for yellow nutsedge. If the critical period ends anytime after 40 DAE, then halosulfuron may be a valuable tool for watermelon growers for the control of yellow nutsedge.

Future research will be to repeat the 1997 experiment of POST timing applications, with the addition of more rates. A selected PRE treatment will be added to compare to POST treatments.

Literature Cited

Florida Agricultural Statistics. 1997. Vegetable Summary 1995- 1996. Fla. Agr. Stat. Serv., Orlando, FL.

Johnson, F. A. 1992. Watermelon Production Guide for Florida. Florida Coop. Extension Service. Report SP-113. 29 pp.

Stall, W. M. 1997. Florida Weed Management Guide. Florida Coop. Extension Service. SP - 53 1997. 318 pp.

Stall, W. M. 1995. Weed Control Trials In Vegetable Crops. Florida Coop. Extension Service. SSHOS-48. 29 pp.

Stall, W. M. 1992. Watermelon Production Guide for Florida. Florida Coop. Extension Service. Report SP - 113. 29 pp.

USDA Stat. Mann77.mannlib.cornell.edu/reports/nassr/fruit/pvg-bb/1997/vegetables. 1997.

Vencill, W. K., J. S. Richburg, J. W. Wilcut and L. R. Hawf. 1995. Effect of MON- 12037on purple (*Cyperus rotundus*) and yellow (*C. esculentus*) nutsedge. Weed Technology 9:148-152.