Table 4. Influence of postemergence herbicide treatments upon weed control, crop vigor and yield of carrot in 1983.

Treatment[y]	Rate (lb. a.i./acre)	Weed control and crop vigor ratings[z] BL	GR	CV[x]	Carrot yield (lb./acre)[w]
Check	—	0.0	0.0	9.0	11745
Fluazifop-butyl + oil	0.125	0.0	9.7	9.5	14575
Fluazifop-butyl + oil	0.25	0.0	9.4	9.8	18794
Fluazifop-butyl + oil	0.5	0.0	9.7	9.5	17755
Haloxyfop-methyl + oil	0.075	0.0	9.7	9.5	18465
Haloxyfop-methyl + oil	0.15	0.0	9.5	9.2	18200
Haloxyfop-methyl + oil	0.3	0.0	9.6	9.2	18550
DPX-Y 6202 + surfactant	0.014	0.0	8.8	9.0	15635
DPX-Y 6202 + surfactant	0.028	0.0	8.3	9.3	14490
Sethoxydim + oil	0.3	0.0	9.5	9.5	18635
Linuron	1.0	9.5	8.3	9.0	15285
Linuron + fluazifop-butyl	1.0 0.25	9.5	9.7	9.3	15720
Thiobencarb + fluazifop-butyl	4.0 0.25	9.2	9.8	9.2	18020
Thiobencarb + fluazifop-butyl	6.0 0.25	8.5	9.6	9.3	21910
LSD (0.05)		0.6	0.9	0.7	800

[z]Weed control 0 = 0% control, 10 = 100% control; Crop vigor 0 = dead, 10 = no damage.
[y]Oil = Agridex (1% v/v); surfactant = WK (0.25% v/v).
[x]BL = broadleaf weeds; GR = grass weeds; CV = crop vigor; 4 weeks after treatment.
[w]Harvested 60 days after planting.

postemergence grass herbicides may be possible herbicides for carrot production. Cost is the major consideration in radishes since it is only a 28 day crop. Hand weeding is unfeasible. Cost is also a consideration in carrot production but the growing season is much longer and a weed management program might be utilized such as preemergence applications of thiobencarb followed by a combination of thiobencarb and fluazifop-butyl. At the present, hand weeding is being used to maintain carrots weed-free and the costs are astronomical ($200–600/acre). Weeds reduce quality, yield, and interfere with harvesting procedures. A weed management program is necessary and herbicides would be economically feasible.

Acknowledgments

The author thanks South Bay Growers, Inc., A. Duda & Sons, Inc., and Hundley Farms for their assistance in conducting these studies. The technical assistance of Mr. Gene Wachter is also greatly appreciated.

Literature Cited

1. Dusky, J. A. 1982. Herbicides for celery, lettuce and carrots in the Everglades Agricultural Area. Proc. Fla. State Hort. Soc. 95:339-342.
2. Dusky, J. A. 1984. Chemical weed control for radishes. Proc. Southern Weed Sci. Soc. 37:134.
3. McCollum, T. G., S. J. Locascio, and W. T. Scudder. 1982. Weed control in carrots on organic soil. Proc. Southern Weed Sci. Soc. 35:129-132.
4. Williams, R. D. 1980. Weed control guide for commercial vegetable production in Florida. Florida Coop. Ext. Serv. Cir. 196G.

Proc. Fla. State Hort. Soc. 97: 171-174. 1984.

WEED CONTROL IN MULCHED STRAWBERRY PRODUCTION[1]

J. P. GILREATH
IFAS, University of Florida,
Gulf Coast Research & Education Center,
5007-60th Street East,
Bradenton, FL 34203
AND

E. E. ALBREGTS
Agricultural Research & Education Center,
Rt. 2, Box 157,
Dover, FL 33527

Additional index words. herbicide, *Fragaria* x *ananassa.*

Abstract. **Preplant applications of 1 and 2 lb./acre of alachlor and 2 and 4 lb./acre of ethofumesate and postemergence applications of 0.5 lb./acre of 2 formulations of acifluorfen (Blazer and Tackle) were evaluated for weed control and crop toxicity in mulched 'Tufts' strawberries** (Fragaria x ananassa **Duch.) during the 1982-1983 production season. Alachlor and ethofumesate provided excellent early season grass and broadleaf weed control. Acifluorfen (both formulations) provided good control of Carolina geranium** (Geranium carolinianum **L.), but did not control grasses. Strawberry plant vigor was reduced by the higher rate of alachlor and both formulations of acifluorfen; however, the effect of acifluorfen was confined to the foliage present at treatment and plants soon overcame the visible injury. None of the treatments provided season-long weed control. Fewer fruit were produced in herbicide treated plots than in the untreated control plots.**

Weed control in strawberry production fields is a major

[1]Florida Agricultural Experiment Stations Journal Series No. 5907. The authors wish to acknowledge the partial support of this research by the Federal IR-4 pesticide registration program.

Table 1. Effect of herbicide on plant vigor, weed control, and total seasonal yield of mulched 'Tufts' strawberries. Dover, FL, 1982-83.

Treatment	Rate (lb a.i./acre)	Method of application	Vigor[z] rating	Weed control rating[y]					Fruit yield/acre	
				Crabgrass		Carolina geranium		Evening primrose		
			Nov. 22	Nov. 22	Apr. 7	Nov. 22	Feb. 8	Apr. 7	No. of fruit (10,000's)	No. of flats
Hand weeded check			9.9 a[x]	10.0 a	9.0 a	9.2 ab	9.9 a	9.2 a	2.8 a	749 a
Alachlor	1.0	Pretransplant	8.8 b	10.0 a	0.0 b	9.4 ab	5.0 bc	0.0 c	2.1 b	590 ab
Alachlor	2.0	Pretransplant	8.0 c	10.0 a	0.0 b	10.0 a	6.0 b	0.0 c	2.2 b	601 ab
Ethofumesate	2.0	Pretransplant	9.3 ab	9.5 a	0.0 b	9.5 ab	3.8 c	0.0 c	1.9 b	567 ab
Ethofumesate	4.0	Pretransplant	8.7 bc	9.8 a	0.0 b	9.7 ab	4.5 c	0.0 c	1.8 b	476 b
Acifluorfen (Blazer)	0.5	Postemergence	4.0 d	5.0 b	0.0 b	9.5 ab	9.4 a	1.8 b	2.1 b	613 ab
Acifluorfen (Tackle)	0.5	Postemergence	4.0 d	5.1 b	0.0 b	8.5 b	8.8 a	2.2 b	1.7 b	522 b

[z]Vigor was evaluated on a 0 to 10 scale where 0 indicates all plants dead, and 10 represents no phytotoxicity.
[y]Weed control was evaluated on a 0 to 10 scale where 0 represents no control and 10 indicates 100% control.
[x]Means separation within columns by Duncan's new multiple range test, 5% level.

problem. The production season is spread over 6 to 7 months and, as a result, the weed species present in a field change over time. Due to fumigation of beds with methyl bromide and subsequent covering of the beds with plastic mulch, weed control in the row is not as much of a problem as is control in the row middles. However, hard seeded weeds, such as Carolina geranium, can become a problem in the bed by emerging through the plant holes in the plastic mulch. In addition, water soluble herbicides applied to the row middles may move into the bed with the soil moisture and injure strawberry plants. Application of preemergence herbicides to the bed and row middles prior to covering with plastic would screen for phytotoxicity which might result should the herbicide infiltrate the bed.

A number of herbicides have been evaluated for weed control in the row middles (1, 2); however, their utility for application in the bed or in instances where they would come in contact with the roots or foliage of strawberry plants has not been researched. Furthermore, there is a need for evaluation of additional herbicides to provide the grower with a greater choice of materials and a broader spectrum of weed species controlled. Therefore, research was conducted during the 1982-83 production season to evaluate the non-labeled herbicides alachlor, ethofumesate and 2 formulations of acifluorfen for weed control and toxicity to 'Tufts' strawberry grown on plastic mulch when applied to the bed and row middles.

Materials and Methods

The experimental area was disked, rototilled and bedded on September 17, 1982. Fertilizer was applied both broadcast and banded on the bed center to supply N, P and K at 200, 23 and 183 lb./acre, respectively. In addition, micronutrients were supplied by application of 16 lb./acre of Tem 300. The beds were fumigated with the nematicide ethylene dibromide which was applied in 2 bands 6 to 8 inches deep at 6 gal/acre on September 17, 1982. The beds were covered with black polyethylene mulch immediately after application of the nematicide. Treatment plots were arranged in a randomized complete block design. Plot size was 4 x 16 ft with each plot split into two 4 x 8 ft subplots. Within each plot one subplot was used for weed control evaluations, while the remaining subplot was used for crop response data. In the subplot maintained for weed control evaluations the polyethylene mulch film was removed for the duration of the experiment. On the crop response subplot 16 plants were planted, spaced 1 ft apart in 2 rows spaced 1 ft apart on the bed. Treatments were replicated 4 times. Treatments were a hand-weeded check, preemergence applications of 1 and 2 lb./acre alachlor and 2 and 4 lb./acre ethofumesate, and postemergence applications of 0.5 lb./acre of 2 formulations of acifluorfen (Blazer and Tackle). Although not included as a treatment in the experiment, weedy check plots were established on border rows in order to monitor the weed population in the area and use as a reference for weed control evaluations. Preemergence applications were made to the bed and row middles October 14, 1982 with a CO_2 back-pack sprayer operated at 3 mph and 24 psi pressure with 3 unijet nozzles delivering 26.6 gal/acre. Prior to applying the preemergence herbicides the polyethylene mulch was removed from the beds, then reapplied to the crop response subplots once application was complete. 'Tufts' strawberry plants were transplanted October 15, 1982. Immediately after planting, plots were irrigated with overhead sprinklers, and irrigation was continued 8 hr per day for approximately 2 weeks to establish the plants. Postemergence treatments were applied over the row on November 10, 1982 and again January 26, 1983. The check plots were hand weeded as needed throughout the season.

Weed control and strawberry plant vigor were evaluated November 22, 1982. Weed control was evaluated again February 8 and April 7, 1983. Weed control ratings are a composite of evaluations made on the bed in the weed control subplots and in the plant holes of the mulched subplots. Strawberries were harvested 23 times during the season, beginning January 3 and ending April 7, 1983. Data were analyzed by analysis of variance and treatment means were ranked by Duncan's new multiple range test.

Results and Discussion

Strawberry plant vigor was generally good with all treatments except applications of acifluorfen (Table 1). Both rates of alachlor and 4 lb./acre ethofumesate reduced vigor as compared to the hand weeded check. Application of acifluorfen reduced vigor below that of the other treatments by desiccating the foliage and producing necrotic lesions where spray droplets accumulated. Although the injury appeared severe, the plants recovered rapidly.

Early season crabgrass [*Digitaria ciliaris* (Retz.) Koel] control was excellent with alachlor and ethofumesate, while control with acifluorfen (both formulations) was poor (Table 1). Carolina geranium was controlled well by all of the treatments early in the season.

Only Carolina geranium was distributed evenly enough to evaluate for weed control in February. Alachlor and ethofumesate did not provide acceptable control of this weed (Table 1). Postemergence applications of acifluorfen controlled geranium as well as hand weeding and was superior to the preemergence herbicides.

Late season control of crabgrass and evening primrose (*Oenothera laciniata* Hill) was poor to non-existent with all of the herbicide treatments (Table 1).

Strawberries were harvested 23 times during the season. Relative differences for early season yield were the same as those observed for season total yield; therefore, only season total yields are presented (Table 1). Total numbers of fruit were reduced by all of the herbicide treatments as compared to the hand weeded check with no differences observed among the herbicide treatments. Total weight of fruit was significantly less in plots treated with 4 lb./acre ethofumesate and Tackle brand of acifluorfen than in the hand weeded check, but was not different from that in plots treated with the other herbicides.

Although acifluorfen was injurious to 'Tufts' plants, the injury appeared to be mostly cosmetic as numbers of fruit produced were not less than that obtained with the other herbicides. Low yields in the herbicide treated plots most probably were the result of a combination of phytotoxicity and weed competition since weed control was rather short lived. The brevity of the period of acceptable weed control is believed to be due to the extreme leaching conditions to which the herbicides were subjected during plant establishment and subsequent periods of irrigation for frost protection. Considering the high cost of hand weeding, it is believed that strawberry growers would be willing to accept a certain amount of injury if a herbicide had the potential for providing good weed control.

Alachlor and ethofumesate thus appear to be acceptable compounds for weed control in strawberries. They would be especially useful in row middles since they were only mildly injurious to strawberry plants placed in direct contact with soil treated with these compounds. Acifluorfen was somewhat more phytotoxic; however, the plants recovered rapidly from the injury. In addition, acifluorfen did not reduce the number of fruit relative to the other herbicide treatments and for these reasons may be useful

for control of difficult to control winter annuals like Carolina geranium, especially if appied with a shielded sprayer.

Literature Cited

1. Albregts, E. E. and C. M. Howard. 1983. Weed control in the strawberry fruit production field. Proc. Fla. State Hort. Soc. 96:75-76.
2. Gilreath, J. P. 1983. Herbicides for strawberry row middles. Agr. Res. Educ. Center-Bradenton Res. Rpt. BRA1983-19. 2 pp.

Proc. Fla. State Hort. Soc. 97: 174-176. 1984.

SEED ORIENTATION, SEED QUALITY AND THEIR EFFECT ON EMERGENCE AND SEX EXPRESSION IN CUCUMBER[1]

D. J. CANTLIFFE
Vegetable Crops Department, IFAS, University of Florida, Gainesville, FL 32611

Additional index words. Cucumis sativus, pickling cucumber, slicing cucumber, plant growth, female flowering.

Abstract. **In order to determine the effects of seed storage on sex expression in cucumber (Cucumis sativus L.), seeds were aged at high temperature and humidity. This led to a reduction in seed vigor and an alteration of sex expression in a gyneocious hybrid cultivar. More male flowers reached anthesis on this cultivar aged under stressful conditions for 15 days or more and fewer females reached anthesis on plants derived from seed aged for 90 days. Seed storage stress had no effect on sex expression in a gyneocious breeding line, even after 90 days. Cucumber seeds were placed with radicle ends at different angles with respect to gravity to determine the effect of seed placement on germination on paper towls and emergence in soil. Placement had little effect on germination or emergence but horizontal or upper vertical placement led to the greatest seedling vigor. The results clearly show the need for proper seed storage conditions and precision seed placement to insure high quality seeds and rapid seedling development for potentially optimum yield in cucumbers.**

Commercial production of cucumbers has depended more on the use of hybrid female cultivars in recent years in the production scheme. Many of these cultivars do not produce all female flowers, and under the stressful conditions of Florida's spring and fall crops, the hybrids may have a profuse male flowering habit.

Many factors are known to influence sex expression in cucumber. These include light intensity (1), temperature (2), photoperiod (3, 5), and conditions which might lead to early loss of cotyledonary tissue. Generally, any condition which leads to stress on early plant growth can result in a shift of the predominately female flowering habit to a male flowering pattern in gynoecious hybrid cucumber cultivars. Thus, in Florida fall plantings of cucumber can be made during August and September when day and night temperatures are extremely high (ie, in excess of 30°C day and 25°C night), and where water stress can be a major problem, especially when subsurface irrigation practices are used.

Other factors can cause reduced seedling growth during early plant development, including soil crusting and poor seed quality. These factors have not been investigated as to their potential effect on alteration of sex expression in cucumber. It was the purpose of the present research to determine what effect reduced seed vigor had on sex expression in cucumber and whether or not seed placement had any influence on early seedling growth rates.

Materials and Methods

Effect of seed aging on germination and seedling growth. Seeds of 'Pioneer' pickling cucumber and its female parent line 'MSU 713-5' were aged by placing them under conditions of high relative humidity and temperature according to the procedures of James (4). The duration of these conditions was varied from 0 to 90 days. After the aging period was completed the seeds were dried at 10°C and 50% relative humidity for 1 week. Germination tests were run on paper towels placed in an incubator at 25°C. Percent germination, radicle length average, and seedling fresh and dry weights were recorded after 7 days.

Effect of seed aging on sex expression. Seeds from each of the 2 cucumber cultivars and 6 aging treatments were planted in 15-cm plastic pots containing a vermiculite-peat (1:1) medium amended with fertilizer and lime. The plants were grown in the greenhouse at approximate temperatures of 25°C day and 20°C night under natural light intensities and photoperiods of 13 hr. At anthesis the male flowers were recorded (node and date) and removed and the female flowers were tagged. This was done for the first 10 nodes. The plants were grown for 60 days, then measured and the plant fresh weights were taken.

Effect of seed placement on germination and seedling growth, laboratory experiment. Slicing cucumber seeds, cv. Poinsett, were placed on germination paper on a drawn horizontal line. The radicle end was placed vertical, horizontal, or at an angle with respect to gravity (see Fig. 1). The papers were moistened with distilled water and then placed vertically in wire trays in an incubator at 25°C. Germination was recorded daily for 7 days after which radicle lengths were measured and fresh and dry weights were taken.

Effect of seed placement on germination and seedling growth, greenhouse experiment. 'Poinsett' seeds were placed as described for the previous experiment, except that the seeds were placed directly in soil in 15 cm pots. The seeds were covered with approximately 1.5 cm of soil and watered. The greenhouse was maintained at 28°C day and 22°C night temperatures. Emergence was counted daily until seeds no longer came up; then the seedlings were cut at the soil surface and fresh and dry weights were taken.

Germination rate index (GRI) and emergence rate index (ERI) were calculated according to previously published procedures (6).

Results and Discussion

Germination of aged 'Pioneer' and 'MSU 713-5' cu-

[1]Florida Agricultural Experiment Stations Journal Series No. 6062.