

Effects of Four Weed Management Systems on Soil Quality in Junebearing Strawberry Production

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Introduction

Few herbicides are registered for use in Junebearing matted-row strawberry culture. This study was conducted to develop alternative methods of weed management that are both economically and environmentally sustainable. The experiment evaluated the effects of two alternative and two conventional weed management systems on soil quality in Junebearing matted-row strawberry production. A soil quality index, based on chemical, physical, and biological properties of soil, was developed to help growers improve crop profitability and soil conservation.

Materials and Methods

The experiment consisted of four weed management treatments in a randomized complete block design with four replications. The experimental plots were 30 ft × 30 ft. Plots contained seven rows of strawberries spaced 42 in. apart, center to center. Dormant crowns of Jewel Junebearing strawberries were planted on June 1, 2004. Alternative systems were living mulch of sorghum-sudangrass hybrid or compost + corn gluten meal + straw mulch. Conventional systems were methyl bromide fumigation + herbicide or herbicide + no fumigation.

Results and Discussion

Total yield in the first bearing year for the fumigation treatment was higher than all other treatments by 52, 43, and 26% for living mulch, straw mulch, and herbicide treatments, respectively (Table 1). Marketable yield, berry number, and berry size were similar among all treatment plots. Strawberry leaves from plants

in the fumigation- and herbicide-treatment plots had a higher percentage of zinc, iron, and aluminum than plants found in the straw mulch- or living mulch-treatment plots (Table 2). The level of ammonium nitrogen was found to be 10% higher in the fumigation- and herbicide-treatment plots than in the straw mulch and living mulch plots; nitrate-nitrogen levels were 43 % higher in the living mulch and straw mulch plots than in the herbicide- and fumigation-treated plots.

There were no differences in percent weed cover in the strawberry row among the four weed management treatments in July or August 2004, or in May or August 2005 (data not presented). Preliminary analysis indicated that in October 2005, respiration in the top 3 in. of soil was higher in the living mulch- and straw mulch-treatment plots than in the herbicide-treatment plots or plots fumigated with methyl bromide (data not presented). Microbial biomass carbon and earthworm counts were not different among treatments in fall 2004 (data not presented).

All weed management systems provided comparable weed control in 2004 and 2005. Fumigated treatment plots produced significantly more total yield (marketable and nonmarketable) than the other treatment plots in the first year of bearing. Results showed that the four weed management systems produced similar amounts of marketable strawberries in the second week of picking (June 13, 2005). Soil nutrient analyses, soil respiration, and physical soil quality measurements indicated that living and straw mulch-treatment strategies created soil conditions beneficial for microorganisms. Enhanced nutrient cycling provided by microorganisms shows that measuring microbial activity in soil may

become a valuable part of efficient soil fertility management. The experiment will be continued in 2006.

Acknowledgments

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Table 1. Yield and plant growth measurements of Jewel Junebearing strawberry grown under four weed management treatments in 2004 and 2005 at Iowa State University, Horticulture Station, Ames, IA.

Treatment ^z	Total yield (kg)	6/13/05 ^y			8/20/04	6/30/05
		Marketable yield (kg)	Marketable berry no.	Marketable berry size (g)	Strawberry runner no.	Percentage row fill ^x
Herbicide	44.0 b	5.6	431.5	12.9	10	99.3
Fumigation	59.8 a	6.2	458.0	13.5	8	100.0
Living mulch	28.8 c	4.8	411.0	12.0	7	87.3
Straw mulch	34.3 b c	7.4	589.5	12.6	7	95.3
LSD ^w	11.9	NS	NS	NS	NS	NS

^zMeans of four replications.

^yMeans for total yield is the cumulative yield for entire season; marketable data were obtained from the first significant picking only.

^xMeans for percentage row fill were based on visual estimate of three 30 ft × 1.5 ft rows/plot.

^wLeast significant difference @ $P < .05$; NS=not significant. Values with the same letter are not significantly different from each other.

Table 2. Leaf tissue and soil nutrient analysis for Jewel Junebearing strawberry grown under four weed management treatments in 2004 at Iowa State University, Horticulture Station, Ames, IA.

Treatment ^z	Leaf tissue ^y			Soil nutrient analyses ^x		
	Zn	Fe	Al	K	NH ₄ -N	NO ₃ -N
Herbicide	31.0 a	472.3 a	450.8 a	215.4 b	2.95 a	19.6 b
Fumigation	31.3 a	554.3 a	538.8 a	198.4 b	2.70 a	17.2 b
Living mulch	25.3 b	160.8 b	112.3 b	271.4 a	2.58 b	32.8 a
Straw mulch	27.8 b	198.5 b	150.5 b	289.2 a	2.51 b	31.6 a
LSD ^w	2.5	191.5	212.7	43.0	0.28	5.3

^zMeans of four replications.

^yLeaf tissue were sampled August 2004. Units are in ppm.

^xSoil samples were collected October 2004, at depths of 0–7.5 cm. Units are in ppm.

^wLeast significant difference @ $P < .05$; NS=not significant. Values with the same letter are not significantly different from each other.