

Effect of Living or Straw Mulch on Weed Management and Soil Quality in Grape Vineyards

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Introduction

The use of herbicides in vineyards has been a cost-effective means of in-row weed management under the grape canopy. However, as public concerns about issues such as pesticide run-off, ground water quality, and soil erosion have increased, grape growers have become aware of a need for alternative methods of weed management. The overall objective of this project was to identify optimal weed management practices that maximize grapevine growth and development as well as vineyard soil quality. A sub-objective of the project was the determination of physical and biological soil measurements that could be used in combination with standard chemical soil analyses to indicate an improving or declining condition of a vineyard soil. The experiment began in 2004 and was completed after the 2007 grape harvest.

Materials and Methods

A mature vineyard (est. 1985) at the Iowa State University Horticulture Station, Ames, IA, was used in the experiment. The project used four weed management treatments and four replications and was arranged in a randomized complete block design. Grape cultivar was Maréchal Foch. Treatments applied to the mature vineyard consisted of: 1) conventional herbicide, 2) cultivation, 3) straw mulch, and 4) living mulch of creeping red fescue (*Festuca rubra*).

Results and Discussion

In 2007, yield data and grape pruning weights were obtained for this experiment (Table 1).

There were no year by treatment interactions among the grape yield, quality, or growth variables; therefore, years are combined for four years (2004–2007) (Table 2). Total yield per vine over all four years was similar among grapevines grown with the living mulch, straw mulch, and herbicide treatments (2.1, 2.5, and 2.6 kg, respectively) and was similar between the cultivation (1.6 kg) and living mulch treatments. Grapevine cluster number was similar among the living mulch, straw mulch, and herbicide treatments, and the cultivation and living mulch treatments were similar. There were no differences among treatments for grape cluster weight, berry weight, grape berry total acidity, or percentage soluble solids. Vine pruning weight of dormant canes was highest in the herbicide and straw mulch treatments (0.55 and 0.50 kg) followed by living mulch (0.37 kg). The vines in the cultivation treatment had the lowest pruning weight (0.26 kg). In our study, grapevines in the living mulch treatment experienced a reduction in pruning weight compared with the straw mulch and herbicide treatments, but was not reduced as much as vines grown in cultivated plots. The alternative weed management practices studied in this research, straw mulch or living mulch, provided excellent weed control and improved soil quality (data not presented). The reduced vigor of the grape plants in the living mulch treatment indicated a need for further investigation before living mulches can be recommended for commercial practice.

Acknowledgements

Appreciation is extended to Nick Howell, Lynn Schroeder, and Jim Kubik for their assistance in vineyard maintenance.

Table 1. Grape yield variables and dormant pruning weight as affected by four weed management treatments, 2007.

Treatment	Vine yield (kg)	Vine cluster no.	Cluster weight (g)	Berry			Vine pruning wt. (kg)	
				Weight ^z (g)	pH	Total acidity (g/L)		SSC ^y (%)
Living mulch	1.3 ^x	33	36.6	1.1	3.3 b	0.57	19.5 ab	0.42
Straw mulch	1.8	44	38.8	1.0	3.6 a	0.54	19.1 b	0.58
Herbicide	1.7	39	41.4	1.1	3.3 b	0.56	20.2 a	0.48
Cultivation	0.7	24	34.6	1.0	3.3 b	0.54	19.9 a	0.27
LSD ^w	NS	NS	NS	NS	0.2	NS	0.70	NS

^zAverage weight calculated from a 100 berry sample.

^yPercentage soluble solids concentration.

^xMeans of four replications.

^wLeast significant difference @ $P < 0.05$; Means in the same column with the same letter are not different. NS=not different.

Table 2. Grape yield variables and dormant pruning weight as affected by four weed management treatments, 2004–2007.

Treatment	Vine yield (kg)	Vine cluster no.	Cluster weight (g)	Berry			Vine pruning wt (kg)	
				Weight ^z (g)	pH	Total acidity (g/L)		SSC ^y (%)
Living mulch	2.1 ^x ab	47 ab	42.4	1.04	3.2 b	1.01	19.9	0.37 b
Straw mulch	2.5 a	57 a	43.8	0.95	3.4 a	0.91	19.9	0.50 a
Herbicide	2.6 a	57 a	45.9	0.99	3.3 ab	0.92	20.1	0.55 a
Cultivation	1.6 b	41 b	41.5	0.96	3.2 b	0.95	20.0	0.26 c
LSD ^w	0.5	10	NS	NS	0.1	NS	NS	0.10

^zAverage weight calculated from a 100 berry sample.

^yPercentage soluble solids concentration.

^xMeans of four replications and four years.

^wLeast significant difference @ $P < 0.05$; Means in the same column with the same letter are not different. NS=not different.