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Alternative Weed Management Strategies:Effects on Weed Control and Grapevine Yield in an Established Vineyard

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Abstract

Weeds compromise vineyard productivity by competing with grapevines for water and nutrients. To manage weeds, viticulturists commonly used herbicides and/or cultivation within the vineyard row. Although temporarily effective, these techniques may jeopardize soil quality and the ultimate sustainability of a viticultural enterprise. The need for alternative weed management strategies that effectively manage weeds, maintain grapevine performance and quality, and conserve soil resources are of increasing concern. The first objective of this study was to evaluate the effects of four weed management strategies on weed control, grapevine physiological responses, and assayed soil parameters in an established vineyard. Secondly, this study is investigating the influence of irrigation on grapevine growth and development grown with or without a living mulch.

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences | Horticulture

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Introduction

Weeds compromise vineyard productivity by competing with grapevines for water and nutrients. To manage weeds, viticulturists commonly used herbicides and/or cultivation within the vineyard row. Although temporarily effective, these techniques may jeopardize soil quality and the ultimate sustainability of a viticultural enterprise. The need for alternative weed management strategies that effectively manage weeds, maintain grapevine performance and quality, and conserve soil resources are of increasing concern. The first objective of this study was to evaluate the effects of four weed management strategies on weed control, grapevine physiological responses, and assayed soil parameters in an established vineyard. Secondly, this study is investigating the influence of irrigation on grapevine growth and development grown with or without a living mulch.

Materials and Methods

Data were collected from a vineyard established in 1985 at the Iowa State University Horticulture Research Station, Ames, IA. All treatments addressing the first objective were established in 2004 within rows of Maréchal Foch and include: 1) cultivation, 2) herbicide application, 3) straw mulch, and 4) a living mulch of creeping red fescue (*Festuca rubra*).

To address the second objective, rows of Reliance and Swenson Red grapes were used. Treatments were established in the fall of 2007 and also included a living mulch of creeping red and Chewings fescue (*F. rubra* and *F. rubra* ssp. *fallax*, respectively). Treatments include: 1) herbicide application, 2) herbicide application plus irrigation, 3) living mulch, and 4) living mulch plus irrigation. Irrigation regimes were based on fescue evapotranspiration. In 2009, supplemental irrigation was provided 11 times from May through September.

Weed data were collected in the late spring and summer of 2009 (May, July, and August). Data collected include visual estimates of percentage weed cover, as well as monocot and dicot shoot biomass.

Grapevine yield and harvest-related variables also were measured. Completion of the project will include the collection and analysis of fruit quality, pruning weights, and soil biological, chemical, and physical factors.

Results and Discussion

Weed data. Within rows of Maréchal Foch, percentage weed cover and biomass were highest in the cultivation treatment from May through July, whereas it was among the lowest in the living mulch treatment. In August, the living mulch treatment had the highest percentage weed cover and monocot biomass, likely due to an infestation of brome grass (*Bromus* spp.) within one of the plots (Table 1).

Few differences were observed in percentage weed cover and overall monocot biomass in treatment plots of Reliance and Swenson Red in May. However, dicot biomass was consistently lower in both living mulch treatments across all three sampling times. In July and August, percentage weed cover was lowest in the two living mulch treatments (Table 2).

Combined between the two experiments, results to date suggest living mulch is an effective method of controlling weeds with these grape cultivars.

Yield data. No statistically significant differences in average grapevine yield were observed across all cultivars and experimental treatments (data not presented), which is consistent with yield results from 2008.

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Table 1. Percentage weed ground cover and shoot biomass of monocot (grass) and dicot (broadleaf) weeds from four weed management treatments in rows of Maréchal Foch, 2009.[z]

	Percentage weed cover			Weed shoot biomass (g)					
Treatment	May	July	August	May monocot	May dicot	July monocot	July dicot	August monocot	August dicot
Cultivation	69.2 a	97.9 a	12.1 a	9.4 a	20.4 a	19.0 a	37.4 a	0.4 b	1.4 a
Herbicide	11.8 b	18.6 bc	6.7 a	1.0 b	2.8 a	0.0 b	3.7 b	0.0 b	1.5 a
Living mulch	0.7 c	14.0 c	16.9 a	0.0 b	0.6 b	2.3 b	2.0 b	5.0 a	0.1 a
Straw mulch	0.7 c	35.6 b	9.6 a	0.7 b	0.4 b	11.7 a	7.7 b	0.3 a	1.3 a
LSD[y]	10.6	17.0	NS	9.8	10.4	11.5	11.7	11.7	NS

[z]Means of four replications; means calculated from averages of 0.25 m^2 quadrats, three quadrats per plot.
[y]Least significant difference at $P < 0.05$; NS = no significant difference; values sharing the same letter are not significantly different.

Table 2. Percentage weed ground cover and shoot biomass of monocot (grass) and dicot (broadleaf) weeds from four weed management treatments in rows of Reliance and Swenson Red, 2009.[z]

	Percentage weed cover			Weed shoot biomass (g)					
Treatment	May	July	August	May monocot	May dicot	July monocot	July dicot	August monocot	August dicot
Herbicide	18.0 a	41.7 a	13.8 a	2.1 a	5.0 a	0.3 a	16.6 a	1.0 a	2.3 a
Herbicide + irrigation	16.9 a	23.5 b	10.5 a	2.0 a	3.4 ab	0.5 a	5.5 b	0.0 a	1.7 a
Living mulch	13.3 a	3.7 c	3.3 b	1.5 a	1.8 b	0.2 a	0.6 b	0.2 a	0.2 b
Living mulch + irrigation	13.2 a	3.7 c	4.4 b	1.3 a	1.6 b	0.2 a	0.6 b	0.5 a	0.2 b
LSD[y]	NS	11.2	5.4	NS	2.2	NS	23.5	NS	23.7

[z]Means of four replications; means calculated from averages of 0.25 m^2 quadrats, three quadrats per plot.
[y]Least significant difference at $P < 0.05$; NS = no significant difference; values sharing the same letter are not significantly different.