

Evaluation of the Long Term Impact of Vineyard Floor Management Practices

Larry Bettiga
Viticulture Farm Advisor
Monterey, San Benito and Santa Cruz Counties



University of California Cooperative Extension
Division of Agriculture and Natural Resources

Project was initiated to examine floor management practices on:

1. Weed Control
2. Effects on runoff from the vineyard
3. Soil water and water use
4. Soil physical properties
5. Soil microbiology
6. Soil and vine nutrition
7. Grape yield and quality
8. Economics of practices

Research Cooperators

- Jason Smith and Daryl Salm, Growers
- Larry Bettiga, Viticulture Advisor
- Richard Smith, Weed Science Advisor
- Michael Cahn, Irrigation and Water Quality Advisor
- Laura Tourte, Farm Management Advisor
- Kendra Baumgartner, USDA Sustainable Vineyard Scientist
- Louise Jackson, Soil Ecology Specialist, UC Davis

Funding Acknowledgement

- California Department of Pesticide Regulation Reduced Risk Management Program
- Western Sustainable Agriculture Research and Education Program
- Viticulture Consortium Grant Program

Vineyard Floor Management Project

Site characteristics:

- 7.0 acre plot in Greenfield
- The site is mostly flat and has uniform Elder Loam soil
- The variety is Chardonnay on Teleki 5C rootstock
- Vine and row spacing is 6 x 8 feet
- Planted in 1996
- Treatments initiated in winter 2000

Vineyard Floor Management Practice Comparison Row Treatments

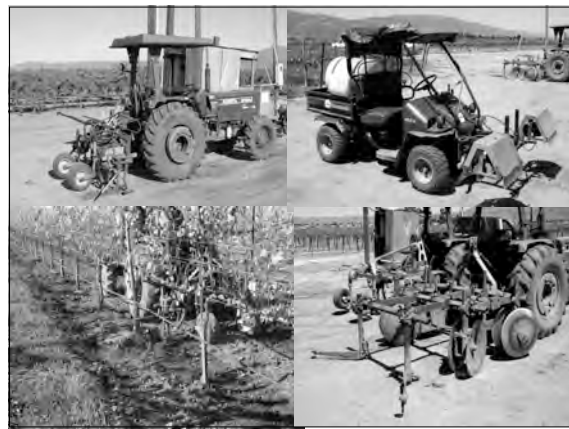
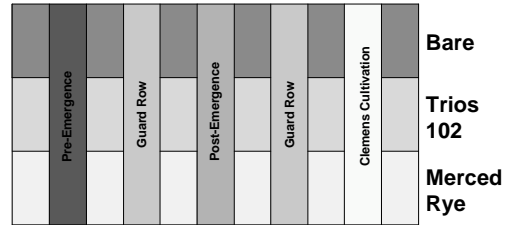
1. Pre-emergence (Standard)
 - Simazine + Goal in winter
 - followed in summer by post emergence applications of Goal + Roundup (applied with Patchen®)
2. Clemens® cultivation
 - Non-chemical
 - Cultivated as needed (~ 1/month)
3. Post-emergence
 - applications (applied with Patchen®), Goal+Roundup/Rely in spring/summer

Vineyard Floor Management Practice Comparison Row Middle Treatments

Each weed control strategy includes the following cover crop treatment:

1. Bare ground in row middles
 2. Merced Rye cover crop in row middles
 - Tall, fast growing, earlier maturing
 3. Trios 102 cover crop in row middles
 - Short early in life cycle, late maturing, deep rooted (?)
- Cover crop strip is 32 inches wide
 - Cover crops planted in early fall and mowed early summer

Vineyard Floor Plot Layout



Changes in the Weed Populations over four years

- The trial was initiated in the 6th year of an established vineyard
- The weed control program prior to the initiation of the trial was a combination of cultivation and postemergence applications of Roundup + Goal applied with the Patchen[®] applicator
- Weeds were evaluated by utilizing one 100 foot long transect per plot and recording the weed species at each foot marker

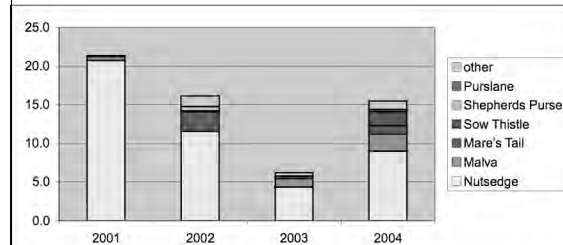
Initial Weed Populations

- Initial weed populations in the trial site were assumed to be uniform
- The combination of cultivation and postemergence treatments provided low populations of purslane and shepherd's purse
- Mare's tail, malva, and nutsedge were present at the site

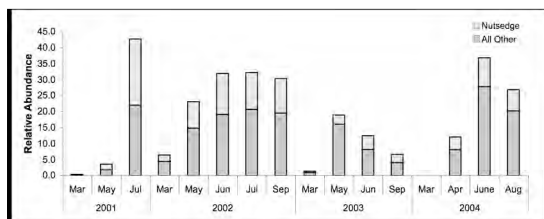
Preemergence Treatment

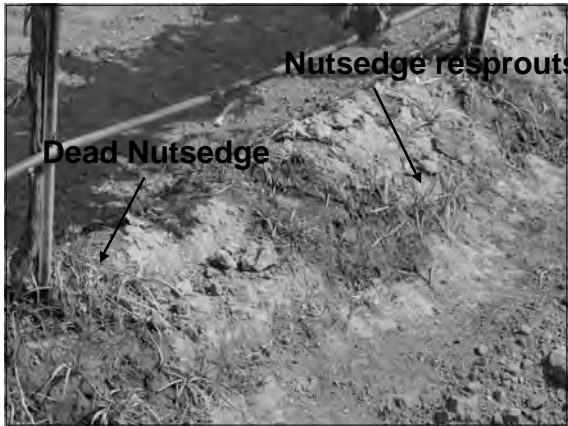
- The most notable weed in this treatment is yellow nutsedge
- It is not controlled by the preemergence simazine + Goal combination
- Supplemental postemergence applications of Roundup + Goal keep have kept the nutsedge populations stable over the past four years

Change in Nutsedge Population In the Preemergence Treatment Over Four Years - Summer Evaluation



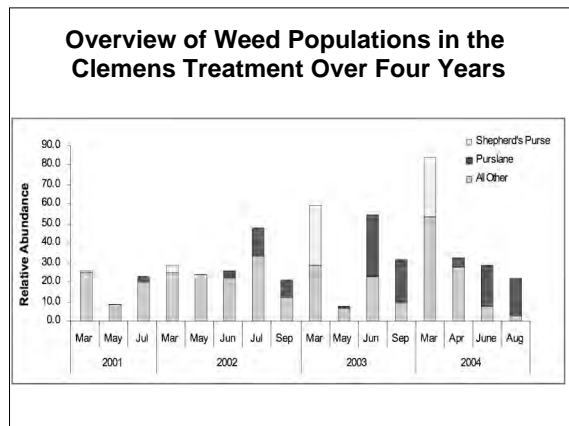
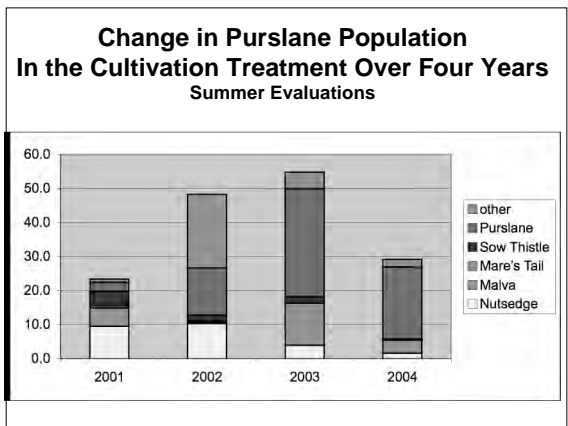
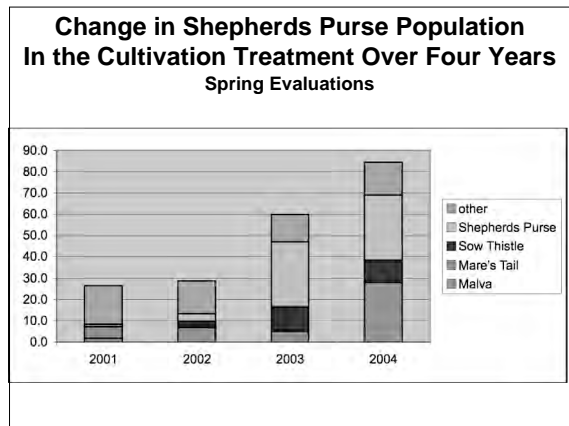
Overview of Weed Populations in the Preemergence Treatment Over Four Years

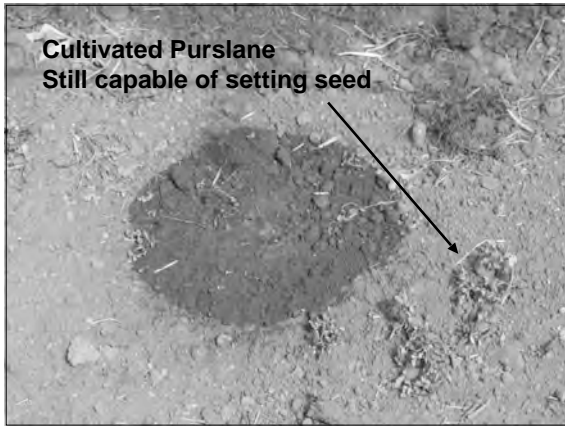




Cultivation Treatment

- Monthly cultivations have allowed species such as shepherd's purse (winter) and purslane (summer) to set seed unabated and increase in population
- High purslane populations have prompted the grower to resort to hand weeding 1-2 times during the summer to remove "islands" of this weed from around the base of the vines
- This has substantially increased the cost of this weed control strategy



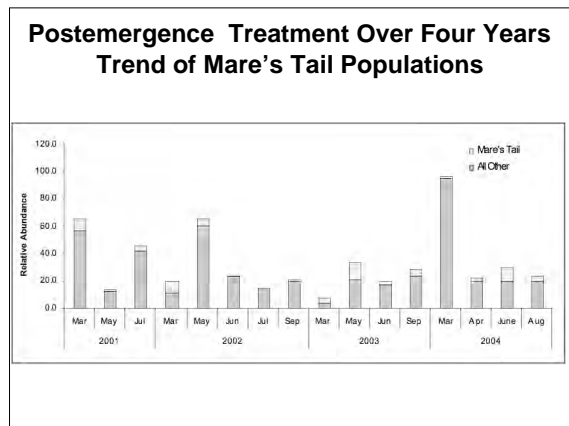


Post Emergence Treatment

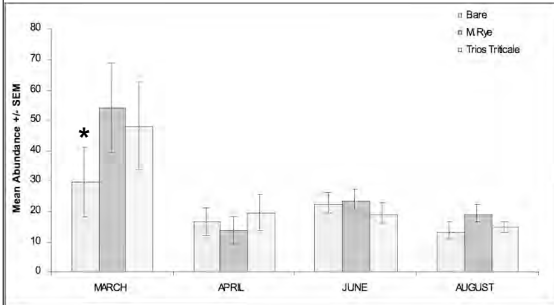
- Mare's Tail has emerged as a notable weed in the postemergence treatment
- It is not controlled by the Roundup + Goal mixture commonly used, which allowed this weed to increase in importance in this treatment
- An additional herbicide, Rely, was necessary to bring this weed under control

Mare's Tail

- Susceptible to cultivation and Simazine
- Resistant to Roundup + Goal
- Susceptible to Rely



Impact of Cover Crops on Total Weeds 2004



Weeds utilizing the edge of the cover cropped zone for germination

Vineyard Floor Weed Control Cost Comparisons

- The postemergence treatment was the cheapest weed control strategy in 2002, 2003 and 2004
- The preemergence treatment was the most expensive in 2002 due to the chemical costs
- The cultivation treatment was the most expensive in 2003 and 2004, due to hand weeding (one time in 2003 and 2 times in 2004)

Summary of Floor Management Costs 2002 - 2004

Floor Practice	Preemergence			Clemens Cultivation			Post Emergence		
	Total \$/A			Total \$/A			Total \$/A		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
Bare	138	138	112	113	156	349	94	131	75
Merced Rye	168	154	143	142	180	380	118	146	106
Trios 102	173	162	148	148	186	386	123	153	111

Soil Compaction in the Various Weed Control Treatments

- Greater soil compaction was observed in the cultivation treatment in 2004
- In spite of this observation, no differences in water penetration or yield have been noted in this treatment to date

Impact of Vineyard Floor Practices on Soil and Plant Nutrition

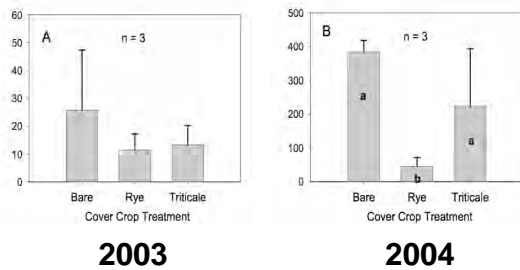
- There were no differences in the nutrition of the vines over three years of evaluation of leaf blade and petiole samples (collected at flowering)
- There were higher levels of organic matter, and zinc in the row middles in the cover crop treatments
- There were lower levels of nitrate and sodium in the row middles in the cover crop treatments

Impact of Vineyard Floor Practices on Soil Moisture

- There was less soil moisture content in the Rye treatment in March (due to greater ground cover and evapotranspiration)
- The use of moisture in the row middles by the cover crops reduced the amount of lateral movement of water to the vine row once irrigation started in late April



Runoff from Cover Crop Treatments



Impact of Vineyard Floor Practices on Vine Growth and Productivity

- To date no differences have been observed in vine growth, grape yield, and fruit quality

Impact of Vineyard Floor Practices on Soil Microbial Biomass

- Use of cover crops has increased microbial biomass in row middles
- Weed control treatments have had no effect on microbial biomass
- Use of cover crops has increased microbial biomass in the vine row

**Impact of Vineyard Floor Practices on
Soil Arbuscular Mycorrhizal Fungi**

- Mycorrhizal colonization was a consequence of weed suppression.
- Cover crop had no effect on mycorrhizal colonization of adjacent grapevine roots. There was little contact between grapevine and cover crop roots.

END