

Project Number: OW14-032
Project Title: Selecting and Managing Vineyard Cover Crops to Reduce Net Consumption of Basin Water

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Organization: Vineyard Team

FINAL REPORT: Tables and Figures

Table 1: Seeding rates of the cover crop species and varieties (treatments) planted in the cover crop species experiments.

Crop	Variety	Seed rate/acre (lbs)
Barley	UC937	120
Triticale	Trios 888	100
Pea	Dundale	75
Medic	Paraggio	20
Brome	Blando	25

Table 2: Cover crop termination treatments.

Clean Cultivation

No till, mow after seed set

Mow at bud break

Mow & disk at bud break

Mow 30 days after bud break

Chemical mow at bud break

Table 3: F scores and p-values from ANOVA on dry matter biomass from the species experiments

Site/Year	F(5,10)	<i>p</i>	Sig.
J. Lohr			
2015	7.425	<.001	*
2016	1.369	0.314	
Opolo			
2015	13.843	<.001	*
2016	-	-	

Table 4. F scores and p-values from ANOVA on gravimetric soil moisture content in the cover crop species experiments.

Site/Year	F(5,10)	<i>p</i>	Sig.
J. Lohr			
2015	2.179	0.138	
2016	0.729	0.617	
Opolo			
2015	1.183	0.383	
2016	0.473	0.789	

Table 5. F scores and p-values from ANOVA on gravimetric soil moisture content in the cover crop termination experiments.

Site/Year	F(5,10)	<i>p</i>	Sig.
J. Lohr			
2015	4.084	0.028	*
2016	4.112	0.027	*
Derby			
2015	0.032	0.901	
2016	1.093	4.21	
Treasury			
2015	0.122	0.408	
2016- 18"	1.668	0.229	
2016- 36"	3.792	0.035	*

Table 6. F scores and p-values from ANOVA of dry matter biomass in the cover crop termination experiments.

Site/Year	F(5,10)	<i>p</i>	Sig.
J. Lohr			
2015	5.373	0.001	*
2016	1.609	0.262	
Derby			
2015	14.489	<.001	*
2016	6.591	0.006	*
Treasury			
2015	30.52	<.001	*
2016	11.606	0.018	*

Table 7. Costs of Practices (Treatments) in Cover Crop Termination Experiment.

Practice	Cost per acre
No-till	\$45.30 *
Single cultivation pass	\$136.50
Single mowing pass, early	\$136.50
Single mowing pass, late	\$136.50
Single pass chemical application (Glyphosate)	\$152.30
Single mowing pass, single disking pass	\$159.00

Notes: These are average costs based on the actual costs reported by the collaborating growers. These costs include the cost of establishing a Blando Brome cover crop.

*Growers (both collaborators and others) reported that no-till systems need to be "reset" every five to eight years. For this example, the cost of planting a Blando Brome cover crop is amortized over 5 years with the assumption of a single mowing pass in late spring/early summer once the cover crop has reseeded and weeds have reached mower height without going to seed.

Table 8. Costs of practices included in cover crop species experiment.

Crop	Variety	Cost per acre to plant these crops	Cost per acre including termination/incorporation strategy	
			Mow only	Mow and disk
Barley	VNS	\$41.13	\$63.63	\$86.13 *
Barley	UC937	\$49.95	\$72.45	\$94.95
Triticale	Trios 888	\$61.75	\$84.25	\$106.75
Pea	Dundale	\$37.50	\$60.00	\$82.50
Medic	Paraggio	\$98.35	\$120.85	\$143.35
Brome	Blando	\$114.00	\$136.50	\$159.00

Note: These are average costs based on the actual costs for these operations reported by the collaborating growers.

* VNS Barley is included in this analysis as it is more commonly used than UC937 Barley due to cost.

Cover Crop & Water Management Field Design - Western SARE

J. Lohr

←End of Row

Whole Plot - 1 Site

Vine Row - Border

Row Middle Rep-1

Vine Row - Data

Row Middle Rep-1

Vine Row - Border

Row Middle Rep-1

Vine Row - Data

Row Middle Rep-1

Vine Row - Border

Row Middle Rep-2

Vine Row - Data

Row Middle Rep-2

Vine Row - Border

Row Middle Rep-2

Vine Row - Data

Row Middle Rep-2

Vine Row - Border

Row Middle Rep-3

Vine Row - Data

Row Middle Rep-3

Vine Row - Border

Row Middle Rep-3

Vine Row - Data

Row Middle Rep-3

Vine Row - Border

	150 ft.				
	50 ft.	50 ft.	50 ft.	50 ft.	50 ft.
	Border Vine Row				
Border Panels	B1	B3	B4	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B1 ●	B3 ●	B4 ●	Border Panels	
Data Loggers	10	11	12		
Border Panels	B5	B6	B2	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B5 ●	B6 ●	B2 ●	Border Panels	
	Border Vine Row				
Border Panels	B6	B5	B4	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B6 ●	B5 ●	B4 ●	Border Panels	
Data Loggers	13	14	15		
Border Panels	B1	B2	B3	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B1 ●	B2 ●	B3 ●	Border Panels	
	Border Vine Row				
Border Panels	B4	B2	B3	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B4 ●	B2 ●	B3 ●	Border Panels	
Data Loggers	16	17	18		
Border Panels	B1	B6	B5	Border Panels	
	Data Vines	Data Vines	Data Vines		
Border Panels	B1 ●	B6 ●	B5 ●	Border Panels	
	Border Vine Row				

Northeast →
● → soil sensor data point

Block 1

Block 2

Block 3

Treatments

B1	Clean Cultivation	Seed order
B2	Barley (UC 937)	1
B3	Medic (Paraggio)	5
B4	Triticale (Trios 888)	4
B5	Brome (Blando)	3
B6	Peas (Dundale)	2

Notes:

3 replicate sites for each of the 2 studies: 1) treatments of one cover crop and 2) cover crop variety evaluation.

3 replicates per cover crop treatment reach over 2 row middles, each rep straddling a vine row, 5ft wide cover.

3 soil sensors at each treatment replicate at 30, 60, 90cm, in one site J.Lohr.

Vine data collected from 4 pseudo-replicate vines within a treatment, for a total of 12 vine replicates per site.

Figure 1: Example of experimental design employed in the cover crop species experiments.

Cover Crop & Water Management Field Design - Western SARE

J. Lohr

←End of Row

Whole Plot - 1 Site

Vine Row - Border

Row Middle Rep-1

Vine Row - Data

Row Middle Rep-1

Vine Row - Border

Row Middle Rep-1

Vine Row - Data

Row Middle Rep-1

Vine Row - Border

Row Middle Rep-2

Vine Row - Data

Row Middle Rep-2

Vine Row - Border

Row Middle Rep-2

Vine Row - Data

Row Middle Rep-2

Vine Row - Border

Row Middle Rep-3

Vine Row - Data

Row Middle Rep-3

Vine Row - Border

Row Middle Rep-3

Vine Row - Data

Row Middle Rep-3

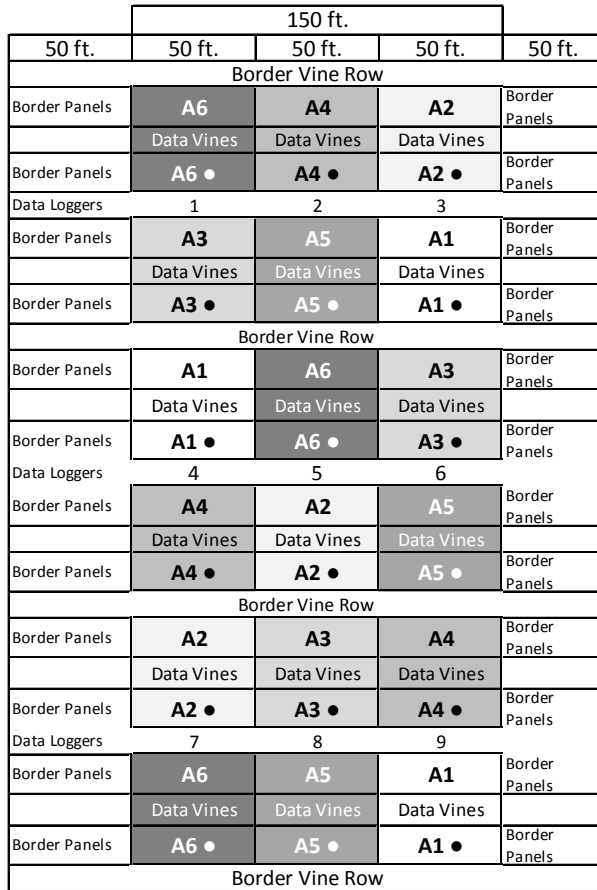
Vine Row - Border

Row Middle Rep-3

Vine Row - Data

Row Middle Rep-3

Vine Row - Border



Northeast →
● → soil sensor data point

Block 1

Block 2

Block 3

Testing treatments on cover crops to reduce water use (Blando Brome)

A1 Clean Cultivation	Soil cultivated and allow resident vegetation
A2 Fallow - No Till Control	No cover crop planted, no till, volunteer vegetation monitored, cover species identified (mow timed)
A3 Early Mow	Mow about budbreak (Mid Mar.)
A4 Early Mow + Disk	Mow & disk about budbreak (Mid Mar.)
A5 Late Mow	Mow cover 30 days after bud break (Mid-April, soil temp.)
A6 Chemical Mow	Chemical mow: glyphosate just before budbreak

Notes:

3 replicates for each treatment of one cover crop

3 replicates per cover crop treatment reach over 2 row middles, each rep straddling a vine row, 5ft wide cover.

Vine data collected from 4 pseudo-replicate vines within a treatment, for a total of 12 vine replicates per site.

Figure 2: Example of experimental design employed in the cover crop termination experiments.

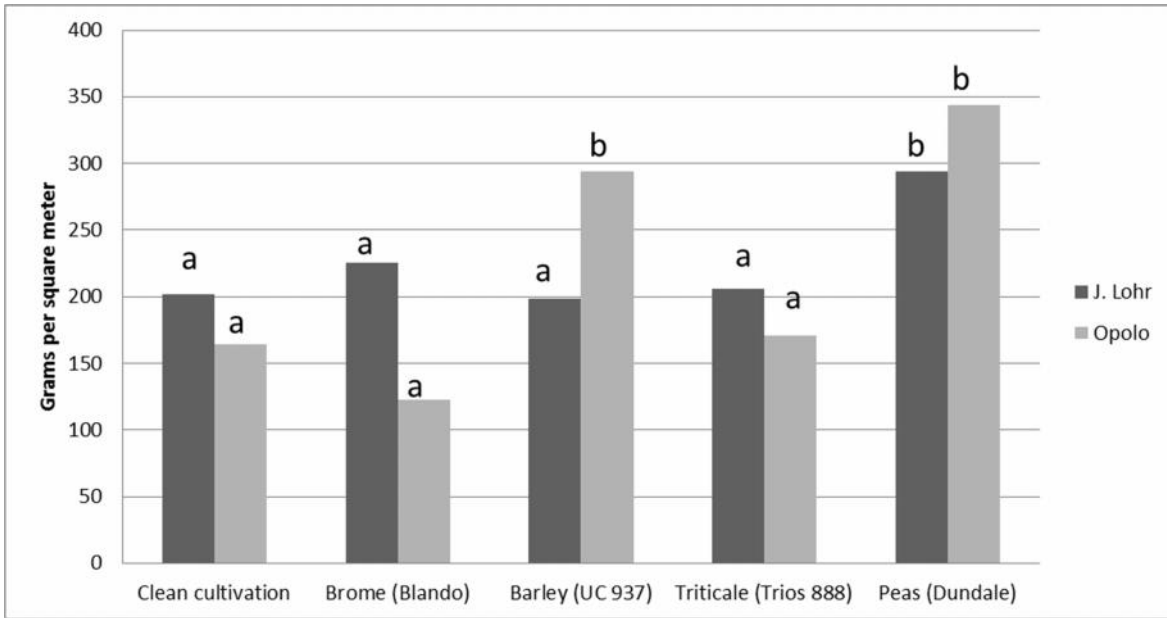


Figure 3: Mean dry matter biomass of five species of cover crop and an unplanted control. Different letters indicate significant differences ($p < .05$).

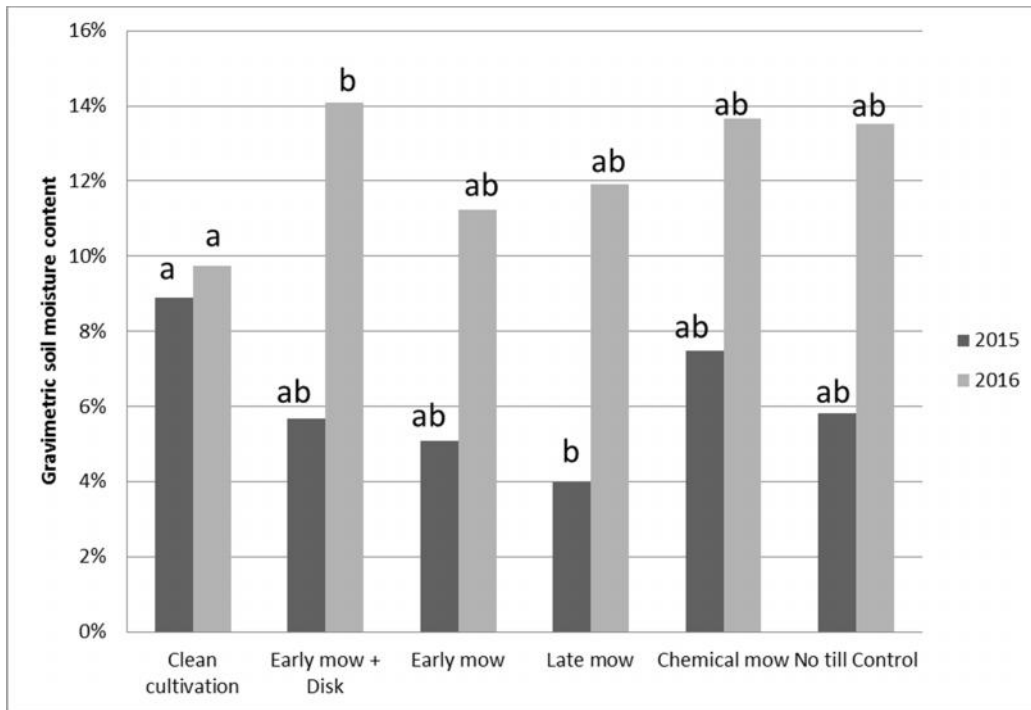


Figure 4: Mean gravimetric soil moisture content in five treatments of cover crop termination and a cultivated control in 2015 and 2016 at the J. Lohr vineyard. Different letters indicate significant differences ($p < .05$).

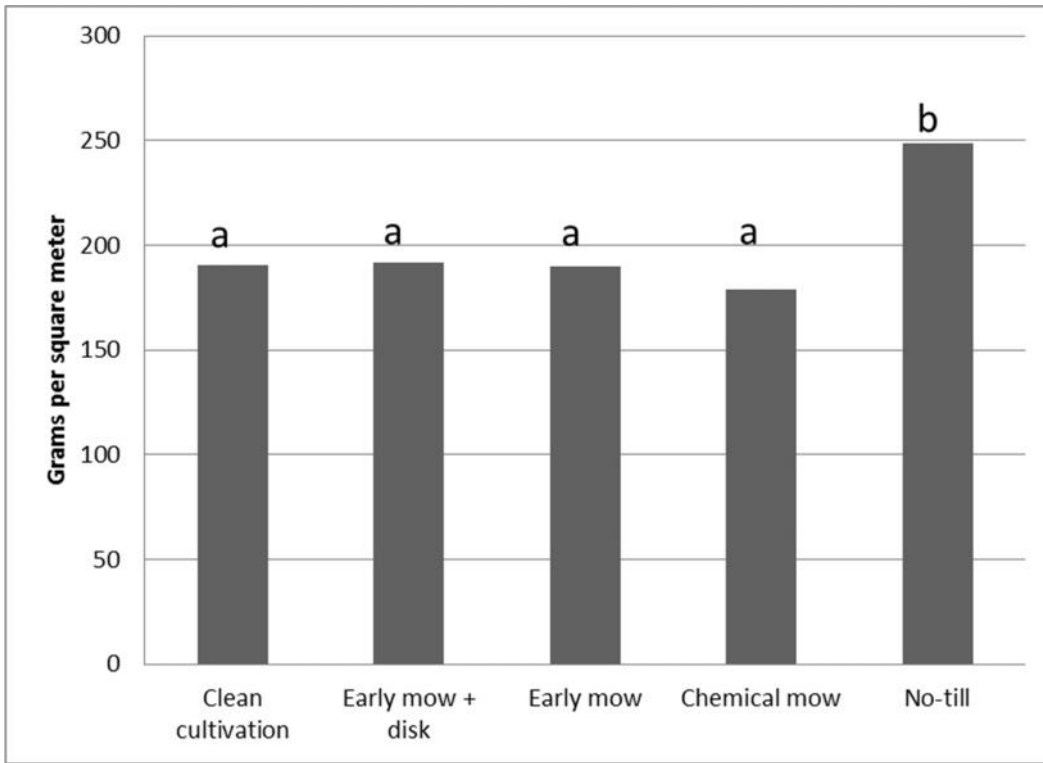


Figure 5: Mean dry matter biomass in four treatments of cover crop termination and a cultivated control at the J. Lohr vineyard in 2015. Different letters indicate significant differences ($p < .05$).

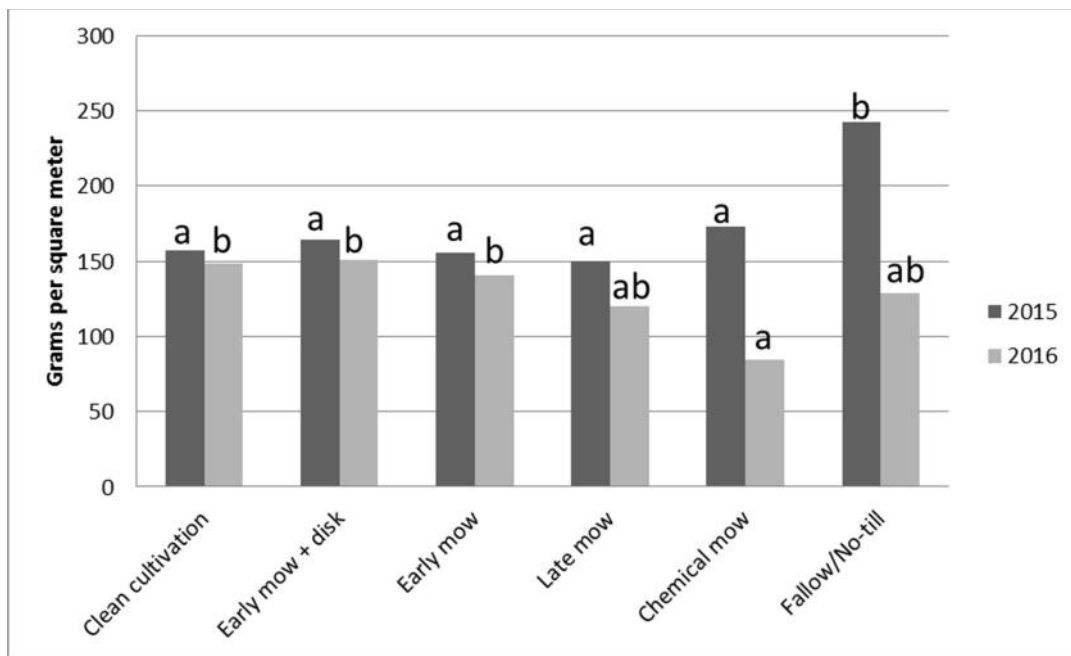


Figure 6: Mean dry matter biomass of five treatments of terminating a cover crop and a cultivated control at the J.Lohr vineyard in 2015 and 2016. Different letters indicate significant differences ($p < .05$).

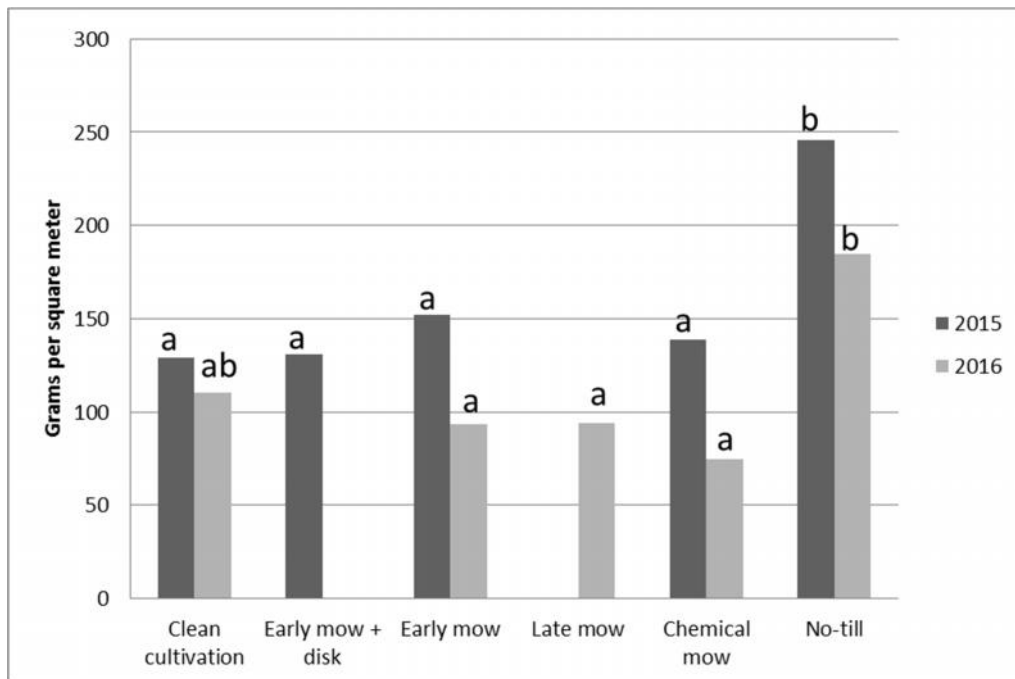


Figure 7: Mean dry matter biomass of five treatments of terminating a cover crop and a cultivated control at the Treasury Wine Estates vineyard in 2015 and 2016. Different letters indicate significant differences ($p < .05$).

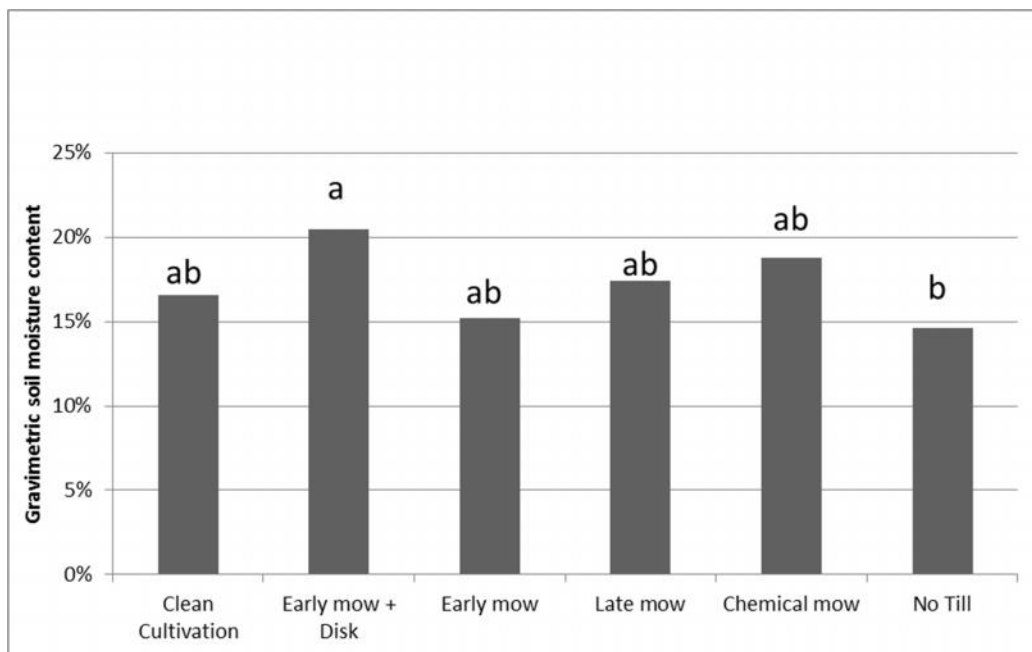


Figure 8: Mean gravimetric soil moisture content of five treatments of terminating a cover crop and a cultivated control at the Treasury Wine Estates vineyard in 2016. Different letters indicate significant differences ($p < .05$).