Performance of 18 Cover Crop Species in a Newly Planted Vineyard in Lake County

by
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Abstract

18 cover crop species representing a broad range of agronomic qualities were seeded into a newly planted vineyard in Lake County. The vineyard at the site is planted on Sobrante/ Geunoc/ Hambright complex soil, 2-15% slope, at approximately 1750 foot elevation. Species included foenugreek, crimson clover, subterranean clover, persian clover, balansa clover, burr medic, austrian winter peas, daikon radish, oilseed radish, yellow mustard, common rye grain, triticale, barley, as well as a non-seeded control (endemic vegetation). A randomized complete block design was use consisting of 4 replications per selection evaluated. Measurements included yeild, cover crop height, and estimated percent cover. Most covercrops grew moderately well, and successful stands were established both years. Exceptions were foenugreek in both years, common barley in 1998, and Persian clover in 1998. 'Trios 102' triticale produced the most biomass, reaching 10.9 tons/acre in 1999. Common barley provided the densest cover in 2000, covering 92 % of the plot. Oilseed radish grew the tallest of the selections, averaging 41.5 inches for the two years. 'Antas' subterranean clover was the most successful low statured selection, averaging 7.9 inches in height, but covering 85% of the ground in 2000. This trial indicates that there is a wide range of plant materials available to growers in Lake County for their cover cropping programs.

Introduction

Lake County is part of the prestigious North Coast American Viticultural Area, and differs from the neighboring counties in that nearly all of the vineyards are planted at relatively high elevations (greater than 1300 feet). Winters are frequently quite cold, with minimum temperatures in the mid-teens, and freezing temperatures are likely in late October or early November in many locations. Rainfall averages between 30 and 40 inches most seasons, but may also exceed 60 inches during very wet winters in some vineyard locations.

Lake County has greatly expanded vineyard acreage in the past 5 years, with many new plantings going into areas that historically were planted as walnut orchards on sloping ground with soils originating from volcanic parent materials. Erosion, low fertility and poor soil structure are concerns as vineyardists develop and manage these sites, and the need for well adapted cover crop materials are of great concern.

Increasing environmental awareness and community concern has prompted growers to develop vineyard floor management practices that lessens the risk of erosion. Cover crops play a vital role in stopping erosion from happening. During the first two years of vineyard installation, many growers favor annual covercrops that germinate and grow rapidly, with straw mats applied to augment erosion control. Disking during the growing season prevents competition from cover crops or other vegetation. Once the vineyard has been completely installed, and vines are becoming well established, many growers convert to self-reseeding cover crop species that require no additional tillage to establish and

grow. With this in mind, a broad range of cover crops were selected for evaluation under Lake County conditions.

Materials and Methods

The trial was established in a newly planted 'Cabernet sauvignon' vineyard on a gently sloping site (5 to 10 % slope). The soil is of the Sobrante/Guenoc/Hambright complex, moderately deep and well-drained, of low fertility. The plot is at approximately 1750 feet elevation, facing north and east. The vineyard is planted with 9 foot rows, and vines are planted 6 feet apart in rows. A vertical shoot positioned trellis system is used. Nineteen different cover crops were selected represent a broad range of agronomic characteristics:

Foenugreek: A winter annual legume used in field crop rotations. Aromatic seeds used as a spice. Low in stature, 12 inches or less..
'Flame' Crimson clover: A winter annual legume used as a pasture species, and also for erosion control. Colorful flowers. Moderate in stature, 18 inches.
Subterranean clover: Winter annual legumes that readily reseed themselves. Primarily used for pasture in areas with mild wet winters and warm, dry summers. Different cultivars chosen on the basis of winter dormancy and early maturity. In our experiment, 'Dalkeith' is the least winter dormant, 'Denmark' is intermediate, and 'Koala' and 'Antas' are late.
'Nitro' Persian clover: A grown in the mid-east with attractive lavender colored flowers. Low in stature, less than 16inches.
'Bolta' Bolsana clover: A winter annual legume used for pastures. Low in stature, less than 16 inches.
Max Organic builder: A proprietary mix of 'Cayuse' oats, Austrian winter peas, bell beans and common vetch recommended by many agronomists as a soil building cover crop mix. Large statured and creeping, up to 48 inches.
Santiago burr medic: A winter annual that readily reseeds. Grows well under poor soil conditions with minimal amounts of water. Seed pods are spineless.
Austrian winter peas: A winter annual used for building soil nitrogen. Long winter dormancy, and very cold tolerant.
Daikon radish: Winter annual with large taproots, and large stature. Good seedling vigor, inexpensive seed. Useful in mixes and crop rotations.
Oilseed radish: Large statured winter annual, growing to 60 inches in height. Copious biomass producer. Useful in crop rotations.
Yellow mustard: Large statured winter annual, growing to 48 inches in height. Copious biomass producer. Useful in crop rotations. Self-reseeding if the ground is tilled.
Common ryegrain: Large statured winter annual grain, long winter dormancy. Can achieve up to 60 inches in height. Extensive root system.
'Trios 102' triticale: Low statured winter annual grain, long winter dormancy, extensive root system. About 36 inches in height.

'***Juan' triticale:*** Winter annual grain, tall stature, medium winter dormancy, extensive root system. About 48 inches in height.
Common barley: Annual winter grain, excellent drought tolerance and good winter germination. To 36 inches in height.

The experimental design was a randomized complete block analysis of variance design. Four replications of each cover crop were planted. Each replication was 6 feet by 18 feet in size, with each of the four blocks planted down separate middles between vine rows. Soil was disked prior to seeding. Plots were seeded by hand broadcasting, and the middles ring rolled to press the seed into contact with the soil. In 1998, irrigation was provided to assist the seeds to germinate by over head sprinkling. In 1999, germination was dependant on rainfall. Plots were harvested by using quarter quadrat harvesting frames. Samples were oven dried and then weighed. Percentage cover was determined by visual estimation. Cover crop height was measured in 4 locations, and averaged for each plot.

Results: Following are the yield data from the plot:

Cover Crop	**1999 Yield, tons/acre**	**2000 Yield, tons/acre**	**Average of 2 years**
Foenugreek	0.12	0.04	**0.08**
Crimson Clover	2.63	2.76	**2.69**
'Dalkeith' subclover	0.44	0.33	**0.38**
'Koala' subclover	1.48	1.01	**1.24**
'Antas' subclover	1.70	1.41	**1.55**
'Denmark' subclover	0.40	0.76	**0.58**
'Nitro' persian clover	0.36	1.16	**0.76**
'Bolta' balansa clover	1.14	1.06	**1.10**
Santiago burr medic	0.87	0.74	**0.80**
Austrian winter peas	2.44	1.84	**2.14**
Max Organic Mix	2.96	3.73	**3.34**
'Daikon' radish	5.84	3.37	**4.60**
Oilseed radish	5.97	4.36	**5.16**
Yellow mustard	1.79	2.42	**2.10**
Common rye grain	7.45	1.05	**4.25**

'Trios 102' triticale	10.9	2.42	**6.66**
'Juan' triticale	5.48	3.53	**4.51**
Common barley	0.63	3.64	**2.14**
Control (weeds)	0.48	1.07	**0.77**

Following are the data for percent area of the plot that is covered with each selection:

Cover Crop	**% Cover, 1999**	**% Cover, 2000**	**2 Year Average % Cover**
Foenugreek	2.5	8.0	**5.3**
Crimson Clover	72.5	88.25	**80.4**
'Dalkeith' subclover	55.0	65.0	**60.0**
'Koala' subclover	68.75	90.0	**79.4**
'Antas' subclover	76.25	95.0	**85.6**
'Denmark' subclover	42.50	76.25	**59.4**
'Nitro' persian clover	26.25	75.0	**50.6**
'Bolta' balansa clover	60.0	75.0	**67.5**
Santiago burr medic	57.50	71.25	**64.4**
Austrian winter peas	42.50	87.0	**64.7**
Max Organic Mix	35.0	90.25	**62.6**
'Daikon' radish	52.50	88.75	**70.6**
Oilseed radish	57.50	93.0	**75.2**
Yellow mustard	37.50	86.25	**61.9**
Common rye grain	80.0	86.25	**83.1**
'Trios 102' triticale	63.75	75.0	**69.4**

'Juan' triticale	41.25	88.75	**65**
Common barley	9.50	92.0	**50.7**
Control (weeds)	25.0	60.5	**42.7**

Following are the data for the height of each selection:

Cover Crop	**Height in inches, 1999**	**Height in inches, 2000**	**2 year average height, in inches**
Foenugreek	7.4	6.9	**7.1**
Crimson Clover	12.7	18.5	**15.6**
'Dalkeith' subclover	3.1	6.5	**4.8**
'Koala' subclover	4.4	8.0	**6.2**
'Antas' subclover	4.6	11.0	**7.8**
'Denmark' subclover	1.9	6.5	**4.2**
'Nitro' persian clover	6.5	12.5	**9.5**
'Bolta' balansa clover	7.4	12.2	**9.8**
Santiago burr medic	4.7	29.7	**17.2**
Austrian winter peas	18.7	11.0	**14.8**
Max Organic Mix	17.5	21.5	**19.5**
'Daikon' radish	22.1	36.0	**29.0**
Oilseed radish	29.0	54.0	**41.5**
Yellow mustard	21.2	45.0	**33.1**

Common rye grain	43.2	23.7	**33.45**
'Trios 102' triticale	34.4	29.7	**32.0**
'Juan' triticale	38.9	42.2	**40.5**
Common barley	16.5	25.0	**20.7**
Control (weeds)	6.5	10.5	**8.5**

Discussion:

In this trial, many of the selections performed adequately, giving the vineyardist a wide selection of materials to choose from. 1998 was a wet, cool year, and some species didn't perform well at all–barley performed very poorly due to water logged soils. Barley does best in lower rainfall conditions. The two triticales and common rye grain performed well, showing that they have good agronomic vigor, and are good choices for stabilizing newly planted areas. 'Trios' has a lower stature than 'Juan' triticale, which may make it easier to manage during spring tillage and mowing. The mustard and radish selections performed well both years, showing that they are well adapted to the cool wet conditions that often occur in Lake County winters. Among the various clovers, crimson clover and 'Antas' subterranean clover performed the best, providing good cover, yet not growing excessively tall. Austrian winter peas also performed moderately well, and would be a good choice for making nitrogen in the soil. Foenugreek was the only entry that performed very poorly. Seed viability might have been a problem for this selection.

It is clear that there are many cover crop species to choose from that will grow adequately in an upland site in Lake County. Mixes of cover crop species with similar heights and yields would also be worth considering.

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