Perennial Cover Crop Evaluation for Enhanced Vineyard Floor Management

Final Research Report

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Cover crops are an essential tool for a sustainable approach to vineyard floor management. Proper cover crop selection can help decrease herbicide use and mowing costs, as well as improve overall soil health. The objectives of this study are to 1.) Evaluate ease of establishment and persistence for cool season cover crops between vine rows, 2.) Evaluate weed suppression for each perennial cover crop, 3.) Determine crop suitability criteria such as: traffic, drought, and cold tolerance as well as maintenance requirements, 4.) Evaluate cover crop influence on overall soil health. The first year of this project addressed objectives one and two.

Materials and Methods

Two perennial cool season grass trails were established at Virginia Tech's Glade Road Research Center in Blacksburg, Virginia. First trial, a non-irrigated trial, was seeded on September 17, 2012. An irrigated trial was seeded on October 5, 2012. Plot size was 5 feet by 7 feet. One set of plots was not seeded and served as a control. Turf establishment and percent weed cover data was collected 2, 4, 8, and 12 weeks after treatment (WAT) (see Tables 1 to 4). Dominate weeds in the irrigated and non-irrigated plots were: henbit, bittercress, broadleaf dock, and buckhorn plantain. On November 20, 2012, Lontrel (clopyralid) was applied at 2/3 pt/A (0.5 fl oz/gal); and on December 4, 2012, Crossbow (2,4-D + triclopyr) was applied at 1.5 oz/gal for broadleaf weed control. These plots have not been mowed.

A warm season trail was seeded on June 25, 2012 (Table 5 and 6). Dominant weed species in June, July and August were morningglory, galinsoga, yellow foxtail, carpetweed, Canada thistle, and dandelion. In September, corn speedwell and Canada thistle began to flourish. Galinsoga and carpetweed competed with all cover crops thus two applications of Lontrel at 1/3 pt/A was applied for broadleaf weed control. All warm season plots were mowed on August 15, 2012 at a 4 inch mowing height. This damaged the blue grama plots. Yellow foxtail invaded the plots during the summer and was the predominant weed following the Lontrel applications.

Two trials were established in Virginia Beach on September 21, 2012 and both were irrigated studies. Plot size was 5 feet by 7 feet. One set of plots was not seeded and served as a control. Speedzone was applied at 2 pints per acre on 12/3/12 for broadleaf weed control to all plots except those containing microclover.

Results and Discussion

In the Blacksburg trials, the highest turf cover at 12 weeks after seeding (WAT) in the non-irrigated study occurred in the Rough and Ready mix, 'Applaud' perennial ryegrass, and 'Fawn' tall fescue (Table 1). The hard fescue and Kentucky bluegrass established slower than perennial ryegrass or tall fescue. By May, 2013, though, all had 90% cover or greater. Percent

weed cover was inversely related to percent turf cover (Table 2). Weed cover was low in May 2013 in the seeded plots due to crop competition combined with the herbicide applications made the previous fall.

In the irrigated trial, the highest turf cover early in the trial occurred in the Rough and Ready mix and in Applaud perennial ryegrass (Table 3). By May 2013, however, all cultivars contained 88% or greater cover. The herbicide applications eliminated the broadleaf weeds in these trials (Tables 2 and 4), which allowed for improved turf establishment.

In the warm-season trial, plots containing blue grama or annual ryegrass established quicker than the monoculture of zoysiagrass by 8 WAT (Table 5). By 12 WAT, all seeded plots contained about 70% turf cover. When evaluated in spring 2013, turf cover ranged from 60 to 75% depending on turf species. Weed cover ranged from 25 to 39% in the seeded plots in spring.

In the Virginia Beach trials, On December 11, 2012, 5 WAT, plots seeded with Kentucky bluegrass, hybrid bluegrass, or zoysiagrass plus Gotham hard fescue had less than 20% cover (Table 7). Other treatments resulted in 40 to 66% cover at this time. By June 2013, overall highest cover was with the tall fescue cultivars DTT43, DTT 20, Fawn, and Justice, ranging from 55 to 80% cover. Plots with perennial ryegrass, although having high cover in January, had unacceptable cover in June, probably due to heat and drought stress. The bluegrasses have not established successfully. Lowest weed cover in June was observed in plots of Fawn and Justice tall fescues, with the primary weeds being white clover and buckhorn plantain. Weed cover was inversely related to turf cover (Table 8). Speedzone was applied in December for winter weed control to all plots except those containing microclover.

Aurora Gold hard fescue did not establish in our trial (Table 9). Perhaps there was some problem with the seed batch. The other two hard fescues, Bighorn GT and Gotham, had approximately 45% cover by 16 WAT and 50 to 53% cover by June.

Conclusions

All of the cool season grasses eventually attained excellent cover in Blacksburg, although certain ones, including perennial ryegrass and Fawn tall fescue, established faster. The warm-season grasses have lower cover 6 months after seeding than the cool-season grasses, but the plots containing zoysia should increase over time as this grass spreads vegetatively by stolons. Only the tall fescue cultivars are providing acceptable cover in Virginia Beach the following spring after seeding. Perennial ryegrass established quickly but cover decreased over time, probably due to heat and drought. The bluegrasses did not establish, probably due to weed competition resulting from slower cover crop germination. Different grasses will be needed for vineyards in the eastern part of Virginia compared to the western part.

Technology Transfer

On December 11, 2012 we hosted the quarterly New River Valley Grape Growers Meeting at the Glade Road Research Center. Mr. Charles Lytton, Giles County Extension, assisted us in conducting the meeting. We showed the three trials underway at the center, along with distributing a research summary sheet to the attendees. Attendance at this meeting included 27 local growers and vintners from Giles, Pulaski, Bedford, Roanoke and Montgomery counties. One June 9, 2013, the trials were discussed at the River Valley Grape Growers

Meeting in Giles County. The importance of cover crops was discussed at the March 21, 2013 IPM in the Vineyard Workshop near Leesburg and at the April9 IPM in the Vineyard Workshop near Fishersville.

Table 1.Mean percent turf cover for perennial non-irrigated cool season cover crops seeded on September 17, 2012 in Blacksburg.

		% turf cover						
Treatment	**Seeding Rate (lb/1000 ft^2)**	**2 WAT**	**4 WAT**	**8 WAT**	**12 WAT**	**20 WAT**	**24 WAT**	**28 WAT**
'Bighorn GT' Sheep /Hard Fescue	2	0	5	18	22	68	90	90
'DTT-43' Dwarf Tall Fescue	2	0	16	38	45	66	93	92
'DTT-20' Dwarf Tall Fescue	2	0	13	29	44	71	95	93
'Rough and Ready' Microclover mix*	5	2	76	86	90	95	99	95
'Companion Grass ' Cover Crop Mixture**	1	2	28	53	65	86	99	92
'Applaud' Perennial Ryegrass	5	6	92	93	93	97	100	100
'Fawn' K31	2	4	83	90	91	97	98	95
'Midnight' Kentucky Bluegrass	1	0	4	8	15	49	92	90
'Silverlawn' Creeping Red Fescue	2	0	34	63	66	85	97	97
Unseeded (control)	0	0	0	0	0	0	0	0
LSD (p=0.05)		2	10	11	10	11	9	10

*34% Quatro Sheep Fescue, 30% Eureka II Hard Fescue, 30% PR8821 Perennial Ryegrass, 5 % Microclover

**80% PR8821 Perennial Ryegrass, 20% Creeping Red Fescue

Table 2. Mean percent weed cover for non-irrigated cool season perennial grass covers seeded on September 17, 2012 in Blacksburg.

Treatment	Seeding Rate (lb/1000ft^2)	2 WAT	4 WAT	8 WAT	12 WAT	20 WAT	24 WAT	28 WAT
'Bighorn GT' Sheep /Hard Fescue	2	0	5	35	5	7	10	10
'DTT-43' Dwarf Tall Fescue	2	0	3	41	0	7	7	8
'DTT-20' Dwarf Tall Fescue	2	0	3	41	0	9	5	6
'Rough and Ready' Microclover mix	5	0	0	5	0	5	1	5
'Companion Grass ' Cover Crop Mixture	1	0	1	19	0	9	1	7
'Applaud' Perennial Ryegrass	5	0	0	2	0	2	0	0
'Fawn' K31	2	0	0	4	0	3	2	5
'Midnight' Kentucky Bluegrass	1	0	4	44	2	5	8	10
'Silverlawn' Creeping Red Fescue	2	0	2	24	0	5	3	3
Unseeded (control)	0	0	5	69	5	12	51	95
LSD (p=0.05)		-	2	9	2	5	3	5

*On November 20, 2012, Lontrel was applied at 2/3 pt/A (15 ml/gal).

** On December 4, 2012, Crossbow was applied at 1.5 oz/gal.

Table 3. Mean percent turf cover for perennial irrigated cool season cover crops seeded on October 5, 2012 in Blacksburg.

		% turf cover					
Treatment	**Seeding Rate (lb/1000ft^2)**	**2 WAT**	**4 WAT**	**8 WAT**	**16 WAT**	**20 WAT**	**24 WAT**
'Bighorn GT' Sheep /Hard Fescue	2	0	4	6	67	91	89
'DTT-43' Dwarf Tall Fescue (Allied Seed Co.)	2	0	8	10	64	94	92
'DTT-20' Dwarf Tall Fescue (Allied Seed Co.)	2	0	9	10	68	96	93
'Rough and Ready' Microclover mix	5	6	40	43	88	97	92
'Companion Grass ' Cover Crop Mixture	1	2	18	24	82	99	95
'Applaud' Perennial Ryegrass	5	15	55	63	98	100	100
'Fawn' K31	2	8	33	35	97	95	90
'Midnight' Kentucky Bluegrass	1	0	2	4	45	90	88
'Silverlawn' Creeping Red Fescue	2	0	11	14	86	92	92
Unseeded (control)	0	0	0	0	0	0	0
LSD (p=0.04)		5	8	11	9	10	11

*On November 20, 2012, Lontrel was applied at 2/3 pt/A (15 ml/gal).

** On December 4, 2012, Crossbow was applied at 1.5 oz/gal.

Table 4. Mean percent weed cover for perennial irrigated cool season cover crops seeded on October 5, 2012 in Blacksburg.

		% weed cover					
Treatment	**Seeding Rate (lb/1000ft^2)**	**2 WAT**	**4 WAT**	**8 WAT**	**16 WAT**	**20 WAT**	**24 WAT**
'Bighorn GT' Sheep /Hard Fescue	2	1	20	1	2	8	11
'DTT-43' Dwarf Tall Fescue (Allied Seed Co.)	2	1	15	1	3	6	8
'DTT-20' Dwarf Tall Fescue (Allied Seed Co.)	2	1	15	2	2	6	10
'Rough and Ready' Microclover mix	5	0	5	1	1	3	8
'Companion Grass ' Cover Crop Mixture	1	0	10	2	1	1	5
'Applaud' Perennial Ryegrass	5	1	5	0	0	0	0
'Fawn' K31	2	2	5	0	0	5	10
'Midnight' Kentucky Bluegrass	1	1	25	1	2	9	11
'Silverlawn' Creeping Red Fescue	2	2	15	1	2	8	8
Unseeded (control)	0	2	25	2	5	25	76
LSD (p=0.05)		1	8	1	3	4	5

*On November 20, 2012, Lontrel was applied at 2/3 pt/A (15 ml/gal).

** On December 4, 2012, Crossbow was applied at 1.5 oz/gal.

***Less weeds were present 8 WAT due to herbicide application

Table 5a. Mean percent turf cover for perennial warm season cover crops seeded on June 25, 2012 in Blacksburg.

		% turf cover				
Treatment	**Seeding Rate (lb/1000ft^2)**	**2 WAT**	**4 WAT**	**8 WAT**	**12 WAT**	**16 WAT**
'Bad River' blue grama	1	13	41	73	75	71
'Zenith' zoysia	2	1	0	35	63	63
'Zenith' zoysia + ryegrass*	2 + 1	14	58	69	69	66
'Bad River' blue grama + ryegrass*	1 +1	6	43	73	73	70
Unseeded (control)	0	0	0	0	0	0
LSD (p=0.05)		10	11	13	10	11

* annual ryegrass was from Green Seed Company, Knoxville, TN; Lot #L105-10-16G (variety: not stated)

Table 5b. Mean percent turf cover for perennial warm season cover crops seeded on June 25, 2012 in Blacksburg.

		% turf cover				
Treatment	**Seeding Rate (lb/1000ft^2)**	**20 WAT**	**28 WAT**	**32 WAT**	**36 WAT**	**40 WAT**
'Bad River' blue grama	1	23	71	72	70	71
'Zenith' zoysia	2	66	70	72	65	64
'Zenith' zoysia + ryegrass*	2 + 1	79	81	80	79	75
'Bad River' blue grama + ryegrass*	1 +1	44	41	45	40	60
Unseeded (control)	0	0	0	0	0	0
LSD (p=0.05)		14	11	12	15	11

Table 6a. Mean percent weed cover for perennial warm season cover crops seeded on June 25, 2012 in Blacksburg.

		% weed cover				
Treatment	**Seeding Rate (lb/1000ft^2)**	**2 WAT**	**4 WAT**	**8 WAT**	**12 WAT**	**16 WAT**
'Bad River' blue grama	1	9	41	14	20	26
'Zenith' zoysia	2	15	80	30	19	24
'Zenith' zoysia + ryegrass	2 + 1	12	22	19	9	21
'Bad River' blue grama + ryegrass	1 +1	12	37	18	31	31
Unseeded (control)	0	19	79	24	38	53
LSD (p=0.05)		6	17	15	11	17

*August 16, 2012 Lontrel was applied at 1/3 pt/A (7 ml/gal).
**August 30, 2012 Lontrel was applied at 1/3 pt/A (7 ml/gal).
***November 20, 2012, Lontrel was applied at 2/3 pt/A (15 ml/gal).

Table 6b. Mean percent weed cover for perennial warm season cover crops seeded on June 25, 2012 in Blacksburg.

		% weed cover				
Treatment	**Seeding Rate (lb/1000ft^2)**	**20 WAT**	**28 WAT**	**32 WAT**	**36 WAT**	**40 WAT**
'Bad River' blue grama	1	23	20	25	29	29
'Zenith' zoysia	2	20	15	28	32	36
'Zenith' zoysia + ryegrass	2 + 1	15	6	19	20	25
'Bad River' blue grama + ryegrass	1 +1	38	31	50	49	39
Unseeded (control)	0	63	34	60	80	95
LSD (p=0.05)		12	11	15	12	21

*August 16, 2012 Lontrel was applied at 1/3 pt/A (7 ml/gal).
**August 30, 2012 Lontrel was applied at 1/3 pt/A (7 ml/gal).
***November 20, 2012, Lontrel was applied at 2/3 pt/A (15 ml/gal).

Table 7. Turf cover in the first Virginia Beach trial.

Treatment	Seeding rate lb/1000 ft2	Percent turf cover 10/5/12 2 WAT	10/24/12 5 WAT	12/3/12 10 WAT	1/10/13 16 WAT	6/28/13 40 WAT
Companion grass	1	11	40	58	69	31
Rough and Ready	5	34	50	66	69	48
DTT 43	4	18	49	58	70	68
DTT 20	4	18	48	59	64	55
K 31 Fawn	4	14	50	65	60	80
Justice tall fescue	4	34	61	74	84	70
Mallard Ky bluegrass	1.5	3	5	15	28	16
Perennial ryegrass	4	55	66	74	84	21
Hybrid bluegrass	1.5	7	9	14	11	19
Zoysia + perennial ryegrass	1.5 2	33	53	68	83	20
Blue Grama	4	54	60	9	25	1
Zoysia + Gotham	1.5 2	9	16	23	45	58
No seed		0	2	5	0	3
LSD (P=.05)		11	10	11	18	15

Table 8a. Weed cover in the first Virginia Beach trial.

Treatment		Seeding rate		% weed cover 11/21/12 9 WAT			
				Henbit	Carolina geranium	Common chickweed	Speedwell
1	Companion grass	1	lb/1000 ft2	7	8	5	5
2	Rough and Ready	5	lb/1000 ft2	5	11	6	2
3	DTT 43	4	lb/1000 ft2	10	7	7	2
4	DTT 20	4	lb/1000 ft2	5	9	7	3
5	K 31 Fawn	4	lb/1000 ft2	5	10	5	3
6	Justice tall fescue	4	lb/1000 ft2	4	6	7	2
7	Mallard Ky bluegrass	1.5	lb/1000 ft2	11	16	21	3
8	Perennial ryegrass	4	lb/1000 ft2	3	5	5	1
9	Hybrid bluegrass	1.5	lb/1000 ft2	8	16	7	2
10	Zoysia +	1.5	lb/1000 ft2	4	5	9	1
10	perennial ryegrass	2	lb/1000 ft2				
11	Blue Grama	4	lb/1000 ft2	18	9	10	5
12	Zoysia	1.5	lb/1000 ft2	9	24	7	3
12	Gotham	2	lb/1000 ft2				
13	No seed			18	5	12	7
LSD (P=.05)				7.4	5.9	11.0	4.0

Table 8b. Weed cover in the first Virginia Beach trial.

Treatment		Seeding rate		% cover 11/21/12 9 WAT			
				Shepherd's purse	Buttercup	Vetch	Buckhorn plantain
1	Companion grass	1	lb/1000 ft2	7	13	1	3
2	Rough and Ready	5	lb/1000 ft2	5	4	3	3
3	DTT 43	4	lb/1000 ft2	2	4	6	2
4	DTT 20	4	lb/1000 ft2	14	10	5	3
5	K 31 Fawn	4	lb/1000 ft2	8	11	6	2
6	Justice tall fescue	4	lb/1000 ft2	8	5	7	3
7	Mallard Ky bluegrass	1.5	lb/1000 ft2	6	8	10	4
8	Perennial ryegrass	4	lb/1000 ft2	2	4	10	3
9	Hybrid bluegrass	1.5	lb/1000 ft2	13	12	6	13
10	Zoysia +	1.5	lb/1000 ft2	1	4	9	3
10	perennial ryegrass	2	lb/1000 ft2				
11	Blue Grama	4	lb/1000 ft2	2	9	8	3
12	Zoysia	1.5	lb/1000 ft2	6	14	2	15
12	Gotham	2	lb/1000 ft2				
13	No seed			8	12	10	5
LSD (P=.05)				11.3	6.2	8.0	12.2

Table 8c. Weed cover in the first Virginia Beach trial.

Treatment	Seeding rate lb/1000 ft2	Weed cover 11/21/12 9 WAT	Weed cover 6/28/13 40 WAT	Clover cover 7/3/13 41 WAT	Buckhorn plantain cover 7/3/13 41 WAT
Companion grass	1	49	45	12	33
Rough and Ready	5	38	36	14	28
DTT 43	4	40	20	12	11
DTT 20	4	55	30	14	21
K 31 Fawn	4	50	8	5	14
Justice tall fescue	4	41	16	9	16
Mallard Ky bluegrass	1.5	77	63	14	29
Perennial ryegrass	4	33	44	14	33
Hybrid bluegrass	1.5	76	65	9	46
Zoysia + perennial ryegrass	1.5 2	36	50	13	35
Blue Grama	4	63	70	20	26
Zoysia + Gotham	1.5 2	79	38	13	35
No seed		77	73	6	39
LSD (P=.05)		18	16	13	18

Table 9. Turf and weed cover in the second Virginia Beach trial.

Treatment	Seeding rate lb/ 1000 ft2	Percent turf cover					% weed cover	
		10/5/12	10/24/12	11/28/12	1/10/13	6/28/13	11/16/12	6/28/13
		2 WAT	5 WAT	10 WAT	16 WAT	40 WAT	8 WAT	40 WAT
Bighorn GT	2	7	19	34	43	50	89	45
Aurora Gold	2	1	2	15	0	1	100	80
Gotham	2	11	23	34	46	53	99	43
LSD (P=0.05)		4	9	7	8	14	18	16