EVALUATION OF CHEMICAL AND MECHANICAL METHODS FOR MAINTAINING STAND PRODUCTIVITY IN FINE FESCUE SEED CROP PRODUCTION SYSTEMS IN THE ABSENCE OF OPEN FIELD BURNING, 2010

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There are no effective, non-thermal post-harvest residue management practices available that maintain an economic yield over the life of the stand (5 years +) in fine fescue seed production for western Oregon. Seed yields typically decline following the first harvest in the absence of field burning. Yield reductions ranged from 10 to more than 50% when non-thermal treatments such as baling and flail chopping the stubble were compared with burning (Young et al., 1998, Zapiola et al., 2006). Aggressive stubble management improved yields over baling alone, but was still lower yielding than field burning and not an economic substitute given the added cost of baling and flail chopping.

The primary obstacle in fine fescues and Kentucky bluegrass is the need to expose the lower crown area at the soil surface (Meints et al., 2001, Chastain et al., 1997) and to minimize the amount of crop residue remaining. Research has been conducted on both fine fescues and Kentucky bluegrass in a effort to determine a way to substitute field burning with a nonthermal mechanical method. Vigorous fall tillers that are the major contributor to seed yield originate from the crowns of well established plants (Canode and Law, 1979). In addition to the need for crown tillers to predominate, the creeping habit of red fescue also can cause excessive crowding in the stand and limit the size and capability of the new tillers. If stand conditions are crowded in the fall, then fewer tillers are sufficiently mature to be vernalized, a process required for flowering.

With these two factors in mind, residue management and stand crowding, this research will determine if there is a lower cost way of encouraging strong tiller development in the fall using two different strategies:

1) Row spraying technology (Young, et al., 1996) to thin and maintain defined rows.
2) No-till row cleaners to expose row strips in regular intervals. Crown exposure and improved light penetration should increase growth in exposed rows and cover areas between the rows with a straw mulch.

Procedures

Trials were established in cooperating grower fields. Four fields received treatments that included row-spray treatments and/or mechanical row cleaner (thatching) treatment. Two fields were younger stands (2nd and 3rd year crop) and two fields were older (5th and 6th year crop). Three of the fields had replicated trials and one had strips of different treatments applied. All sites were either baled and flail chopped or had the full straw load flail chopped back on the stand. Row-spray and row- cleaner treatments were applied in the late fall using the equipment purchased with funds granted for this project. A tractor from one of the farms was used to operate the equipment. One younger and one older stand also had a spring applied row-spray treatments. All plots were field scale ~25-50 ft. (wide) by ~300 ft. (long), which allowed for standard harvest using grower equipment.

In addition to harvesting for seed yield, foot-row samples were taken to determine fertile tiller number, height of crop at maturity, and specific dry weight (dry wt/tiller).

Results

Site 1 – *Lustrous* creeping red fescue, Doerfler Rd.

This site is an older stand of creeping red fescue that was declining in yield. Treated areas all had a full straw load flail chopped and left in the field. The disk/re-grow treatment was done by the grower to renovate the stand. This strip was disked after harvest several times and left to re-grow. The untreated control only had the full straw load left on the field. The thatch treatment was applied by going over the area 4-5 times with the row cleaner in an attempt to cut out portions of the stand. The fall row spray (glyphosate at 2% solution) was applied in November with nozzles set to sprray a 6-inch wide band on 12 inch centers in an attempt to take out about 1/2 - 2/3 of the stand. The spring row spray was applied in mid-March at the onset of rapid re-growth.

Seed yields were dramatically lower in the spring row-spray treatment (Table 1). There were also fewer and shorter fertile tillers in this treatment (Table 6), which may have caused the lower yields. The effective spray out was about 75% of the stand and it was unable to recover. All other treatments were comparable in yield. Regrowth on the spring row-spray was very good after harvest, as the stand looked healthy with strong rows formed. These strips will be harvested in 2011 to determine the long-term effects on using row-spraying to renovate the stand.

Table 1. Response to residue management treatments in Lustrous creeping red fescue, Doerfler Rd, 2010.

Residue Treatment	Clean-out	Seed yield	1000 seed wt.
	(%)	(lb/a)	(g)
Disk/regrow	17.9	1018	1.014
Untreated	19.0	1047	1.028
Thatch	18.0	1017	1.066
Fall row-spray	19.3	931	1.034
Spring row-spray	20.3	529	1.097

Site 2 – *Foxfire* creeping red fescue, Lorence Rd.
This site is an older stand of creeping red fescue that was declining in yield. A three acre section of the field was reserved to apply treatments. One-half of the area had the full straw load flail chopped in place and the other half was baled before flail chopping. The rest of the field was open burned. Row-spray (RS) treatments were applied across both residue regimes in November. Treatment combinations are listed in Table 2. The fall row-spray (glyphosate at 2% solution) was applied in November with nozzles set to spray a 6-inch wide band on 12 inch centers with the aim of taking out about 1/2 - 2/3 of the stand. The row-cleaner was operated in unison with the row-sprayer to thatch the strips between the nozzles that were not receiving the row-spray.

The full straw main plot treatment reduced seed yields compared to the bale + flail treatments by about 200 pound per acre. There was also higher cleanout with the full straw load residue treatment as well as fewer fertile tillers (Table 6). Seed yield was somewhat lower in the RS+RC treatment. The two row-spray treatments were applied on sequential days and the effect of the row-spraying was much greater in the second day due to better spray conditions when the RS+RC treatments were applied. This may explain some of the differences in seed yield. Enough of the stand was taken out that the remaining stand was unable to compensate for the difference. Fertile tiller counts were significantly lower in the RS+RC treatment (see Table 5) and likely contributed to treatment differences. Seed yields were measured from windrows combined in the adjacent open burn area to assess a reference open burn field yield. The open burn strips produced ~300 pounds per acre more than the non-burn residue regime. Plots will be harvested in 2011 to determine additional residual effects on row-spraying treatment.

Table 2. Response to residue management treatments in Foxfire creeping red fescue, 2010.

Residue Treatment	Clean-out	Seed yield	1000 seed wt.
	(%)	(lb/a)	(g)
Residue main factor			
Full straw FC 1X	15.6 a[1]	1043 b	1.09
Bale+FC 1X	12.7 b	1258 a	1.10
LSD 0.05	0.7	208	NS
P value	0.003	0.047	
Row-spray factor			
Untreated	14.3	1181 (ab)	1.10
RS+RC	14.2	1012 (b)	1.09
RS only	13.9	1259 (a)	1.08
LSD 0.05(0.10)	NS	(170)	NS
P value	0.520	0.082	
Field comparison			
Open burn	14.5	1499	1.14

[1] Numbers followed by the same letter are not significantly different by Fishers protected LSD 0.05 (0.10)

Site 3 – *Lustrous* creeping red fescue, Riches Rd.
This site is a stand of creeping red fescue in its fourth crop harvest. The area for the row-spray treatments was baled and flail chopped. The design of this site was a randomized complete block with treated (row-sprayed) and untreated plots. Treatments were applied as in the previous trials. Row-spray treatments were not very effective in taking out much of the stand and thus, there was very little difference in the seed yields (Table 3) comparing the row-spray treatment with the untreated plots. Seed yield from open burned areas adjacent to the non-burned area was about 250 pounds per acre greater.

Table 3. Response to residue management treatments in Lustrous creeping red fescue, Riches Rd, 2010.

Residue Treatment	Clean-out	Seed yield	1000 seed wt.
	(%)	(lb/a)	(g)
Bale+Flail only/Row-spray factor			
Untreated	14.5	1255	1.068
Rowspray only	14.7	1183	1.074
Field comparison			
Open burn	15.8	1481	1.063

Site 4 – *Wendy Jean* creeping red fescue, Silver Falls Hwy. This site is a continuation of trials that were establish in the fall of 2008 after the first seed crop harvest. The 34 acre field was divided into four equal quarters to look at different residue treatments over the life of the stand. Table 4 lists the sequence of post-harvest residue treatments planned for the second through fourth seed crop. One quarter of the field was open burned (OB) (as a reference treatment) and one quarter of the field was managed with bale+flail chop (B + FC) residue treatment each year and not be open burned. The other two quarters will each alternate between B + FC and OB on either odd or even years to determine whether yields can be maintained with alternate year OB. The row-spray trial is imposed only within the non-burn quarter of the field. Row-spray treatments were applied in the fall 2009 and the spring 2010 to determine if the timing is important in maintaining or renovating stands. The row-spray trial is a five treatment randomized complete block with three replications. Final treatments are scheduled to go on fall/winter, 2010 -2011

In the quartered field study, the seed yields for 2009 (2nd crop) were about the same for either the B + FC or the OB treatments (only two treatments for 2009). However, in 2010 (3rd crop), the two field sections that received the B + FC treatment yielded about 300-400 pounds per acre less than the OB treatments. Both 2009 and 2010 OB sections yielded comparably even though the previous year one of the sections was a B + FC treatment. In contrast, the two sections that had the B + FC treatment in 2009 and 2010 had lower yields. For this site, the current year residue treatment had the greatest effect on the subsequent seed crop.

Seed yields for fall row-spray and untreated were very similar and very close to the field yields that were measured for the NW quarter of the field (Table 5). The spring row-spray removed over 75% of the stand resulting in a reduction of fertile tillers. The spring row-spray plots were unable to compensate for this loss of fertile tillers (Table 6) causing the seed yield to drop dramatically to less than half the yield of the other treatments.

Table 4. Response to residue management treatments in Wendy Jean creeping red fescue, 2009 – 2010.

Post-harvest residue treatment			Field Qtr.	Seed yield 2009	Seed yield 2010	1000 seed wt.
------ Crop year --------				------(lb/a) -----		(g)
08/09	**09/10**	**10/11**				
B+FC	B+FC	B+FC	NW	1710	1822	1.14
B+FC	OB	B+FC	SW	n/a	2254	1.17
OB	B+FC	OB	NE	n/a	1909	1.22
OB	OB	OB	SE	1690	2275	1.16

Table 5. Response to row-spray treatments in Wendy Jean creeping red fescue, 2010.

Residue Treatment	Clean-out	Seed yield	1000 seed wt.
	(%)	(lb/a)	(g)
Row spray factor			
Untreated	19.8	1884	1.16
Spring row-spray	26.0	740	1.21
Fall row-spray	17.0	1940	1.13

Table 6. Harvest tiller data, 2010.

Location Residue Treatment	----Per ft.-row-- Total dry wt.	Fertile tillers	Dry wt. per tiller	Plant height
	(g)	(no.)	(g)	(cm)
Lustrous creeping red fescue, Doerfler Rd.				
Disk/regrow	50.8	173	0.26	64.9
Untreated	87.8	326	0.23	74.3
Thatch	76.6	315	0.23	71.6
Fall rowspray	75.0	280	0.23	74.7
Spring rowspray	41.8	133	0.25	61.3
Foxfire creeping red fescue, Lorence Rd.				
Residue				
Full straw FC 1X	53.8	184	0.22	70.1
Bale + FC 1X	60.1	233	0.21	69.9
P-Value	NS	0.089	NS	NS
Row treatment				
Untreated	58.1	237 (a)	0.19	70.2
RS + Thatch	46.6	150 (b)	0.24	68.2
RS	66.2	238 (a)	0.21	71.6
P-Value	NS	0.058	NS	NS
Wendy Jean creeping red fescue, Silver Falls Hwy.				
Fall RS + Thatch	74.1	266 (ab)	0.30	77.8
Fall RS only	73.8	257 (ab)	0.23	76.6
Untreated	75.8	246 (ab)	0.25	74.6
Spring RS	56.0	129 (b)	0.26	74.3
Untreated	90.3	347 (a)	0.21	77.6
P-Value	NS	0.089	NS	NS

[1] Numbers followed by the same letter are not significantly different by Fishers protected LSD 0.05 (0.10)

Benefits and Impacts

These trials were established to determine what would be the best, low cost post- harvest management method in the absence

of burning, so open burn treatments were not incorporated into the primary treatment areas. Row-spraying is effective at reducing the stand and taking out excessive growth. A major finding in the 2010 data is that, in most cases, spraying out at least half of the stand did not generally reduce yields (except the RS+RC treatment at Site 2). The plants were able to compensate for this loss in stand. Spring row-spraying generally had a negative effect on the current year crop, but the same treatments also have vigorous growth in the subsequent fall. The thatch treatment needs to be much more aggressive in future to remove a larger portion of the stand than was done in this trial. These plots will be followed to harvest in 2011 to determine if there is a carryover in the improvement of stand productivity. At Site 4 there appears to be less effect on seed yield in the second year (early stand life) without burning but in the third crop, yields were declining compared to the open burn treatment. This would indicate that if a grower would want to reduce the number of fields that will be open burned, it may be best to focus open burns on older stands and try alternate treatments in the second year to keep the stand productive. This strategy was evident at Site 4 where there was a bale + flail chop in 2008 followed by an open burn in 2009. This area did as well as the continuous open burn treatments. In contrast the site that was open burned in 2008 then bale+flail in 2009 had a drop off in yield after one year on no-burning. Three of these sites will be followed through the 2011 harvest.

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