Tillage and establishment systems in annual ryegrass seed production

The acreage of annual ryegrass has been among the most stable of the grass seed crops over the past 35 years and as such is an important contributor to the economic welfare of Oregon seed producers. This stability and need for a crop on low productivity soils means that annual ryegrass has been grown on some land continuously for decades without rotation. The long-term influences of continuous cropping of annual ryegrass has not been examined nor have any long-term practices been evaluated in annual ryegrass seed production.

Experimental approach:

Trials have been conducted at the long-term study site located on Hyslop Farm for the past 9 years. Gulf annual ryegrass was used in each year of the study. The following tillage and crop establishment systems have been examined:

1. Continuous conventional tillage (CT) and planting system
2. Continuous no-till (NT) planting system
3. NT/CT cycle (alternate year tillage)
4. Volunteer/CT cycle (alternate year tillage)
5. Burn and NT/CT cycle (alternate year tillage)
6. Volunteer/NT/CT cycle (tillage every 3rd year)

Crop residues were flail-chopped but not removed from plots. In the burn and NT treatment, residues were not flailed prior to burning. Conventional tillage involved primary tillage by moldboard plow followed by disking and other secondary tillage operations required as needed to produce a seedbed for planting. No-till planting was done with a Great Plains no-till drill, but the same drill using different settings was used to plant the CT stands. In the volunteer treatment, seed shed from the previous crop was the source of seed for establishment of the stand and rows were created by row-spray removal of approximately 75% of the stand. No tillage was done in the volunteer treatment.

Findings:

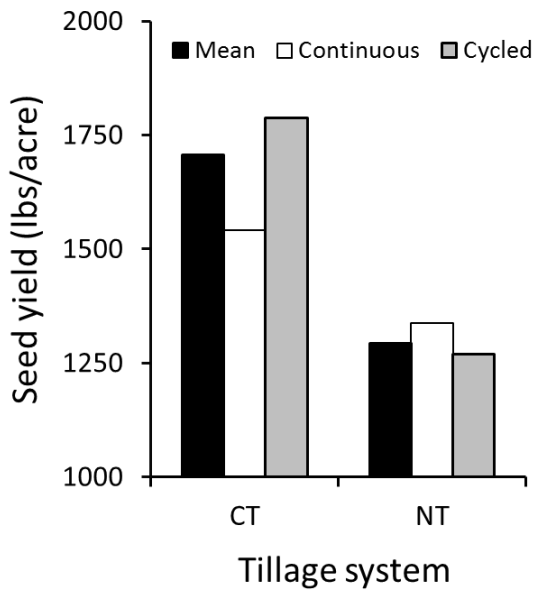
After eight years, differences among tillage and stand establishment system practices are emerging (Table 1). The lowest seeds yields were observed when continuous NT practices were employed. Seed yield in continuous NT was 15% lower than continuous CT, the predominant system employed by valley seed growers for producing annual ryegrass. In fact, over the 8-year period, the loss in seed yield in the continuous NT was 1632 lbs/acre – thus a grower employing continuous NT would have lost a bit more than one year of seed yield over the period compared to continuous CT.

Table 1. Annual ryegrass results after 8 years.

System	Tillage	Seed yield	Seed weight
	years	lbs/acre	mg
Continuous CT	8	1541b†	3.17b
Continuous NT	0	1337a	3.05a
NT/CT	4	1489b	3.05a
Volunteer/CT	4	1487b	3.06a
Burn and NT/CT	4	1701c	3.08a
Volunteer/NT/CT	2	1491b	3.04a

Increased frequency of tillage from zero in the continuous NT to once every other year (NT/CT) boosted yields so that they were equivalent to continuous CT. Mixing in volunteer crop establishment and alternating with CT produced yields that were not different from the NT/CT system, without increasing the frequency of tillage over the NT/CT system. Yields from volunteer establishment (1280 lbs/acre) were not different from that obtained with NT establishment (1292 lbs/acre). A 3-year cycle of volunteer establishment and NT/CT also produced yields similar to the NT/CT and continuous CT systems but the frequency of tillage was reduced to once every 3 years. Disturbance of residue in preparation of the seedbed in an alternate-year cycle produced an overall increase in yield over the continuous NT system.

Figure 1. Effect of tillage systems on seed yield.



Highest seed yield over the 8-year period was found in the burn and NT/CT cycle. Removal of residue by burning was accompanied by disturbance of residues in seedbed preparation in the CT portion of the alternate-year cycle. The combination of residue management on an alternate year basis in the burn and NT/CT system produced a 10% increase in yield over continuous CT. Increased yield in did not primarily come from the burn + NT portion (1563 lbs/acre) of the cycle, rather CT (1839 lbs/acre) was greatly improved by having the burn + NT present in the cycle.

Yields attained by the two tillage systems varied with frequency of use (Figure 1). Yields from CT were increased by 16% when cycled with NT, volunteer, or burn + NT over continuous CT. On the other hand, yields from NT were the same whether they were continuous or cycled. Yields in NT were lessened because of predation by slugs. The best yield performance of NT came when the practice was coupled with burning. The results suggest that moderate frequency of tillage with disturbance of crop residues and occasional removal of residues are required to produce the best seed yield over time in annual ryegrass. Seed weight was greatest with continuous CT; however, the differences observed among tillage and establishment systems were primarily attributable to seed number rather than seed weight.

Changes in soil carbon and organic matter are small in the short-term. Nevertheless, trends for increased carbon and organic matter were evident in continuous NT with these effects most pronounced in the uppermost portion of the soil profile.

For more information contact:
Thomas G. Chastain, Ph.D.
Department of Crop and Soil Science 351C Crop Science Building
Phone: 541-737-5730 http://blogs.oregonstate.edu/seedproduction/

Oregon State UNIVERSITY