

# SOIL CARBON BUDGET FOR ANNUAL AND PERENNIAL RYEGRASS GROWN FOR SEED

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## Summary

There is much interest in carbon (C) sequestration (C accounting) in cropping systems due to the potential for agriculture to participate in ‘Cap and Trade’ opportunities, or purely as a matter of understanding soil quality. Here we have constructed C budgets for two temperate grass species, perennial ryegrass (*Lolium perenne* L.) (Table 1) and annual ryegrass (*L. multiflorum* Lam.) (Table 2). Data were collected from western Oregon grown seed crops. Both data sets are comparable to what was previously reported for a 12-yr-old pasture (mixture of annual and perennial grasses) in western Oregon near Corvallis, OR (Sharrow and Ismail, 2004) of 40,980 kg C ha<sup>-1</sup> (0-15cm soil depth). We hypothesize that most temperate grass systems grown in western Oregon that are not limited by water or nutrients will have similar C budgets. It has been shown that sometimes soil C in grass seed cropping systems, over the long term, can be affected by crop rotation and residue management (Griffith et al., 2010). Usually, however, that is not the norm. Regardless, soils of grass seed production systems in western Oregon have high organic C levels (Table 3), greater than those frequently observed in conventional cropping systems that involve annual soil disturbance for crop establishment. Future reports will construct more precise C budgets with more subcomponents (e.g., longer vs. shorter term sequestered C), but these data establish a baseline that will be useful for evaluating C cycling in grass seed production systems.

## References

- Griffith, S.M., J.H. Davis, R.P. Dick, G.M. Banowetz, and J.J. Steiner. Crop rotation and straw residue effects on soil carbon in three grass seed cropping systems of western Oregon. In Young III, W.C. (ed.) 2009 Seed Production Research at Oregon State University, USDA-ARS Cooperating. Dep. Crop and Soil Science Ext/CrS 129, April. Corvallis, OR. 2010. (Technical Bulletin)
- Sharrow, S.H. and S. Ismail. 2004. Carbon and nitrogen storage in agroforests, tree plantations, and pastures in western Oregon, USA. *Agroforestry Systems* 60:123-130.

Table 1. Preliminary carbon data: Perennial ryegrass, 3-year rotations, on-farm study for the 2004-2005 crop year.

Component	Total carbon	
	Conventional tillage (first seed year)	No-tillage (second seed year)
	----- (kg C ha <sup>-1</sup> )-----	
Crop shoot/seed	8,954 ± 1,527	7,551 ± 1,264
Crop root	211 ± 21	833 ± 94
*Crop residue	5,820	4,908
Soil (0-15 cm depth)	22,385 ± 464	30,960 ± 603
Total	28,416	36,701

\*Assumed to be 65% of total crop biomass.

Table 2. Preliminary carbon data: Long-term annual ryegrass trials at Hyslop for the 2006-2007 crop year.

Component	Total carbon	
	Continuous conventional tillage	Continuous no-tillage
	----- (kg C ha <sup>-1</sup> )-----	
Crop shoot/seed	4,010 ± 1340	7,990 ± 717
Crop root	635 ± 320	965 ± 221
Crop residue	2,610 ± 410	2,870 ± 145
Soil (0-15 cm depth)	29,800 ± 951	31,400 ± 1040
Total	33,000	35,300

Table 3. Percent soil organic matter: Perennial ryegrass, 3-year rotations, on-farm study.

Soil depth	Percent soil organic matter			
	Conventional tillage		No-tillage	
	First seed year	Second seed year	Second seed year	Third seed year
0 to 15 cm	4.43 ± 0.05	5.69 ± 0.06	5.06 ± 0.04	5.33 ± 0.07