ORGANIC REDUCED TILLAGE IN WESTERN WASHINGTON AND THE IMPACTS ON WEED POPULATIONS: PRELIMINARY RESULTS

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BACKGROUND

Annual production systems commonly rely on a number of primary and secondary tillage activities to prepare the soil for cash crops. Resulting from these activities are potential detrimental effects on soil health, increased production costs, and threats to the long-term success of agricultural producers (Grandy et al. 2006). Weed pressure is commonly ranked as the number one cost for organic producers. Additionally, the primary weed management tool for organic producers is the use of cultivation equipment to reduce weed pressure and seed production (Walz 1997). All of these activities invert/churn/disrupt soil and thus simultaneously bury and uncover weed seeds in the seedbank. An increasing number of organic producers are looking to incorporate reduced tillage practices into their production systems. Reducing and/or eliminating tillage forces the need for an alternative weed control, such as using overwintering cover crops to create a mulch from the residue. To kill the over-wintering cover crop so that it does not compete with the following cash crop reduced tillage systems commonly rely on herbicides. Recent developments in other regions of the United States have identified the potential for an organically approved reduced tillage system relying on mechanical termination of the cover crop. Transfer of this technology will require adjustments in this system so that it is adapted to the Pacific Northwest climate and production systems and to maintain the economic competitiveness of producers within the parameters of this regions marketplace.

OBJECTIVES

- To evaluate an organically approved reduced tillage system in the Pacific maritime Northwest, and
- To monitor changes in weed emergence and growth as tillage activities are reduced.

METHODS

Two varieties of barley ('Kold' and 'Strider') were planted (100 lbs/acre) as a cover crop with a grain drill on 9/18/2009 into tilled soil at Washington State University's Puyallup Research and Extension Center in Puyallup, WA. Treatments included: a.) Rolled/Crimped ('Strider' barley), b.) Flailed-Mowed ('Kold' barley), c.) Disced + Spaded ('Strider' barley). Treatments were replicated three times and plots were setup in a completely randomized design. Cover crop biomass samples were taken (5/25/2010) just prior to rolling/crimping of the cover crop. Two days later (5/27/2010) flailed plots were mowed and residue was left on the surface. Tilled plots were disced then spaded (6/9/2010) and 'Hunter' winter squash was hand-transplanted using a Hatsfield transplanter after mechanical disruption of a 2" wide strip. Weed populations were assessed on 7/15/2010 by placing a quadrant (¼ m^2) over row-centers and weeds were counted by species. Weed biomass samples were taken five days later. All plots were hand-weeded on 8/16/2010 & 8/17/2010. Squash was harvested on 9/7/2010 and harvest weights were recorded. All data was analyzed utilizing PROC GLM (SAS Institute, NC).

RESULTS

'Strider' and 'Kold' barley showed no significant differences (p=0.57) in biomass accumulation when sampled on 5/25/2010. Observations throughout the winter supported this finding as both varieties exhibited similar growth patterns and ground cover. Weed count assessments (31 days after transplanting) showed significant differences (p=0.012) between treatments; where a significantly higher number of weeds were observed in conventionally prepared plots as compared to either rolled/crimped or flailed plots (Figure 1). Though it should be noted, no significant difference in weed numbers was observed between rolled/crimped (mean=80/m^2) or flail-mowed (mean=36/m^2) plots. Contrary to weed numbers, no significant difference (p=0.21) in weed biomass was observed amongst the three tillage treatments (Figure 2). During harvest squash was separated into three categories including: a.) Mature, b.) Immature, and c.) Split; only mature weights are discussed here. Flailed plots has significantly higher yield (120.2 lbs/50') compared to crimped (70.3 lbs/50') and tilled (69.8 lbs/50') plots which were not significantly different from each other (Table 1). There were no significant differences amongst the tillage treatments in either the number of squash or the average fruit size.

CONCLUSIONS

Organic reduced tillage systems show strong potential for integration into vegetable farms in the Pacific maritime Northwest. Specifically, the finding that weed numbers were significantly reduced (crimped/rolled and flail-mowed) and yield quantity was increased (flailed-mowed) compared to conventional tillage preparation. Undoubtedly, these systems require additional equipment whether it's a roller/crimper, a high residue transplanter/seeder, or a tractor with more horse power. A critical component to the use of these systems and the wide-spread adoption is the correct identification of a suitable cover crop for the local microclimate that can be effectively killed through mechanical termination. To this end, a newly formed collaboration between Washington State University and Oregon State University plans to continue to build upon this work and to develop an organic production system that is both economically feasible and environmentally sound.

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Roller/crimper (I and J Manfacturing, Gap, PA).

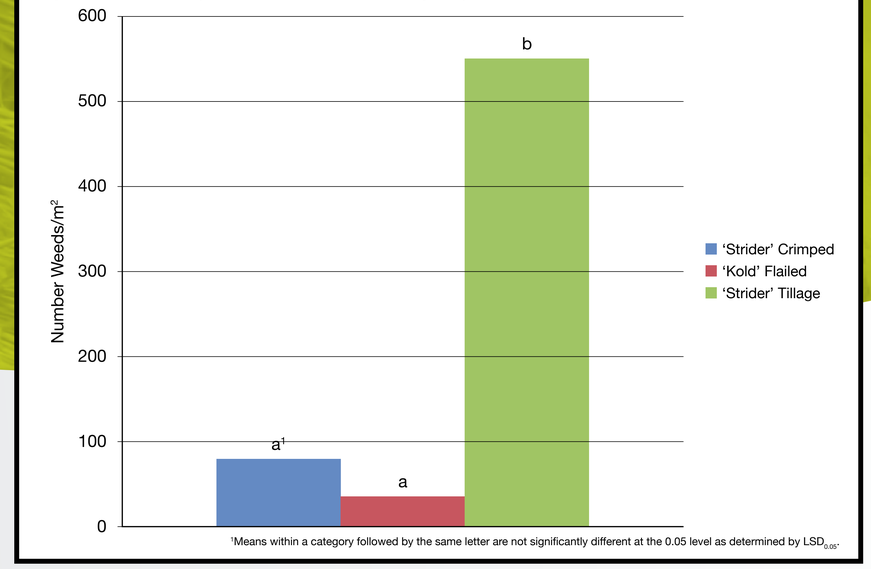
Roller/crimper mechanical termination.

2010 field trial (WSU Puyallup Research and Extension Center, Puyallup, WA).

Research plots 31 days after transplanting (7/15/2010).

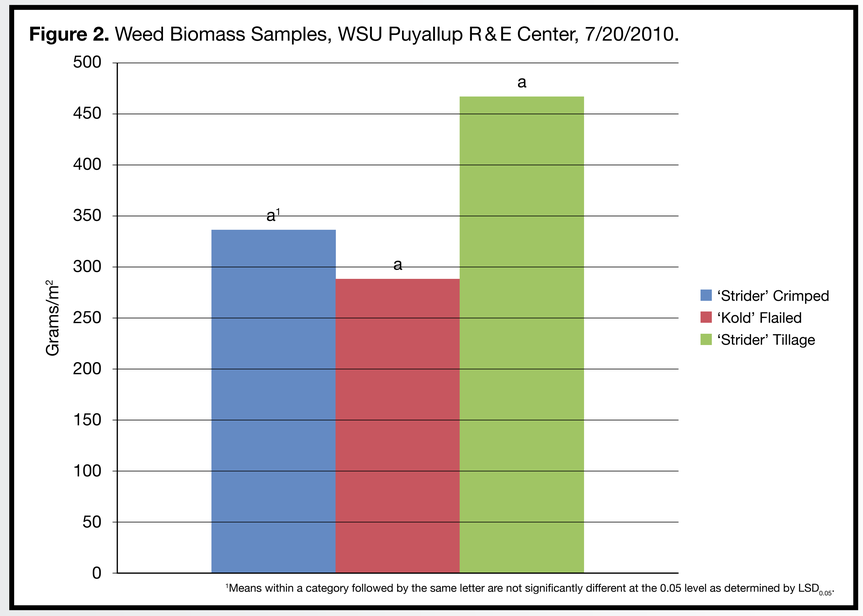
Rolled/crimped barley at harvest, 115 days after transplanting (9/7/2010).

Figure 1. Weed Population Counts, WSU Puyallup R&E Center, 7/15/2010.



¹Means within a category followed by the same letter are not significantly different at the 0.05 level as determined by $LSD_{0.05}$.

Figure 2. Weed Biomass Samples, WSU Puyallup R&E Center, 7/20/2010.



¹Means within a category followed by the same letter are not significantly different at the 0.05 level as determined by $LSD_{0.05}$.

Table 1. 'Hunter' Squash Yield Reduced Tillage Trial WSU Puyallup R&E Center, 2010.

		'Hunter' Squash		
		Mature Fruit	Count	Mature Fruit Size
Barley Variety	Tillage Treatment	(lbs/50')	(Number/50')	(lb/fruit)
'Kold'	Flailed	120.2 a¹	85.0 a	1.46 a
'Strider'	Crimped	70.3 b	53.3 a	1.34 a
'Strider'	Tilled	69.8 b	64.7 a	1.08 a
	p-Value	0.0047	0.135	0.1469

¹Means within a category followed by the same letter are not significantly different at the 0.05 level as determined by $LSD_{0.05}$.

LITERATURE CITED

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