Management of Fresh Wheat Stubble for Irrigated Winter Canola Production

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Introduction

Irrigated winter canola acreage is increasing in the Inland Pacific Northwest because it produces an average seed yield of 3,300 lbs/acre and provides excellent disease control benefits for potatoes grown in the rotation. There is a belief among irrigated canola growers that fresh wheat residue must be burned (Fig. 1) and the soil then heavily tilled before winter canola is planted. Growers believe that fresh (i.e., newly harvested) wheat straw is toxic to winter canola.

We are currently in the third year of field experiment to better understand the physiological mechanism(s) governing the health of irrigated winter canola when planted soon after the harvest of winter wheat. The objective of our study is to learn how to profitably produce irrigated winter canola without burning or excessive of fresh wheat stubble. Our hypothesis is that fresh wheat stubble is not phytotoxic and canola can be successfully produced in a direct-seed system after wheat harvest.

Materials and Methods

Winter wheat stubble management treatments were established in late August–early September just prior to planting winter canola. The experiment was embedded in a circle of irrigated winter canola. The treatments were: (i) stubble burned + disked ; stubble burned + direct seeded; (iii) stubble chopped + moldboard plowed; and (iv) direct seeding into undisturbed stubble (Fig. 2). A fifth treatment of broadcasting canola into standing wheat before wheat harvest (Fig. 3) was added beginning in year 2. Experimental design was a randomized complete block with four replications. Fertilizer rate was 120 lbs N, 40 lbs P, and 40 lbs S per acre applied in the fall with an additional 50 lbs of N top dressed in the spring. Application of irrigation water, which totals 15 inches for the crop year, is managed by Mr. Schibel, the collaborating grower (Fig. 4). The same five treatments were again established in the 2015 crop year.

Results

No root or foliar diseases were detected in any of the treatments in the 2013 and 2014 crop years. Winter canola seed yields among treatments in 2013 ranged from 2988 to 3246 lbs/acre (Table 1). In 2014, all canola in the direct seed into stubble and broadcast into wheat before wheat harvest treatments (Fig. 5) was killed by cold winter temperatures. Many, but not all, canola plants in the stubble chopped + moldboard plow treatment were also killed in the winter. Canola in the stubble burned + disked and the stubble burned + direct seeded treatments suffered the least winter damage (Fig. 6). Canola seed yields in the three surviving treatments in 2014 ranged from 2538 to 2962 lbs/acre (Table 1).

Discussion and Questions

Why did some treatments winterkill and not others in 2014 (Fig. 6)? The height of the crown and length of hypocotyl were greater in canola when direct seeded into stubble and broadcast into standing wheat before wheat harvest (Fig. 5). Crowns and growing points are formed at the end of the hypocotyl, so a longer hypocotyl means the crown is further from the ground and possibly more prone to freeze damage as suggested by research in the US Great Plains. The winter of 2014 was very cold and there was no snow cover. Was the canola winterkill event of 2014 a rarity? Grower Jeff Schibel (Fig. 4) has grown irrigated winter canola for 15 years and never experienced winterkill. Could winter canola varieties be developed that do not elongate their hypocotyl in response to shading as occurs in direct-seed systems, thus becoming more cold tolerant?

Table 1: Irrigated winter canola seed yields during the first two years of wheat stubble management experiment conducted near Odessa, Washington.

	Year		
	2013	2014	2-yr avg.
	Grain yield (lbs/ac)		
Stubble burned + disked	3092	2832	2962
Stubble burned + direct-seeded	3020	2678	2849
Stubble chopped + moldboard plowed	3246	1830	2538
Direct seeded into undisturbed stubble	2988	**	
Broadcast into standing wheat	*	**	
Statistical significance	ns (p = 0.40)	ns (p = 0.06)	ns (p = 0.11)

* The broadcast into standing wheat before harvest treatment was not present in 2013.
**Canola killed by cold temperatures in 2014.
ns = No significant statistical differences at P<0.05.

Fig. 1. Burning a circle of newly-harvested winter wheat stubble prior to conducting heavy tillage in preparation for planting winter canola. This is the standard method of stubble management for many growers who produce irrigated winter canola following winter wheat.

Fig. 3. A new (fifth) residue management treatment was added to the experiment beginning in the 2014 crop year. Winter canola seed was broadcast in the standing winter wheat crop before wheat harvest. Following wheat harvest, five inches of irrigation water was applied, resulting in excellent emergence of canola. Volunteer wheat was then controlled with an application of a grass weed herbicide.

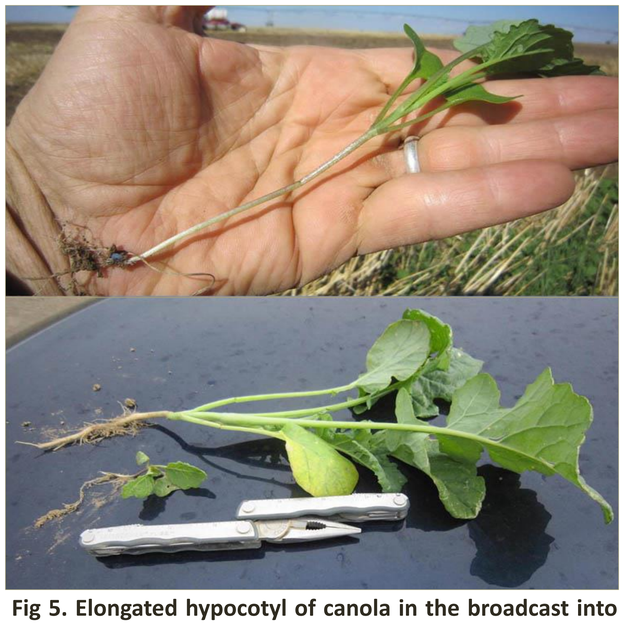

Fig 5. Elongated hypocotyl of canola in the broadcast into standing wheat before wheat harvest treatment on September 9, the day the other treatments were planted with a drill (top). Size of plants in the broadcast into standing wheat treatment versus the burn + disk treatment on October 2 (bottom).

Fig. 2. Direct seeding winter canola into newly-harvested winter wheat stubble. The drill is equipped with hoe openers spaced 12-inches apart with openers staggered on three ranks to enhance residue clearance. This drill was used to plant all (except for the broadcast) treatments in the experiment.

Fig. 4. Collaborator Jeff Schibel has successfully grown irrigated winter canola in rotation with winter wheat and potatoes for more than fifteen years. His average winter canola seed yield is 3300 lbs/acre.

Fig. 6. Overview of the experiment during a field tour held on May 29, 2014. Bare areas are the treatments seeded into wheat stubble and broadcast into standing wheat before wheat harvest. Does the elongated hypocotyl of canola plants in these treatments make them more subject to cold damage? Photo courtesy of Darrell Kilgore, WSU CAHNRS Communications.