Volunteer buckwheat control in irrigated spring wheat.

Mark Thorne, Henry Wetzel, Jacob Fischer, Drew Lyon, and Tim Waters

Volunteer buckwheat (*Fagopyrum esculentum* Moench) contamination in wheat is a problem for export markets where allergies to buckwheat are a serious health risk. In some areas of the Columbia Basin, buckwheat grown as a crop is followed by spring wheat the next year. Buckwheat germinating from the seed bank can infest the wheat crop and produce seed that will contaminate the grain (Figure 1).

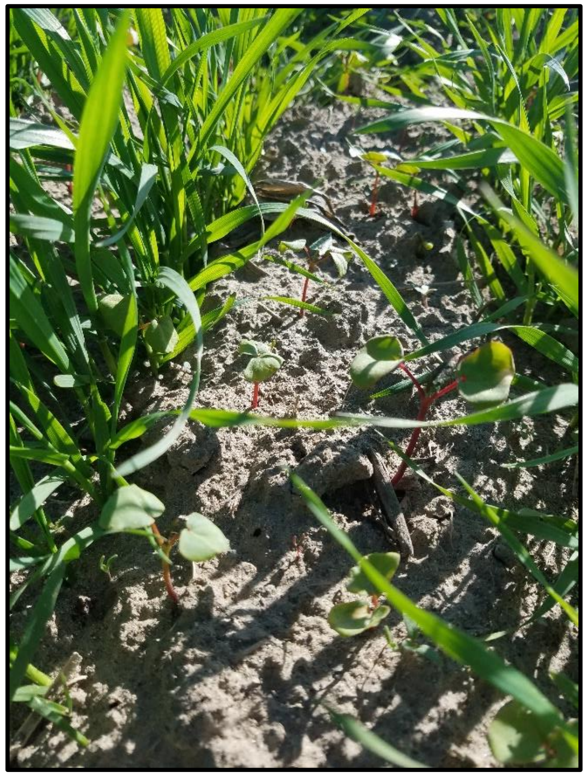

Figure 1. Volunteer buckwheat seeds in spring wheat.

An herbicide trial in 2018 compared early postemergence (EPOST) and late postemergence (LPOST) treatments for control of volunteer buckwheat in spring wheat. The study site was a center-pivot irrigated field near Pasco, WA farmed by WSU Franklin County Extension for agricultural research. Buckwheat seeds were broadcasted at a rate of 50 lb/A over the whole plot area on March 7, 2018 and then incorporated into the soil with a disked harrow to a maximum depth of six inches. The plot area was seeded with hard-red spring wheat (variety not know) at 180 lb/A with a John Deere® Van Brunt drill with double-disc openers on 7 ½ inch spacing.

The EPOST treatments were broadcast-applied when the wheat was beginning to tiller and the buckwheat seedlings were still mostly in the cotyledon stage (Table 1). Volunteer buckwheat density averaged 24 seedlings/m^2. The EPOST treatments were applied on April 20, 2018 with a CO_2 pressurized backpack sprayer and 10-foot spray boom at 3 mph. Application rate was 15 gpa at 25 psi. The LPOST treatments were chemigation-applied on May 11 when the wheat was still in the boot stage and the buckwheat ranged from cotyledon up to seedlings with three leaves. Only the non-treated check plots had larger buckwheat plants with three leaves. The LPOST treatments were applied with a tractor-pulled applicator that simulated center-pivot chemigation. Herbicides were metered into a stream of water flowing into an 11.7-foot spray boom with HH Fulljet nozzles. Volume output was 2774 gpa at 66 psi and moving 1 mph to simulate a 0.1-inch irrigation rate.

Table 1. Application and soil data.

Application timing	Early postemergence	Late postemergence
Application date	April 20, 2018	May 11, 2018
Growth stage, volunteer buckwheat	cotyledon to 1 leaf	cotyledon to 3 leaves
Growth stage, wheat	4 leaves to 1 tiller	1 to 2 tillers, boot stage
Air temperature	71	64
Relative humidity (%)	28	47
Wind (mph, direction)	2 to 4, WSW	3 to 6, SE
Cloud cover (%)	0	50
Soil temperature at 3 inches (F)	82	68
Soil texture	Quincy loamy fine sand	
Soil pH (0-12 inches)	7.9	

The EPOST treatments were applied to all plots except the non-treated checks and included either Huskie® at 13.5 oz/A or GoldSky® at 16 oz/A (Table 2). Applications of Huskie included ammonium sulfate at 1 lb/A as a spray adjuvant. The GoldSky applications included non-ionic surfactant R-11® at 0.5% v/v. The LPOST treatments included Brox 2EC®, Maestro Advanced®, or Starane NXT® and were applied only to plots that had been previously treated with the EPOST herbicides. The non-treated check plots were not treated with any herbicide but were hand weeded to remove all other weeds except the volunteer buckwheat.

Table 2. Early postemergence (EPOST) and late post emergence (LPOST) herbicides applied for control of volunteer buckwheat in irrigated spring wheat.

Trade name	Chemical name	Application	Rate applied
			(fl oz/A)
EPOST treatments			
Huskie	pyrasulfotole/bromoxynil	broadcast	13.5
GoldSky	florasulam/fluroxypyr/pyroxsulam	broadcast	16
LPOST treatments			
Brox 2EC	bromoxynil	chemigation	32
Maestro Advanced	bromoxynil/MCPA	chemigation	25.6
Starane NXT	bromoxynil/fluroxypyr	chemigation	27.4

.

Treatment efficacy was assessed by counting buckwheat plants that were flowering or had produced seeds in each of two 1 m^2 quadrats placed in each plot at the beginning of the trial. By May 11, three weeks after the EPOST applications, no buckwheat had yet flowered in any of the EPOST-treated plots, but were stunted or had emerged since the EPOST applications. The non-treated check plots averaged 3.6 flowering plants (Table 3). By the June 1 census, flowering plants were only found in the non-treated check and the EPOST-only plots. GoldSky-only plots average 1.9 plants/m^2, Huskie-only plots averaged 4.4 plant/m^2, and the non-treated check plots averaged 17.8 plants/m^2 (Table 3). By the June 19 harvest census, none of the treatments had maintained 100% control. The treatments with the highest number of plants that had flowered or had produced seeds were Huskie only or GoldSky only and were not different from the non-treated check or GoldSky followed by Maestro Advanced (Table 3). It is not exactly clear why the number of flowered plants in the non-treated checks declined by the June 19 census. Competition from the wheat crop or predation by either rodents or rabbits may have been contributing factors.

Table 3. Volunteer buckwheat control in irrigated spring wheat.

Herbicide treatments[1]		Buckwheat plants with flowers or seeds: May 11[2]	June 1[3]	June 19[4]	Buckwheat contamination
(EPOST)	(LPOST)	-------(flowering plants/m^2)--------			(seeds/kg wheat)
Huskie		0 b	4.4 b	4.1 a	12.3 abc
Huskie	Brox 2EC	0 b	0 d	0.9 bcd	7.3 de
Huskie	Maestro Advanced	0 b	0 d	1.1 bcd	7.0 e
Huskie	Starane NXT	0 b	0 d	0.3 d	6.1 e
GoldSky		0 b	1.9 c	3.6 ab	19.6 ab
GoldSk	Brox 2 EC	0 b	0 d	0.6 cd	14.0 bc
GoldSky	Maestro Advanced	0 b	0 d	1.9 abc	13.1 c
GoldSky	Starane NXT	0 b	0 d	0.9 cd	11.7 cd
Non-treated check		3.6 a	17.8 a	2.9 abc	22.7 a

[1] Means in each column followed by the same letter are not different from each other (α=0.05).
[2] May 11 census was three weeks after EPOST applications.
[3] June 1 census was three weeks after the LPOST applications.
[4] June 19 census was just prior to crop harvest.

At the end of the trial, all plots were harvested with a Wintersteiger plot combine with a 5-ft header. Wheat harvested in each plot was individually bagged to determine yield and buckwheat seed contamination. There was no difference in yield between the treatments, which averaged 96 bu/A. The number of buckwheat seeds per kg of wheat was greatest with the non-treated check and the GoldSky-alone treatments. The Huskie EPOST treatments followed by any of the LPOST treatments resulted in the lowest buckwheat seed contamination averaging between 6 and 7.3 seeds/kg of wheat. The GoldSky treatments followed by a LPOST treatment averaged between 11.7 and 14.0 seeds/kg of wheat but were less than the non-treated check, which averaged 22.7 seeds/kg of wheat. Either Huskie or GoldSky not followed by a LPOST treatment were not different from the non-treated check.

Competition from the wheat crop was also a factor in this trial. Replicates (a block containing all treatments) one and two were in a bottom of a slight draw that traversed the field, consequently they had higher yields compared with replicates three and four, which were upslope (Figure 2). The higher yields in replicates 1 and 2 corresponded to much lower buckwheat contamination, as well.

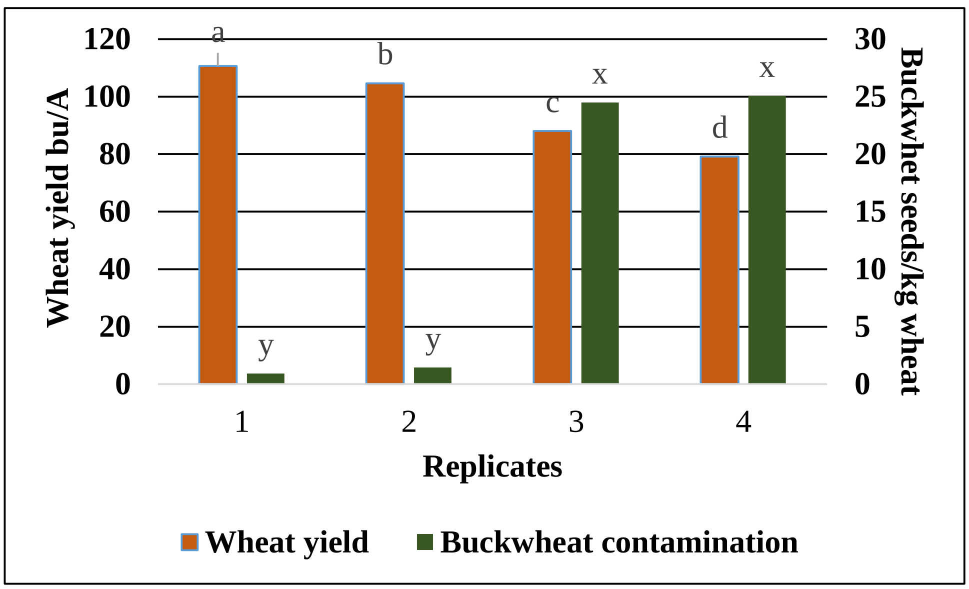

Figure 2. Relationship between wheat yield and buckwheat contamination in each replicate of the trial. Wheat yield columns with the same letter (a-d) are not different. Buckwheat columns with the same letter (x,y) are not different.

The results of this trial suggest a competitive crop is the first line of defense against volunteer buckwheat contamination in irrigated spring wheat. Relying only on a single herbicide application is not likely a good strategy; however, effective control up until harvest is a challenge, even with a follow-up herbicide application at boot stage. It is not exactly clear why the LPOST treatments following GoldSky were not as effect as the LPOST treatments following Huskie. It is possible that Huskie caused greater injury than GoldSky to the earlier establishing buckwheat plants. Weakened plants combined with crop completion may have aided the LPOST treatments in reducing the number of buckwheat seeds produced.