K-STATE Kansas State University Research and Extension

Keeping Up With Research

Volunteer Corn in Fallow

Johnathon Holman, Troy Dumler, Scott Maxwell, Brian Olson, Tom Roberts, Alan Schlegel, and Curtis Thompson

Introduction

Volunteer corn is a common weed in the fallow phase of wheat-corn-fallow in western Kansas and the west central Great Plains. No-till increases precipitation storage, reduces soil erosion, and often increases crop yields when compared to conventional-till. As a result, many producers have adopted no-till cropping systems that use glyphosate extensively for weed control in fallow. Because most of the corn grown is herbicide-tolerant, volunteer corn in fallow may not be controlled with glyphosate. Failing to control weeds in fallow can reduce soil moisture storage and subsequent crop yield.

Impact of volunteer corn on soil moisture and wheat yields

Field studies were conducted at Kansas State University Research-Extension Centers in western Kansas at Colby, Garden City, and Tribune from 2006 to 2010 to evaluate the impact of volunteer corn on soil moisture storage in fallow and the succeeding winter wheat crop (Holman et al., 2011). These impacts were evaluated at eight different populations of volunteer corn: 0, 250, 500, 1,000, 2,000, 4,000, 6,000, and 8,000 corn plants/a. Figures 1 and 2 show how these populations look in the field and Table 1 lists equivalent plant populations in a 30-ft by 30-ft area.

Volunteer corn reduced available soil water by 1 in. for every 2,500 plants/a (Figure 3). Wheat tillers were decreased by 1/ft for every 170 volunteer corn plants/a and yield was reduced 1 bu/a for every 500 volunteer corn plants/a (Figure 4). However, when wheat yields were above 70 bu/a or below 35 bu/a, other factors affected wheat yield more than the preceding volunteer corn population or available soil moisture at wheat planting.

When wheat yields were very high (greater than 70 bu/a), growing season precipitation was sufficient to overcome the negative impact of volunteer corn during the previous fallow period. On the other hand, when wheat yields were very low (less than 35 bu/a), the impact of volunteer corn on wheat yield was not detected because growing season precipitation was too low.

Table 1. Equivalent plant populations. Use this table to estimate your weed population.

Plant population/a	Plants in a 30-ft × 30-ft area
250	5
500	10
1,000	21
2,000	41
4,000	82
6,000	124
8,000	165

Survey of volunteer corn in producer fields

Volunteer corn was measured in four producer fields annually from 2006 to 2009 to determine typical plant populations. Sampled fields contained low to very moderate infestations of volunteer corn. Volunteer corn densities averaged from 120 to 1,250 plants/a, and the average of all fields across years was 500 plants/a. Densities within a field were variable, reaching up to 2,800 plants/a in certain areas. When a lot of grain remains in a field, volunteer population can exceed 3,000 plants/a.

Figure 1. Image of 500 volunteer corn plants/a.

Figure 2. Image of 1,000 volunteer corn plants/a.

Factors influencing volunteer corn population

Corn plant lodging late in the growing season and grain loss at harvest both influence volunteer corn population. Late-season lodging can be caused by disease, insect damage, or hail, and can result in large amounts of mature grain left in the field. Failing to take appropriate measures at harvest also can result in grain loss and volunteer corn. To minimize grain loss, producers need to harvest at appropriate grain moisture content, properly adjust harvest equipment, and operate harvest equipment at correct speed. (See Kansas State University *Corn Production Hanbook,* available at http://www.ksre.ksu.edu/library, for more complete information on minimizing harvest loss.) A harvest loss of 2 corn kernels/ft^2 equals 87,120 seeds/a or 1 bu/a. Tillage also can affect volunteer corn population. Conventional-till results in about 80% corn kernel germination as volunteer compared to only 10% with no-till (Martin and Thrailkill, 1993). Table 2 provides an estimate of potential volunteer corn population based on corn loss at harvest.

Table 2. Potential volunteer corn population resulting from grain loss. Use this table to estimate your potential weed population.

Corn grain loss (kernel or cobs) in a 30-ft × 30-ft area	Potential volunteer corn plants in a 30-ft × 30-ft area using no-till	Potential volunteer corn plants in a 30-ft × 30-ft area using conventional-till
6	<1	5
12	1	10
26	3	21
51	5	41
102	10	82
155	15	124
206	21	165

Controlling glyphosate-tolerant volunteer corn

Producers can control volunteer corn in several ways; not all methods are cost-effective. Producers must evaluate the wheat market, potential wheat yield loss if volunteer corn is not controlled, and cost of controlling volunteer corn. Grass herbicides such as clethodim, fluazifop-P, quizalofop, and sethoxydim can be applied during the fallow period to control glyphosate-tolerant volunteer corn, but these products can be expensive and do not affect broadleaf weeds. Paraquat applied alone will have posteemergence activity on volunteer corn and broadleaf weeds but no residual activity. Tank-mixing atrazine with parquat will provide postemergence control of volunteer corn and other weeds and some residual broadleaf weed control. Producers should control volunteer corn when plants are small, controlled best, and before plants have used moisture and nutrients. Table 3 lists herbicides with

labeled rates and the maximum recommended volunteer corn size at treatment. Of the grass herbicides, Assure II and Select Max will be most effective on volunteer corn. Ignite 280 activity will vary and will likely be more effective in eastern Kansas due to higher humidity than in western Kansas. Paraquat can be unpredictable if corn size exceeds 6 to 8 in. All herbicides are adversely affected in severely dry conditions. Appropriate adjuvants are critical with each of the herbicides listed; read and follow label directions. (See Kansas State University *Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland*, available at http://www.ksre.ksu.edu/library, for more complete information on herbicides for controlling volunteer corn.)

Another option is to graze the volunteer corn that establishes during the fallow period, which, depending on the situation, might result in a profit rather than an expense during the fallow period. Producers must consider the effects of removing residue by grazing and the potential impact on the subsequent crop.

Economic threshold to justify control

The economic threshold for controlling volunteer glyphosate-tolerant corn varies depending on the price of wheat, wheat yield, and the cost of herbicide application. Table 4 shows the net value of herbicide application based on volunteer corn population and wheat price. The analysis assumes a yield goal of 45 bu/a and herbicide cost of $13.00/a (including application cost).

According to the results in Table 4, controlling volunteer corn at 500 plants/a is not cost-effective. Controlling volunteer corn at 1,000 plants/a pays when the price of wheat is $8.00/bu and higher, 1,500 volunteer corn plants/a pays when the price is $5.00/bu and higher, and 2,000 volunteer corn plants/a pays when the price is $3.00/bu and higher. Substantial returns can be earned if populations are above 2,500 plants/a and the price of wheat is above the historical average.

References

Holman, J., A. Schlegel, B. Olson, S. Maxwell, and K. Martin. 2011. Effects of volunteer corn on fallow moisture storage and winter wheat. Crop Management.

Martin, D., and D. Thrailkill. 1993. Surface seeding irrigated corn. Trans. ASAE 36:1633-1638.

Table 3. Herbicides to control glyphosate-tolerant volunteer corn in fallow. Read the herbicide label for guidelines.

Trade name	Common name	Maximum corn size, in.[2]	Application rate	Efficacy	Price	Cost
			fl oz/a		$/gal	$/a[6]
Ignite 280[1]	Glufosinate	12	22 to 29	2 to 8[3]	57	14.90
Assure II	Quizalofop	30	5 to 8	9	136	10.41
Fusion	Fluazifop-P + fenoxaprop	24	6	8	208	14.85
Fusilade DX	Fluazifop-P	24	6	8	154	12.32
Select Max	Clethodim	36	6 to 16	9	105	10.02
Poast Plus[4]	Sethoxydim	20	24 to 36	8	67	17.66
Gramoxone Inteon	Paraquat	6	24 to 64	7	33	11.29
Raptor[5]	Imazamox	8	6	8	588	32.66

[1] Ignite will not control Liberty Linked tolerant corn. Check with your seed supplier to make sure that last year's corn crop was not Liberty Linked.
[2] When treating the maximum corn size shown in this table, the maximum rate of the herbicide should be used. Most consistent control from each of the herbicides listed will occur when volunteer corn plants are small.
[3] Volunteer corn control with Ignite may decline in western Kansas, where relative humidity is low.
[4] Rate is dependent upon your location within Kansas.
[5] Crop rotation restriction: No restriction when planting a Clearfield wheat variety; 3 months for all non-Clearfield wheat varieties.
[6] Cost is based on minimum application rates and includes application costs of $5.10/a.

Table 4. Net value ($/a) of herbicide application based on volunteer corn population and wheat price.

Volunteer corn plants/a	Wheat price ($/bu)					
	$3.00	$4.00	$5.00	$6.00	$7.00	$8.00
500	-11.90	-10.90	-9.90	-8.90	-7.90	-6.90
1,000	-8.90	-6.90	-4.90	-2.90	-0.90	1.10
1,500	-5.90	-2.90	0.10	3.10	6.10	9.10
2,000	-2.90	1.10	5.10	9.10	13.10	17.10
2,500	0.10	5.10	10.10	15.10	20.10	25.10
3,000	3.10	9.10	15.10	21.10	27.10	33.10
3,500	6.10	13.10	20.10	27.10	34.10	41.10
4,000	9.10	17.10	25.10	33.10	41.10	49.10
4,500	12.10	21.10	30.10	39.10	48.10	57.10
5,000	15.10	25.10	35.10	45.10	55.10	65.10

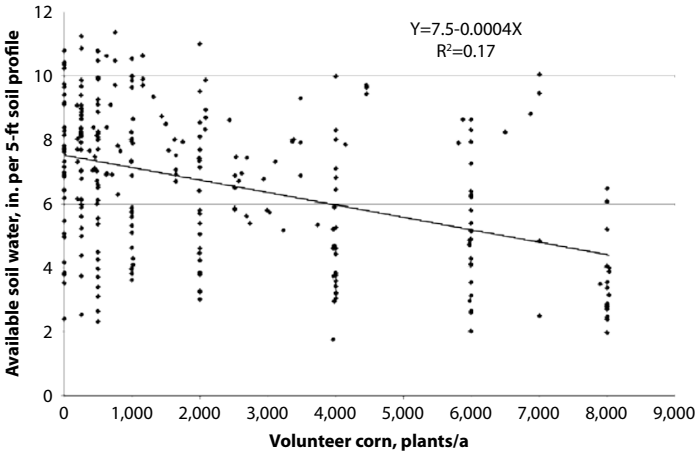

Figure 3. Impact of volunteer corn on available soil moisture. Volunteer corn reduced available soil water by 1 in. for every 2,500 plants/a.

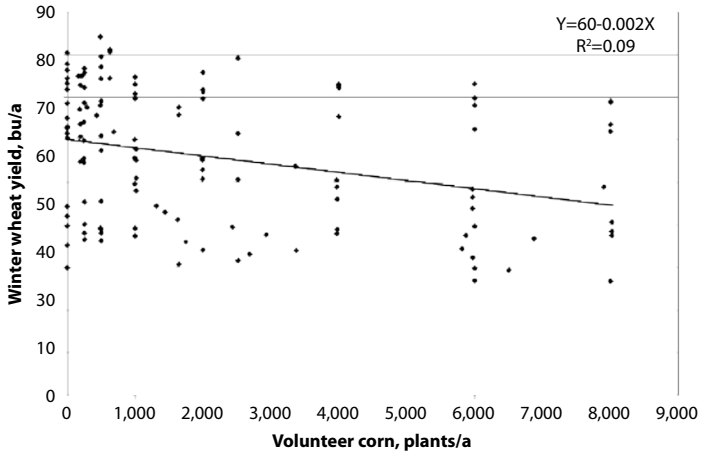

Figure 4. Impact of volunteer corn on winter wheat yield. Wheat yield was reduced 1 bu/a for every 500 volunteer corn plants/a.

Publications from Kansas State University are available on the World Wide Web at: ***www.ksre.ksu.edu***

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

SRL 141 May 2011