NORTHWEST CROPS & SOILS PROGRAM

2013 Flax Weed Control Trial

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2013 FLAX WEED CONTROL TRIAL

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INTRODUCTION

Flax is a spring annual that is usually planted as early as the ground can be worked. One of the main challenges to successfully growing flax is weed control. Flax plants compete poorly with fast growing weeds due to its relatively short height (between 12 and 36 inches when mature) and tiny leaves. This trial was initiated to see if management, including different row spacing and cultivation, would affect weed densities in flax.

MATERIALS AND METHODS

This trial was planted at Borderview Research Farm in Alburgh, VT on 19-Apr 2013. General plot management is listed in Table 1. The previous crop was spring wheat. The field was disked and spike tooth harrowed prior to planting. Plots were seeded with variety 'Rahab 94' at a seeding rate of 50 lbs acre^{-1}. The experimental design was a randomized complete block with four replications. Four weed control techniques were compared against a control of standard 6" row spacing and no cultivation (Table 2). The narrow row treatment was planted with a Kverneland grain drill at 4.5" row spacing. The wide row treatment was also planted with a Kverneland grain drill (by plugging every other hole in the hopper for 9" row spacing) and cultivated with a Schmotzer hoe on 4-Jun. The tine-weed treatment was planted with a Great Plains grain drill at 6" row spacing and tine-weeded on 4-Jun. The interseed treatment was planted with a Great Plains grain drill at standard 6" row spacing with the addition of Alice white clover at 4 lbs acre^{-1}.

Heights, population, and weed counts were measured on 31-May. Populations were determined by counting flax plants in one ½ meter^2 quadrat per plot. Annual and perennial broadleaf and grass weeds were counted in one ½ meter^2 quadrat before and after cultivation. The tine-weed and wide row treatments were cultivated on 4-Jun. Additionally, weed cover was determined on 18-Jun as a percent of total plant cover using the web based IMAGING crop response analyzer. Digital images were taken with a compact digital camera, Canon PowerShot G12 (Melville, NY) (10.4 Megapixels). One picture covering approximately 1/2 m^2 was taken in each plot before weeding and one picture was taken after weeding. Digital images were analyzed with the automated imaging software, which was programmed in MATLAB (MathWorks, Inc., Natick, MA) and later converted into a free web-based software (www.imaging-crop.dk). The outcome of the analysis is a leaf cover index, which is the proportion of pixels in the images determined to be green. Total plant cover (1st picture) – flax cover (second picture)/ total plant cover = weed cover (%).

Flax plots were harvested with an Almaco SPC50 small plot combine on 6-Sep 2013. The harvest area was 5' x 20'. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). Results were analyzed with an analysis of variance in SAS (Cary, NC). The Least Significant Difference (LSD) procedure was used to separate cultivar means when the F-test was significant ($p < 0.10$).

Table 1. General plot management.

Trial Information	Borderview Research Farm Alburgh, VT
Soil Type	Benson rocky silt loam
Previous crop	Spring Wheat
Planting date	19-Apr
Harvest date	6-Sep
Seeding rate	50 lbs acre^{-1}
Tillage methods	Mold board plow, disk, and spike tooth harrow

Table 2. Weed control techniques.

Treatment	Row spacing inches	Planter	Cultivation
Narrow row	4.5	Kverneland grain drill	none
Wide row with cultivation	9	Kverneland grain drill	Schmotzer hoe
Tine-weed	6	Great Plains grain drill	Tine-weeder
Interseed	6	Great Plains grain drill	none
Control	6	Great Plains grain drill	none

Variations in yield and quality can occur because of variations in genetics, soil, weather and other growing conditions. Statistical analysis makes it possible to determine whether a difference among varieties is real, or whether it might have occurred due to other variations in the field. At the bottom of each table, a LSD value is presented for each variable (i.e. yield). Least Significant differences (LSD's) at the 10% level of probability are shown. Where the difference between two treatments within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two varieties. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the example to the right, A is significantly different from C but not from B. The difference between A and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that B was not significantly lower than the top yielding variety.

Variety	Yield
A	6.0
B	7.5*
C	9.0*
LSD	**2.0**

RESULTS AND DISCUSSION

Seasonal precipitation and temperature recorded at a weather station in Alburgh, VT are shown in Table 3. From April to September, there was an accumulation of 4,511 Growing Degree Days (GDDs) in Alburgh which is 18 GDDs less than the 30-year average. Flax needs 1,603 GDDs to reach maturity.

Table 3. Seasonal weather data[1] collected in Alburgh, VT, 2013.

Alburgh, VT	April	May	June	July	August
Average temperature (°F)	43.6	59.1	64	71.7	67.7
Departure from normal	-1.2	2.7	-1.8	1.1	-1.1
Precipitation (inches)	2.12	4.79	9.23 ǂ	1.89	2.41
Departure from normal	-0.7	1.34	5.54	-2.26	-1.5
Growing Degree Days (base 32°F)	349	848	967	1235	1112
Departure from normal	-35.6	91.4	-47.0	36.8	-27.2

[1]Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT.
ǂ June 2013 precipitation data based on National Weather Service data from cooperative stations in South Hero, VT (http://www.nrcc.cornell.edu/page_summaries.html)

Two weed treatments in this study so poorly competed with weeds that we did not harvest them due to the excessive weed pressure. Only the narrow row treatment, wide row with Schmotzer hoe, and control were harvested (for comparison purposes) (Table 4). Images of these treatments just before harvest are presented below (Figures 1-3). Visually, it was clear that the wide row with hoeing treatment was most effective at competing with weeds; the narrow row treatment was a close second, and the control was over-run with weeds.

The Schmotzer hoe was very effective at removing weeds from the flax plots. From weed counts taken before and after cultivation on 4-Jun, the average percent of weeds removed from tine weeding was 23.4% while the average percent of weeds removed from wide rows after Schmotzer hoeing was 80.5% (data not shown).

Figure 1. Flax control plot.

Figure 2. Wide row flax with Schmotzer hoe.

Figure 3. Narrow row flax.

Table 4. Plot characteristics and harvest yield of flax grown with different weed control techniques, Alburgh, VT.

Treatment	Flax population plants m^2	Weed population plants m^2	Height in	Weed cover %	Yield lbs. ac^{-1}
Wide w/ hoe	404	567	8.1	16.6*	**622***
Narrow row	409	352	8.6	**14.0***	474*
Control	321	351	7.6	40.8	272
Trial Mean	378	423	8.1	23.8	456
LSD ($p<0.10$)	NS	NS	NS	15.6	187

*Varieties with an asterisk are not significantly different than the top performer in **bold**.
NS – No significant difference amongst varieties.

Flax populations, weed populations, and heights measured on 31-May were not significantly different for any of the weed control treatments. The weed cover, measured on 18-Jun resulted in significantly different weed cover (out of total plant cover), 14.0 and 16.6% for the narrow row and wide row treatments compared to over 40% weeds for the control (Figure 4). The wide row with cultivation yielded the highest at 622 lbs $acre^{-1}$, over twice the yields from the control plot (Table 4 & Figure 4). Challenges of direct cut combining, such as losing the light flax seed in nooks and cracks in the combine, likely resulted in harvest yields lower than actual yields.

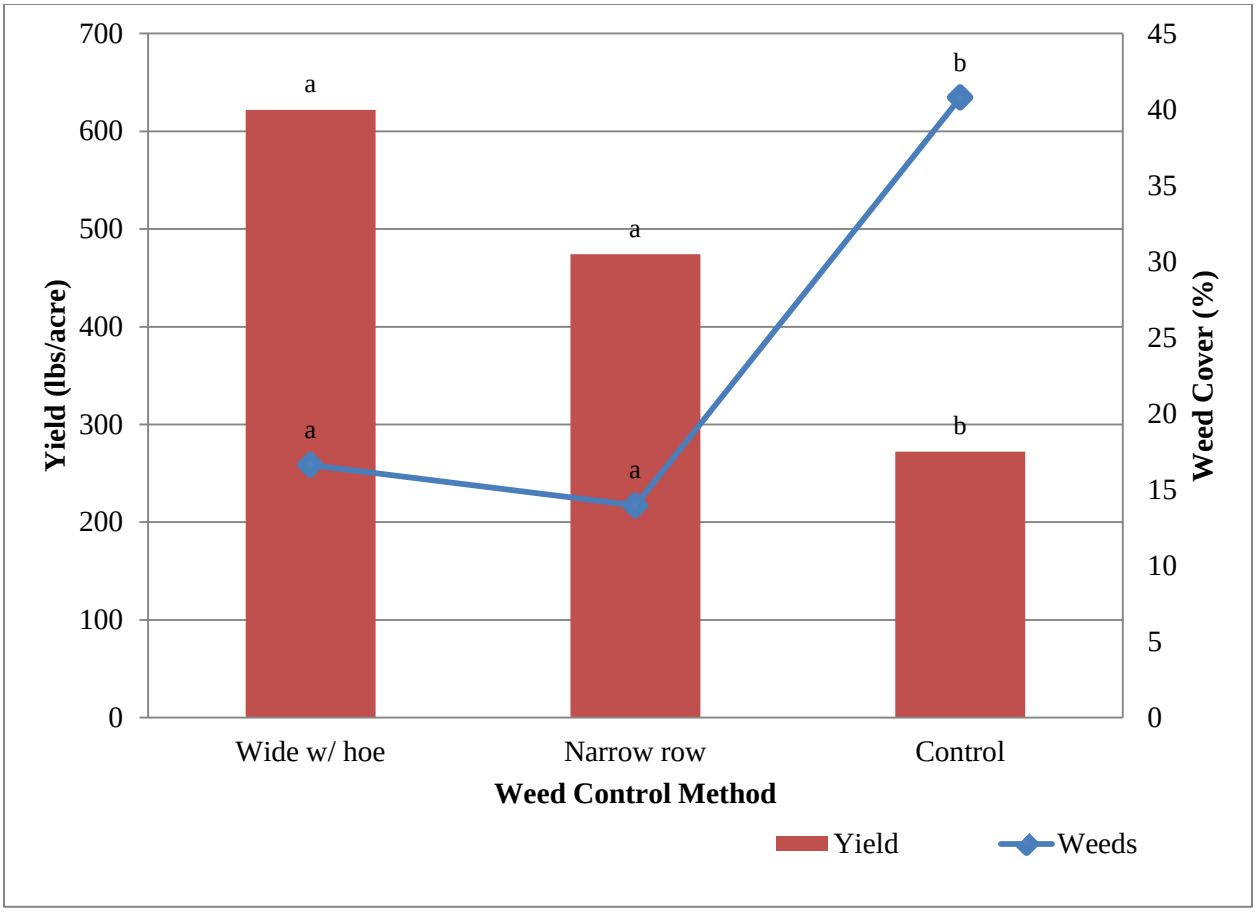

Figure 4. Yield (lbs/acre) and weed cover (%) of flax plots managed with different weed control techniques.

ACKNOWLEDGEMENTS

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