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Tineweeding Trials

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NW CROPS & SOILS PROGRAM

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2010 Tineweeding Trials

Figure 1. Early season crop tineweeding.

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2010 Vermont Tineweeding Trials

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In 2010, the University of Vermont Extension Crops and Soils Team conducted an evaluation of tineweeding as a weed management strategy in corn and sunflowers in Alburgh, VT. Tineweeding is a type of mechanical cultivation that is implemented early on in the field season (Figure 1). A tineweeder is a low cost and simple piece of equipment designed to disturb the root zones of weed seedlings while they are in the very delicate “white thread root” stage (Figure 2). This disturbance often results in weed seedling desiccation and death. Success of this practice is highly dependent on weather conditions at the time of weeding. Wet soils can prohibit the use of tineweeders when weeds are at the critical white thread stage.

Figure 2. White thread root stage of growth.

Weather Data

Seasonal precipitation and temperatures recorded at a weather station in close proximity to the 2010 research site are shown in Table 1. This year presented a growing season that was above average in temperatures, and while we had a drier spring, overall, we ended up with above average rainfall. This year we accumulated 26.4 more Growing Degree Days (GDD) than usual. GDDs are reported for corn (base 50° – 86°F) and sunflowers (base 44˚ – 95°F) in Table 1.

Table 1. Temperature, precipitation, and GDD summary – 2010.

	May	June	July	August	September	October
Average Temperature (°F)	59.6	66.0	74.1	70.4	64.0	50.6
Departure from Normal	3.00	0.20	3.00	1.40	3.60	1.80
Precipitation (inches)	0.92	4.61	4.30	5.48	4.32	*
Departure from Normal	-2.01	1.40	0.89	1.63	0.86	
Corn (Base 50° – 86°F)						
Growing Degree Days	331.8	478.5	747.1	634.0	418.5	128.7
Departure from Normal	71.4	4.5	94.6	45.0	106.5	26.4
Sunflower (Base 44° – 95°F)						
Growing Degree Days	482.1	658.5	933.1	820.0	598.5	221.7
Departure from Normal	91.5	4.5	94.6	45.0	106.5	26.4

*Missing data
Based on National Weather Service data from South Hero, VT. Historical averages are for 30 years of data (1971-2000).

The effectiveness of a tineweeder as a weed control tool in corn and sunflowers was evaluated with replicated plots at Borderview Farm in Alburgh, VT. The soil type was a silt loam and the previous crop was cereal rye. For each experiment, the design was a randomized complete block with four replications. Corn was planted on May 19, 2010. Sunflowers were originally planted on May 26th, but due to poor germination, they were replanted on June 9, 2010. Five weed control strategies were evaluated in sunflowers: tineweeding 6 days after planting (DAP), tineweeding 12 DAP, tineweeding 6 & 12 DAP, pre-plant herbicide, and no weed control. Corn was only tineweeded once, at 6 DAP, due to wet conditions, tineweeding at 12 DAP was not possible. The pre-emergence herbicide and no weed control treatments were also evaluated in the corn plots. The seedbed for all plots was prepared with a moldboard plow, disked, and then finished with a spike tooth harrow.

Corn

Corn (Seedway variety 390L) was seeded with a John Deere 1750 four row planter at 34,000 seeds/acre in 30 inch rows. A starter fertilizer (10-20-20) was applied at a rate of 200 lbs/acre. The plot size was 10’ x 25’. On May 30th Lumax (S-metolachlor, atrazine, and mesotrione) was sprayed on the plots that had an herbicide treatment at 2 qts/acre. Weed and crop populations were measured at 6 DAP. Weeds were identified pre- and post-tineweeding (Table 2). On July 9th, the corn was sidedressed with 92 lbs N/acre. Weed biomass was measured on September 21, 2010, prior to harvest. The plots were hand harvested with machetes. Two 10’ row sections were harvested and weighed with a small platform scale on September 29, 2010. Populations were counted on two 17.5’ row sections. A 5 plant subsample was chopped with Troy-Built chipper shredder. After mixing, a one pound subsample of chopped corn was dried, ground, and analyzed for forage quality by the Cumberland Valley Forage Laboratory in Maryland. Analysis determined crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and 30 hour digestible NDF (dNDF). Pertinent forage quality information is summarized in Table 3. All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate treatment means when the F-test was significant ($P < 0.10$).

Table 2. Impact of weed control strategies on corn.

Treatment	Harvest population plants/ac	Weed biomass lbs/ac	Harvest moisture %	Yield 35% DM tons/ac
6 Day	19000	1280	**43.7***	18.1*
Control	**34700***	3350	36.0	11.7
Herbicide	34000*	**130***	**43.7***	**23.0***
LSD (0.10)	4000	638	3.28	5.06
Means	29200	1590	41.1	17.6

* Treatments that are not significantly different than the top performer in a particular column are indicated with an asterisk.

At 6 DAP, corn had not emerged, and was not visually affected by tineweeding. However, lower harvest populations in the 6 DAP tineweed indicate that corn seed may have been disturbed through the weeding action. At 12 DAP, corn was still germinating or in the spike stage, but heavy rains made tineweeding impossible until the proper window had passed, resulting in weeds that were too well established to be affected by tineweeding. Mustards (*Brassica* spp.), redroot pigweed (*Amaranthus retroflexus L.*), dandelion (*Taraxacum officinale* Weber), yellow woodsorrel (*Oxalis stricta* L.), common lambsquarters (*Chenopodium album* L.), hairy galinsoga

(*Galinsoga* ciliate (Raf.) Blake), foxtails (*Setaria* spp.), and quackgrass (*Elymus repens* (L.) Nevski) were all eradicated by tineweeding measures. While the herbicide weed control method had the least number of weeds (Figure 3), it did not have a significant effect on yield when compared with tineweeding 6 DAP (Table 2). The control plots had the highest weed biomass that resulted in the corn taking longer to dry down and lower silage yields (Figure 4).

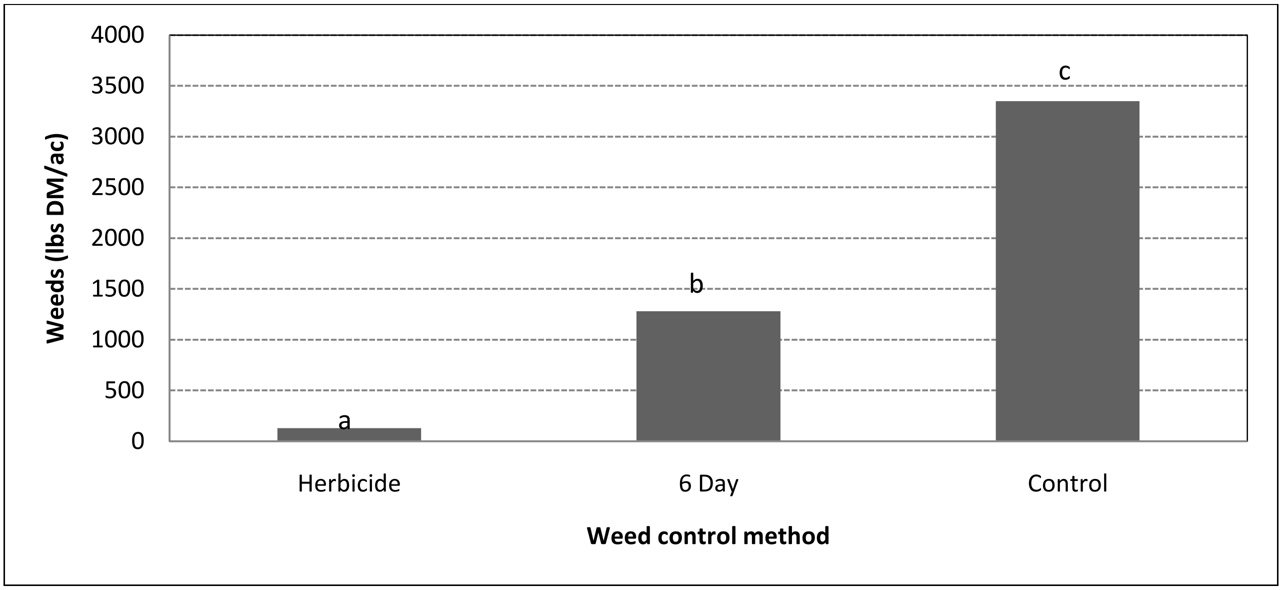

Figure 3. Effect of corn weed control on weed biomass in pounds of dry matter per acre.

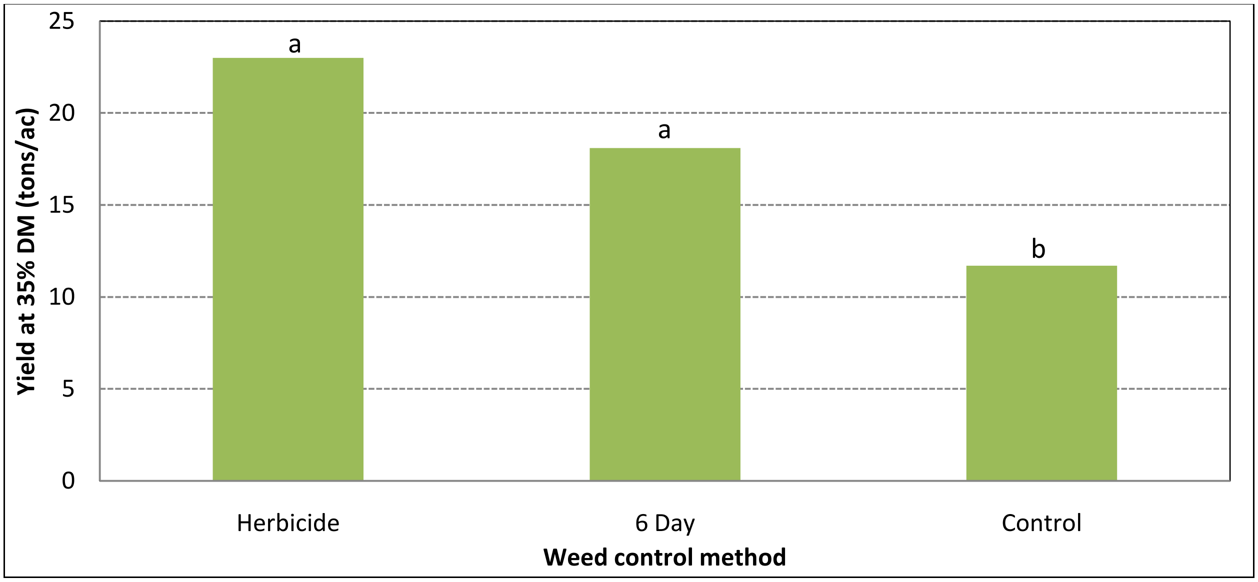

Figure 4. Effect of weed control method on corn silage yield (tons/acre).

Table 3. Impact of weed control on corn forage quality.

Treatment	Forage quality characteristics					Milk per	
	CP	ADF	NDF	dNDF	NEL		
	%	%	%	%	Mcal/lb	ton	acre
6 Day	**5.53**	27.5	**45.9**	**58.8**	**0.74**	**2820**	17900*
Control	5.08	**32.1**	52.3	54.4	0.71	2620	10700
Herbicide	5.15	29.5	47.9	55.7	0.73	2700	**21750***
LSD (0.10)	NS	NS	NS	NS	NS	NS	5020
Means	5.25	29.7	48.7	56.3	0.73	2710	16800

* Treatments that are not significantly different than the top treatment in a particular column are indicated with an asterisk.
NS - None of the treatments were significantly different from one another.

Treatments did not differ significantly in CP, ADF, NDF, dNDF, NEL, and the performance indices milk per ton. Significance was detected at the 0.10 level for milk per acre because of the higher yields found in the 6 DAP and herbicide treatments (Table 3; Figure 5).

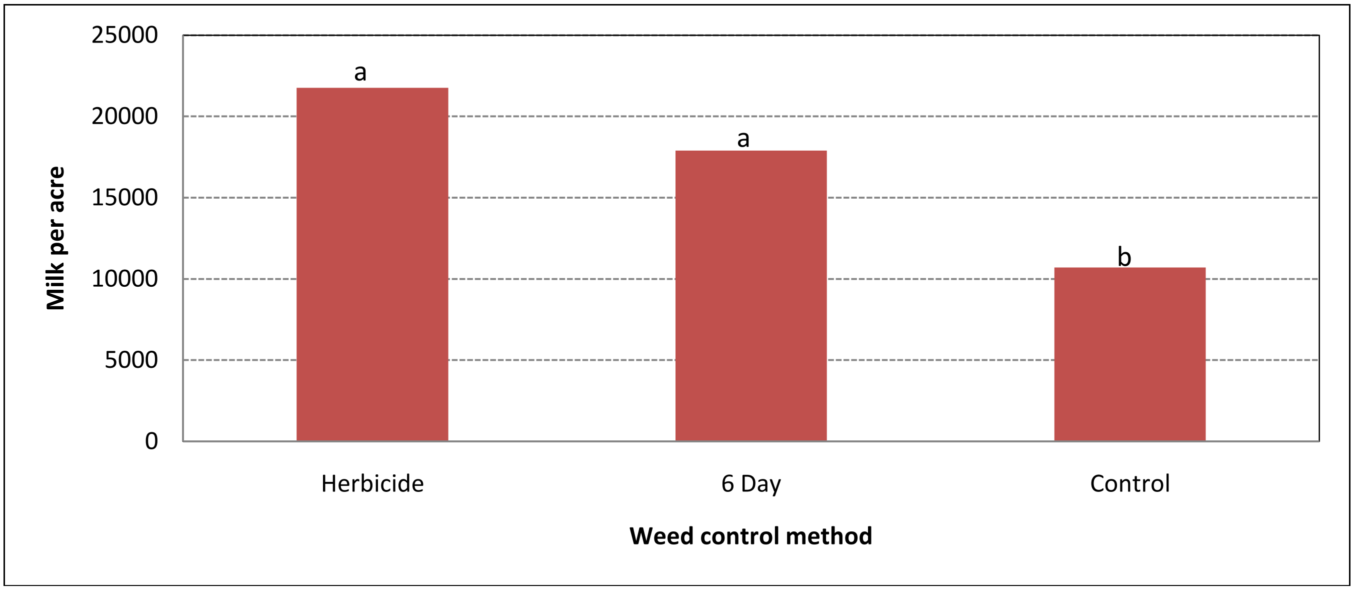

Figure 5. Effect of weed control on milk per acre in corn.

Sunflowers

Sunflower plots (Seeds 2000 variety Viper) were seeded with a John Deere 1750 planter equipped with sunflower fingers at a rate of 29,000 seeds per acre, with 30 inch spacing between rows. The plots size was 10' x 25'. Starter fertilizer (10-20-20) was applied at a rate of 200 lbs/acre. An additional 70 lbs of N were topdressed in early July.

A pre-plant application of Trust (trifluralin) was applied to the herbicide plots at 1.5 pints per acre. Weed and crop populations were measured at 6 and 12 DAP. Weed identification was performed at each interval. Weed biomass was measured on September 21st, 2010. To prevent bird predation, all plots were covered with bird netting and "scary eye" bird deterants were errected in close proximity to the research trials. Plots were harvested with an Almaco SP50 plot combine on November 2, 2010. Yield was measured by weighing the harvested seeds on a platform scale. At harvest, moisture, and test weight were measured. All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate treatment means when the F-test was significant ($P < 0.10$). No significance difference was observed among tineweeding treatments for harvest moisture, test weight, or yield (Table 4).

At 6 DAP, sunflowers had not emerged, and so were not visually affected by tineweeding. Very few weeds were present at that time, and those that were present were in white thread stage. Mustards (*Brassica* spp.), redroot pigweed (*Amaranthus retroflexus L.*), common lambsquarters (*Chenopodium album* L.), prickly lettuce (*Lactuca serriola* L.), dandelion (*Taraxacum officinale* Weber), yellow woodsorrel (*Oxalis stricta* L.), foxtails (*Setaria* spp.), and quackgrass (*Elymus repens* (L.) Nevski) were all eradicated when tineweeded at 6 DAP. At 12 DAP, sunflowers were still germinating or at the cotyledon stage. Some seedlings were pulled out by the tineweeding, and some were covered up. An average of 21% of the crop was either pulled up or covered up when the crop was tineweeded 12 DAP. By harvest, all tineweeded stands had recovered to such an extent that those few that were buried or uprooted caused no significant difference in yield (Table 4).

Table 4. Impact of weed control strategies on sunflower characteristics.

Treatment	Weed biomass lbs/ac	Harvest moisture %	Test Weight lbs/bu	Yield at 13% moisture lbs/ac
12 Day	1528*	13.0	27.1	1740
6 & 12 Day	**1360***	12.7	27.0	1750
6 Day	4011	12.9	26.8	1810
Control	2842	13.0	26.5	1850
Herbicide	2590*	13.1	27.3	1780
LSD (0.10)	1325	NS	NS	NS
Mean	2466	12.9	26.9	1790

* Treatments that were not significantly different than the top treatment in a particular column are indicated with an asterisk.
NS - None of the treatments were significantly different from one another.

Weed control method had a significant impact on final weed biomass recorded near harvest (Figure 8), but weed pressure was not significant enough to impact yield (Figure 6).

Tineweeding at 6 & 12 DAP resulted in significantly less weed biomass than only tineweeding once or no weed control. The 6 & 12 DAP, 12 DAP, and herbicide weed control methods were equally effective at reducing weed biomass. Based on this season's data it is obvious that tineweeding can be an effective weed control tool in sunflowers. The best control seems to be achieved with multiple tineweeding events. The multiple tineweeding could result in reduced plant populations and therefore higher seeding rates may be warranted. Overall, sunflowers appear to be extremely competitive with weeds as the sunflower yields were not reduced even under high weed pressure.

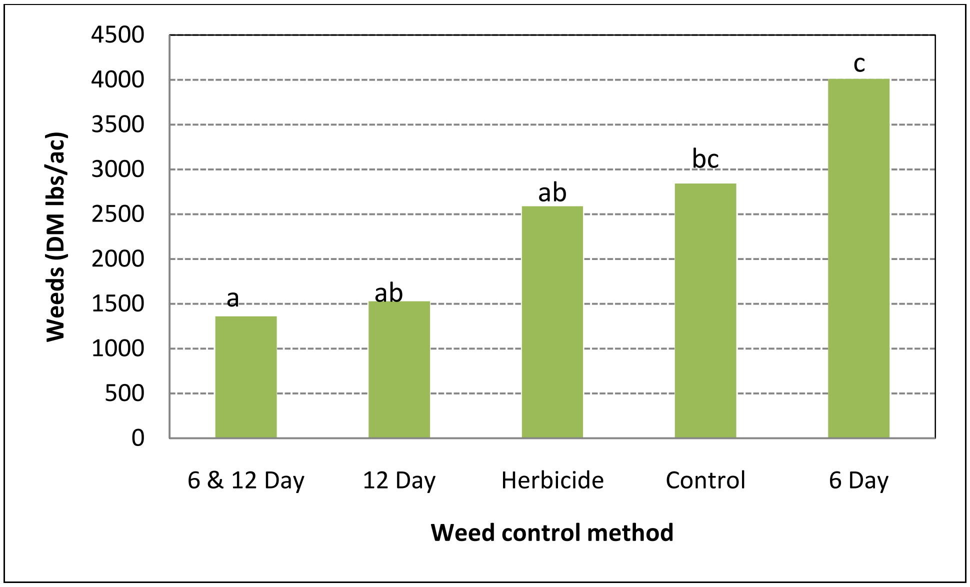

Figure 6. Effect of weed control on weed yield in pounds of dry matter per acre.

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