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Value Added Agriculture Program

Weed Management in Flax Production On-farm Trials - 2005

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Practical Farmers of Iowa

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Project Need

With increased demand for flax in human and feed markets, both organic and conventional farmers have shown interest in growing flax in Iowa. A new crushing facility for flax in northwestern Iowa has provided a nearby market for organic producers. Because flax is not a highly competitive crop, farmers question the best way to manage weeds, particularly where herbicide use is not an option.

Project Summary

Four certified organic farmers and one conventional farmer tested three weed management strategies in flax. They compared no underseeding with both alfalfa and red clover in drilled flax to evaluate the effects on flax yield and weed suppression. Different flax varieties were planted on each farm and average combine-harvested, clean, seed yields for farms ranged from 818 to 1,674 lbs/A, but there were no differences in flax yield due to the underseedings. The underseedings also did not affect weed growth during the flax growing season. But, in August and September following flax harvest, red clover provided the most biomass regrowth (1,563 lb/A) and the best weed suppression. Alfalfa produced only 2/3 the biomass (915 lb/A) and was intermediate in weed growth suppression. As expected, where there was no underseeding with the flax, weed growth was greatest following flax harvest. Results are similar to those from plot trials on two Iowa State University research farms in 2005. Results indicate that seedling legumes do not provide much competition with weeds in a flax planting. But by late summer, established red clover stands are very effective at preventing weed regrowth and establishment of new weed seedlings.

Project Description

Three weed management strategies for flax were compared on five farms in 2005. Oilseed flax was planted alone, with an alfalfa underseeding and with a red clover underseeding. On each farm, these treatments were randomized and replicated six times. Practical Farmers of Iowa member research cooperators were: Doug Alert, Hampton; Paul Mugge, Sutherland; Ron Rosmann, Harlan.; John Veith, Mt. Pleasant; and David Williams, Storm Lake.. Each farmer planted a different flax variety (Table 1). Four varieties were brown seeded; Omega III is a golden-seeded variety. Crops preceding the flax in rotation were soybeans on three of the farms, corn and triticale. Where flax

John Veith of Mt. Pleasant, Iowa, visits with Iowa State University graduate student Sarah Carlson in Veith's flax field.

followed soybeans, no supplemental fertility was supplied on two farms. A small amount of commercial N, P, K, and lime were applied on the conventional farm following soybeans. Plots following corn and triticale both received manure applications. Flax and underseedings were drill planted from April 8 to 18, depending on the farm. Flax seeding rates ranged from 47 to 70 lbs/A, alfalfa from 10 to 19 lbs/A, and red clover from 13 to 16 lbs/A (Table 1). Flax establishment was not as uniform on the Alert and Williams plots as at the other three sites. Depth of seed placement appeared to be a factor, although measurements were not taken. In the week before mechanical flax harvest, plots were hand sampled for flax grain and straw, underseeding legume biomass and weed biomass. Four, 1 ft. square samples were selected randomly from within each plot and all plant growth was cut at ground level. Legume biomass and weed vegetation were separated by hand from the flax. Flax grain was hand threshed and cleaned in the laboratory. The weed and legume biomass and the flax straw were dried and weights are reported on a dry matter basis. Flax grain weights are expressed at harvest moisture levels. Farmers windrowed their flax from July 27 to August 5, depending on the farm. Flax and other cut vegetation dried in the windrow from 5 to 12 days before farmers combined the grain. John Veith combined his flax without windrowing. Flax seed sample were analyzed for total oil content with a nuclear magnetic resonance (NMR) spectroscope.

Table 1. Field operations and yields for flax weed management trials on five Iowa farms in 2005.

	Farm				
	Alert	**Mugge**	**Rosmann**	**Veith**	**Williams**
Area in Iowa	northcentral	northwest	southwest	southeast	northwest
Flax variety	York	Bethune	Norlin	Webster	Omega III
Previous crop	soybean	triticale	soybean	soybean	corn
Nutrients added	none	liquid sw. manure	none	N-P-K fertilizer and lime	turkey manure
Planting date	April 10	April 9	April 8	April 10 & 16	April 18
Planting method	drilled	drilled	drilled	drilled	drilled
Flax seeding rate lb/A	47	49	51	50	70
Alfalfa seeding rate lb/A	15	19	14	14	10
Red clover seeding rate lb/A	15	16	13	14	16
Packed after planting	yes	yes	yes	no	yes
Weed pressure*	XXX	XXX	XX	X	XXX
Predominant weeds	giant foxtail, smartweed	lambsquarter	giant & common ragweed	ragweed, lambsquarter	giant ragweed, smartweed, thistles
Cutting date	August 5	July 27	July 29-30	--------	?????
Cutting height	4"	6"	4-8"	--------	4-6"
Combine date	August 17	August 8	August 3	July 29-30	August 23-25
Average grain yield† lb/A	1,366	2,051	1,571	1,446‡	---------§
Average straw yield† lb/A	1,803	2,797	1,853	1,948‡	---------§
Average grain oil %	39.1	41.7	43.4	42.3	not measured

*** Key:**
XXX= much heavier weed pressure than with small grains;
XX = heavier weed pressure than with small grains;
X= comparable weed pressure as with small grains
† Hand-harvested yields
‡ Average of 4 harvested replicates.
§ Plots were not randomized. Hand-harvested grain and straw yields were not taken. Combine harvested, cleaned seed yield averaged 818 lbs/A.

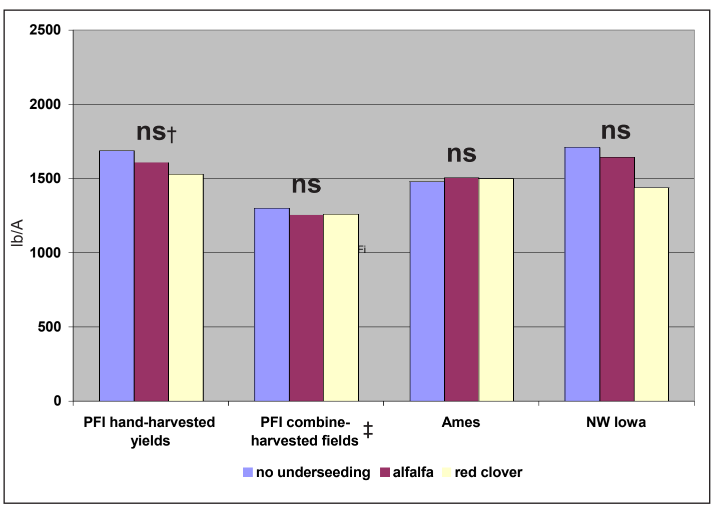
Approximately 60 days following windrowing, plots were sampled again for weed and legume biomass at the Alert and Mugge sites. John Veith had mowed his field and Ron Rosmann grazed cattle on his plot area following harvest, so these sites could not be sampled. Again, four, 1 ft. square samples were selected randomly from within each plot and all plant growth was cut at ground level. Legume biomass, weed vegetation, and seedling flax were separated by hand, dried and weights reported on a dry matter basis. For the production season, farmers provided a visual assessment of weed growth by comparing it with weed competition they have experienced in their current and previous small grain crops.

Results

Grain and Oil Yield

Flax grain yields averaged over the three seeding treatments ranged from 1,366 to 2,051 lbs/A for the four farms sites that were hand harvested (Table 1). Yields did not differ for the three underseeding treatments. This was consistent at the four farm sites, so values are averaged for the farms. (Figure 1). Combine-harvested yields were approximately 17% less than hand-harvested yields indicating some combine loss, but results from combine harvesting were consistent with the hand harvested yields. These results were also consistent with yield response to these same underseedings in small plots studies conducted at two Iowa State University research farms near Ames and Calumet (in northwestern Iowa) in 2005 (Figure 1).

Figure 1. Effect of three underseeding treatments on flax grain yield for four* PFI farms and two Iowa State University research farms in 2005.



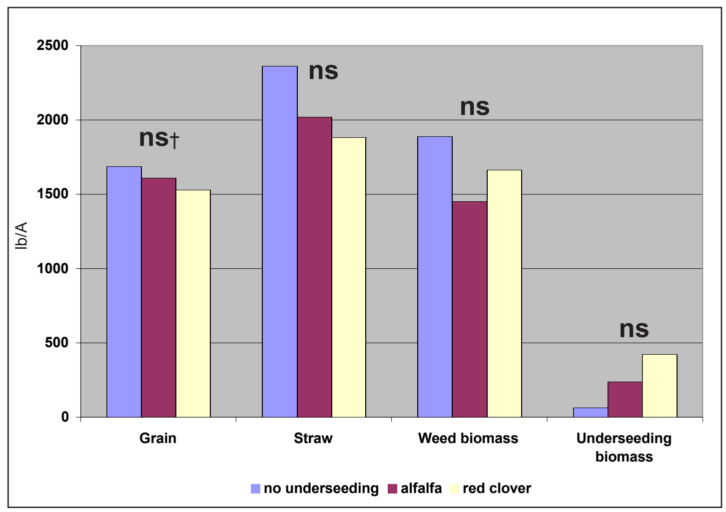
*Alert, Mugge, Rosmann and Veith farms.
† Treatment means illustrated by contiguous bars were not significantly different.
‡Alert, Mugge, Rosmann, Veith and Williams farms.

Percent oil in the flax grain was not affected by the underseeding treatments (42% where there was no underseeding, 40.7% with alfalfa, and 42.1% with red clover). The oil content did vary from 39.1 to 43.4% for the different farms (Table 1). We cannot determine whether this was a result of different flax varieties, geographic locations, or other factors. All of these values though, indicate sufficient levels of oil to meet requirements for organic flaxseed contracts.

Straw Yield

Flax straw yields ranged from about 1 ton/A to 1 ½ tons per acre from cooperator's plots when averaged across all the underseeding treatments (Table 1). Although there appeared to be a trend toward more straw with less underseeding, straw yields did not differ significantly due to the underseeding treatment (Figure 2). Feasible current uses for flax straw include for livestock bedding and mulch. Straw can be fed to livestock, but measured values of 3.4% protein and a Relative Feed Value (RFV) of 47, indicate a very low quality feed. Straw is slow to break down due to its high fiber content and high carbon to nitrogen ratio of 97:1.

Figure 2. Effect of three underseeding treatments on flax grain and straw yields and weed and underseeding biomass yields at the time of flax harvest averaged over four* PFI farms in 2005.



*Alert, Mugge, Rosmann and Veith farms.
† Treatment means illustrated by contiguous bars were not significantly different.

Weed Growth

Weed biomass production was higher on all the certified organic farms than on John Vieth's conventional farm. John was in his second year following a long-term hay seeding which may have contributed to fewer weeds. Predominant weed species also varied from farm to farm (Table 1). Despite these differences, weed biomass growth responded similarly to the underseeding treatments on all the farms and was not different up to the time of flax grain harvest in late July (Figure 2). Weed biomass production in the flax plots averaged 1667 lbs/A. For weed management in subsequent crop years, the amount of viable weed seed produced until harvest may be critical. We observed many developing seed heads at the time of harvest, but made no measure of viable seeds.

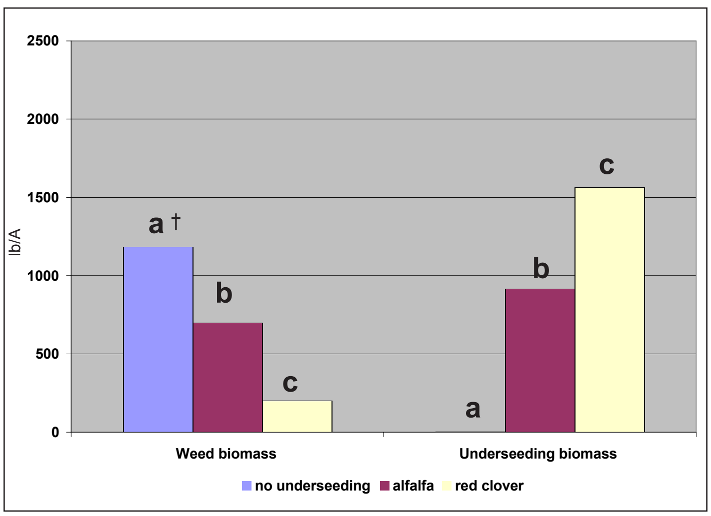
Following flax harvest, there were marked differences in the amount of weed regrowth and newly established weeds in the Alert and Mugge flax plots. As expected, weed biomass production was highest where there was no underseeding, intermediate with the alfalfa seeding and extremely low (200 lbs/A) with the red clover underseeding (Figure 3).

Legume Underseeding Growth

Seedling legume biomass production was low up to the time of flax harvest (Figure 2). On the Mugge and Veith farms, small amounts of legume vegetation were measured even where no underseeding had been planted, due to either previous crop or contamination with seed from neighboring plots. In the planted treatments, the average production of only 239 lbs/A of alfalfa and 423 lbs/A of red clover did not suppress weed growth. In fact, weeds produced 7 times as much dry matter as the newly seeded legumes (Figure 2).

Following flax harvest, there were distinct differences in the amount of legume regrowth in the Alert and Mugge trials. Alfalfa production was nearly ½ ton (915 lbs) and red clover produced ¾ ton (1563 lbs) of dry matter/A (Figure 3). Legume regrowth did suppress weed regrowth during this time period. The greatest legume dry matter production (red clover) was associated with the least amount of weed regrowth (Figure 3).

Figure 3. Effect of three underseeding treatments on late-season legume underseeding and weed biomass weights for two PFI farms.*



*Alert and Mugge farms.
† Different letters above bars denote significant differences among treatment means.

Ron Rosmann, Harlan, Iowa, spoke to a group of interested producers during his flax field day in 2005.

Conclusions

Legume underseedings planted with flax in the early spring did not appear to compete with the flax and lower grain or oil yields. However, they also did not compete with weeds up to the time of flax grain harvest. Both alfalfa and red clover regrowth following flax harvest did, however, compete with weed regrowth and suppressed the potential weed biomass production. Red clover was the more effective at suppressing late-season weed growth.

Legume underseedings were readily established with flax. It appears that either hay seedings (alfalfa or mixed alfalfa/grass) or green manure (red clover) may be successfully planted with flax depending on the farmer's need or the sequence of flax in the crop rotation.

This experiment will be repeated both on station and on farm in 2006.

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