

SARE Farmer Grant Final Report FNE08-628

1) Project Title: **Interseeding legume and grain crops with high oil content sunflower**

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2) Goals:

Although our sunflower yields have been fairly consistent with national averages, there were some areas of the crop which had heavy weed pressure. Because we are most interested in organic methods, we would like to see if an early interseeded crop might cut down on weed pressure and provide either a green manure, or palatable dry matter. Even with multiple passes with sweeps and Lilliston cultivators weed pressure is an issue. Although the weeds top out below the sunflower heads and do not interfere with harvesting, weed pressure can and does complicate harvesting downed crops. Because of the slow drying conditions in New England, often sunflower moisture content is not low enough to harvest until it is too late to plant a winter crop. Sunflower crop residue degrades quickly and does not provide an ideal winter cover which adds to the negative effect of missing a second crop on any given piece of land. We would like to see if interseeding might provide a means of getting a winter cover crop planted without the risk of missing a late fall planting.

3) Farm profile **Background**

Our 250 acre organic family farm has been producing biodiesel from waste vegetable oil for five years and biodiesel provides the bulk of our on farm fuel needs. I have been working with UNH to study the growing and harvesting of high oil sunflower for animal feed and biodiesel production for on-farm use. We are now feeding our beef cattle the pressed seed cake and we are processing the sunflower oil into biodiesel. We have been able to successfully grow sunflower in New Hampshire and get respectable yields comparable to national averages using organic cultivation.

4) Participants

Dorn Cox (project leader)

Becky Grube (Trial layout and data analysis)

Heather Darby (UVM extension agronomist, consulting on covercrop varieties and planting dates)

UNH Kingman and Woodman research farms (Evan and John Mclane)

5) Project activities

Planning

This stage involved discussions in March and April with the project leader Dorn Cox, technical Advisor Becky Grube, and consulting with Heather Darby on the planting methods and dates for cover crops and sunflower planting. We also chose the sunflower variety and developed the randomized plot layout and design.

Seedbed prep

This stage involved project leader Dorn Cox, and Staff at Woodman farm . The following link provides a report on the soil condition prior to spreading manure.

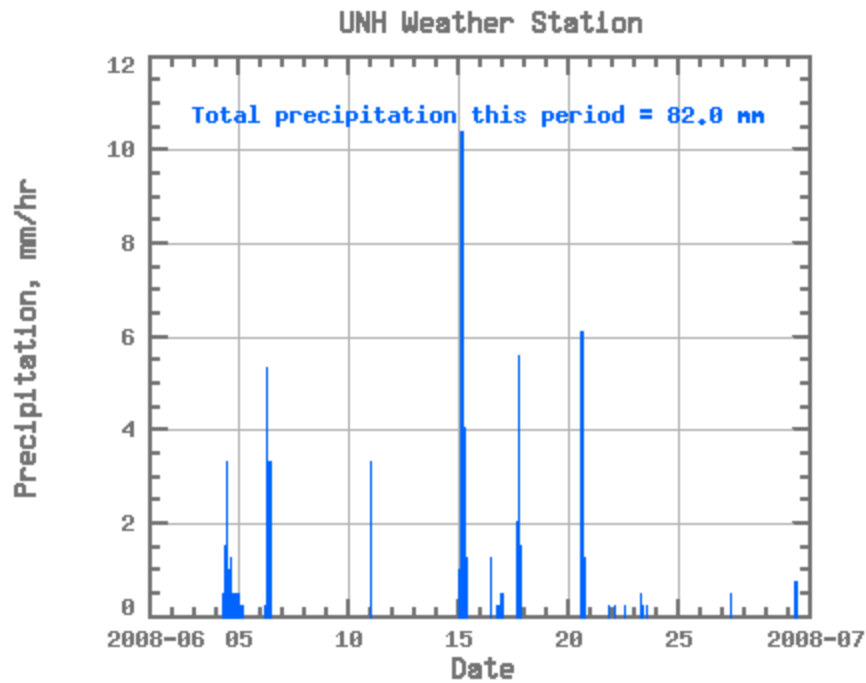
(http://ceadmin.unh.edu/soils/reports/soils_report.cfm?cust_type=15&lab_id=7783) Fields were prepped on April 25th. The fields had sunflowers grown on them in the past, so the weed bank in the soil was significant, but provided a good test case for the effectiveness of the covercrop treatments.

Planting

This stage involved project leader planting the sunflowers (untreated Seeds2000 Defender) with a two row MF plate style corn planter on 36" rows with seed spacing of 8". The plots were all planted with sunflowers on May 9th. Broadcast seedings of buckwheat were done on June 12th and rye, vetch and clover on June 27th. A later planting date would have been desirable, but because of the mid-month rains and the rapid growth of the sunflowers later planting was not practical.

Cultivating

Cultivating was done by project leader Dorn Cox once before the early interseeding treatments and a second time before the late interseeding treatments. Cultivating was done with a lilliston style rotary cultivator head. There was too much rain right before the first cultivation with would have allowed for an initial tine weeding. The cultivation dates were June 10th and a second and third cultivation done the 25th.



However, as can be seen by the above precipitation graph, there was significant rain in the middle of the month. This made an earlier cultivation impossible. The rain also accelerated the growth of the sunflowers, making any later cultivations impossible because of the height of the plants. In future years, an earlier time weeding would have been desirable. We have also fitted our cultivator with more aggressive disks to catch later stage weeds, and with a large tine behind the tractor wheel to break up the compaction and make the cultivator more effective.

Deer deterrence

Although deer pressure is often an issue, it was minimal this year. There was also more limited bird damage.

Interseeding crops

This stage involved project leader Dorn Cox and Interns from UNH, broadcast seeding the treatments on June 12th and June 27th. These seedings were broadcast and tamped down at the recommended seeding rates.

Observation

Observation was conducted at least weekly and included taking photographs of the treatments at various stages, and keeping notes on findings.

Harvesting

Harvesting took place on October 10th using a Gleaner K2 plot combine set up with a load cell bucket to automatically weigh seed samples from plot rows. The corn head worked extremely well with minimal harvest loss, other than stalks already lodged by high winds. Ideal harvest would have been 2 weeks earlier, but weather and combine availability were issues.

Data tabulation and analysis

Harvest data was gathered from the combine readouts and data entry into a spreadsheet was performed by project leader Dorn Cox. Initial analysis was performed by Dorn and assisted by Becky Grube.

Outreach

Dorn Cox arranged the twilight meeting locations and times, and they were published through extension newsletters and targeted e-mails in collaboration with Becky Grube. Dorn Cox also made calls to the Strafford County Conservation district and the state USDA office.

The following is a list of dates and public events and tours arranged and hosted by Dorn Cox

- 3 UNH Student Interns June 1st – July 31st
- demo dates - June 5-9th
- June 19th
- MIT July 16th
- July 2nd
- July 3rd
- July 19th
- August 5th
- August 14th Channel 9, television coverage on *Chronicle*
- Aug 28th and September 11th Bioiesel commission hearings
- Tours with Governor Jeane Shaheen & Senator Jon Tester September 10th
- September 14th Kindle New England Gathering
- October 30th NRCS engineer tour
- October 18th Bioneer conference presentation
- December 2nd UNH tour and discussion for Sustainable Agriculture class

6) Results

Yields were from 700lbs/acre to over 900 lbs/acre.

100' rows - 2 rows (out of 6) harvested per rep								
	rep 1	rep 2	rep 3	rep 4	rep 5	total	average	
Clover		3.4	4.9	4.8	5.2	4.18	22.48	4.496
Rye		6.2	5.5	6.3	7.8	7.6	33.4	6.68
Vetch		2.5	4.7	5.8	6	5.8	24.8	4.96
Buckwheat		3.5	5.5	3.4	4.4	2.5	19.3	3.86
Clover/vetch		2.8	4.6	4.5	6.2	2	20.1	4.02
cultivation only		4.8	6	4.1	4.6	3	22.5	4.5

Treatments	seed rate
Chrimson Clover	2/3 lb/1000sqft
Buckwheat early	3lbs/1000sqft
Vetch	1lb/1000sqft
Reserve treatment	3lbs/1000sqft
Winter Wry Late	6 lbs/1000sqft
Cultivation only	

Comparisons with control using Dunnett's Method

Control Group = Cultivation only

|d| Alpha
2.73477 .05

Level	Abs(dif)-LSD	p-Value
Rye	.363	.016
Vetch	-1.36	.932
Cultivation Only	-1.82	1
Clover	-1.81	1
Clover/vetch	-1.34	.921
Buckwheat	-1.18	.797
Positive values show pairs of means that are significantly different		

Level		Mean
Rye	A	6.68
Vetch	AB	4.96
Cultivation only	B	4.5
Clover	B	4.49
Clover Vetch	B	4.02
Buckwheat	B	3.86
Levels not connected by same letter are significantly different		

Interpretation of Results

Using on-way anova, the rye treatment was significantly different ($p=0.016$) from the control- cultivation only. None of the other treatments were significantly different from the control. This indicates that there was some yield benefit to the rye treatment and none from any of the other treatments.

The reasons for the better performance of the rye treatment are not known. In discussions with Becky Grube, one possibility is that the rye out-competed many of the weeds, but competed less with the sunflower.

Photos of the results



The test plots after interseeding but before bloom



Example of control plot with cultivation only



Plot with buckwheat beside cultivation only plot



weed pressure between plants and out-competing buckwheat treatment



heavy weed pressure on winter rye treatment



Winter rye treatment shows some resistance to weed encroachment.



Despite heavy weed pressure, the crop was harvestable



The corn head on the gleaner K2 plot combine striped the sunflower head from the stalks, picked up very minimal weed material and provided very reliable data.



Vetch treatment post harvest



Winter Rye treatment post harvest

Conclusions

The weather for the year was unusually wet, which made weed control difficult and also accelerated the early stage growth of the sunflowers. This combination forced an earlier interseeding planting date than might otherwise be desirable for success of the trial, but was very desirable for the crop. The earlier interseeding planting date meant that there was more weed pressure and less sunlight for the interseeded covercrop. However, the trial provided valuable insight into how the crop performed in these unusual conditions. The rapid early growth also enabled an earlier dry-down and harvest which would have made winter covercrop seeding possible without the interseeded treatments – which is a very desirable result. 2008 was the first season that the sunflowers have matured early enough to enable such an early harvest.

When results are taken in conjunction with past years results interseeding shows some promise as a method for establishing a winter cover crop without significantly reducing productivity. From this years results we also can say that there may even be a benefit to interseeding with rye if there are field and weather conditions similar to 2008 with a very dry early May and a wet middle of June. This years results also highlight the importance of early weeding, and weed seed management from previous seasons. Additional years of data with more typical weather patters with wetter may and dry June which would force a later planting date and later cultivation and intersowing dates might provide significantly different results. If weather patterns were such that the sunflower was not harvestable until much later in the season, the benefit from the interseeded treatment would be greater.