

## **Progress Report – SARE Program**

### **Project Number: FNC10-828**

Title: Optimizing sorghum-sudan/forage soybean cover crop populations and screening sorghum varieties for organic cover crop performance, forage, and seed production in the Northern Great Plains region

This two-year project will investigate optimal mixing ratios and seeding densities of sorghum-sudan/forage soybean mixtures and will trial sorghum varieties for organic cover crop performance, forage, and seed production in the Northern Great Plains region.

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### ***WORK ACTIVITIES***

#### *Ray Berry Farm:*

The seed for the trial was purchased from Albert Lee Seed House. The ground was prepared, however due to rain the plant date was delayed. This worked out to be an advantage since there was considerable growth of wild oats.

The test plot was clean as we were forced to work the ground two extra times. A trial was planted on May 30<sup>th</sup> but unfortunately, due to a malfunction with the meter, the soybeans were placed in the ground but not the Sudan grass.

On the 11<sup>th</sup> of July, the Sudan grass was planted over the soybeans. This process worked somewhat well, however the second pass did remove some of the soybeans.

It was discovered that the 20lb/60lb of Sudan grass/soy beans mixture was better at weed control and allowed for more forage than the lighter planting of 15/30 lb mix. The variant from the two ratios had little affect.

The cowherd went into grazing when the Sudan was shoulder high, which took approximately six weeks. The gates were left open so the cows could return to native pasture and water at will. An additional 30 acres of straight Sudan was planted, so the 40 acres provided feed for 60 days for 160 head of animals, or 320 AUMs. We also found that as the animals grazed, they trampled nearly 50 percent of forage onto the ground for good cover & weed control.

Also another benefit was that no manure patties lasted more than four days before the bugs had removed it entirely. It was also observed that there were hardly any flies while the animals were grazing the Sudan grass/soy mixture, with no more than 10 to 15 flies per animal.

Leland Schoon visited to observe the progress and took photos on the good results of the project.

### *Dave Podoll Farm:*

On July 21<sup>st</sup>, approximately 2 tons per acre of turkey manure was spread and incorporated into the soil. Black hawk sorghum was sown and forage soybean Derry, in a 4 to 1 ratio at 30 lb per acre, onto 35 acres. The soybeans were inoculated. Note: Originally, it was planned to plant the mix about 1 month earlier but rain and wet ground delayed sowing until July 21<sup>st</sup>.

The trial was intended as a green manure thistle control and fall cover, and because of the lateness of planting it was left to freeze down for winter cover, waiting spring incorporation. By Aug 20<sup>th</sup> the sorghum averaged 2 ft tall and the soybeans 8-10 inches tall. On Oct. 8<sup>th</sup>, the population was killed by frost. The sorghum topped out at about 7 ft and the soybeans at 2 ft or less. It was clear that the soybeans could not compete with the sorghum in such a mix. They provided little benefit.

### *Seeding rate*

Initially, the seeding rate seemed too small as it took a fair amount of time for the sorghum to make complete cover. Recommendation for future trial data: try a higher sorghum-seeding rate and removing the soybeans, (although it did come as a surprise that such large growth was obtained with the sorghum seeding was so late); and try to seed about a month earlier. Initially, it was speculated that the deer would destroy the soybeans if a more dense population of soybeans had been seeded.

### *Notes*

Each trial participant found that the seed was much more expensive than anticipated. The budgeted seed was \$3,447 for two years, or \$1,723 per year. For the first year, David spent \$1,448, Richard, \$565 and Ray, \$880, for a total of \$2893 spent on seed for the first year alone. In our opinion, the seed costs were budgeted extremely too low for this particular trial. We suspect that the number of acres anticipated to be used was dramatically lower than the actuals. Due to the cost-benefit ratio, it is more cost effective and convenient to plant an entire field. For next year, the trial area would be the same, therefore, seed costs will exceed budget. David chooses not to be reimbursed for the entire field, but for what was budgeted.

Please refer to attachment "Budget B" including receipts for an explanation on how the grant funds were used.

# ***1. List the results of your project and what you have learned so far.***

*Richard Gross Farm:*

## *Sorghum Sudan / Soybean Cover Crop Trial 2011*

Plot Size: Each plot 1/4 mile long, 36 feet wide = 1 acre

Previous Crop: Flax/Clover

Green Manure: Clover plowdown 6-13-11

Manure: 1.2 Ton/Acre, Fall 2009

Tillage: Disked 6-13-11, 6-25-11

Planting Date: 6/30/2011

### *Land Prep:*

Field had sweet clover growing and was disked 6-13-11 when clover was about 20 inches tall. Field was disked again on 6-25-11.

### *Seeding:*

36 foot JD 730 air disc drill was used to seed cover crop on 6-30-11. Soybeans were in one tank of the cart and Sorghum Sudan was in another tank. Plot 1 was seeded length of field and Plot 5 was seeded back at same rate. The seeding rate was changed and repeated with Rows 2,6 and 3,7 and 4,8. Organic BMR Blackhawk Sorghum Sudan and Organic Viking 0-2265 Soybean seeds were used on the plots.

### *Seeding Rate Chart:*

<u>Plot</u>	<u>Acre</u>	<u>Sorghum Sudan</u> <u>#/A</u>	<u>Soybean</u> <u>#/A</u>
1	1	15	60
2	1	15	30
3	1	20	30
4	1	20	60
5	1	15	60
6	1	15	30
7	1	20	60
8	1	20	30

**Total**

**8**

**140#**

**360**

### *Results*

The ground was warm and moist allowing the crop to emerge quickly. The canopy closed-over in about 28 days and provided good weed control. Due to a warmer and wetter summer than usual, plots varied more within the same plot than between different seeding rates. Plots 1 and 5 seemed to have more growth. Sorghum Sudan height was 3 to 5 feet tall and soybeans were 2-3 feet tall and had good nodules on the roots. Forage samples were taken on September 20th and crop was grazed after November 14th.

### *Weed Control:*

#### *Dave Podoll Farm:*

The ground was fairly clean but manure spurred the growth of pigweeds. Heavy rain after seeding caused concern about the pigweed germination with the sorghum. As it turned out, some pigweeds went to seed but the plants struggled under the sorghum canopy. The thistles tried valiantly to grow under the canopy but made little headway. The preference would have been to have an earlier sorghum planting, let the sorghum grow to approximately 5-6 ft tall, incorporate it, and then sow another fall cover. Bio mass production was very high.

#### *Ray Berry Farm:*

The trial showed good weed control and excellent cover once grazing was over; the Sudan stalks were 18-24 inches tall which will be good for stopping snow; due to the huge number of insects devouring manure and fly larvae, no patties lasted more than 4 days; 8 AUMs of forage was produced per acre, which turns out to be approximately \$200 per acre of value. This will prove to be a good source of mid-summer grazing while letting the native pastures mature.

The planting density estimation was at 20lb Sudan and 60 lb soy. Photos, provided by Ray Berry, can be found below.

### ***WORK PLAN FOR 2012***

The plan is to prepare ground in the same way and plant the mix the last week of June, with the same amounts used in 1<sup>st</sup> year trials.

Next year David Podoll will probably scratch soy from mix and maybe set up to 30lb of Sudan grass. We plan to plant a month earlier, incorporate it and plant another cover crop for the fall.

Ray Berry will be planning a field day demo the last of week July or the first week of August, and will follow with photos of various stages of growth.

## ***OUTREACH***

This year Ray Berry shared with local producers how the field turned out. It was not clear at first the best way to conduct a formal field day for the first year. Now, having the experience of the first year, Leland and Ray can prepare and schedule a field day, arrange a video of the program and include it as a rangeland tour.

David Podoll held a field day on Oct. 10<sup>th</sup>, and discussed both trials. There were approximately 25 participants.

*Second Trial, Small Plot trial of sorghum, pearl millet and vetch. Screening for cold and drought tolerance:*

### *Dave Podoll Farm:*

Twenty-one accessions (experimental varieties) of sorghum were received; one of the pearl millet from Matt Kolding; one of the (hungarian) vetch (*Vicia pannonica*), and one of sorghum, Red Kaoliang (from northern China) from Frank Kutka. All were sowed on June 11<sup>th</sup> into very wet, relatively cool soil. A 3 ft row of each was planted.

All of the plants emerged by June 16<sup>th</sup>. The sorghum, Red Kaoliang emerged first and showed the most vigorous, early growth. The pearl millet was surprisingly vigorous, especially for a plant adapted primarily for more tropical climates.

By Aug. 5<sup>th</sup> all sorghums began to shoot up, with the red Kaoliang about twice the height of the others. The pearl millet was quite uniform at about 2.5 ft tall. The red Kaoliang had relatively thinner leaves and long inter-nodes. While the Kaoliang grew much taller than the others, it would not shade the ground nearly as well as the Kolding varieties which had very wide leaves and thick stalks. The pearl millet growth was surprising. It began to shoot heads eight weeks after planting and was responsive to the very high heat, (90 degrees and dew points in the 80's). It is possible that the day-length had an impact on the growth, or possibly both temp/dew and day-length were contributing factors. For comparison purposes, the Crown proso millet began heading and was taller at 5 weeks. The Hungarian vetch grew very little and was far less vigorous than hairy vetch. The value for nitrogen or bio mass production was minor, so far. It appears to act as a biennial in this latitude.

Reference for future trials: Is this plant a biennial; and how might the 2<sup>nd</sup> years' growth compare? Is it shade tolerant?

On Aug. 12<sup>th</sup> the pearl millet and sorghums began to flower. The pearl millet continued some blooming thru August, however, the early heads set poorly. Perhaps this was weather related.

Frost stopped growth of the plants on Sept. 15<sup>th</sup> but did not kill any plants. The heads continued to ripen.

On Oct. 6<sup>th</sup> all the seed heads were cut for threshing. Mature height for the Kolding accession were 3-4 ft.; the Red Kaoliang, 6-7 ft.; and the pearl millet, 3ft.

At threshing, 21 accessions of the 'Matt K.' sorghum were bulked. The yield was 27lbs with a test weight of 57 lbs. The red Kaoliang harvest yield was 1lb and the pearl millet was approximately 1.5 lbs.

In late October, one plant of the *vicia pannonica* was lengthening and beginning to bloom, however, the others remained small and were left for over-wintering.

Observations about drought and cold tolerance traits: since this past summer was perhaps one of the wettest summers on record, there was little chance to assess drought tolerance. However, as it remained cool through June, we could assess that the seed had good cold-soil-tolerance based on a normal or average planting time. Summer temperatures were very hot which possibly allowed the sorghums and millet to ripen before the initial frost. No disease was noted even with the very humid/tropical conditions during the growing seasons.

Future observations will include planting the bulk sorghum population mix and pearl millet and assessing the *vicia* for winter survival and shade tolerance.

### *Richard Gross Prospective work plan for second year trials:*

I plan to repeat the trial next year at the same rates to see if different growing conditions give different results.

NRCS staff along with about 14 others observed the test plot at various times throughout the growing season. I plan to share my results at the NPSAS Winter Conference this year and next year.

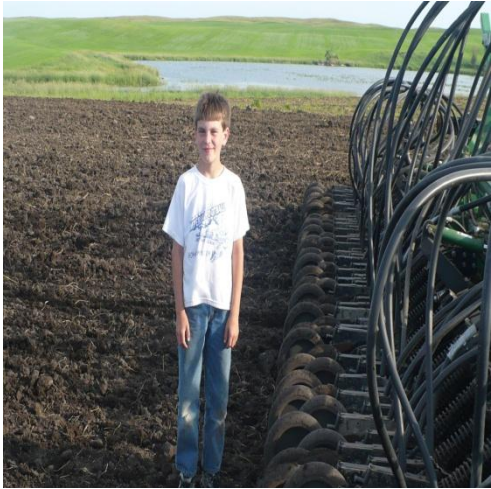


*Matt Kolding soybean accessions*



Blackhawk sorghum, 10/10/11, Podoll Farm





June 30<sup>th</sup>, 2011 – Seeding!



Growing sorghum-sudan/soybean mix – 60 days after planting