**FNE07-597: Japanese Millet Harvest**

Final Report:

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**Goals**

Japanese Millet is a warm season annual crop, which is valued as a “smother crop”, green manure and is also a very good fodder crop for animals. The grain is useful as livestock and wildlife feed, with only a small amount being consumed by humans in the US. Japanese Millet is more tolerant of rainfall extremes and requires fewer nitrogen inputs than most other summer annual crops such as sudangrass or sorghum-sudan crosses. As a green manure Japanese millet is capable of weed suppression, improves soil tilth, reduces compaction and is known to help control rhizoctonia in potato crops. Japanese millet is well adapted to the short growing season in Vermont.

Despite the valuable characteristics of this crop to organic farming there is no source of certified organic seed. We wanted to grow Japanese millet for seed as a cash crop on our farm to provide seed for ourselves and other farmers and growers. When possible, it is important for farmers to develop self-sufficiency in seed production. This reduces reliance on the US seed industry which has become extremely consolidated with a few giant companies controlling increasingly large portions of the agricultural germplasm. Farm level seed saving enhances sustainability by increasing the likelihood that regionally adapted varieties will continue to be produced and available for future generations.

Having grown Japanese millet as a forage crop on our dairy farm we were confident that we can consistently grow good stands under organic management. The millet stands are competitive and the stands are generally quite free of weeds. While we were confident in our ability to grow millet to produce mature grain harvesting technique were less certain and in need of experimentation. This project focused on two combine harvest methods – “direct cut” and “swathed”.

Through phone conversations with a Minnesota millet grower I learned that he prefers to swath the crop when partially mature and allow it to dry for a few days before combining. Millet heads tends to ripen unevenly with the top portion of the seed head ripening more quickly. By swathing the millet when it is partially mature seed loss due to shattering is reduced. However prolonged rains or wet weather after swathing can ruin the crop or create other harvest issues. The other harvest method is direct cut combining. The harvest takes place when the standing crop is mature and at the appropriate moisture for safe storage. This method is more familiar and offers the advantage of not requiring a separate swathing operation. There may however be significant seed loss if the crop becomes over mature. The objective of this project is to try both harvest methods under Northeast conditions to determine advantages in both seed quality and quantity harvested.

**Farm Profile**

My wife, Regina, and I operate a 40 cow organic dairy in Randolph Center, Vermont. We have owned our 145 acre farm for nine years. Our milk is shipped to Organic Valley/CROPP cooperative.

We use management intensive grazing practices on our pastures and strive to optimize the amount of forage which our animals can harvest for themselves. We put up dry hay and legume silage for winter months. In addition to permanent pasture we normally plant a plot of ground to millet each year to provide extra grazing during July and August when cool season pasture plants grow more slowly. Millet, an annual warm season grass, provides a nice rotation crop from sod. Millet is not planted until the soil is warm, so we can harvest one crop of grass in the early spring before preparing the soil for millet. At this time of year the soil is normally dry and plows easily resulting in less compaction than soil prepared in the early spring. The millet germinates quickly and the soil is bare for only a few weeks. The millet has an extensive root system and seems to improve the tilth of the soil.

In recent years we have experimented with growing small grains, including rye, which we have marketed for seed. Our experiences with growing rye seed has taught us the importance of proper harvest, cleaning and storage of grain crops. As Japanese millet is a completely new crop for this region, this project reduced risk to our farm operation while we experimented. We were hoping to find Japanese millet seed production to be a viable diversification to our dairy operation. In addition to the seed, the millet crop also produces straw which is useful for bedding. The straw can help reduce bedding costs and also improves the composting process for our cow manure. Straw bedding makes much better compost than the sawdust we normally purchase.

**Participants**

Project leader – Brent Beidler

Advisor – Dr Heather Darby , agronomist /UVM Extension

Data collection assistance- Regina Beidler

**Project Activities**

A ten acre plot of hay land was dedicated to millet for seed production. Prior to land preparation the plot was grazed by the milking herd in early May. The plot received a liberal coating of dairy manure at a rate of approximately 20T/acre plowed in. Soil tests did not indicate a need for liming or other soil amendment. The land was plowed with a mold board plow, harrowed then rolled before planting with a grain drill. The seeding rate was 25 lbs/A.

Planting dates: June12 (8 acres)

June 28 (2 acres)

Seed head initiation: August 15 for early planting, August 21 for later planting

Weed control was fairly good throughout the plots with some wild mustard present but not enough to impede millet growth. The millet plants were observed throughout the growing period and no nutrient deficiencies or disease were noted by myself or Dr. Heather Darby. The millet grew to a height of approximately 5 feet. The seed heads appeared with a purple hue which slowly turned to brown as the seeds matured.

Harvest:

Swathing Method: mowed October 5, combined October 21

I learned from conversations with a Minnesota millet grower that the optimal stage to cut the millet is when the top two thirds of the millet has turned from purple to brown. Accordingly, I mowed a 2 acre portion of the field to be used for the “swathed” harvest treatment. I used a disc hay mower with out a conditioner according to our trial plan. While the mower was effective in mowing the crop it laid the crop out flat where a specialized swather designed specifically for grain crops would have formed an upright windrow. The stems were still quite green at the time of mowing and much of the crop was lodged. The mower was kept low to the ground leaving the millet crop resting on very little stubble and therefore without much air circulation from underneath. The drying conditions were poor with several rainstorms and consequently harvest was delayed. When good drying conditions did return the moist ground prevented the lower portions of the millet crop from drying completely. Some of the millet was raked up into windrows to see if this would facilitate more complete drying of the stems. The raking, however, resulted in loss of seed and some rocks being brought into the windrows.

I was able to combine the crop on October 21, over two weeks after mowing. The combine had a flexible header with pick-up reel. The combine was able to take in the crop effectively but had difficulty with the slimy stems and rocks plugging the machine. The seed moisture content was at 16 percent. There was a significant amount of seed loss observed. In places the ground appeared to be covered with brown millet seeds.

Direct-cut method: October 14- 21

For the direct cut harvest treatment we waited until after several killing frosts which helped to dry down the millet stems. Although there was still some moisture in the stems at harvest time the rotary combine (IH 1420) was able to handle the crop and did an excellent job of separating the grain from straw. Although portions of the crop were lodged the flexible header was able to run low enough to pick up the crop. The moisture content of the seed at harvest time ranged from 15-17 percent moisture. It was aerated in grain wagons and the moisture dropped below 12 percent within one week of harvest.

**Results**

The harvested grain was weighed in wagons. The field area of 4 combine passes for each treatment was measured and used to calculate harvest yield per acre for each treatment. Perimeter portions of the field were excluded. All measurements were taken on the earliest planted millet only. The direct cut harvest method produced 1584 lbs/acre, while the “swathed” method produced 461 lbs/acre. It was apparent that much more seed was lost due the mowing and raking. Seed quality appeared similar in terms of moisture content and no molding was observed.

In the weeks following harvest it was interesting to observe a wild turkey flock gravitating towards the portions of the field where the millet had been swathed. It was clear that the gleaning was much better in those areas.

**Conditions**

It is clear that the”swathed” method probably would have yielded better results if I had used a specialized swather. These implements are hard to find in this region and I had hoped that a hay mower would do an adequate job. A long stretch of dry weather would still have been required to adequately dry the millet stems. I believe that both harvest methods are more effective after frost or when the stems have started to dry down as well as the seed heads. It should be noted that there are large differences between combines and not all machines would have been able to process the large amounts of less than dry millet stems. The flex header was essential to be able to pick up all the millet heads as the plants were close to the ground in perhaps 40 percent of the field area. A rigid platform grain head would not have worked well as it would not have been able to cut as low to the ground without damaging the knives and bringing dirt into the machine.

**Economics and Assessment**

Our experimentation suggests that direct harvest of millet is possible and had distinct advantages over swathing under our growing conditions this year. As this was our first year growing millet we have learned baseline yield potential for this new crop. As with all combined-harvested crops yield can be greatly enhanced by proper combine setting adjustments and grower experience levels.

The seed was easily cleaned with a small, antique “clipper” seed cleaner and will be tested for purity and germination before marketing. We have not yet determined a selling price for the seed. It is likely that we will add a modest organic premium onto the $1.00/lb price that we paid for the conventional untreated seed that we planted. We hope to set the price at a level that we can receive a sustainable profit margin. We anticipate that seed yield will be somewhat variable from year to year and will try to set our price accordingly. The millet straw was baled up and is providing excellent bedding for the dairy herd. I estimate that the straw added a value of approximately $175/ acre to the cropping system.

**Adoption**

We plan to plant Japanese millet again next year for seed. This experiment has demonstrated to us that we can effectively direct harvest the seed without the added expense of a swathing operation. We also have learned that millet seed is a good match for our farming system and are excited about the opportunities.

**Outreach**

A demonstration field day was held at our farm on October 11, 2007. Forty farmers, agronomists and other interested individuals attended. It was actually a well timed event as the millet crop had been swathed and not yet harvested due to wet weather. Attendees were able to observe the amount of seed loss in the “swathed” plot. There was healthy advice sharing with a general consensus among the more experienced combine operators that I should wait until frost to try to direct harvest. Swathing was not considered advisable unless a good swather was available and a long stretch of dry weather was in the forecast. The group also offered advice on future crop rotations with millet. It was the first time that many folks had seen Japanese millet so there was much discussion about the crop’s use for forage and green manure. Another highlight of the field day was the combine. There are very few combines in Vermont and many farmers were interested to check it out and see it running. Lunch time offered the invaluable networking and information sharing that always happens when groups like this gather. In addition to discussion of this millet project there was also discussion of another new crop, camelina, which we grew for the first time last year. A handout for this field day is included with this report.

Another field day occurred a few weeks later when a class of students from Vermont Technical College visited the farm. There were 20 students in attendance. Their professor is a native of Zambia and is quite familiar with similar millet crops. For many of the students it was a first look at grain cropping, combines and grain handling equipment. I was able to show them the harvested grain, aeration fans, and moisture testing.

Additional outreach is planned for the project.

1. An article has been written for NODPA Newsletter January 2008 edition, a publication which reaches almost all organic dairy producers in the Northeast region.

1. Vermont Grass Farming Association annual winter meeting January 19, 2007. Presentation along with Dr. Heather Darby, handout provided to 40 people in attendance

**Report Summary**

Japanese millet is an important forage and green manure crop for farmers in the Northeast region. Seed production techniques for this crop are unfamiliar and there are currently no sources of organic seed available. This grant explores two combine harvesting methods for millet seed production 1. **direct combining** and 2. **swathing** before combining. Millet ripens unevenly and swathing is thought to facilitate drying, speed up harvest and reduce seed loss.

Our results demonstrated that direct harvest is the preferred harvest method with a properly equipped combine. Swathing with a disc mower was found to be a poor substitute for the specialized swathing machines that are generally used in grain cropping. The additional field operation of swathing caused additional seed loss and expense. While the swathing method definitely should not be discounted by the poor performance in this trial, we can confidently conclude that direct cut combining is a viable method to harvest millet in this region.

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