FNE 96-157

November 19,1996

Dear Final Report Reviewers,

There was some doubt about the fact that I was going to grow sweet sorghum and make syrup from it here in Vermont. After my second year at it there is no question that sorghum is here to stay on our farm. Last year the growing season was hot and dry, and this year cool and wet, but the sorghum grew well both years. I have government crop reports from the year 1880 that claim 40 gallons of sorghum syrup was made here in Vermont. There must have been one producer here at that time. In the late 1800s sorghum syrup was a large crop and nearly 5,000,000 gallons were produced annually in the United States. When the sugar cane industry developed at the turn of the century people preferred the flavorless sweetening sugar cane provided and sorghum syrup died out.

I was invited to attend the National Sweet Sorghum Association (NSSPPA) meeting in Nashville, Tennessee last spring. They were surprised to hear that we were making sorghum syrup this far north. They are just as interested in our maple syrup industry as I am of the sorghum. The Association has been together for about twelve years and is represented by 21 states and is growing in membership every year. It is estimated that a million gallons of sorghum syrup is produced annually in the United States at this time.

In late September two Amish friends of ours took a 14 hour bus ride from western New York state. They were interested in seeing the seed variety test plots that we grew. They have been making sorghum syrup for over fifty years and have just moved to New York from Ohio. Much was learned from their visit and they returned home with sorghum seed heads from what they thought looked to be the best varieties for their location. I have had a good response from my customers that have tried sorghum syrup. Occasionally someone comes along from down south and they know what sorghum syrup is, but the majority of people in our area have never heard of it. Hopefully with some publicity and promotion sorghum syrup will be as widely known as Vermont maple syrup.

Sincerely,

John Williamson

John Williamson

FINAL REPORT FOR SARE GRANT PROJECT #FNE96-157
SWEET SORGHUM SYRUP PRODUCTION IN VERMONT

The goals of our 1996 SARE Project were to determine the best sweet sorghum varieties for Vermont's growing season, to test and evaluate machines to help in the mechanical harvesting of sorghum stalks, to develop evaporator pans that would boil both sorghum and maple syrup, and to experiment with sorghum ensilage as cattle feed.

Our farm is located in N. Bennington, VT and consists of 130 acres. We produce milk, maple syrup, honey, and sorghum syrup.

There were four collaborators in this project in addition to the Williamsons. Emily Hunter was responsible for the sweet sorghum seed variety test plots. Michigan Orchard Supply and Frontier Technology provided a fruit press and technicians to test and evaluate their machine for extracting sorghum juice. G. H. Grimm Co., a maple sugaring equipment manufacturer, made modifications to our sorghum evaporating pan to make it perform better. Clear Brook farm provided a second location for test plots.

SWEET SORGHUM SEED VARIETY TRIAL REPORTED BY EMILY HUNTER

The sweet sorghum variety trial for 1996 included 22 varieties, of which six varieties had been grown in 1995. The rest were acquired from sweet sorghum producers in the southeast. These varieties were selected because they mature early in other parts of the United States. This is an important consideration when growing sweet sorghum here in Vermont.

We grew the varieties at two locations 10 miles apart. One is the Williamson farm where sweet sorghum was grown in 1995. This site is ledgey and the soil is heavy clay. Soil tests showed adequate nutrients in this field. Manure was spread on the field in 1994 and sweet sorghum was then grown on the same ground for two years without further applications of fertilizer. A pre-emergent herbicide was applied immediately after planting. The second site is on Clear Brook Farm. This field is sandy loam and had no fertilizer applied before the sweet sorghum was planted. A crop of buckwheat had been grown and plowed under the previous fall. A soil test done in the early summer showed deficiencies in most nutrients. No herbicides were used.

The 22 varieties were planted in two row plots on May 20 and 22. The rows were 36 inches wide, and 50 feet long. The plantings were done by hand. Five varieties that had been grown and did well in 1995 were planted in half acre plots with a seeder at Williamsons farm. Each plot was harvested at maturity and processed into syrup. At Clear

Brook Farm the variety plots were weeded once with a roto tiller and hoed once by hand. Every 1-2 weeks the varieties were evaluated for developmental stages. Brix readings, a measure of sugar concentration in the plant sap, were taken as soon as the varieties began to mature. Main stalk and tiller counts were done on all varieties, at both sites, at the end of the growing season.

Overall, the plants were stunted in height and smaller in diameter at Clear Brook Farm when compared with the sweet sorghum at the Williamson farm. We expected some decrease in yield there due to the soil deficiencies, but not to the extreme we observed. This is an important finding because although sweet sorghum does not require as much fertilizer as other row crops such as corn, we are finding out what the lower limits for fertilizer are. Too much fertilizer can affect the taste and quality of the finished syrup, so fine tuning the fertilization of sweet sorghum is a challenge.

The rate of maturation for each variety differed at each site. This again could be due to fertilizer differences, soil temperatures, or total solar radiation. There is no clear pattern at either site. However, growing the varieties at multiple sites is important because each site represents a different set of soil and climatic conditions. Therefore each plot is a test in a new environment, as is each year a test. So we learn a little more about how sweet sorghum responds when grown in Vermont. Specific site information is even more important because sweet sorghum is sensitive to temperature, solar radiation and day length, the combination of which cause it to be slightly unpredictable when grown in a new location. For example, Kansas Orange, a variety that is consistently early when grown in the midwest, matured late at both sites here.

Of the 22 varieties grown this summer, ten produced mature seeds by the first killing frost. The summer of 1996 was cool and wet. In these conditions sorghum usually does not thrive. Given average temperatures we expect that morecf the 22 varieties would have matured. All of these varieties will be tested again, the more they are tested in different years and sites, the more accurate our choices for production varieties will be. The brix readings taken from the test plots give us some idea as to a possible order of maturity for processing for syrup, based on sugar content of the plant. We also evaluated the varieties for standability. An early september hurricane caused moderate to severe damage in some varieties. Standability in sweet sorghum is very important because windblown sorghum is almost impossible to harvest. Finally, the varieties differed in the number of tillers, or suckers produced by each main stalk. There are a few varieties that seem to consistently

have fewer, thicker tillers and these would be more desirable for syrup production. We need to learn more about these varieties before recommending them for syrup production.

THE TESTING OF THE FRUIT PRESS

I talked with Frontier Technology engineers last winter about the use of their newly developed continuous flow fruit press for extracting sweet sorghum juice. They told me the press had been used in many applications but not for sorghum. I was invited to bring sorghum stalks out to their factory in Allegan, Michigan to test their machine out. I did so in mid October. They had a press set up to test different types of material and ways evaluate its performance. This belt press worked very well extracting sorghum juice. The best you can expect from a traditionally used roller mill is 50% juice extraction by weight. This belt press will get 60% juice extraction from the sorghum stalks.

The successful test of the fruit press to squeeze juice from sorghum stalks opens up new possibilities to mechanically harvest sorghum. With all the row crop handling equipment available it is a matter of assembling the right components to do the job of harvesting sorghum stalks. There is no modern sweet sorghum harvesting equipment on the market to date.

G.H. GRIMM, CO.

Our original plan was to build a new set of redesigned sorghum evaporator pans. After looking at many designs and asking a lot questions on how they operate we decided to modify the pans we used last year. We were thinking of building a pan that could boil both maple syrup and sorghum syrup but learned that it wasn't possible for one pan design to do a good job boiling down both kinds of syrup. Maple sap is 2% or 3% sugar and takes a lot of heat to evaporate it to syrup. Sorghum juice is 15% to 20% sugar and takes very little heat to boil it down to syrup. A sorghum pan must be designed to facilitate ease of skimming of the impurities that accumulate on the top of the foam while boiling. From what we learned by using the modified pans this year we now know what to build that will work well.

SORGHUM SILAGE

It is a standard practice I learned to utilize the sorghum stalks for cattle feed after the juice has been squeezed from them. Most sorghum producers I talked with chop and

and feed it to their cattle if they have some. Others would pile the sorghum stalks to compost them and spread them back on the land. I chopped one wagon load by hand feeding sorghum into our corn chopper and put it in the silo. It made a layer about 1½ feet deep and the rest of the silo is filled with corn. It will be near spring before we empty the silo down to where the layer of sorghum silage is. It should be interesting to see how the cows respond to it.

ECONOMIC FINDINGS

While I was attending the Sorghum Association meeting I asked many producers why their is no one selling sorghum syrup up our way in Vermont. I was told by all that there is not enough sorghum syrup produced to supply the market demand in the southern states. They do not need to market it anywhere else. The response to my product has been great and I know I could sell all that I can make.

NEW IDEAS AND NEXT STEP

There are many things I have done this past year to make my sorghum operation more efficient, but I can see more things to be done to make it better. I learned what it takes to make a top quality sorghum syrup and will use those techniques to expand off of in the coming years. We will keep trying different varieties, there are many, and evaluate them to find the right ones to grow here in our region that will produce the best syrup. We will save the seeds from these varieties to replant or distribute to others. The next step with the harvest equipment would be to build a row crop machine to cut the sorghum stalks into billets, small 2"-3" pieces. Once this is accomplished then a belt press could be utilized to squeeze out the sorghum juice. This setup could possibly eliminate the labor intense job of cutting sorghum by hand and increase productivity. We will build a redesigned sorghum evaporator pan that will make it easier to produce a high quality syrup. Some marketing and promotion techniques are needed to educate the consumers about the use of this product. There should be some quality standards established for sorghum syrup. I have talked with the Vermont Agricultural Department about getting the Seal of Quality for my sorghum syrup. That should get the wheels turning toward some type of standards.

WHAT I TELL OTHERS

Since my involvement with this sorghum project word has spread. I am surprised at the amount of interest this project is to all types of people. I am certain that others

will try to make sorghum in our region and will encourage them to do so.

OUTREACH

In the past year I have done extensive outreach in many directions. I gave a lecture and slide show at the Vermont Maple Sugarmakers meeting in January. In March I attended the National Sweet Sorghum Association meeting and gave a lecture and slide show and took part in a discussion panel. Sherry Russell a reporter for Country Folks paper wrote an article about this project. Larry Myott, UVM Maple Specialist, included a note in his November column in New England Farmer with a promise to write more at a later date. Our local TV station made a film this fall that aired in early November. I was invited to be a demonstrator at the Organic Farmers (NOFA) meeting in August, but was unable to attend. I promised to attend next summer. I have a good outreach opportunity coming up next July. Maplerama, Vermont's annual maple tour and trade show is being held in our county. One of the tour stops will be at my place. This will be a good time to explain to the three to four hundred maple producers who attend the process of making sorghum syrup. I plan to attend the NSSPPA meeting in Kentucky this coming March and give a report on the fruit press experiment as well as the seed tests. This information will be submitted to the editor of the NSSPPA Newsletter along with any other sorghum news from the Northeast.