

Northeast Sustainable Agriculture Research and Education Program Farmer Grant Final Report

1. Project name and contact information

Introducing Rice as a Commercial Crop to the Northeast USA, Phase 2, FNE 09-653

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2. Goals

Our overall goal is to establish a sustainable rice growing system for the northeastern USA. In 2009 we concentrated on three general objectives:

A. AGRONOMIC

- a. Looking for new varieties and doing preliminary evaluation to find varieties that produce seed at Akaogi Farm.
- b. Expanding last year's production comparisons to several varieties in each of four categories.
- c. Hosting a full day sustainable rice growing system workshop at our farm during summer to exchange information.

B. WETLAND WILDLIFE

- a. Investigating the wildlife species inhabiting our rice paddy.

C. WATERSHED MANAGEMENT

- a. Identifying aspects of watershed management that relate to sustainable rice growing systems.

3. Farm profile

We have been farming for 29 years, 24 years at our current 10-acre farm (a part of the Earthbridge Community Land Trust) in Westminster West, Vermont. At the moment, the two of us are full-time farmers and we do not have any hired help.

From the beginning, we have farmed organically and have made it a point to sell our produce only to local markets. Our current outlets are: our own farm Community Supported Agriculture (CSA) and local farmers markets. Since 2002, Vermont Organic Farmers (VOF) has certified us as organic. We sell vegetables, fruit, honey, and eggs.

We have designed our farm landscape ecologically by putting a buffer zone on the north and west border and planting various trees for windbreaks and wildlife. Next to the buffer zone, we located fruit trees (apple, peach, plums, pears, grapes, and quinces). In the southeast section, we have 3 greenhouses and the vegetable fields. We also have 100 laying hens and 6 beehives.

Across the middle of our farm we have a wetland and adjoining it is marginal land that we couldn't use for production of traditional fruits and vegetables. In the marginal land, we came up with the idea to try to grow rice, which is well suited to grow in waterlogged soil. This initiated the beginnings of our "Northern Rice Project". Our intention is to have no impacts on

identified/protected wetlands and to enhance marginal lands as wetlands for wildlife and other values. We built a small rice paddy in 2006 and two larger paddies in October of 2007. In 2008 we produced 467 lbs of rough (unhulled) rice.

4. Participants

Technical Advisor: Gen Fumio Onishi of Cornell University is our technical advisor for this project. He was a rice farmer in Japan for 20 years prior to coming to the USA. He is now the greenhouse manager of the Rice Research Lab of the Department of Plant Breeding and Genetics at Cornell University.

Collaborator: Professor Susan McCouch head of the Rice Research Lab of the Department of Plant Breeding and Genetics of Cornell University is our collaborator for this project. Susan McCouch is a rice geneticist who specializes in breeding rice for adaptation to particular environments.

We communicated regularly with both of them through e-mail. Both of them attended and presented at the 2009 “Sustainable Rice Production System for the Northeast Workshop” at our farm. We visited them in Ithaca, NY in early December 2009 to discuss the results of this year’s experiment and plan future projects.

Wetland Wildlife Group Members: Alma Beals, Jan Lambert, Em Richards (environmental scientist and former watershed coordinator), and Rebecca Salem (stream ecologist and field scientist).

We gathered a team of four people in several specialties to set up a wildlife and vegetation assessment method plan unique to our rice paddy research project and to do field observations and collect data for amphibians, birds, and vegetation.

Watershed Management Group Members: Marie Caduto (State Watershed Coordinator for Southeastern Vermont), Rebecca Chalmers (District Wetlands Ecologist, Springfield Office), Sylvia Harris (Agricultural Resource Specialist/Basin Planner, Vermont Association of Conservation Districts), and Em Richards (environmental scientist and former watershed coordinator).

We met a few times in 2009 to discuss Vermont state and federal regulations on water quality and watershed management processes related to rice paddy systems and systems and practices to protect and/or enhance associated wildlife in marginal land. We developed a fact sheet on “Federal, State, and Local/Town Regulations Regarding the Construction of a Rice Paddy System in Vermont.”

5. Project activities

A. Preliminary evaluation

In 2009, 33 new varieties were received from the National Small Grain Collection (NSGC) and the Genetic Stocks Oryza (GSOR) Collection of the Dale Bumpers National Rice Research Center in Stuttgart, Arkansas (see Table 1 in Section 6). These varieties were chosen because they are the earliest maturing varieties from various rice growing regions.

The rice seeds were soaked starting on April 13 and the seeds were sowed on April 22. Rice seedlings were transplanted May 23-25. On June 1, fertilizer (Cheep Cheep 4-3-3) was scattered on the surface with 3 inches of water in the rice paddy at a rate of 70 lbs/acre. The rice was harvested from September 15 to October 6.

Seed Importation: The USDA Plant Germplasm Quarantine Program in Beltsville, Maryland received seeds for 5 Korean rice cultivars and entered them into quarantine in March 2009. They went through the quarantine process and we received the seed in fall of 2009 to grow during the 2010 season.

B. Production comparison

Eleven Hokkaido varieties were used in the production comparison (see Table 2 in Section 6). There were 6 early maturing varieties, 2 mid-early maturing varieties, 3 late maturing varieties, and 5 mochi varieties. Each variety was planted in two locations (i.e. two replications) for comparison. Five of the varieties were new for 2009 and were used in the production comparison without preliminary evaluation because they were Hokkaido varieties.

C. Wetland wildlife

The Wetland Wildlife Group had: two organizational meetings (April 14 and May 12), one training workshop (June 23), a mid-season meeting (July 13), and a end of the season meeting. Beyond that, people met with each other or visited our farm as needed.

In the beginning we needed to spend time to discuss the various assessment methods available, and to choose a method that would work for this unique situation. We had to combine aspects of both conservation and agriculture, which was difficult because we were unable to find information for this type of assessment.

Two members worked together to design a plan for data collection and developed a long-term wildlife and vegetation assessment and survey plan unique to the Akaogi's rice paddy research project. This plan included an outline of specific assessment methods, a definition of the study area and data sheets that can be used for collecting data in an organized manner. They also set up all of the monitoring areas and provided a short training for the rest of the members on how to collect data according to the field methods outlined in the plan. We were unable to use this assessment because it was completed towards the end of the 2009 growing season, which limited its application. Also we are not sure that the assessment method developed will work for conservation objectives on agricultural land and that we will use the same method next time.

Data was collected for vegetation, birds, and amphibians. Appendix A is the "Biodiversity Assessment of Akaogi Farm" and includes: the study design, a vegetation survey, and vegetation survey field notes. Appendix B and C are the bird survey report. Unfortunately, the amphibian survey could not be completed as planned so the results are not included in this report.

D. Watershed management

The Watershed Management Group met a few times in 2009 to discuss water quality and watershed issues related to the production of rice. We created a document that outlines federal, state, and local/town regulations regarding the construction of a rice paddy system in Vermont

(see Appendix D). This document will ensure that anyone interested in creating a new rice paddy in Vermont will comply with state and federal regulations and not have a detrimental impact on water quality and watershed processes. Marie Caduto attended the 2009 “Sustainable Rice Production System for the Northeast Workshop” and gave a short talk regarding rice paddy applications within a watershed context (see Appendix G for more information).

E. Spring/Fall Workshops

See Section 11.

F. Summer Workshop

See Section 11.

G. Seed Packet Distribution (funded through 2008 Northeast SARE Farmer Grant)

See Section 11.

6. Results

1. Preliminary evaluation

Of the 33 new varieties grown in 2009, 11 varieties grew well and will be grown again in the 2010 growing season. Table 1 lists all of the preliminary evaluation varieties grown in 2009 and gives the dates for soaking seed, sowing, transplanting, first heading, and harvesting and stem number counts. Table 2 lists the varieties we harvested in 2009 and describes lodging, sterility, shattering and the varieties that did well. Jouiku 393 seems like it was mislabeled because it turned out to be a medium grain variety and one of the last varieties we harvested in 2009.

Table 1. Preliminary Evaluation: New Varieties for 2009

Variety Name	Dates			Weekly Observations/Stem Count & First Heading										Harvest Date
	Start Soaking	Sow	Transplant	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	
Tsao Ling Ho	4/14	4/19	5/22	2.0	3.0	8.0	10.3	14.0	17.6	24.0	-	X	X	nh
Fan Ho Chan	4/14	4/19	5/22	2.6	3.6	5.6	9.6	15.0	18.3	24.0	-	*	-	nh
Hsin Chow Tsao Sheng	4/14	4/19	5/22	2.6	3.6	7.0	11.0	14.6	17.6	20.3	-	X	*	nh
Gum Nisiki	4/14	4/20	5/22	1.6	4.3	7.0	7.3	10.0	*11.6	-	-	-	-	9/19
Huk Zo Dou	4/14	4/24	-	-	-	-	-	-	-	-	-	-	-	nh
Ku Jung Do	4/14	4/19	5/22	2.6	6.0	9.3	13.3	16.0	21.6	22.3	-	X	*	nh
Su Bio	4/14	4/20	5/22	2.0	4.6	5.6	10.0	14.0	15.3	17.6	-	X	X	nh
Ooba	4/14	4/20	5/22	3.0	7.0	10.3	15.6	20.0	22.0	24.0	-	*	-	9/20
Early Sutarsar	4/14	4/20	5/24	2.6	8.6	11.0	16.3	19.3	22.6	22.6	-	*	-	9/19
Zerow Shani	4/14	4/20	5/22	2.0	5.0	8.0	12.6	15.0	16.6	17.0	-	*	-	9/21
JC 78	4/14	4/20	5/22	3.0	7.6	11.6	15.0	17.0	18.3	18.3	-	*	-	9/19
Torz A2	4/14	4/21	5/22	2.6	8.0	11.0	17.0	20.3	23.3	24.6	-	*	-	9/21
Cow San Huan	4/14	4/19	5/22	3.0	7.6	12.6	20.3	25.3	32.6	35.3	-	*	-	nh
Hsian Ai Tsao 7	4/14	4/20	5/22	2.6	5.6	8.6	13.0	15.0	18.0	20.6	-	*	-	nh
Hunan Early Dwarf No.7	4/14	4/20	5/22	2.0	5.3	7.6	13.3	16.0	16.6	20.6	-	*	-	nh
Er Jing Qing	4/14	4/20	5/22	2.3	5.3	8.0	12.0	13.6	14.6	16.3	-	*	-	nh
Hang Chong Tse	4/14	4/23	5/22	1.6	4.6	6.6	11.6	15.3	16.6	19.3	-	*	-	9/21
Kitahikari	4/13	4/23	5/23	2.3	3.6	6.0	12.0	15.6	17.6	21.6	-	*	-	9/22
Hayakogane	4/13	4/20	5/23	2.0	4.0	7.0	13.3	16.0	*22.0	-	-	-	-	9/20
Tannemochi	4/13	4/24	5/23	1.6	3.6	5.6	9.6	14.0	*16.3	-	-	-	-	9/22
Kamuimochi	4/13	4/20	5/23	2.3	4.6	7.0	14.0	16.6	21.6	24.6	-	*	-	9/21
Jouiku 393	4/13	4/20	5/23	2.3	4.6	6.6	11.6	14.3	18.0	22.3	-	X	*	10/6
300069	4/14	4/20	5/22	3.0	6.0	10.0	13.6	*15.6	-	-	-	-	-	9/15
300070	4/14	4/21	5/22	3.0	8.3	12.0	17.0	23.6	*26.6	-	-	-	-	9/15
300090	4/14	4/20	5/22	1.3	1.3	2.0	2.6	2.6	2.6	2.6	-	*	-	9/15
300092	4/14	4/20	5/22	2.6	7.0	11.3	15.3	20.0	*20.6	-	-	-	-	9/15
300095	4/14	4/20	5/22	3.6	8.6	12.6	19.0	22.6	27.0	27.3	-	*	-	9/21
300126	4/14	4/20	5/22	2.0	5.3	8.0	11.0	14.3	16.0	17.3	-	*	-	nh
300128	4/14	4/22	5/22	2.3	7.3	8.6	11.6	14.3	15.0	16.3	-	*	-	nh
300130	4/14	4/22	5/22	2.3	7.3	10.0	15.3	18.3	21.3	24.6	-	*	-	nh
300143	4/14	4/22	5/22	1.6	4.3	6.6	11.3	16.6	20.6	24.3	-	*	-	nh
300150	4/14	4/20	5/22	1.6	3.3	4.3	6.3	7.0	10.0	12.3	-	*	-	9/15
300170	4/14	4/20	5/22	2.6	7.6	9.3	14.3	16.0	17.6	19.6	-	*	-	nh

Definitions Used in the Table Above.

1. Stem Count = the number of stems taken from an average of 3 plants.
2. X = no first heading at time of observation
3. - = no record
4. nh = not harvested
5. * = first heading

Table 2. Preliminary Evaluation: Ratings for Varieties that Produced Seed

Variety Name	Lodging	Sterility	Shattering	Result
Gum Nisiki	1	1	1	*
Ooba	3	2	3	
Early Sutarsar	1	1	2	
Zerow Shani	3	2	3	
JC 78	1	1	2	
Torzs Az	2	2	3	
Hang Chong Tse	2	2	3	
Kitahikari	1	1	1	*
Hayakogane	1	1	1	*
Tannemochi	1	1	1	*
Kamuimochi	1	1	1	*
Jouiku 393	1	1	1	*
300069	1	1	1	*
300070	1	1	1	*
300090	1	-	1	
300092	1	1	1	*
300095	1	1	1	*
300150	1	2	1	*

Definitions Used in the Table Above.

1. Lodging (scale from 1 to 5): 1 = no problem, 2 = 1-2 hills start leaning, 3 = more than 1/2 of the plants are leaning – some are 45 degrees or more, 4 = all are leaning 45 degrees or more, 5 = flat to the ground.
2. Sterility – visual estimate of sterility of spikelet (scale from 1 to 4): 1 = less than 10%, 2 = 10-25%, 3 = 25-50%, 4 = 50% or more.
3. Shattering (scale from 1 to 3): 1 = no problem; 2 = medium; 3 = bad.
4. * = Varieties that did well during the 2009 growing season.

2. Production comparison

A majority of the varieties had good yields above 1.5 ton/acre and the most productive varieties had 3 ton/acre. A few of the earlier varieties were partially eaten by pests (rats and sparrows) and these varieties had yields slightly lower than 1.5 ton/acre.

Table 3. Production Comparison Chart

Category	Variety
Early maturing	Hayayuki
	Kitaake
	Hayakaze
	Kaoriwase
	Jouiku 393*
	Hayakogane*
Mid-early maturing	Yukihikari
	Kitahikari*
Late maturing	Matsumae
	Tomoyutaka
	Shimahikari
Mochi (sweet rice)	Kuro Mochi
	Kurikara Mochi
	Yukimochi
	Kamuimochi*
	Tannemochi*

* New varieties for 2009 which were used in the production comparison because they were Hokkaido varieties.

7. Conditions

During the 2009 growing season we had a very wet and cloudy June and part of July. The weather was similar to the rainy season during the monsoon in a tropical area. The rice plants developed slowly and were delayed by 7-10 days in comparison to 2008. In August there were two weeks of very hot and sunny days and September was around average temperatures but had more sun and was dryer than an average fall. Because of a warm August and mild September, by the end of the season the rice plants had caught up and were only delayed 3-4 days in comparison with 2008. In the spring the last frost was on May 19 and the first frost in the fall came on September 26. Average, minimum, and maximum monthly temperatures during the growing season (May-September) can be found below in Table 3.

Table 4. Monthly Temperatures in 2009 at Akaogi Farm

Month	Average Temperature (°F)	Minimum Temperature (°F)	Maximum Temperature (°F)
May	55.14	29.9	86.8
June	61.57	32.5	79.7
July	64.94	47.1	83
August	67.23	44.5	89.9
September	56.24	30.9	80.6

8. Economics

N/A

9. Assessment

We are beginning to realize that the major barriers to introducing rice as a commercial crop to the northeastern United States are: unfamiliarity with farming with water (i.e. rice paddy systems) and unfamiliarity with how to eat rice as a consumer. Even after workshops, most participants had difficulty growing their rice seedlings in a 5 gallon bucket. Future plans should focus on improving education and outreach to the grower and the consumer. An improved rice growing manual, website with detailed information, and additional workshops (similar to the summer 2009 “Sustainable Rice Production System for the Northeast Workshop”) will help provide agronomic information to growers and researchers. Rice cooking workshops will help educate people about how to use rice in everyday meals and create a demand for this grain in this region. As growers we are currently limited to Hokkaido varieties of rice, which are short grain rice varieties. No other types of rice (e.g. basmati, jasmine, sweet rice) are able to grow in this climate. Future breeding programs will focus on new varieties that will provide some variation for the consumer market. With Susan McCouch and Gen Onishi, we are evaluating which varieties will be used as recurrent parents for the breeding program. The objective has been identified as: an early, upright, cold-tolerant, aromatic, medium-long grain temperate rice variety adapted to the northeast.

An additional consideration for rice paddy systems in the northeastern United States is how to manage them to support wildlife conservation. How do we take into consideration conservation issues, how do we catalogue species, their habitat, and identify recommendations? Research is needed to compile basic wildlife information regarding rice paddy systems. Specific species of amphibians (e.g. frogs, toads, salamanders) and invertebrates (dragonfly, damselfly, mayfly) require small ponds or wetlands devoid of fish to complete their life cycle. These important wildlife species need to be identified and researched. This information can then be used to develop conservation management plans for this specific environment.

10. Adoption

See Section 9.

11. Outreach

A. Spring/Fall Workshops

The “Growing Rice Workshop” held on May 17 and September 13 was a two-part workshop. Participants were asked to attend both the spring and fall workshops. In May, participants learned about basic rice growing techniques, were given rice seedlings to raise in 5 gallon buckets, and were given data sheets to collect their observations over the growing season. In September, participants were given a tour of the Akaogi rice paddies and returned with their data sheets for a discussion.

Ten participants attended the spring workshop and only 4 attended the fall workshop. The workshop announcement can be found in Appendix E and the “Observation Report Sheet” can be found in Appendix F.

B. Summer Workshop

On Saturday, July 25, from 8am-5pm we held the “Sustainable Rice Production System for the Northeast Workshop.” The purpose of this workshop was to educate growers and researchers in sustainable rice production methods for the Northeast and the challenges and issues involved. And by doing so, hopefully, encourage rice related research, both for agronomic and conservation issues. Presentations focused on pest management, rice breeding, equipment, rice products, and the integration of conservation and agriculture. More than 60 people participated including growers, professionals, academia, and students. Details can be found in the workshop proceedings in Appendix G.

C. Seed Packet Distribution (funded through 2008 Northeast SARE Farmer Grant)

In Spring 2009, we distributed more than 150 sample seed packets and 100 copies of the rice growing manual.

D. NOFA Notes Article

Cheryl Bruce (VOF Certification Staff) wrote an article about our progress with growing rice entitled “Success with Rice Production at Akaogi Farm” for the Spring 2010 edition of “NOFA Notes” (Appendix H).

12. Report Summary

Our goal is establish a sustainable organic rice paddy production system for the northeast. We conducted preliminary evaluations on 33 new varieties, which further emphasized that the Hokkaido varieties tend to be the most adapted to the climate at Akaogi Farm. Production records for 11 Hokkaido varieties showed that rice can be grown productively in Vermont with yields of at least 1.5-3 ton/acre. We assembled information on wetland wildlife and watershed management aspects of a sustainable rice production system and educated farmers and researchers through the spring/fall workshop, article in “NOFA Notes”, and proceedings of the “Sustainable Rice Production System for the Northeast Workshop.” We have shown that rice can be grown productively in the northeast, but the challenge remains that it is a new crop to this area and this type of aquatic agriculture is unfamiliar. In addition, there is unfamiliarity with how to use rice from the consumer. Future plans will attempt to address these issues and focus on providing education to the grower through an improved rice growing manual, website, and additional workshops. Rice cooking workshops will provide education to the consumer.

Enclosures

Appendix A: Biodiversity Assessment of Akaogi Farm

Appendix B: Bird Survey Report

Appendix C: Bird Survey Datasheet

Appendix D: Federal, State, and Local/Town Regulations Regarding the Construction of a Rice Paddy System in Vermont

Appendix E: Growing Rice Workshop Announcement

Appendix F: Observation Report Sheet

Appendix G: Proceedings of the Sustainable Rice Production System for the Northeast Workshop

Appendix H: Success with Rice Production at Akaogi Farm

Linda Akaogi

February 17, 2011