

Quinoa Introduction in the River Valley Farmer/Grower Grant Final Report – FNE02-406

Restatement of Goals:

This project was undertaken with the purpose of determining the practicability and profitability of Quinoa cultivation in Western Maine. To determine this, it was necessary to grow Quinoa for the first time in Maine, and to determine the likely yield of future crops, the risk of pests and disease, the likely farm gate price, and the depth of the market.

Changes in Farm Status:

There has been no change in the status of my farm since the grant application was made.

Project Partners:

The project had three key partners of cooperators. First, there was the Rive Valley Growth Council, an organization keenly interested in developing new crops and opening new markets in Western Maine. The Growth Council assisted with project design and technical resources, and also assisted in monitoring and evaluating the crop. The Growth Council was responsible for gathering market data. Another key partner was the Threshold to Maine RC&D Area. This organization provided key project design and evaluation inputs, and also assisted in monitoring results. RC&D has agreed to take on the development of a Quinoa crop in Western Maine as a key project, and will work with U Maine and research farms to this end. The project also worked with U Maine Extension and the Soil Conservation Service in project design and monitoring activities. Finally, University of Colorado Quinoa Expert Dr. Sarah Ward was a key cooperator and consultant.

Project Activities:

To start, I met with the project cooperators and communicated with Dr. Ward. Together, we decided on a project design. I treated two acres of sod with Roundup and, after it had worked for a while, I tilled the two acres several times over. The land was then divided into 17 separate plots, and all the plots were stringed off. The plots were arranged in two rows of 8 (with one plot set aside for the planting of a special strain) and the plots were planted so that there were two plots of each of the eight strains, and in no case were any of the identical seed plots close to each other.

Seeding the plots was vexing, due to the size of the seed (it is smaller than a radish seed). After some discussion among the technical advisors, it was decided to use a belly-seeder

set on the lowest setting. The soil was then lightly raked with birch branches to cover the seeds to the preferred $\frac{1}{4}$ " depth. Seeding was completed on May 27.

The Quinoa came up much too close and it was decided that it had to be hand-thinned. With the assistance of 20 young people from the local jobs training program, this thinning was accomplished not once but twice.

Because of a severe drought in New England, I was forced to irrigate the crop. To do this I had to purchase piping and heads and supplies and run water from a well.

During the first thinning, a number of small caterpillars were noticed on the plants. Two weeks later, the plants were wilted and virtually decimated. No action was taken because first, we didn't know what kind of bugs were on the plants and, second, the caterpillars were gone by the time the plants wilted and partially died. At this point, granular fertilizer was applied to the test beds to assist in any recovery the plants might make. The cooperators regretted the application of water and fertilizer since the original idea was to grow the Quinoa without any additional inputs, but it was also felt that the activities had to respond to the events experienced. As it happened, the plants rebounded remarkably.

In August Dr. Sarah Ward traveled from Colorado to visit the site. Her report is attached. Dr. Ward reviewed the events of the difficult growing season, reviewed the condition of the strains, and concluded that Quinoa could grow in Maine successfully, though it would be necessary to prevent another attack of caterpillars. Also, Dr. Ward concluded that the crop was sterile due to record heat and drought during the critical blooming period.

During the visit of Dr. Ward, the Agricultural Commissioner for the State of Maine visited the project and showed great interest in the project. During the course of his visit, Dr. Ward explained that Quinoa was originally cropped by the Inca Indians and that they had a corn, potatoes, Quinoa rotation that boosted the production of each crop in turn. The Commissioner grew to be very interested in Quinoa and is now supporting Quinoa efforts for next year.

Toward the end of August, a second wave of caterpillars attacked the crop. This time, live specimens were overnighted to Dr. Ward and an colleague of hers at University of Colorado identified the pest as the Diamondback moth. Interestingly, this is the first recorded incidence of Diamondback preying on Quinoa. Fortunately, the methods for dealing with the Diamondback pest are very well established.

The crop was plowed under in October, and meetings were held with various cooperators through November to discuss the project and the future of Quinoa in Maine. It was concluded that the project would go forward under the capable leadership of the Threshold to Maine RC&D area, with additional assistance from the River Valley Growth Council. I will remain involved in future efforts.

During the course of the growing season, soil temp, rain, strain growth, and growing degree data was collected.

Findings, Accomplishments, and Unexpected Results:

I found that Quinoa would grow in Maine and that it may be an important addition for several reasons, especially when it is noted how positively it affects corn and potato rotations. It was also found that the crop is susceptible to the Diamondback Moth in Maine. This was previously unknown and was unexpected. It was also unexpected that the crop would be sterile, but then the heat and drought waves were among the worst in recorded history. Finally, we learned that great care must be taken not to overplant Quinoa.

Site Conditions and Their Impact:

There were no conditions related to the site *per se*, but the severe drought and heat that affected the region were of course reflected in the site, as was the prevalence of the Diamond Back Moth.

Economic Findings:

Research by the River Valley Growth Council indicates that the farm gate price for organic Quinoa is currently about \$.80 a pound. Further, research by the RVGC has indicated that many small farmers choose to market their quinoa direct to consumers over the internet at prices ranging from \$1.50 to \$3.00 a pound. Thus, it is possible to grow and market Quinoa very profitably even if there is no local large purchaser of the crop.

New Ideas:

The project was a success in the sense that it has been established that Quinoa will grow in Maine, and all eight strains seem to have potential for commercial cropping in Maine. Now the right methods need to be arrived at from planting and harvesting, and a large purchaser of the crop needs to be attracted. I am continue working with Threshold to Maine RC&D and the RVGC to solve these problems.

Continuance:

I will continue to participate and lead out in the introduction of Quinoa to Maine.

Outreach:

I notified a couple local papers of the project and, as a result, got about half a dozen articles written about the project, including two front-page articles in a regional newspaper. There were also a few radio programs about the crop. I include a couple press clippings.

This report submitted by Norris Conant on November 18, 2002.

Norris Conant 11-18-2002

REPORT ON FIELD TRIALS OF QUINOA IN OXFORD COUNTY, MAINE

This set of quinoa field trials was sponsored by the River Valley Growth Council and funded by a small farmer grant from the USDA SARE program. The objectives of the trial were:

1. To determine whether quinoa would be viable as a crop in western Maine.
2. To identify quinoa varieties suitable for cultivation in western Maine.
3. To gather information on best cultivation practices for quinoa in western Maine.

Commercial quinoa production in the U.S. and virtually all U.S. quinoa trials have to date been confined to the dry Intermountain West. Determining whether quinoa varieties and cultivation practices developed in the western US can be transferred to the different environment of the northeast is an important first step in assessing the feasibility of quinoa production in Maine. If quinoa can be adapted as a crop for the region, long term goals are to establish quinoa as an alternative crop for Maine and to develop local processing and marketing capability.

Planting

Sufficient seed to plant one-eighth of an acre with each of the following quinoa varieties was provided from Dr. Sarah Ward's quinoa collection held at Colorado State University in Fort Collins, CO.

<u>Variety</u>	<u>Origin</u>
Baer	Chile
Tango	Chile
Isluga	Bolivia
Amachuma	Bolivia
Apelawa	Bolivia
CO407	U.S.*
13744	U.S.*
13756	U.S.*

* Lines developed at Colorado State University

A small quantity of a saponin-free experimental quinoa line from Dr. Ward's research program was also included in the trial. Two replicates of each variety were planted on May 29, 2002 in plots located on land loaned by Mr. Norris Conant at Canton, ME. Seed was planted by broadcasting with a belly seeder except for two lines which were sown by hand on a grid.

Crop development

The trials plots suffered an overnight frost on June 3, 2002 but the emerging seedlings were undamaged. Damage from caterpillars eating the leaves and growing points of the plants was observed in early July. Samples of the caterpillars sent to Colorado State University were identified as belonging to the plutellid moth family. The diamondback moth, a major agricultural pest, belongs to this family but without an adult specimen from the quinoa plots complete species identification was not possible. This insect has not previously been recorded on quinoa. Most plants recovered from the insect infestation but lost the main inflorescence and started to develop seed heads on side shoots. The crop was also affected by an unusually hot and dry summer, which reduced growth. Some water was applied to the plots in late July and early August. Weed control was also problematic, with one plot replication being abandoned due to weed pressure and the other being hand weeded.

Site visit

I visited the site at Canton August 18-19, 2002. Typically by this stage (75 days after seedling emergence) visible seeds would be forming but not yet dry and mature. I observed that some of the quinoa plants were still flowering, especially where insect attack had damaged the central stem and the plant had subsequently developed side shoots to compensate. Immature seeds were visible on some plants. I noted several plants which had completed flowering but failed to set seed, most likely as a result of high temperatures (> 95 degrees F) during flowering which had sterilized the pollen. Plants were shorter than normal for these varieties, probably from heat and drought stress and from loss of the main shoot. Plant density was much higher than recommended and weed competition was intense, with the plots heavily infested with lambsquarters (*Chenopodium album*) and redroot pigweed (*Amaranthus retroflexus*). This had also reduced plant growth.

Conclusions and recommendations

Given the problems encountered with insect attack, unusual heat and drought, and the level of weed infestation, it was surprising that so many plants had survived and were still growing - a reflection on the resilience of quinoa as a crop. Based on my field observations and on climate norms for western Maine, I consider that quinoa could be cultivated in this region. Due to the damage to the plots this year, it will not however be possible to collect sufficient data to recommend the most suitable varieties. I suggest the trials should be repeated in 2003, with the following recommendations:

1. Trial should be replicated in more than one location both to provide more information and to avoid problems at one location from wiping out the year's work.
2. Efforts should be made to involve the University of Maine Agricultural Experiment Station system, preferably with one of the trial locations being at a university agricultural research center. This will bring valuable local agronomic expertise to the project. Many agricultural research stations hold annual field days when they are open to the public, which could be a good way to showcase quinoa and

quinoa products for a wider audience.

3. As recommendations on the best varieties will not be possible based on this year's results, all the varieties in this year's trial should be included again in 2003, even if this means planting smaller areas of each. Selecting suitable varieties will be vital to the eventual success of the project, and it should be noted that a variety which does well one year may not be the best in a different growing season.
4. Seed should be planted earlier (first or second week in May) and the seed bed should be as weed-free as possible. Flushing weeds by pre-planting irrigation and then spraying the emerging weed seedlings with glyphosate (Roundup) would help with initial weed control. Quinoa seed can be sown 7-10 days after applying glyphosate.
5. Seed should be sown much more thinly, in rows 18 inches apart. This will allow mechanical cultivation between rows, which should be carried out regularly for weed control while the quinoa plants are small. Final plant density within rows should be no more than 4 plants per foot. If a small belt planter is available (such as those used commercially for carrot or lettuce seed) this is recommended, or a hand-propelled wheel planter. Possibly the University of Maine agricultural research staff could help with the loan of suitable planting equipment. Emerging seedlings can be hoed or hand-thinned when 2-3 inches tall if the within-row density is too high. Planting quinoa seed in rows, especially if the rows are marked or flagged, will help with early stage weed control when lambsquarters closely resembles quinoa, to which it is related. Elimination of lambsquarters from quinoa fields is essential if quinoa seed is to be saved for replanting, as cross-pollination of the crop by the weed can occur with detrimental effects on seed purity.
6. The trial plots should be inspected carefully and frequently (every 1-2 days) for any reappearance of moth larvae. Given the levels of damage caused by the pest this year, I recommend application of a fast-acting insecticide such as sevin or malathion immediately any larvae are seen, with reapplication if necessary. If quinoa plots are on land in organic production, Bt spray can be used. Early identification and control will be vital if this pest is again observed on quinoa plots in 2003.
7. Arrange for irrigation of the plots if possible, and water the plants earlier and more often if the 2003 growing season is again hot and dry.

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