Quinoa Farming Report
2014 Season
Marion-Polk Food Share/OSU Extension Service

Land

The planting site for the MPFS quinoa (*Chenopodium quinoa*) in 2014 is an 11.2acre field south of Salem, OR (Fig. 1). The field is immediately south of Mill Creek Correctional facility, located at 5465 Turner Road SE. Soil type is predominantly Salem gravelly silt loam, with Witzel very stony silt loam along the eastern edge of the planting and Nekia silty clay loam in the northeast corner. Elevation is approximately 250' and the field is almost completely level in all directions.

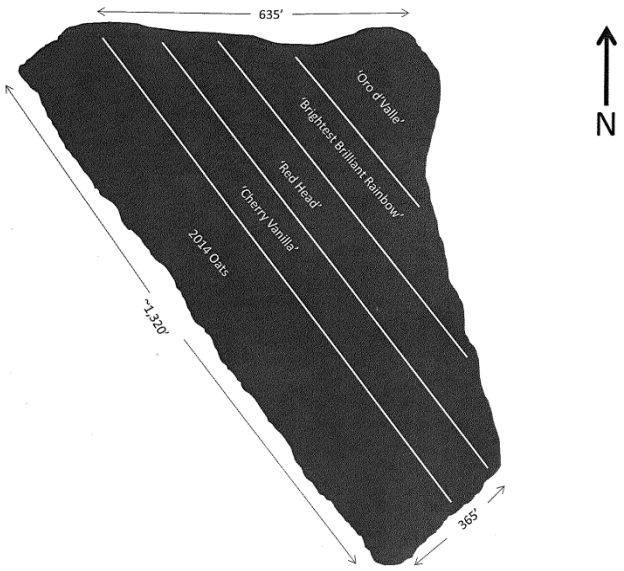

Fig. 1. Map of planting site on Turner Road, south of Salem, OR

Seed Sourcing

Seed was purchased from Wild Garden Seed, a small seed company in Philomath, OR. Owner Frank Morton has been growing quinoa for 30+ years in the Pacific Northwest and has developed unique strains of the crop, derived from seed imports in the mid-1980's. The following cultivars were purchased (germination figures provided by Wild Garden Seed):

- 'Cherry Vanilla', 24lbs. 90% germination.
- 'Red Head', 24lbs. 96% germination.
- 'Brightest Brilliant Rainbow', 16lbs. 90% germination.
- 'Oro d' Valle', 28lbs. 64% germination.

Preparation & Planting

Seed was planted on April 15th (Figs. 3, 4). All cultivars were seeded at approximately 7 lbs/acre, except for 'Oro d'Valle', whose rate was closer to 10 lbs/acre to compensate for its much lower germination rate. Seed was cut approximately 1:2 with Metarex® slug bait (Ag Nova Technologies). The total acreage planted of each cultivar was approximately: 'Cherry Vanilla', 2.5 acres; 'Red Head', 3 acres; 'Brightest Brilliant Rainbow', 2 acres; 'Oro d'Valle', 2.5 acres.

Watering

This crop received no supplemental irrigation. See the weather section for a description of temperature and rainfall trends during crop development.

Weeds

Weed emergence began simultaneously with the quinoa. A number of different weeds were common in the planting, the most consequential of which as a cvompetitor for the developing crop was Mayweed Chamomile (*Anthemis cotula*), which developed into dense stands up to 2' tall, particularly in the northwestern corner of the planting, and evidently suppressing growth of the quinoa in that area. Other weeds were either too diminutive or sporadic in occurrence to have a similar effect. Other weeds species present included Queen Anne's Lace (*Daucus carota*), Shepherd's Purse (*Capsella bursa-pastoris*), Smartweed (*Polygonum* sp.)), Spiny Sow Thistle (*Sonchus asper*) and Field Bindweed(*Convolvulus arvensis*)

Pests

The most evident problem with this crop became evident in mid-May, when yellow and pink blotches developed on foliage throughout the planting (Figs. 8, 12). Samples of the affected foliage were sent to the OSU Plant Clinic for diagnosis. The spots turned out to be a symptom of downy mildew, caused by *Peronospora* sp. The species *P. variabilis* has been identified from Pennsylvania in 2012 as a cause of downy mildew on quinoa. The spots continued to appear on foliage throughout May and into June, but as the weather became warmer and remained dry, incidence of infection decreased. As the plants continued to grow, the newer foliage subsequently did not exhibit signs of infection. Warm, dry weather during much of the summer appeared to inhibit disease spread within the plants. This is fortunate as there are no fungicides (or other pesticides) registered for use on quinoa. Downy mildew has been associated with major yield reductions (33-90% or more) in warm, humid environments.

The developing crop was sampled for insects on June 30th and July 18th. The technique used involved walking through the northern part of each cultivar block, making 10 double sweeps with a sweep net (Fig. 11) then estimating the relative populations of insects present. The principal insect species present on June 30th was Western Spotted Cucumber Beetle (*Diabrotica*

undecimpunctata ssp. *undecimpunctata*), which was present in considerable numbers (i.e. 20-50 adults per sweep set). Also present were thrips and some aphids (species not identified). Monitoring on July 18th detected similar numbers of Cucumber Beetles as well as significant numbers of nymphal Miridae (seed bugs). Insect populations in general appeared to decline following this and by harvest there were no noticeable insect pest issues.

Fertility

On June 13th, the planting received an overhead application of 15 gal of 20-0-0 and 1 gal of Structure®, (Actagro®, LLC) which is 7-21-0.

Growth

Quinoa germinates readily, and even with in the first week after planting on April 15th, seedlings could be observed. By the end of the first week of May, seedling emergence was evident throughout the planting. By the end of May, plants in general were 4-12" tall. Rapid growth ensued throughout June. Inflorescence development became apparent by the third week of June and the maximum height of the crop was reached near the end of the month. Average height of each cultivar was estimated on July 18th:

'Cherry Vanilla': 47"
'Red Head': 44"
'Brightest Brilliant Rainbow': 46"
'Oro d'Valle': 48"

Estimates of the height are based on averages of several individual seedlings. Flowering is subtle on this crop and the flowering period was not precisely defined but the first two weeks of July seem to be the principal flowering period.

Weather

The climate in the Willamette valley in a typical growing season follows a Mediterranean pattern in that there is decreasing incidence of rainfall throughout spring, a very dry summer and increasing incidence of rain after the beginning of September. This year was no different in that respect, but overall, conditions from May through the end of August in 2014 featured above normal temperatures and abnormally dry conditions, even considering the usual lack of precipitation. Data from the nearest U.S. Bureau of Reclamation Agrimet weather station (Corvallis, OR, ~25 miles south) shows that following planting on April 15th, there was approximately 2" of rain through the end of April. A further 2" of rain fell through May 30th. Rain for the remainder of the growing season was very limited, with the only significant accumulations being on June 27th (0.33"), July 13th (0.19") and July 23rd (0.31"). Temperatures as mentioned were warmer than average in general, with the maximum temperature exceeding 90°F on 21 occasions in July and August.

Harvest

The entire planting was harvested by combine on August 27th (Figs 22-24).

Processing

Processing quinoa involves multiple stages, including drying (if harvested damp), cleaning, scarifying/de-hulling and rinsing. The last two steps are to remove the bitter saponin coating on quinoa seed. We attempted to dry the first batch of quinoa (BBR) simply by thinly spreading on tarps on our warehouse floor and running fans and heaters. This worked, although it took 4 days to dry the seed. We dried the second batch of seed (Cherry Vanilla and French Vanilla) using a propane fueled industrial seed dryer at a local seed cleaners, K/S Seeds in Silverton, OR. K/S professionally cleans all kinds of specialty seed, including flowers, grasses and vegetable seed. They frequently process food grade seed as well as high quality specialty seed crops. The entire cleaning process – removing sticks, leaves, stones and other debris – was completed by K/S seeds with their existing machinery. It took them less than a day to complete and the seed came out very clean. After the cleaning process, K/S also ran the seed through a scarification machine. This is a large cylinder with rotating blades inside. The seed rapidly scrapes itself, removing the outer coating. The process "polished" the seed and, we hope, removed some of the saponins.

After K/S processing, we still needed to do saponin removal to remove the bitter taste. After much trial and error, we've settled on a process. We should note that we use our quinoa in a cooked batter for garden burgers immediately after the process, so we don't need a process that ends in shelf stability. We soak the seed overnight deep in water, and skim off the top layer of water/saponins in the morning. Then rinse several times in fast moving, heavy volume water. Then we toast over a large skillet at high heat (200 degrees), constantly moving the quinoa while toasting to avoid burning. Then the quinoa goes straight into the batter.

Photos

Fig. 2. Quinoa field in April. Looking south

Fig 3. Planting, April 15th

Fig 4. Planting equipment.

Fig. 5. Crop emergence, May 6th

Fig. 6. Crop growth, May 29th

Fig. 7. Crop growth, May 29th. Looking south

Fig. 8. Symptoms of downy mildew, May 29th

Fig.9. Crop growth, June 30th

Fig. 10. Inflorescence development, June 23rd

Fig. 11. Monitoring for pests, June 30th

Fig 12. Basal downy mildew symptoms, June 30th

Fig. 13. Cucumber beetles and flowering, July 7th

Fig. 14. Crop Growth and weeds, July 14th

Fig. 15. Crop color change, July 18th

Fig. 16. Color change and stress, July 18th

Fig. 17. Seedhead development, July 28th

Fig. 18. Crop color deverlopment, August 4th

Fig. 19. Testing for seed development, Aug 4th

Fig. 20. Crop development, Aug 19th

Fig. 21. Mature seedheads, Aug 26th

Fig. 22. Harvest, Aug 27th

Fig. 23. Harvest, Aug 27th

Fig. 24. Harvested seed before cleaning