Introduction

Amaranth originated in South America and has been cultivated for centuries. It is grown as a high quality, gluten-free grain, and occasionally used as a leafy vegetable as well. While the seeds are sold as a grain, it is a broad-leaved plant and not a grass as are most grains. There are three species of amaranth normally grown in the United States: *Amaranthus cruentus*, *A. caudatus* and *A. hypochondriacus*. All are related to another amaranth species, redroot pigweed, but have not proven to be weeds where they are being grown.

Amaranth grain plants are large and bushy, often reaching over 6 feet in height. They have a thick central stem, large fleshy leaves and numerous small, tightly clustered, bright-colored flowers that grow in a large group on the tops of the stems. Flower color can range from bright burgundy to pink, yellow and green. The seeds are very small with approximately 850,000 seeds in a pound. This makes successfully planting amaranth a challenge.

They are annual, warm-season plants and not frost tolerant. As such, amaranth should be planted when soil temperatures exceed 60 degrees Fahrenheit and after the last expected frost.

Interest in non-gluten grains such as amaranth is increasing as more individuals are being diagnosed as gluten-intolerant. Individuals exhibiting gluten intolerance are considered to have Celiac disease and a 2012 study found that approximately 1 in 141 people in the United States suffer from this condition, with most going undiagnosed. Currently amaranth grain is used in more than 40 products in the U.S.

Amaranth production in western Nevada was evaluated from 2008 through 2010 as part of the Walker Basin project. http://www.nevada.edu/walker/

Production Techniques

In late May 2008 “Plainsman” amaranth was seeded at two pounds pure live seed (PLS) per acre using a Truax seed drill with the seed being placed at approximately a quarter inch deep, in rows located 8 inches apart. Seeding rows were firmed by press wheels located behind each double disc opener on the seeder. The amaranth was seeded into plots 30 feet wide by 24 feet long. The amaranth was seeded in two adjacent sites with similar soils but differing in past production histories in the south end of Mason Valley, Nev. approximately 20 miles south of the city of Yerington. The 5-C site had not produced any crops or been subject to irrigation for at least 20 years. The Valley Vista (VV) site was an actively
producing alfalfa field until the fall of 2007 when the alfalfa was killed using a glyphosate and dicamba herbicide combination. Both sites were prepared in a similar fashion by being disced, rototilled, leveled and rolled with a cultipacker.

Both sites were irrigated using Rainbird-type sprinklers. Irrigation treatments included 100 percent (4 acre-feet per acre), 75 percent (3 acre-feet per acre) and 50 percent (2 acre-feet per acre) of normal amount permitted in Mason Valley. Irrigation water amounts on the 5-C site were inadequate to meet the 75 and 100 percent levels planned in 2008. The planting and irrigation treatments were repeated in 2009 with both sites receiving all planned irrigation treatments. Irrigation was applied every seven days throughout the season.

Both sites were treated to reduce winter annual weeds with 2,4-D amine in April followed by rototilling in May 2008 and were weed-free when planted. All plots were treated by spot-spraying with glyphosate as necessary to reduce weed populations without harming the seeded plants. Continual hand-weeding occurred throughout the growing seasons each year. In 2009 one-half of each plot was treated with Poast® (sethoxydim 18 percent) in an attempt to control severe weed pressure from annual grasses especially a native lovegrass (*Eragrostis mexicana*).

Prior to seeding during the 2010 season, grass weed populations in the seeded plots were predicted to be a limiting factor. Therefore, a second seeding treatment was added. A heavy seeding rate treatment of 6 pounds per acre was added to the previous trial in an attempt to provide the seeded amaranth a competitive advantage over the existing grass weeds. Shortly after the seeded amaranth plants emerged in June 2010, it became obvious that neither seeding treatment (light or heavy) was adequate to reduce the grassy weeds growing in the plots on either site. The plots were then treated with Poast® or Select Plus® (clethodim) at recommended rates.

The plots were not fertilized in 2008. In 2009 and 2010 the plots were fertilized with 21-0-0 at a rate of 238 pounds per acre (50 pounds per acre/Nitrogen).

All plots were harvested in October of each year following hard frosts. Most commercial amaranth fields are harvested by combines set up for harvesting very small seeds. Due to the small plot size and fear of seed loss due to shattering, all plots were harvested and cleaned by hand. No harvests were possible from the VV site in 2008 or either site in 2010 as weed competition reduced establishment and production of the amaranth plants to minimal levels.

The results were analysed using analysis of variance to determine significant differences at the 0.05 level of probability.

**Results**

**2008**

The 2008 harvest of amaranth on the 5-C site resulted in an average yield of 637 pounds per acre clean seed after receiving 2 acre feet of water per acre. The values are averaged across all plots because no differential irrigation treatments were possible due to insufficient amounts of irrigation water being available.

**2009**

In 2009 amaranth was harvested from both sites and was subject to the planned
irrigation treatments of 50, 75 and 100 percent of normal irrigation. Amaranth production was not statistically different between the two sites. However, yields increased with applications of additional water. Yields of amaranth grain were increased significantly when water applications were increased from 50 percent to 75 or 100 percent. However, there were no significant increases between the 75 or 100 percent water applications at either site.

### Discussion and Recommendations

While demand in the U.S. continues to grow for non-gluten grains, producing them in commercial quantities is a challenge. The majority of these non-gluten grain-producing plants, including amaranth, are grown on very limited acreages and have no pest management chemicals registered for their use. This limits pest management strategies such as weed control to mechanical techniques such as cultivation or hand-weeding. Unfortunately, field crops such as amaranth do not produce enough income to support large-scale hand-weeding projects, and mechanical tillage between rows as was employed in this project was only marginally effective, especially against grassy weeds such as occurred on these project sites.

A second limitation experienced in this project was the need to produce amaranth at the same location for three consecutive years. Because amaranth is harvested relatively late in the fall, existing annual weeds such as lovegrass, barnyardgrass, pigweed, lambsquarter and others are able to produce fully mature seeds before the crop is harvested. As a result, annual weed populations in the plots continued to increase every year of the project, in spite of each plot being completely weed-free at the time of seeding. After three years, the weed populations increased to the point that they prevented successful establishment of the amaranth plants regardless of the weed control efforts. The available literature supports this result, with most publications concerning amaranth production indicating that weed control is the primary challenge to successful production.

### 2010

During the 2010 growing season, no weed control treatments were successful and the amaranth seedings failed to produce enough plants to sample and estimate yields.
The differences in production between the selected sites during the first two years were due primarily to the additional weed pressures experienced on the VV site. The VV site was a producing alfalfa field prior to the amaranth seeding, while the 5-C site had not been irrigated or produced any crops for at least 20 years. Weed seed populations in the soil were undoubtedly higher on the actively irrigated alfalfa field found on the VV site.

This evaluation resulted in amaranth production levels comparable to other amaranth-producing regions in the U.S. during the first two production years. This indicates that the climate/soils of western Nevada are not limiting. It appears that the application of three feet of irrigation water is desirable but additional irrigation amounts result in minimal yield increases of amaranth grain.

Based on the current evaluation results, amaranth can only be recommended for production in fields with a history of minimal weed pressures and production limited to one season. Also, a producer must have access to an appropriate combine, and seed cleaner and be willing to market their grain directly to consumers or retailers, or food cooperatives. Additional work is planned with this crop in the future, and this fact sheet will be updated as other results become available.

Additional Resources


