

Grain Amaranth Variety Trial

Farmer-researcher(s):

	Farmer(s)	Farm Name	Region
1	Kristine Hammel	Persephone Market Garden	West
2	Phil Mount	Flat Earth Farm	East
3	Rob Read	Willow Creek Permaculture Farm	West
4	Ronaldo Eleazar Lec Ajcot and Myriam Legault	Ecology and Solidarity Council (ECOSOL)	West
5	Tarrah Young	Green Being Farm	West
6	Janna Van Blyderveen	Norfolk Gardens	West

Project type: Variety trial

Research priorities: Seed selection, production and breeding

EFAO Contact: Rebecca Ivanoff, rebecca@efao.ca

Objective

We aim to determine which varieties of amaranth are best suited for the region of southern Ontario in terms of early maturity, grain yield, disease and pest resistance, and adaptation to ecological growing conditions by using a replicated, randomized variety trial across different farms throughout southern Ontario.

Background

In 2020, Ronaldo and Myriam conducted a screening trial of grain amaranth. Since then there has been a growing interest for amaranth among ecological farmers in Ontario! The three highest rated grain amaranth varieties will be trialed this year with the addition of farmers' choice varieties. The goal is to generate greater understanding of, and support for, the cultivation of amaranth in southern Ontario in order to contribute to food security and the preservation of Indigenous knowledge and native plants of the Americas. These trials are evaluating grain amaranth and not the green leaves. This multi-farm variety trial aims to confirm results of the screening trial from 2020 with replicates on-farm and across farms.

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These seed variety trials are part of a larger project led by Ronaldo and Myriam to promote amaranth as a tool for promoting the sustainable cultivation, cultural significance and culinary use of amaranth, and how to incorporate it into our daily lives.

Amaranthus sp. has an important story to tell. It is a highly versatile crop – it grows prolifically and is well-known for its capacity to tolerate drastic weather changes. It has been touted as “superfood” due to its unusually high protein, fiber, and iron content, and its greens and seeds were an important staple of the many cultures in the Americas. *Amaranthus retroflexus* (pigweed) is a traditional potherb eaten by indigenous nations here in Ontario, though amaranth grain has not traditionally been eaten.

There are three species of the genus *Amaranthus* which produce large seed heads of edible seeds. *A. cruentus* is native to Central America (such as Guatemala and southern Mexico), and *A. hypochondriacus* is native to Mexico (North America). *A. caudatus* is native to the Andean regions of Ecuador, Peru, and Bolivia. Rony is Kakchiquel, one of the indigenous Maya peoples of the midwestern highlands in Guatemala who have been growing amaranth for thousands of years, and he and Myriam have worked in Guatemala to promote the cultivation of amaranth. Amaranth was so important to indigenous people of this area that the Spanish Crown outlawed the growing of amaranth in the 1500s. Growing these crops in Ontario adds to crop diversity here, which is important for food security and biodiversity resilience. It’s gluten-free properties give it tremendous value-added potential.

Once harvested, amaranth seeds are dry popped over heat and made into a cereal, or ground into a flour.

Climate-resilient and nutrient-dense, amaranth has a huge potential to support food sovereignty locally and around the world, and to serve as a strategy to adapt to climate change. It also provides a unique opportunity to learn about Indigenous knowledge, particularly Rony’s Kakchiquel knowledge, and plants native to the Americas. The seed trials will enable us to determine which is the best species and variety of amaranth to promote in our region.

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Experimental Design

Varieties

The varieties to be send to each farmer are:

Variety Name:	Species:	Source:	Seeds Grown:
Atitlan Dorado	Amaranthus cruentus	The Mesoamerican Permaculture Institute (IMAP)	IMAP, San Lucas Tolimán, Guatemala
Grain Amaranth	Amaranthus hypochondriacus	Richter's	United States
Opopeo Amaranth	Amaranthus hypochondriacus	Annapolis Seeds	Yonder Hill Farm, Lunenburg County, Nova Scotia
Golden Giant Amaranth	Amaranthus hypochondriacus	Annapolis Seeds	Yonder Hill Farm, Lunenburg County, Nova Scotia

Field layout

Each farmer will plant at least 2 replicates of Atitlan Dorado, Richter's Grain Amaranth, and Opopeo. Farmers can add additional varieties such as Golden Giant or a variety of their choice. Having at least 2 replicates of each variety means that we can do statistical analysis.

Each replicate bed should have one of each variety, planted in a random order (that is different from the random order in other beds). See examples below.

One replicate consists of 50 plants, and Ronaldo recommends 10-14 inches between plants in-row, and plants can be planted in a single row or in multiple side-by-side rows in a bed. Rony recommends 20 inches between rows.

When planting two replicates, divide the planting section into two blocks. If planting three replicates of each variety, divide the planting space into three blocks. Within each block randomly assign each of the varieties, so that you have one replicate of each variety in each block. To randomize, you can draw names from a hat, use a random number generator in Excel, e.g., or ask Rebecca to send you a randomized layout.

You are welcome to transplant (vs direct seed)- just note this down in the datasheet.

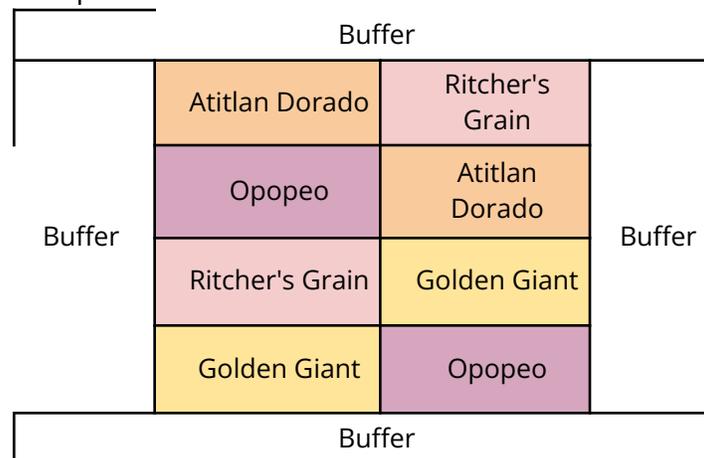
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Please observe these best practices to the extent possible:

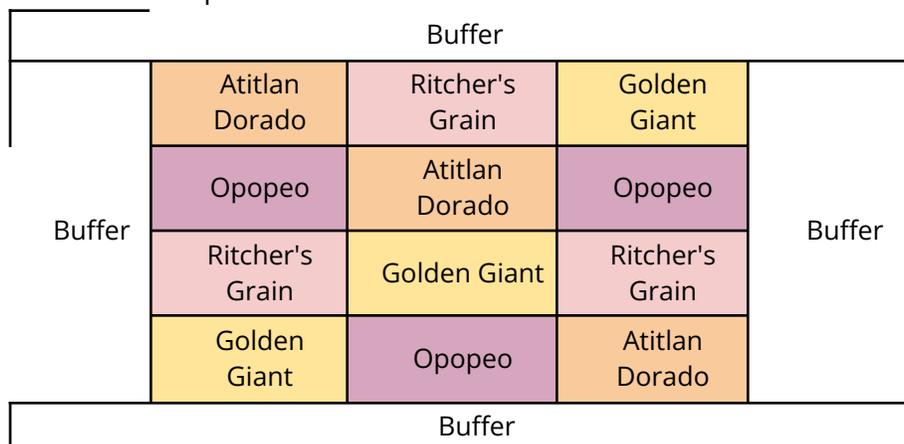
- Plots may be distributed in multiple side-by-side beds or planted in one long bed.
- Avoid the edge of the field and the end of the bed when finding a place for the trial, as well as any areas with known soil, shade, or irrigation differences that would affect some plots more than others.
- A border around your trial of buffer crops not included in your trial is recommended to prevent crop loss from mechanical damage or pests/critters. The crops that make up the border can be other varieties of amaranth, or other types of crops.
- Use stakes to label the plots AND draw a field map showing the order and location of varieties. Please take a photo of this map and text or email it to Rebecca. This serves as a backup in case the stakes get lost!

We strongly encourage growers to read [On-Farm Variety Trials](#) by the Organic Seed Alliance - an incredible how-to-guide on how to implement variety trials for your own farm.

Example layout for two replicates of the four core varieties:



Example layout for three replicates of the four core varieties:



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To determine the space needed you can use [this spreadsheet](#).

Before you plant, please sketch out the layout of your trial and send it to rebecca@efao.ca. This way we can note any issues before the tiny seeds are in the ground. **Rebecca would be happy to work with you on creating a randomized layout unique to your field.**

Additional points

Amaranth germinates best when soil temperatures are between 18-24 degrees celsius, which is around the same for sweet corn. This is usually two weeks after the last frost date, so around late May to mid June in southern Ontario.

Due to their small size, shallow planting is required for amaranth seed. A press wheel on the planter can provide essential seed-to-soil contact to insure rapid germination and emergence. A small vegetable planter with the celery or carrot seed plate could be used. For small amounts hand seeding will also work.

Flame weeding could be used as a possible method of weed control, but keep in mind that amaranth germinates in 4-10 days.

Amaranth resembles red-rooted pigweed, especially in the early stages of growth, so it is best to sow seed in rows to make weeding easier. Weeding between the rows can be done mechanically but in-row weeding may need to be done by hand.

Most amaranth varieties maintain a high moisture content in the stem and are left until the plants are killed by frost. After a killing frost, the plants dry down and can be harvested mechanically. However, seed will often ripen many weeks before a frost, usually after about three to four months (100-120 days). For hand harvesting of small plots, Ronaldo says an easy way to gather ripe grain is, in dry weather, to bend the plants over a bucket and rub the seed heads between your hands.

Pigweeds have the amazing ability to flower and go to seed at any stage of their growth and both will cross with their cultivated progeny. The grower who wants pure strains of amaranth must therefore pay close attention to weeds. Additionally, amaranth cultivars will cross with each other, so grow only one kind of each or separate cultivars by 500 meters for seed saving on commercial scale (150m for home/community use).

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Measurements for each variety

Throughout the season, add your data to [this sheet](#) or print it off and record by hand.

Germination

Farmer-researchers will evaluate the amaranth's germination 6 to 10 days after planting. Of the 50 plants in this replicate, what is the germination rate on a scale from very low (0-20%) to very high (80-100%)?

Early season vigour

Farmer-researchers will evaluate the amaranth's early season vigour around a month after planting. Of the 50 plants in this replicate,, what is the seedling vigor (seedling size, health, and growth rate) on a scale from very poor (1) to very high (5)? [1=very low (0-20%), 5=very high (80-100%)]

Disease Resistance, Insect Resistance and Drought Resistance

In August or September, farmer-researchers will evaluate each replicate of each variety for disease, insect or drought resistance on a scale of 1 (very susceptible) to 5 (very resistant)

Ease of Harvest

At the time of harvest, farmer-researchers will evaluate each replicate for ease of harvest on a scale of 1 (hard to harvest) to 5 (very easy to harvest).

Yield

Each farmer will harvest **each replicate separately**, *when that variety (both replicates) are mature*. They will record the date harvested for each variety. This way we will calculate days to maturity for each of the varieties, which will give us information about if a variety is best suited to our region.

Each farm will treat each variety grown on their farm in the same way post-harvest. Some folks will dry each variety under shelter for a week, and then thresh and winnow each replicate as close to one weeks post harvest as possible. Others will thresh and winnow on the date of harvest of each variety if they don't have the space to dry post-harvest.

Once each replicate is cleaned, the farmers will weigh each replicate and record the pounds **per variety and replicate**. They are welcome to do this immediately after cleaning or leave the grain to dry down further and weigh it all a month after harvest - just note what method you used. Along with weight, they will also rate each replicate on a scale of 1 (poor yield) to 5 (excellent yield).

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Seed Size, Popping Rate, Flavour

After each replicate has been cleaned, farmer-researchers will evaluate each replicate for seed size on a relative scale of 1 (very small) to 5 (very large), as well as how well each replicate pops on a dry skillet or pot on a scale of 1 (poor) to 5 (excellent).

They will also rate each replicate for flavour on a scale of 1 (poor) to 5 (excellent). Farmers will evaluate these ratings on the same date. If you'd like to record popping rate and flavour a second time later in the fall/winter, please do that and let Rebecca know.

Overall rating

After each replicate has been cleaned, weighed, popped, tasted, farmer-researchers will provide an overall evaluation for each replicate on a scale of 1 (poor) to 5 (excellent).

Photos

Please take photos of each variety throughout the season. Farmer-researchers can upload them in to [this Google Folder](#) or email them to rebecca@efao.ca

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Research Plan

Time	Task	Methods & Measurements or Action Item
February- March 2021	Order Seeds	Rebecca will order seeds and distribute them to participating farmers.
Last week in May	Prepare the beds as normally	
End of May /Beginning of June (during Waxing Moon)	Sow Seeds	<p>Though we would like to plant as early as possible to avoid the wet falls, those who are planting outside will all plant that first week in June. Farmers will sow seeds into their fields following the protocol outlined</p> <p>Kristine will sow seeds indoors in her pit greenhouse, and record her sowing and transplanting dates. Rony says that the transplants need to be less than 25 days in the greenhouse or they become too stressed</p> <p>All farmers will send Rebecca a photo of the field layout of their replicates. If you would like support with randomizing the location of the varieties in the field, let me know.</p>
June	Evaluation of Germination	Seeds should germinate in 4 to 10 days
June/July	Evaluation of Seedling Vigour	
July and August	Evaluation of Flowering dates	
September	Harvest	
September -October	Clean, weight, and process grain and evaluate quality	
Deadline October 26	Submit data and photos*	Submit data here in this sheet and send photos to Rebecca
Before December 31	Invoice	Send Sarah invoice for farmer-fee

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*Please note that if data is submitted after the submission deadline, EFAO staff cannot guarantee that your data will be analyzed and written up before the Research Symposium and/or the next growing season.

Staff check-ins

Monthly, or at key points in the trial, via email

Materials

Please list all materials, supplies and equipment that will be reimbursed for this project. If possible, please also indicate a short-list of any in-kind materials, supplies and equipment that you will use.

Material	Unit	Quantity Required	Total Cost*	Note
Seed		~ 100 seeds for each variety.		EFAO will cover costs of seed and cost of distribution to farmers
tarps			Up to \$90 for each farm	
All planting and harvesting equipment			In-kind	
Total				

Acknowledgements

We'd like to acknowledge the great support from Ronaldo Lec in championing this project and providing guidance throughout the process.

Farmer-fee

EFAO members receive a \$250 stipend per farm per variety trial, invoiced to EFAO after the farmer-researcher submits data.

Ronaldo, an expert amaranth grower, will receive \$500 for his trial and also to provide extra guidance and support to farmer-researchers.

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Invoices for Farmer-Fees & Reimbursements

Research expenses

- Email an invoice along with copies of receipts for all qualified expenses to **research@efao.ca**.
- Expenses can be claimed anytime throughout the year.
- Deadline: December 31, 2021

Farmer-fee

- Email an invoice for your farmer-fee to **research@efao.ca**.
- Farmer-fees can be claimed after your data is submitted
- Deadline: December 31, 2021
- If you collect HST for your farm business, you can choose to add HST to your fee.

Memorandum of Understanding

You agree to keep an active membership with EFAO throughout the duration of your trial.

Link to the 2021 MOU

<https://form.jotform.com/210625202854246>

To check the status of your membership, log in here:

<https://efao.z2systems.com/np/clients/efao/login.jsp> or contact Martina, martina@efao.ca.