ROCKY MOUNTAIN SEED ALLIANCE

The Rocky Mountain Seed Alliance is a nonprofit organization working to connect communities in the Rocky Mountain West with the seeds that sustain them.

Rocky Mountain Seed Alliance Grain Trials Project Manual

Thank you for your interest in contributing to this important and exciting work. Our goal with this project is to create a new, resilient local grain economy for our region. By locating the heritage grain varieties of our past and returning them to active production in our farmers' fields, we can restore this vibrant and delicious local food experience in our daily lives. This manual will provide an overview of the project along with helpful plant trialing information to give you a foundation for the work you will be engaged in.

Project Background

In order to revive heritage grain farming in the Rocky Mountain region, the first step is to identify and collect the seeds. We cast a wide (and carefully examined) net in our search for grain varieties. Our path led us to focus on what Glenn Roberts, the visionary behind South Carolina's Anson Mills, calls "pre-industrial, low-input, drought-tolerant, deep-root, tall-straw landrace grains."

We began with digging into USDA Bulletin No. 1074 "Classification of American Wheat Varieties" (1923) for the names of popular landraces grown in Colorado, Montana, and Wyoming. We spoke with professors from the top universities across the Rocky Mountain West—Oregon State, Washington State, University of Colorado, Colorado Springs, University of Wisconsin, Madison and Cornell—all working on heritage and specialty grain programs.

We contacted non-profit programs located in other regions already on the path to creating their own local grain economies, such as Northern Grain Growers, Heritage Grain Conservancy, and Whole Grain Connection. We communicated with Jacob Cowgill of Prairie Heritage Farm and Tevis Robertson-Goldberg of Crabapple Farm, who have both trialed hundreds of heritage and ancient grains in their search for a handful of varieties most suited to their needs. Finally, we scoured the USDA's Genetic Resources Information Network (GRIN) and the extensive KUSA Seed Society list for suitable varieties.

As a result of this thorough and fascinating search, we have collected over 250 varieties of heritage grains adapted to our region. We are indebted to Thumbs Heath, Joseph Lofthouse, John Sherck, Kevin Payne, and the late Anpetu, amongst other local, regional seed stewards already at work on stewarding heritage grains and willing to share their knowledge and seeds.

At the onset of our trial development, we quickly discovered that seeds for the most interesting varieties were available only in very small quantities. This meant farm-scale trials (which require 20 lbs of seed or more) were going to be impossible until our seed supplies increased. Thanks to Monica Spiller and her Whole Grain Connection network (*wholegrainconnection.org*), we had a road map and timeline to increase our precious and limited seeds. By the fall of 2020, we expect to make available 20 lb bags of seeds for farmers of the 20 "best" (most adaptable and favorable growing) varieties that emerged from our data, evaluations, and observations, and increases through this project. Until then, we invite our larger-scale farmers to join us in our "garden-sized" trials for seed increase.

An Introduction to Plant Trials

Before getting into specific instructions for this year, we feel it appropriate to give you bit of an introduction to the art and science of modern plant trials. An excellent and more complete guide, *On-farm Variety Trials*, can be downloaded free from the Organic Seed Alliance (*seedalliance.org*).

http://seedalliance.org/index.php?mact=DocumentStore,cntnt01,download_form,0&cntnt01pid=11&cntnt01returnid=139

Our goal here is to adopt the best practices for plantings and data collection to learn the most important things about our grains with the least amount of time and energy. As Carol Deppe says about trials in her wonderful book, *Breed Your Own Vegetable Varieties*, "Record only what is important, not everything."

Essentially, we want to observe and learn about those differences in our plants that are caused by the environment and those caused by genes. This will help us most to pass on the right characteristics and improve our varieties.

To achieve the best results, your approach to trialing should follow these basic guidelines:

A. **Identify your trial goals.**
   Do you want to grow heritage grains for your own consumption? Will you brew with them? Bake them? Roll them and eat them for breakfast? Will you grow them to be a cash crop?

B. **Choose and prioritize traits.**
   Make sure you are clear as to what is most important for you.

C. **Include a check variety.**
   Plant a familiar standard variety in your trials. This provides an important comparison with the outside grain growing world and a point of reference with which to compare your results. It also allows you to compare growing conditions year to year for your entire trials.

D. **Be on the look out for the "field effect."**
   The field effect refers to changes in the success of crops due to environmental variations across your fields. These differences could be variations in temperature, wind, water, soil fertility, etc.

   Note: We are providing enough seed for what is called "observational trials." You will plant the 50-100 seeds for each variety together in a block or bed, or in a single row. In subsequent years, we hope to provide enough seed for "replicated trials"- trials where more than one block or row is planted of each variety in different parts of a field to normalize the field effect.

E. **As much as possible, provide consistent treatment to all the grain plants in your trials.**
This means that soil should be equally prepared, fertilized, watered and weeded for all the grain plants in your trials. All plants should receive the same amount of sunlight, wind exposure, and so on.

Conducting Trial Evaluations

The following section, from the Organic Seed Alliance's *On-farm Variety Trials,* offers best practices for your field evaluations. To help you organize your data properly, you can download OSA's trials forms, or use the ***Grain Trials Assessment Sheet*** provided with your Grain Trials registration.

Seed Crop Record
http://seedalliance.org/index.php?mact=DocumentStore,cntnt01,download_form,0&cntnt01pid=19&cntnt01returnid=139

Trial Evaluation Sheet
http://seedalliance.org/index.php?mact=DocumentStore,cntnt01,download_form,0&cntnt01pid=20&cntnt01returnid=139

A. **Fill in the varieties you are planting, and identify your desired variety traits for tracking.** *Traits listed on the assessment sheet are samples. Just choose what is of interest to you. Keep it simple.*

B. **Perform field evaluations.**
   a. **First, walk the entire trial field.** Try to get a feeling for the breadth of traits within the field. You will want to base your scoring on what you actually observe. Look for a 0 for the worst expression of each trait you observe in the field and a 5 for the best (think 5 stars).
   b. **Observe from the moment the seed starts to germinate.**
   c. **If doing replicated trials, evaluate each plot individually.** Do not average scores with other plots of the same variety if you are doing replicated trials.
   d. **Evaluate a single trait at a time across all plots**. Return to the first plot to evaluate the next trait, and so on.
   e. **Evaluate all of the plants in a plot as a whole** rather than just assessing the best or worst individuals in the population. When measuring, compute an average for that plot.
   f. **Take notes on each individual plot.** Include notable details not captured by the other traits. Tell a story.
   g. **Finally, make an overall assessment about each variety:** (1) Keeper, (2) Continue to Evaluate, or (3) Drop from Consideration. You do not have to know exactly why you want to keep a variety. Almost everyone develops a favorite variety, sometimes for inexpressible reasons. Let the plants speak to you. Let your deep intuition develop over time, as well as your skill to notice more detail.

Agronomic and Culinary Evaluations

"Agronomic evaluation must come first, for a couple of key reasons. If the plants don't thrive in the field, they will never make it to the kitchen. Secondly, one has to expand the seed supply sufficiently to have enough to experiment with in the kitchen. In the case of grain, the seed itself is being cooked. You must have enough stock to provide for both the kitchen evaluation as well as the fieldwork. In the end though, the culinary evaluation is crucial: the ultimate value of a variety is its worth in our kitchens." Jacob Cowgill

RMSA GRAIN TRIALS PROJECT ACTIVITIES

1st Stage *The primary focus for the first year of trials starting with a small amount of seed is to increase seed for varieties you want to try on a larger scale in coming years. We will provide at least 50 seeds of each variety to each person, and based on supply. Many of the rarer seeds are in very limited supply.*

Trial Goals

a. Seed increase
b. Evaluate whether to keep, evaluate further or drop each variety
c. Practice observation and data recording skills

Suggested Agronomic Traits For Evaluation

a. Plant vigor
b. Plant height
c. Days to harvest (planting date and harvest date)
d. Lodging (0 - 5 scoring scale)
    a. 5 = all plants are upright
    b. 3 = 50% (majority of plants are at 45º angle)
    c. 0 = 100% (majority of plants are at 90º angle)
e. Rust, disease

Planting Instructions

a. Multiply the seed using organic fertility management, nutrient-dense mineral amendments, and cover crop rotations.
b. Small amounts of seed are sometimes best started in flats.
c. Recommended planting of one plant per sq. ft.*
    i. You should have enough seed for fifty linear feet of each variety, or a 40 sq. ft. block. "Wider spacing in heritage grain plots produces higher yield, plus more robust plants and less disease." Eli Rogosa.

    **Some trialists are finding that closer planting provide a more favorable microclimate in very arid conditions.*
d. Label each plot in the field and make a back-up map.

Harvest and Cleaning

Most of the work can be done by hand. The following is a nice summary from Monica Spiller's Whole Grain Connection:

"Equipment used consists of protective gloves and a serrated sickle for harvesting wheat heads into cotton or woven plastic bags (burlap is avoided because it has an odor). Threshing is managed by half filling a strong cloth bag with wheat heads, closing it and treading/scootching the wheat heads to release the grains; running shoes against a woven straw mat works well."

"Winnowing can be achieved in one or two stages: the first can be swirling the threshed grain in a shallow circular bowl, gold-panning style, when the light chaff and straw gathers on the surface and can be lifted off by hand. The second stage of winnowing uses a natural breeze, or a well placed electric fan; the grain is poured in front of the fan and down into a catch bowl, with the result that the light chaff and straw is blown to one side and the catch bowl receives only the grain. A few repeats completes the clearance of the chaff from the grain. All this handwork provides ample opportunity for removing weed seeds and any off-type wheat seeds."

Outcome

You should be able to produce up to ½ lb. of seed for next year's trials. Please send back to RMSA **at least twice as much seed as you originally received** with a copy of your evaluation summary. The rest can be used for your next trials.

2nd Stage *This stage will be Year 2 for beginning grain growers, or Year 1 for experienced grain growers with larger amounts of seed.*

Trial Goals

a. Seed increase until reaching quantities of 100 pounds or more.
b. Decide whether to keep, evaluate further, or drop each variety.
c. Careful evaluation of agronomic data, especially diseases.
d. Beginning evaluation of culinary qualities (if enough seed is produced).

Important Agronomic Traits

Pick at least five and prioritize them. Add other traits depending on the amount of time you have, your farm scale, intended goals (especially commercial sales), and type of grain chosen.

a. Early emergence
b. Plant vigor
c. Tillers per plant
d. Days to flowering
e. Plant height
f. Color
g. Lodging
    a. 9 = all plants are upright
    b. 5 = 50% (majority of plants are at 45º angle)
    c. 0 = 100% (majority of plants are at 90º angle)
h. Rust, disease
i. Winter hardiness (% of survival)

j. Days to harvest
k. Yield (number of grains per 5 spikes)
l. 1,000 kernel weight

Planting Instructions

a. Multiply the seed using organic fertility management, nutrient-dense mineral amendments, and cover crop rotations.
b. Plant one plant per sq. ft., or preferred planting spacing for grains.
   This will create fifty linear feet of each variety, or a 40 sq. ft. block. Wider spacing in heritage grain plots is said to produce higher yield, plus more robust plants and less disease, according to Eli Rogosa. (Crabapple Farm found winter survival rate better when the plants are closer in the row.)
c. If you have enough seed, you can increase seeding rate to 15 lbs. per acre. (One seed per eight inches.)
d. Crabapple Farm seeds in rows with an Earthway Seeder, using the beet plate with every other hole taped over. Put multiple rows of the same variety side by side in a bed to make nice blocks.
e. Larger plantings can use a tractor-drawn planter. If the planting is by broadcasting, follow with a harrowing step using a tractor-drawn harrower.
f. Label each plot in the field and make a back-up map.
g. If you have enough seed, replicate each variety in three of the same-sized plots in a random pattern.
h. Rogue (remove) plants you do not want and save the rest to keep the population diverse.

Post-Harvest Culinary Traits

"Cook the grains whole. Taste them plain for their basic flavor. Mill them and bake long-ferment sourdough bread. Make pasta, cookies, pizza crusts, and tortillas. Try to determine their best uses and how to describe their flavor." Jacob Cowgill

Culinary Traits

a. Flavor, aroma
b. Gluten strength by chewing
c. Loaf volume
d. Flour protein content
e. Texture, mouth-feel
f. Color

Harvest and Cleaning

Small-scale farm equipment can be used. Monica Spiller's Whole Grain Connection website explains:

"Harvesting can be done with a small combine harvester if one is available, like All-Crop, Almaco, or Wintersteiger. Alternatively, the wheat, barley and oats can be hand harvested with the aid of a serrated sickle, leaving only 6 inches of stubble, and bundling it into sheaves with heads well aligned. In this way, wheat heads and straw can be taken from the

field together. Sheaves can then be spread out and threshed by the handful, with the aid of a small bundle thresher such as the Almaco small bundle thresher (www.almaco.com). The bundles are held by the straw and dangled into the path of the threshing drum. The bulk of the straw is then discarded separately."

"Final cleaning to remove every kind of impurity, including residual chaff, straw, un-threshed grains, weed seeds, damaged seeds, and foreign wheat seeds is essential. Only clean dry and variety pure seed should be stored either for replanting or milling. A grain cleaner is sometimes used for the final cleaning of larger amounts of seed. To produce absolutely pure seed it is usually necessary to hand clean the seed even after passage through the seed cleaner."

3rd Stage (2019–onward)

Trial Goals

a. Increase seed to be available to farmers in 25 and 50 lb. bags.
b. Ongoing evaluation of agronomic data
c. Laboratory testing for commercial qualities, protein %, test weight, etc.

Planting Instructions

The purity of the seed is dependent on the farmer's conscientious preparation of the field to minimize weed seed interference and off types. Walk through the field and remove any stray weed or foreign grain types just before harvest to reduce the impurity level in the final seed.

Harvest and Cleaning

Monica Spiller's Whole Grain Connection website explains: "Use a thoroughly clean harvester or larger scale grain cleaner that in no way adds impurity. The most basic grain cleaner has shaking sieves and a fan (e.g., Clipper brand). Gravity table cleaners are secondary cleaners that are often called de-stoners. Millers use them to make certain grain is free from debris that could damage their mills. Other specialized cleaners include spiral cleaners and indent cleaners. Clean and dry bagging and storage are essential. Compressed air and strong fan blowers are useful for cleanout. Steam cleaning can be used when contamination by fungal spores is suspected."

References

Grain Seed Sources (Sample amounts)

Baker Creek Heirloom Seeds
http://www.rareseeds.com/store/vegetables/grains-and-cover-crops/
Earth Dharma Farm
http://www.earthdharmafarm.com/grain.html
Fedco Seeds
http://fedcoseeds.com/seeds/?cat=Grains
Germplasm Resources Information Network (GRIN)
https://npgsweb.ars-grin.gov/gringlobal/search.aspx?

Free access to small (120 seed) samples for as many as 500,000 accessions. An online USDA National Genetic Resources Program software project to comprehensively manage the computer database for the holdings of all plant germplasm collected by the National Plant Germplasm System. The U.S. National Plant Germplasm System (NPGS) is collaborative effort to safeguard the genetic diversity of agriculturally important plants. The NPGS is managed by the Agricultural Research Service (ARS), the in-house research agency of the United States Department of Agriculture (USDA). Funding for the NPGS comes primarily through appropriations from the U.S. Congress.

Heritage Grain Conservancy
http://www.growseed.org

Heritage Harvest Seeds
https://www.heritageharvestseed.com/grains.html

KUSA Seed Society
http://www.ancientcerealgrains.org/seedandliteraturecatalog.html

Peaceful Valley
http://www.groworganic.com/non-gmo-and-organic-seeds/cereal-grain-seeds.html

Seed Savers Exchange – (Members Only)
https://exchange.seedsavers.org/catalog/index.aspx?type=browse&cat=3

Southern Exposure Seed Exchange
http://www.southernexposure.com/grains-cover-crops-c-29.html?zenid=PSXtxG9oGvD2E212DrFIQ3

Grain Seed Sources (Farm Quantities)

Albert Lea Seed (Canada)
http://www.alseed.com/Pages/CropCategoryListing.aspx?categoryID=27

Barley World (Oregon State University)
http://barleyworld.org/osu-varieties

BKW Farms (Arizona) (Organic Hard Red, Khorasan, Durum, Spelt)
http://www.bkwazgrown.com

List of Organic Grain Seed Suppliers
North Carolina State University Extension
https://organicgrains.ces.ncsu.edu/organicgrains-forage-and-cover-crop-seed-suppliers/

University Programs

Oregon State University,
Barley World
http://barleyworld.org

Washington State University
Sustainable Seed Systems
http://www.sustainableseedsystems.org
The Bread Lab
http://thebreadlab.wsu.edu/

University of Colorado, Colorado Springs
Arkansas Watershed Grain Project

nmeyer2@uccs.edu

University of Vermont

Northwest Crops and Soil Program, Grains

http://www.uvm.edu/extension/cropsoil/grains#reports

Cereal Grain Testing Lab

http://www.uvm.edu/extension/cropsoil/cereal-grain-testing-lab

Recommended Articles and Instructions

What You Need To Know About Wheat

Glenn Roberts, Anson Mills

http://www.ansonmills.com/grain_notes/14

Ancient and Heirloom Wheat Trial Varieties

The Ploughshare Institute for Sustainable Culture

http://www.sustainlife.org/blogs/sustainlife/2012/06/ancient-and-heirloom-wheat-trial-varieties/

Southern Small Grains Resource Management Handbook, University of Georgia

http://extension.uga.edu/publications/detail.cfm?number=B1190

Descriptors for Barley, NPGS

https://npgsweb.ars-grin.gov/gringlobal/cropdetail.aspx?type=descriptor&id=1

Nonprofits, Coops and Associations

Heritage Grain Conservancy (Eli Regosa, Maine)

http://www.growseed.org

KUSA Seed Society (California)

http://www.ancientcerealgrains.org

Northern Grain Growers Association (Vermont)

http://northerngraingrowers.org/

Organic Growers Information Sharing Network

http://www.ogrin.org/FS_spring_wheat_varieties.html

Whole Grain Connection (Monica Spiller, California)

http://wholegrainconnection.org