BEAN, GRAIN, EDIBLE SEED RESEARCH 2008 REPORT

Conducted by Harry MacCormack, The Institute of Bio Wisdom
On fields at Sunbow Farm, Corvallis, Oregon

Special thanks to Cheri, Katie, Peter, Santiam School volunteers, and any others who helped.

1. Questions Guiding This Research Project

This project actually began in Spring 2005. At that time I became curious about the feasibility of growing all kinds of diverse grains, dry beans, and edible seeds in this micro climate. My curiosity was prompted by the fact that most of these products being sold at First Alternative Co op originated from either outside the USA, or in a few cases from other growing areas of the USA. What prompts the necessity for this research at this time is the fact that at least 80% of typical human caloric dietary intake is from grain, bean, and edible seed sources. In our attempts to build a locally based food system a diverse selection of these crops is clearly the basis for that local food system. Such diversity exists in more localized food producing areas such as Germany, Italy, parts of China, India, Mexico, Peru and throughout the Fertile Crescent. There exists a history of some of these crops being grown in this valley mostly prior to the 1950's.

The following questions guided the scope and direction of this research:

- Can all kinds of diverse grains, dry beans, and edible seeds be grown on our farm in the Southern Willamette Valley?
- Can these crops yield at consistent rates that make them "affordable" foods?
- Can garden sized or homestead scale plots using organic methods be expanded to industrial scale field operations?
- Can sufficient markets be created locally to allow for a transition from grass seed farming to commodity based dry land food farming?
- What are the infrastructure needs at homestead and small industrial scales which would make such cropping possible?
- What nutritional qualities available from these foods can best feed human cellular communities? And how is that nutrition best available?

2. Crops Chosen for On-Farm Research

Wheat is currently grown in abundance in our valley. Almost all of it is soft white wheat exported to other countries. Hard red, soft red, hard white and a diversity of soft wheat have been one of the main focuses of this project. Seed Ambassadors of Eugene, Oregon sent us many samples gathered from mostly European sources. Washington State University sent samples of very old strains from their breeding project. Alan Adesse sent samples from his trials in the 1990's. Mark Stewart provided a red wheat variety which has become a perennial at Earth Station in the coast range. 20 different varieties of wheat were trialed at Sunbow in 2008,

Rye as a grain is perhaps under utilized in our cuisine. Rye grain typically has about the food energy of hard red wheat, yet rye seems better adapted to many of our soils. Its protein value is very close to red wheat, and possibly higher in our climate. We trialed 4 varieties of Rye. Two versions of one variety are perennial.

A high protein cross of Wheat and Rye is Triticale. I had grown triticale before with great success. We trialed 4 varieties in 2008.

The most visually spectacular and highest protein crop on the farm the last two seasons is Golden Quinoa. Our main variety has been growing at Earth Station just west of us at an altitude of 700 ft. for sixteen years. Bringing it to the valley floor at 200 ft. has been an interesting experiment. We tested 3 other varieties of Quinoa one of which was the original parent to our Mac Mark.

We tested 5 varieties of Amaranth for seed. Both Quinoa and Amaranth are very high protein, amino acid giants, and are non gluten edible seeds.

We also grew Buckwheat and Flax , both edible seeds that have a long history in our valley and are non gluten, high value food sources.

Very small patches of oats (a black variety discovered on our farm and possibly very old, it is much larger than contemporary varieties), spelt, and barley were grown. We have not continued earlier trials of these and other hulled grains because we didn't have de hulling equipment. Stalford farm with whom we have partnered in our trial work is purchasing such a machine which should allow for more diversity in our trials and eventually food availability in our food shed.

2008 was the third season of our dry bean project. We now have comparable data on some varieties. This season we grew Green Lentils and Red Chile Beans for the first time. We again grew Garbanzo, Black, Pinto, and Soy. A staple we've been growing for years is high protein Fava.

We also experimentally grew dry land Potatoes in an attempt to see if this staple could be a rotation crop for local dry farming operations.

Finally, as part of an ability to have local processing of tomatoes, we grew and kept records on a commercial variety of paste tomatoes. This is another possible rotation where at least light irrigation is available.

3. Climate, Soil Fertility, Mulches and other growing considerations

We kept strict weather records related to plant growth and harvest dates because, particularly with dry beans in this climate, we are "normally" at the edge of required light/heat hours. It is for this reason that many have determined that it is not possible to grow dry beans and Spring planted grains and edible seeds in this climate, at least in an industrially reliable manner. During 2008 we experienced the coldest June on

recorded weather records for the South Willamette Valley. In fact a series of inclement weather events beginning in April set up conditions for a strange growing year. Late March and early April warmed soils with unusually hot temperatures. But April 18th and 19th it snowed in the valley then turned very cold on the 20th. This was followed by two weeks of cold rain, which dropped soil temperatures to Winter levels. Early warming in May allowed us to plant beans on May 7th, then a month of mostly clouds, very little rain, and soils remaining too cool for normal Spring rapid plant growth set up a very unusual growing year. This condition continued into June with a near frost on the 5th.
This weather affected the ripening of all the grains, slowing them by an average of 1 - 3 weeks. The Quinoa was stunted in early growth stages but recovered with lowered yields in late July. Some of our normal July harvest grain got pushed back into August, which normally wouldn't matter, except for more inclement rain August 17th – 21st. More dark clouds showed up the last week of August but cleared for early September harvest. All of our dry beans, normally harvested in August, were harvested the first two weeks of September. We were lucky that early morning, heavy dew, burned off for afternoon dry harvests. After three years of dry bean experimentation I would agree that this agricultural gamble is somewhat more risky than some other agricultural gambles, but is totally possible with careful management. I would offer a similar assessment for flax, buckwheat, and dry corn (which we did not grow this season). Quinoa appeared to be somewhat cold tolerant and yielded pretty well after stunting. The same was not true for Amaranth which clearly needs a climate with steady warm soils and lots of warm sunlight over a very long season.

Our dry land soils were managed with leaf mulch. We used year old leaves, partially composted, on soils which are rotated with vegetable crops. On the grains there was no other fertilization. We did experiment running plots of grains without mulch, and we found yields were cut by about a third to a half, depending upon variety.

Because of all the cold weather some of the beans almost froze out. All needed two foliar applications of liquid fish and kelp. The broad leaf beans were visibly weakened by the cold, some leaves turning brown. With foliar fertilization they recovered, but crop yields were lowered as a result of the long period of stress. Both green lentils and garbanzos were less affected by the cold. Yields were slightly lowered compared to previous yields we've experienced. Shattered lentils and garbanzos have germinated this fall, and as of this writing seem to be thriving. We will find out this Winter if these two varieties can be Fall or Winter planted with Fava beans.

4. WHEAT DATA

Variety: Maris Widgeon
Seed Source: Seed Ambassadors/ Bountiful Gardens/England
Plant Date: 9/24/07
Harvest Date: 7/21/08

Plot: 3 x 14 ft. – 18 rows on 8 inch centers
Notes: An old English variety prized as a “thatch” wheat. Six feet tall. Stems have a very oily feel which may be why it is used for thatched roofs. Tops broke off easily while being threshed. Appears to be a semi hard white wheat.
Yield: 6 lbs. 8 oz.
Extension: 3,800 lbs per acre or 66 bushels

Variety: SS 791
Seed Source: Seed Ambassadors
Plant Date: 9/24/07
Harvest Date : 7/ 21/08
Plot: 3 x 28 ft. – 50 rows on 8 inch centers
Notes: On garden soils Seven feet tall. Most fell over in June. Tops broke off easily in the hammer mill thresher. Lots of straw. A semi hard white wheat. Probably needs less residual fertility.
Yield: 4 lbs. 11 ¼ oz.
Extension: 3000 lbs. per acre or 50 bushels

Variety: Tim Stein
Seed Source: Seed Ambassadors
Plant Date: 9/24/ 07
Harvest Date: 7/14/07
Plot: 3 x 9 ft. – 12 rows on 8 inch centers
Notes: Reputation is as a promiscuous breeding wheat. On our soils this wheat was very weak, almost died twice during winter weather, had yellowed leaves, in general was not a wheat I would breed with anything.
Yield: 14 oz.

Variety: Stephens Durum
Seed Source : Seed Ambassadors
Plant Date : 9/24/07
Harvest Date : 7/23/08
Plot : 3 x 20 ft. – 37 rows on 8 inch centers
Notes: Old soft white wheat variety, long kernel, easy thresh, three and a half feet tall, used for Pasta, noodles, flat breads, very healthy strong stem and leaf.
Yield: 14 lbs. 14 oz.
Extension: 9,000 lbs per acre or 150 bushels

Variety: Mark’s Red Winter (perennial)
Seed Source: 2nd year Sunbow, 5 years Mark Stewart, Earth Station, originally OSU
Plant Date: 9/25/07
Harvest Date: 7/25/08
Plot: 10 x 100 ft. or 5 rows seeded with planter
Notes: Large heads with large seeds on leaf mulch; smaller heads with tighter seeds on non mulched plot. We’ve had good reports on this red wheat being a fine bread wheat. Noticed that perennialization in the coast range is probably related to

perpetual moisture availability. Mark's has produced crop for 6 years from one planting. Where mist from a nearby irrigation system drifted onto our plot the plants showed regenerative characteristics. Otherwise they did not.
Yield: 32 lbs. 2 oz.
Extension: 2576 lbs. per acre or 42.9 bushels

Variety: Tim Peters Perennial Wheat (mixed hard red and white)
Seed Source: Sunbow year 2 , 2006 Earth Station, Tim Peters Research
Plant Date : 9/25/07
Harvest Date : 7/26/08
Plot: 8 x 85 ft. or 8 rows seeded with planter
Notes: Shorter stature than in previous year's garden test plot. Three feet high. Even stand. Very hard seed. Threshed easily. Perennial quality seems to be water dependent. Seems to be a hard wheat, but shows both red and white characteristics.
Yield: 42 lbs. 8 oz.
Extension: 3400 lbs. per acre or 56 bushel

Variety: Ruby Hard Red
Seed Source: Alan Adesse (seed harvested in 1996) introduced 1917
Plant Date: 11/ 8/ 07
Harvest Date: 7/26/08
Plot: 3x6 ft.
Notes: Easy thresh. Good stand. Poor germination, late plant and old seed. Nice red color.
Yield: 1 lb
Extension: 2000 lbs per acre or 33 bushels

Variety: Zaeus
Seed Source: Alan Adesse (seed harvested in 1996)
Plant Date:11/8/07
Harvest Date: 7/26/08
Plot: 3x8 ft.
Notes: Looks to be a very heavy yielder. Easy to thresh.
Yield: 2 lbs. 7 oz.
Extension: 3,000 lbs. per acre or 50 bushel. Might yield 90 – 100 bushel.

Variety: Pan Mow 14 A
Seed Source: Alan Adesse (seed harvested in 1994)
Plant Date: 11/8/ 07
Harvest Date: 7/26/ 08
Plot: 3x 4 ft.
Notes: Poor germination. Old seed. Threshing impossible because fronds stayed attached to seed. Might do better with combine.
Yield: 10 oz.

Variety: Crete 13

Seed Source: Alan Adesse (seed harvested in 1996)
Plant Date: 11/8/07
Harvest Date: 8/14/08
Plot: 3x9 ft.
Notes: Only a few germinated. Short, looks like Spring variety.
Yield: 6 oz.

Variety: Rescue
Seed Source: Alan Adesse (seed harvested in 1996)
Plant Date: 11/8/07
Harvest Date: 7/26/08
Plot: 3 x 9 ft.
Notes: Easy thresh, hard seed.
Yield: 6 oz.
Extension: might yield 50 – 60 bushel per acre

Variety: Gypsum Soft White
Seed Source: Alan Adesse (seed harvested in 1999) introduced 1912
Plant Date: 11/8/07
Harvest Date: 7/26/08
Plot: 3 x 9 ft.
Notes: Poor germination. Nice looking wheat plant.
Yield: 4 oz.

Variety: Red Turkey
Seed Source: Alan Adesse (seed harvested 1996)
Plant Date: 11/8/07
Harvest Date: 8/14/08
Plot: 2 X 100 feet
Notes: Planted late on mulch. Spotty germination. Big head, short stature, modern variety, probably bred for Spring planting. Easy to thresh and clean.
Yield: 4 lb.
Extension: 1600 lbs per acre or 27 bushels

Variety: Canyon Bounty Hard Red Wheat (Eastern Oregon) probably Red Turkey
Seed Source: Nana Cardoon
Plant Date: 5/9/08
Harvest Date: 9/5/08
Plot: 1 x 80 ft.
Notes: Commercial Hard Red. Short plant. Large head. Easy to thresh and clean.
Yield: 1 lb.
Extension: Difficult to project bushels, but probably 30 – 40 per acre.

Variety: Currawa Soft White
Seed Source: Washington State University – introduction 1916
Plant Date: 4/18/08

Harvest Date: 7/17/08
Plot: 17 x 25 ft..
Notes: Old variety , not a large stand, spotty germination. No mulch planting for most, but on mulch a larger head and somewhat taller plant. Easy thresh and clean.
Yield: 4 lb. 2 oz.
Extension: 1225 lbs. per acre, or 20 bushels . WSU 1434 lbs. per acre

Variety: Thatcher Hard Red
Seed Source: Washington State University – introduction 1934
Plant Date: 4/18/08
Harvest Date: 7/17/08
Plot: 19 x 25 ft.
Notes: Fairly descent stand. Threshed and cleaned easily.
Yield: 6 lbs. 10 oz.
Extension: 1330 lbs. per acre or 22 bushel. WSU 1547 lbs. per acre

Variety: Marquis Hard Red
Seed Source: Washington State University – introduction 1911
Plant Date: 4/18/08
Harvest Date:7/17/08
Plot: 16 X25 ft.
Notes: Descent stand, small berries. Threshed and Cleaned easily.
Yield: 4 lbs. 8 oz.
Extension: approximately 800 lbs. per acre or 13 bushels WSU 1351 lbs. per acre

Variety : Peawa Soft White (Penawawa?)
Seed Source: Washington State University – introduction 1985
Plant Date: 4/18/08
Harvest Date: 7/17/08
Plot 16 x 25 ft.
Notes: Most germinated. Bigger heads. Low to ground. Easy to thresh and clean.
Yield: 7 lbs. 10 oz.
Extension: 1450 lbs. per acre or 23 bushels. WSU 2014 lbs. per acre

Variety: Ladoga Hard Red
Seed Source: Washington State University – introduction 1888
Plant Date: 4/18/09
Harvest Date:7/17/08
Plot: 16 x 25 ft.
Notes: Looks unstable, about half red, half white. Very hard. Really pretty in the field.
Yield: 4 lbs. 10 oz.
Extension: approximately 800 lbs. per acre or 13 bushels. WSU 1401 lbs. per acre

5. RYE DATA

Variety: Dronial Dark Rye
Seed Source: Seed Ambassadors (Lithuania)
Plant Date: 9/24/07
Harvest Date : 8/4/08
Plot: 3 x 10
Notes: 7 ft. high. Very large head and very large seed. Thresh and clean easily.
Yield: 4 lbs. 4 oz.
Extension: more than 200 bushels per acre

Variety: Licht Kern Raggen Rye
Seed Source: Seed Ambassadors (Muller, Germany)
Plant Date: 9/24/07
Harvest Date: 8/4/08
Plot: 3 x 8 ft.
Notes: 7 ft. tall, large seeds. Easy thresh and clean.
Yield: 2 lbs. 14 oz.
Extension: 7 410 lbs per acre or 123 bushels

Variety: Mountaineer Perennial Rye
Seed Source: Seed Ambassadors (Tim Peters)
Plant Date: 9/24/ 07
Harvest Date: 8/6/ 08
Plot: 3 x 17
Notes: Very uneven ripening. Hard thresh. Very tall weak plants.
Yield: 3 lbs. 4 oz.
Extension 4080 lbs per acre or 68 bushel

Variety: Mark's Perennial Rye
Seed Source: Mark Stewart 2006 (yr. 3 of perennial growth, yr. 2 here.)
Plant Date: fall 2006
Harvest Date: 7/24
Plot: 8 x 85 ft.
Notes: Very weedy. Try new planting with leaf and clover .
Yield: 42 lbs. 8 oz.
Extension: 2970 lbs. per acre or 49 bushels

6. TRITICALE DATA

Variety: Telos B Triticale
Seed Source: Seed Ambassadors (Bountiful Garden)
Plant Date: 9/ 24/ 07
Harvest Date: 7/24/08
Plot: 3 x 7 ft

Notes: Very tall, 6-7 ft. Hard to thresh in the hammer mill. Might be better in combine.
Yield: 1 lb. 7 oz.
Extension:4080 lbs. per acre or 68 bushel

Variety: Pearls Triticale
Seed Source: Seed Ambassadors (Tim Peters Research/ German)
Plant Date: 9/24/07
Harvest Date: 7/23/08
Plot: 3 x 11 ft
Notes: A beautiful plant with very large heads and seeds. Thresh and clean easily.
Yield: 4 lbs. 5 oz.
Extension: 8100 lbs. per acre or 135 bushel

Variety: Douglas Triticale Perennial
Seed Source: Seed Ambassadors / Tim Peters Research
Plant Date : 9/24/07
Harvest Date: 8/4/08
Plot: 3 x 8 ft.
Notes: Seed did not break from heads in the hammer mill thresher. Very small seeds.
Yield: Sitting in a bag to be hand threshed.

Variety: Canadian Triticale
Seed Source: Commercial, Corvallis Feed and Seed
Plant Date: 8/24/07
Harvest Date: 9/19/08
Plot: 50 x 120 ft.
Notes: Made a nice stand about 6 ft. tall. Competitive with weeds. Combined and cleaned easily. Only wild garlic would not clean out. Makes good tasting bread.
Yield: 300 lbs.
Extension: 1800 lbs per acre or 30 bushels

We also grew small patches of Winter Spelt or Dinkel and Emmer Wheat. Neither could be threshed or cleaned with our equipment. Both require de hulling and enough material to combine. These two grains are important to add to our food shed as they have either very low or no gluten, yet can make good bread and other pastries, as well as noodles etc.

7. BEANS

Variety: Green Laird Lentil
Seed Source: First Alternative Co op, Montana grower
Plant Date: 5/8/08
Harvest Date: 9/3/08
Plot: 3 x 85 ft.

Notes: Handled cold weather very well. Was the first ripe bean. Some shattering during harvest. Short plants (a problem in the industrial harvest literature, not a problem for hand harvest). Thresh and clean very easily at homestead scale using a tarp and feet, a broom, and either winnowing with a fan or using the Ten Rivers Food Web small seed cleaner.
Yield: 12 lbs. 8 oz.
Extension: 2.500 lbs. per acre (which is actually very high for lentils) or 41 bushel

Variety: Garbanzo
Seed Source: Sunbow 2007 crop and First Alternative (Turkey)
Plant Date: 5/8/08
Harvest Date : 9/ 11/ 08
Plot: 10 x 85
Notes: Germinated rapidly and evenly. Very cold tolerant, although a little less so than lentils. Responded to on foliar application of fish/kelp. Ripened evenly. Not much shattering. Appeared to be a decline in yield from 2006 estimated 2288 lbs. per acre or 38.1 bushels.
Yield: 40 lbs.
Extension: 2,000 lbs. per acre or 33 bushels

Variety: Black
Seed Source: Sunbow 2007
Plant Date: 5/8/08
Harvest Date: 9/3/08
Plot: 10 x 85
Notes: Germinated slower than in previous years. Suffered visibly in the prolonged cold. Yellowing of lower leaves. Recovered after double applications of liquid fish and kelp. Some uneven ripening compared to previous years. Easier to clean on a tarp with feet than with hammer thresher. Severe reduction in yield over 2006 2860 lbs. or 42 bushels
Yield: 33 lbs. 8 oz.
Extension: 1360 lbs. per acre or 22.6 bushels

Variety: Pinto
Seed Source: Sunbow 2007
Plant Date: 5/8/08
Harvest Date: 8/29/08
Plot: 9 x 85
Notes: Took a hard hit in the cold. Plants about half the size of 2007 and 2006. Yield way down. Took 2 applications of fish and kelp to pull them out of the cold damage. Part of the patch on a slightly lower area of the field. Fertility and moisture not even across the patch. Much easier to clean on a tarp than on a hammer thresher. Very even ripening. Severe reduction in yield compared to 2006 3640 lbs. per acre , 2007 4590 lbs. per acre or 60 bushels and 76 bushels
Yield: 39 lbs. 2 oz.
Extension: 2177 lbs. per acre or 36 bushels

Variety: Red Chili
Seed Source: First Alternative Co op
Plant Date: 5/8/ 08
Harvest Date: 9/6/ 08
Plot: 10 x 85
Notes: Are really good tasting commercial red bean. Acts a lot like Black beans in field conditions. Took a hard hit in the cold Spring weather. Some yellowing of leaves like the Black Beans during the cold. At dry down, even ripening, but the stalk exhibits a "slouch" effect placing the beans very close to the soil. Easy thresh with tarp and feet. Easy clean up in seed cleaner. Even ripening.
Yield: 37 lbs. 11 oz.
Extension: 1875 lbs. per acre or 31 bushels

Variety: Hei Mu Tou Soy
Seed Source : Steve Rose, Peace Seeds
Plant Date: 5/10/08
Harvest Date: (windrowed under cover) 10/3/08
Plot: 10 x 50
Notes: Took forever to germinate. A gold/black soy bean which we've all grown before. Did not like cold. Responded to 2 applications of fish/kelp but early pods empty and later pods not very large. Uneven ripening, and very late. Had to windrow and place under cover to finish ripening. Easy thresh, in fact some shattering in the windrow which we did on a tarp. Not a good year for soy of any kind.
Yield: 4 lbs. (basically got a little more than we seeded originally.)
Extension: 2006 - 1950 lbs. per acre or 32 bushel, 2007 – shattered before harvest

Variety: Fava
Seed Source: Sunbow 2007
Plant Date : 2/13/08
Harvest Date: 7/18/08
Plot: 3 x 100
Notes: Fall planted field favas (as compared to kitchen planted favas protected by the building) did not survive well. Late Winter planting was almost 100 percent. Germination was slow. Beans ripened about a week later than Fall planting. Thresh on tarp with feet went easily, although some beans hung to pod and had to be stomped a second time. Winnowed with a bucket and fan.
Yield: 17 lbs.
Extension: 2080 lbs. per acre or 34 bushel

Variety: Adzuki
Notes: Did not do well in a cold summer. Stunted plants, almost no beans.

Variety: Derby Green Bean for Seed
Notes: When growing bush green beans we harvested green for three markets then left beans for seed on two different plantings. Uneven ripening required windrowing

on a tarp before threshing. We have done this for three years. If enough beans are left for both seed and eating, they are very good as a dry bean.

8. EDIBLE SEEDS

Comments: Many seeds are edible but do not fall into the grain or bean category. One problem nutritionally with most grains is that they contain gluten which gluten intolerant people cannot eat. Many edible seeds do not contain gluten. We have grown out many edible seeds, not all of them in 2008, however. Quinoa, Amaranth, Buckwheat, Flax, Sunflowers, Broccoli Seed, Coriander, and Celery Seed were all part of the 2008 experiments. In the recent past I have also grown Sesame, hot Mustard Seed for pepper, and both Squash and Pumpkin seeds. Edible seeds enhance diversity in both fields and diets. On a commercial scale many edible seeds can be harvested with bean and grain equipment. On a homestead scale simple methods of threshing usually involve some sort of rubbing motion and winnowing with a bucket and a fan.

Variety: Dave Quinoa
Seed Source : Seeds of Change
Plant Date: 3/20/08 – Transplant 5/ 5
Harvest Date: 9/7/ 08
Plot: 2 rows x 30 ft. (transplanted from trays on 8 inch centers)
Notes: This variety was the original parent to our Mac Mark which Mark Stewart has been growing in the coast range for 16 years. Moving Quinoa to the valley I came up with a transplant strategy. With all varieties we notice that they look more like the native Lamb Quarters weed, more branching, than at higher altitude. This season all the transplants were about half as tall as last season. There was virtually no growth during the prolonged June cold. This stunting lowered yields, but also set back harvest time by about a week to two weeks. Dave Quinoa seemed to have a slightly larger seed head than our Mac Mark. Another plus to homestead scale Quinoa is the stem . It makes excellent kindling. Seed thrashing seems easy, but there is a lot of small chaff, the same size as the seed. With the seed cleaning machine and many passes with the $1/8^{th}$ inch screen we are able to clean the seed.
Yield: 5 lbs.
Extension: 4,000 lbs per acre or 66 bushel

Variety: Faro Quinoa
Seed Source: Seeds of Change
Plant Date: 3/20/08 – Transplant 5/ 5
Harvest Date: 9/7/08
Plot: 1 ½ rows X 30 ft.
Notes: Looks more like branching valley Lambs Quarter with a somewhat smaller head. Lighter amount of seed than Dave or Mac Mark.
Yield: 3 lbs.
Extension: 2.800 lbs. per acre or 46 bushel

Variety: Temoca Quinoa
Seed Source: Seeds of Change
Plant Date : 3/20/08 – Transplant 5/ 5
Harvest Date: 9/15/08
Plot: 2 ½ rows x 30 ft.
Notes: Seemed to take cold weather much harder than other varieties.
Yield: Has not been cleaned, although threshed easily.

Variety: Mac Mark Quinoa
Seed Source: Sunbow 2007 – Mark Stewart Earth Station 2006
Plant Date: 3/20/08 – Transplant 5/6/08
Harvest Date: 9/15/08
Plot: 21 rows x 30 ft on 8 inch centers (3 rows to a 4 ft. bed)
Notes: Did not grow fast as it did 2007 in early stages. Cold soils and air. As a result the shorter plants showed more branching. Growth spurt started in July as seeds were starting to set. Some plants yielded well, others not so well. Threshing from the stems in the hammer mill thresher seems fast and breaks away all seed. But there is a large amount of small chaff which is difficult to clean in the 1/8th inch screen, even after repeated passes. The beauty of the plant as it matures, and the golden seed, are worth growing it. However, harvest and cleaning are difficult.
Yield: We have 5 totes full of seed not completely cleaned. Slightly less than Dave, the plant parent.
Extension: Last season close to 3500 lbs per acre or 58 bushel

Variety: Mac Mark Quinoa
Seed Source: Sunbow 2007
Plant Date: Direct Seeded 5/15/08
Harvest Date: 9/18/ 08 Windrowed on a tarp under cover
Plot: 20 rows x 30 in compost, 15 rows direct seeded without compost
Notes: Slow germination because of cold allowed a lot of weed pressure. Taller plants, closer to the usual 5 ft. average , but seed heads about the size of the shorter transplants, and many immature seeds at the later harvest. The seeds in leaf compost germinated much more evenly than the seeds in open tilled soil. The plants were also much larger in the composted rows. For the second season I am convinced that direct seeded quinoa on the valley floor is very difficult to bring to maturity during hot, dry, weather. Transplants mature in August or very early September and give a better chance to have a dry, fully matured seed, harvest. The reason we harvested and placed on tarps to dry in a grow tunnel in late September was moisture and cool weather. The plants needed another hot month to mature fully.
Yield: Currently in the totes with the transplanted seed.

Variety: Golden Amaranth
Seed Source: Seeds of Change
Plant Date:3/20 in trays in greenhouse – Transplant 5/10/08
Harvest Date : 10/8/08 placed on tarp under cover
Plot: 2 rows by 30 ft. on 12 inch centers

Notes: Golden Amaranth was one of 2 that made it through the cold. Three others all but died off or were so stunted that they never recovered. On a very positive note, Pigweed also did not get a growth spurt until late July. Our farm weed pressure was lessened by the cold June weather. This was our second season of growing Golden Amaranth. Both times we ended with harvests very late and some mature but many immature seeds. Beautiful heads, but not a crop I would recommend for a micro climate like ours.
Yield: A few ounces, which I will plant for 2009 hoping some cold tolerance might have developed.

Variety: Golden Flax
Seed Source: First Alternative Co operative – grower not identified
Plant Date : 5/5/08
Harvest Date: 8/20/08
Plot: 2 x 10 ft.
Notes: This was the second time Flax was grown at Sunbow. Both times it was extremely easy to grow. The problem is in the cleaning. The Ten Rivers Food Web seed cleaner made that an easy job.
Yield: 2 lbs. 4 oz.
Extension: 2,700 -3000 lbs. per acre or 45 – 50 bushel

Variety: Buckwheat
Seed Source: Peter Kenegy 2006
Plant Date: 6/7/08
Harvest Date: 9/27/08 Windrowed on tarp, threshed with combine 10/8/08
Plot: 100 X 20 ft.
Notes: Needs to be planted earlier to pick up moisture, although normal May plant date would not have had any moisture either. Very sparse germination. Does much better on irrigated vs. non irrigated plantings. Need to widen combine setting slightly as some seeds were cracked. For human food needs a de hulling machine.
Yield: 7 lbs. 2 oz.
Extension: a good yield at least 50 bushel an acre

Variety: Coriander
Seed Source: Sunbow
Plant Date: 6/25/08
Harvest Date: 8/25/08 - Cleaned: 10/20/08
Plot: 3 x 10 ft.
Notes: Can be windrowed or combined straight up. We sold cilantro from this crop, then left it in the ground for Coriander. Both edible and a seed crop for cilantro.
Yield: 2 lbs. 4 oz.
Extension: 3168 lbs. per acre or 52.8 bushel

Variety: Sunflower: several varieties grown for commercial seed were trialed. We were impressed with the short stature and thin stem and medium- sized flower on a variety from Harris. Birds got most of the seed before we got to it.

9. Other experimental crops included a dry land potato patch and a commercial paste tomato.

The dry land potato patch was planted on a field that had been in grass for 6 years. Prior to that it was in Strawberries. We often use potatoes to "clean up" grass fields before using them for other crops.

We planted by placing the 1 ½ to 2 in seed potatoes in the soil the 20th of May. Fish meal and powdered kelp were added with each seed potato. After planting, we mulched about 6 inches deep with year old leaves. I mulched again with another 6 inches when the potatoes began to show leaf. We had no rain to speak of the month before planting and no rain after planting. We did not irrigate these potatoes. Our patch was 120 ft. x 40 ft. or 7 spader beds with 60 seed potatoes per bed, and yielded 750 lbs. on September 30th . The soil was very damp when we harvested indicating that the mulch held soil moisture evenly throughout the hot Summer months.

We were impressed with the yield and the quality of these potatoes. They had less nematode damage than our irrigated plots, produced about the same number of potatoes per plant, even though the potatoes tended to be just a little smaller and more firm. They are keeping better than irrigated versions of the same three varieties. We estimate that dry land potatoes using appropriate mulch will yield 9,000 to 10,000 lbs. per acre. They could be used as a rotation crop in dry land grain and bean operations with a significant profit. Our homestead scale potato operation uses two double plow trenchers on a three point tool bar to lift the potatoes from the soil. Several passes are necessary to get all the potatoes. Hand labor with buckets gets the potatoes from the soil surface to sorting boxes. Boxes are stored in the potato room located in the center of our oldest barn. That room is dark and insulated from both heat and cold.

The commercial paste tomato data is the result of on going discussions in the Processing Committee of Ten Rivers Food Web. Our research shows that one of the most used and desired potentially local processed crops would be canned tomatoes. Most information indicates that processing tomatoes cannot be grown in a timely, profitable manner in our three county area.

We have grown our Teardrop Paste for years. It was originally a Heinz commercial tomato. We selected for flavor and crossed it with some of Dr. James Bagget's sweeter varieties. These tomatoes are always in great demand by our customers, but we had never kept strict pounds per plant records. Nor had we kept records which would indicate probability of pounds per quart.

Variety: Teardrop Paste
Seed Source: Sunbow Farm
Plant Date: 1/16/08 in trays on heat table- Transplant to 3 inch pots 2/19/08- Transplant into field 5/20/08
Harvest: Began 8/21/08 thru 10/8/08

Notes: This was a very cold tomato year, one of the reasons we originally bred this tomato. The crop was probably two thirds of usual and extended over a longer picking period because of the June weather. The weight per tomato was also somewhat less, particularly during the late September and October harvests.
Yield: 1010 and ½ lbs. or 4.39 lbs per plant (we have measured 5 lbs. per plant several other years)
Extension : 33,000 lbs. per acre or 66 bushel
We estimate 6,600 plants per acre.

225 lbs. made 78 quarts
2.9 lbs. per quart

One acre would make 11,379 quarts.

What this means is that a local, portable, wet processing unit could service several small farms in a local area. This is preliminary data. We would have to enter cultivation, seed, weeding and hand harvesting costs; then processing costs.

10. Nutritional Information

Whole grains are comprised of three layers—the bran, the germ, and the endosperm. The high nutrient density commonly associated with grains exists only when these three are intact. Whole grains contain health promoting substances like amino acids, vitamins, minerals and fiber, but they also contain lignins, phytoestrogens and other important, disease- preventing nutrients that usually are not found in food supplements.

Testing needs to be funded in any local micro climate to understand how climate and soils might affect nutrients in grains, beans, and edible seeds. This is a priority if 80% or more of typical diets is made up of grains, beans and edible seeds. The USDA Composition of Foods Handbook offers some interesting comparisons that might be seen in local grains and edible seeds.

Food Energy or Calories
WW -Whole Wheat Flour from Hard Wheat – 333 per 100 grams
RG -Rye Grain – 334
BW-Buckwheat – 335
AM-Amaranth whole grain – 391

Protein in Grams
WW – 13.3
RG- 12.12
BW- 11.7
AM- 15.31

Calcium in milligrams
WW- 41
RG- 38
BW – 114
AM – 490

Phosphorus in milligrams
WW – 372
RG- 376
BW – 282
AM – 455

One of my interests in this kind of data is that it appears that Rye or the Rye/Wheat cross known as Triticale might offer superior food value in this Southern Willamette Valley micro climate. As both annual and perennial Rye Grasses have been the backbone of the agricultural economy here for more than a quarter century, it would make sense that edible grain relatives would grow easily on transitioned fields. In our trials we did find both Rye and Triticale varieties which yielded as good or better than the typical soft white wheat yields in our area: better than 100 bushels per acre. Rye is used in colder, northern, European climates extensively. Known to be naturally low in gluten, it has an intense flavor which has not been part of most modern diets and tastes. I see Rye as the northern climate substitute for Rice and have used it as such in many recipes. Of course it will not work for gluten intolerant people.

Nutritional comparisons of minerals in grains done by Kevin Murphy, Steve Jones, and others involved in the Washington State University Evolutionary Participatory Wheat Breeding Program show that older varieties tend to show higher levels of certain minerals. As one major factor in Nutrient Density is available nitrogen, both the WSU trials and ours were done with intentionally low nitrogen inputs. An obvious extension question from this research is: were older varieties, bred on soils prior to decades of synthetic chemical inputs, holding more minerals because of higher micro biological activity in those soils? Is nutritional density at least partially a result of conditions in which seed breeding was done? For more on this program contact Kevin Murphy and Steve Jones at WSU Department of Crop and Soil Sciences.

Much has been made recently of the nutritional dangers of grains, beans and edible seeds. More and more modern people appear to be gluten intolerant. Similarly, many of those same people and others appear to be lectin intolerant. Lectins are hardy proteins that do not break down easily. They are not specifically plant based, but they are in edible plant parts. They are resistant to stomach acid and digestive enzymes. In both cases it appears that the biological condition of the human gut, particularly compromises to the gut wall, often as a result of antibiotics and toxic overloads of synthetic chemicals, are the cause of reactions. Internet research on both gluten and lectins will give a more complete picture. One really interesting piece of that research shows that GM (genetically modified foods) are modified by splicing ‘lectins’ from one plant family to another. If you know that you react to a particular plant family but

that lectin has been put in a plant not of that family, you may consume the 'toxic to you' lectin, have the reaction/response, and not know the cause. GM drift from various plants to others may mask the source of some gut related illnesses, such as Crohn's Disease, Celiac-Sprue, and gut permeability.

11. Processing of Grains, Beans, and Edible Seeds

During the 2008 season we participated in a small USDA grant which explored on-farm, post harvest, processing and began to look at potential markets for diverse grains, beans, and edible seeds in our locality.

We found that at the homestead and very small farm scale cleaning after threshing can be effectively accomplished in several ways. The easiest is a form of winnowing using a five gallon bucket and a fan. As the grain, bean, or seed is dropped into a tote or bin placed below fan level, chaff is blown off. It usually takes several passes before the product is clean enough to use or market. A faster, although much more expensive way to accomplish the same task, is to use a small clipper cleaner. Ten Rivers Food Web purchased as part of the grant a table model, lab scale, seed cleaner. It has an adjustable blower, four seed screens, and requires less skill than bucket winnowing. We found that even hard to clean seeds such as Quinoa and Flax were possible to get really clean with this tool.

On a small scale we found that all seeds can be effectively stored in 5 gallon plastic pails with tight lids. We were able to store 25 lbs. of grain in a pail. We also used plastic totes. A 14 gallon tote will hold 75 lbs. of grain. The next size up is a 55 gallon, food grade, steel drum with locking top. Storage is necessary after cleaning because grains, beans, and edible seeds are used in all kinds of ways, will last for years when properly stored, and are actually a basic stored source for further processing such as flour grinding, sprouting, boiling, etc.

12. Financial and other considerations

The following figures are typical of crops which yield 40-60 bushels or 2,400 -3,600 lbs. per acre. These crops include Canadian Triticale, Hard Red Wheat, Perennial Rye, and most of the beans we have trialed. Soft white wheat and two of our rye varieties yielded three times that amount, yet costs per acre are relatively constant. I have formulated two scenarios for this information. The first is using the industrial mind set in which a farm is cost accounted as a factory or other production unit would be. The second may be more like reality for a small, homestead scale, farm. This information is approximate, but valuable as per acre costs and potential on-farm profits are motivational factors in shaping diversity in a transition to locally grown foods. Labor is figured at the current $10-$12 per hour as noted in the Capital Press 9/26/08.

Organic Per Acre Costs for Grains, Beans, Edible Seeds

Scenario One

Seed: 100 lbs. per acre plus sowing ---------- $100.00

Field Preparation: equipment rates per hr. are Sunbow Farm figures based on our on-farm rental rates for share croppers. Our equipment is paid for, so these rates may actually be lower than typical rental rates.

Tractor----------$ 80.00
Plow----------$ 10.00
Disk---------- $ 35.00 (2 ½ hrs.)
Fuel----------$ 24.00 (Bio diesel)
Maintenance----------$ 6.00
2nd Tractor and Spreader ----------$ 80.00
Labor @ $10.00 per hour ----------$ 100.00
Compost----------$ 250.00
Compost Tea ---------- $ 50.00

Total Field Preparation estimated costs ----------$ 735.00

Scenario Two

The way many small farmers would look at these same costs is as follows:

Seeds – no cost, because we saved last season's seed or were given seed.
Tractors and equipment – fuel, maintenance on all equipment – approximately $40
Compost: because we make our own, only fuel is involved – approximately $10
Compost Tea: because we make our own, only materials and brewer electricity - $10

Total Field Preparation estimated costs under this homestead farm scenario: $60 per acre. Notice there is no labor charge, because the farmer doesn't usually think of his time as labor, but rather as part of the bottom line, in other words, profit or loss. $735 vs. $60 is a huge difference. It is why small farmers own their own equipment and do their own work on small acreages. It is why we make our own compost and compost tea. And it is why I can afford to do homestead scale research plots of all these diverse crops.

Scenario Three

By contrast USDA figures for 2008 show a per acre cost of $292.00 per acre. A later figure given at by the Wheat Growers Association is $373.00 per acre. With wheat riding the international roller coaster of $8.35 (the actual payment after the speculation of $20.00) per bushel and now hovering around $5.00 a bushel, it is easy to see why industrial operations put high yields above every other consideration when

dealing with grains and beans. These figures usually include seed, planting, fertilizer and herbicide/fungicide, and harvest expenses. These figures are typically used in obtaining bank and federal government loans to continue the industrial business cycle.

Harvest Costs:

Scenario One
Combine @ $20 per hr. ----------$30.00
Fuel @ $10 per hr----------$ 15.00
Maintenance @ $5 per hr.----------$ 8.00
Labor @$10 per hr ----------$ 15.00
Total per acre cost $68.00

Scenario Two – No Combine
Labor Hand Harvesting- $10.00 per hr. ---------- $ 100.00
Hammer Mill Thresher - $ 2.50 per hr----------$ 25.00
Labor Threshing - $10.00 per hr ---------- $ 100.00
Total per acre cost $ 325.00

Scenario Two- No Labor Costs but Thresher and Hand Harvest
Threshing ----------$25.00

Comparing these three scenarios is interesting. If you do not have to pay for labor, using an old combine or hand harvest with a Hammer Mill Thresher probably cost about the same. Labor is the deciding factor in homestead scale harvest. For that reason, I recommend not planting more than whoever is available on the farm can harvest without having to hire outside. Or, as an old Amish saying goes, one man can manage two acres. If you had only 130 bushel per acre grain on those two acres, that man would be managing 7,800 lbs. of grain. Using a grain and bean rotation, one person could manage enough to feed more than one average family. Scenario Three requires that as much acreage be farmed as possible, getting the highest yields possible for an international market system run by huge corporations that manipulate the market price paid to the farmer.

Cleaning
Cleaning 2,400 lbs. on a homestead scale at a rate of 30 lbs. per hour triple cleaned on the Ten Rivers Food Web machine.
Rent on machine: per acre ----------$ 160.00 (based on 5 yr. amortization of $2,100 cost)
Labor at $10 hr.----------$ 800.00
Seed Cleaning with Labor ----------$960.00

Seed Cleaning by winnowing with a bucket and fan or stomping on a tarp without labor involved as a cost. ----------$1.00 - $5.00

Compare to industrial scale seed cleaning and bagging in 50 lb. poly bags.--- $.03 lb. or $72.00 for 2,400 lbs or grain and beans sold by the truckload for export.

Bagging and Storage
One of the factors we considered this season was the cost of our bagging.
We used poly bags which hold 5 lbs. of grain or beans. We used these so that customers could see the product at farmer's markets or other events.
Bag cost ----------$.14 each
Bags for 2,400 lb. per acre yield----------$ 67.20
It takes about one minute per pound to fill a bag. $.05 per 5 lb. bag
With farm labor, each 5 lb. bag costs $.19

Storage: 5 gallon food grade pail and top ----------$ 5.00 each
(holds 25 lbs. grain)
14 gallon tote with top ----------$ 6.25 each (on sale)
(holds 75 lbs. grain)
50 gallon food grade barrel ----------$10 - $30 each
(holds 225 -250 lbs. of grain)

Marketing
Sunbow test marketed grains and beans this season. We sold all that we could sell at $1.00 lb for grain in bulk and $2.00 lb for beans and grains in five pound bags. We became convinced after looking at yields and costs that beans and grains from small acreages should be sold by the pound if the bottom line is to show a profit, that is money for keeping the farm going and the farmer earning a decent living. Here are some numbers we considered on a 2,400 lb. per acre yield.

$1.00 per pound = $2400 per acre income
$.75 per pound = $1800 per acre income
$.50 per pound = $ 1200 per acre income
$.10 per bushel= $400.00 per acre income

Costs on 2,400 lbs range from $837 on the high side to $220 on the low side without labor costs. Beans, grains and edible seeds sold by the pound can show a good profit for a small farmer. Sold by the bushel there is no profit to speak of without labor costs and a substantial loss where labor is charged at the current industrial rate.
Another consideration was comparative profit on an acre of grains, beans, or edible seeds compared to profit when the same field is rotated into irrigated vegetables. Most irrigated vegetable ground on a homestead scale operation brings in $5,000 - $10,000 per acre, depending upon the crop and season. We show creating a rotational system with beans and grains as a biologically and financially beneficial part of that rotation. As with vegetables, prices per pound rather than bushel need to be negotiated with potential customers including wholesalers.

13. Conclusions

- A small farm can grow a variety of beans grains and edible seeds in the micro climate of the Southern Willamette Valley.
- Careful management can result in a good per acre profit while growing crops which on the international market do not pay enough to grow.
- There is a local market willing to pay a fair price for grains, beans and edible seeds.
- High protein wheat, edible seeds, and diverse grains such as rye, triticale, barley, oats, yield less than half as much as soft white wheat.
- This yield difference is not currently reflected in per bushel pricing.
- Nutritional density should be a focus in growing and marketing. It is an area of testing that needs continual funding.
- Nutritional differences should be reflected in advertising and pricing.
- *Bottom line considerations* for all farms should begin with the activity of perpetual regeneration while producing food. Soil is a farmer's actual bank. Improvements in soil year after year can be measured by looking at biological indicators, such as the health and well being of bacteria, fungi, protozoa, beneficial nematodes, worms, beneficial arthropods, soil texture, and changes in soil chemistry as a result of enhanced biological activation. Growing with no or minimal irrigation stress on the water shed, with clean air free of chemical volatility are key to nutrient density and durability of a local farming/ food system. Food values expressed in actual nutrients available in foods per acre are what constitute profit.