

Whole Grain Connection

A California non-profit corporation, 501 (c) 3

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Aiming to enhance the desirability and availability of 100% whole grain breads, and other 100% whole grain products, from organically and sustainably grown grains, and thereby connecting farmers and bakers.

Catalog of Wheat Seeds & Books

Seed Program

The *Whole Grain Connection* wheat seed program provides organic farmers with enough seed from 12 wheat varieties, appropriate in California, to be able to use their large scale equipment i.e. 25 – 100 pounds. After that, farmers can grow the wheat and trade the seed. None of the varieties of wheat in this catalog are proprietary; and they are all landrace varieties or selections made from a landrace.

Most of the wheat varieties listed in this catalog are intended for cultivation in California, although they can be grown in other states. Short-season varieties come to fruition in 4-5 months, and their season is short enough to be planted in the spring and harvested in the fall. In California they are planted in the fall to take advantage of the rainy winter season, and to head up into the dry hot summer season. White wheat varieties are somewhat drought tolerant and tend to sprout prematurely before harvesting if there are summer rains. The red wheat varieties need somewhat more moisture for a successful harvest and do not sprout so easily in summer humidity. Thus the California climate of a mild rainy winter in combination with a hot dry summer, favors the white wheat varieties.

We would like to encourage landrace seed selection locally elsewhere regionally, to supply the whole grain market locally in other states. There are thousands of wheat varieties that have been collected from other countries, with climates matching practically every region of the United States. Please let us know of your interest and we will try to help you select landrace varieties appropriate for your local climate. The USDA bulletins listed in this catalog dating from 1900 and 1922, and the book by John Percival published in 1921, give much information to help begin the search for old-time landrace varieties appropriate to every region in the USA. Our starting and trial quantity seed source has usually been the USDA Small Grains Collection in Aberdeen, Idaho, under Dr Harold Bockelman, telephone: 208 397 4162 ext 112. This is the most authoritative and complete collection that we know in the USA. Information on every variety in this collection can be obtained from the accession list (www.ars-grin.gov) and the date and region from which each accession was collected are generally given. Other starting and trial quantity wheat seed resources include Seed Savers (www.seedsavers.org), Heritage Wheat Conservancy (www.growseed.org) and Bountiful Gardens (www.bountifulgardens.org).

Support for the Whole Grain Connection

The *Whole Grain Connection* was founded as an educational and research oriented non-profit in 2000 and is supported with seed sales, product development assignments, much volunteer activity and donations from interested farmers and others who want to see a local supply of pleasing whole grain foods.

This wheat seed project began as a result of listening to the comments of several organic vegetable farmers in California, who wanted wheat as a profitable rotation crop. These farmers could only buy modern short varieties bred primarily for conventional agriculture and refined flour milling. These organic farmers found that often they could not sell their wheat crop for a fair price to the refined flour millers and could only obtain a low price as feed; usually they simply ploughed it under. We do not offer modern varieties that have been produced since 1880, by any kind of deliberate crossing or hybridization, since these are available elsewhere. The date 1880 approximately marks the beginning of almost universal roller milling of wheat to refined flour. The date also marks the beginning of systematic modern wheat breeding for specific traits, such as *hard red* grain that would be efficiently roller milled to refined flour. Thus wheat was bred beyond the need to be appropriate locally, primarily for roller milling to refined flour, so that the hard red trait was introduced into many of the varieties developed after 1880. From the 1950s onwards wheat was bred for conventional chemical based agriculture, and greatly increased yield, as well as for the refined flour miller. As a result many post 1950s varieties are short so that they can be planted densely, and grown lushly, without fear of lodging the crop.

By now we fully understand that the commodity system can only provide 5% of our national whole wheat flour needs. Currently the centralized commodity millers produce predominantly refined flour which is just 75% of the whole grain; they profitably sell the germ and bran separately as high quality animal feed.

The production of refined flour for all, which was begun in innocence, must now be regarded as one of the worst food mistakes of the Western world. By now we have learned that the refined flour from the endosperm of the wheat grain cannot be properly assimilated without the B-vitamins and minerals present in the bran and germ. Other compounds in the bran and germ are protective against obesity, diabetes, colon cancer, diverticular disease, and cardiovascular disease. Health care costs resulting from these diseases are astronomical. We need our most basic foods such as bread, pasta and breakfast cereals to be 100% whole grain.

Locally farmed wheat and local whole wheat milling, baking and pasta production, gives us a route to providing people with the whole grain foods that are essential to their good health. Prices for locally stone milled whole wheat flour cannot be compared with commodity refined flour prices, since the two products are quite different. We encourage pricing of local whole wheat flour based first on the true farmer costs. With time the organic production of wheat should be managed with reasonable efficiency and prove to be economically and ecologically sustainable, and therefore preferable.

All the listed selections for California are landrace varieties with histories dating back for centuries, and that were also shown resistant to the current stripe rust fungus in 2005. A further development in the prevention of fungal disease has been to advise rotation of wheat out of a field for at least 3 years and to plant with judicious timing in a clean field.

Wheat growing needs to be considered as part of organic soil building system. In particular wheat can be grown in rotation with legumes to fix nitrogen in the soil. These legumes such as peas, beans and lentils can themselves be valuable cash crops grown according to the

local climate. If animals are included in the rotations then weed control is enhanced along with the effects of manure. Animals can graze down potentially very tall crops, before they come to fruition so benefitting the animals, the soil and reducing the lodging potential in a lush wheat crop.

Local whole grain infrastructure

The current challenge is to encourage the business of localized organic whole wheat handling infrastructure. By this we mean local organic cleaning, bagging, storage, and perhaps also the whole grain stone milling of the wheat, as well as the marketing and distribution. Stone milling is probably best done in the population centers, while the grain cleaning and storage can be handled in the countryside by farmer business consortia. On the small scale farmers grow up to perhaps 10 acres of wheat destined for the farmers market or for a Community Supported Agriculture (CSA) project. In this case each farmer can provide the needed grain cleaning, storage and whole wheat milling equipment or perhaps share with other local small-scale wheat farmers. However when farmers grow organic wheat at a higher more specialized level, perhaps to the 100 acre level or more, then the provision of these facilities becomes much more expensive. Also at this level bakers and restaurants can be served, but they are hesitant customers unless we can convince them of the delicious and attractive products that can be made. Whole wheat flour from local wheat is unfamiliar to bakers and chefs who have been trained to use refined flour from the commodity millers. Marketing and education has become a major part of our work as a result of this hesitance on the part of bakers and chefs.

Whole Grain Connection Chapters

If you are interested in the provision of 100% whole grain foods locally, whether as a consumer or a provider, please consider forming or joining a local *Whole Grain Connection* Chapter.

Acknowledgements

All of this could not have happened without the encouragement and practical help of so many of you the farmers and bakers. We have had help from: Paul Mueller, Sally Fox, Kent Brittan and Lee Jackson. In the early days: Dave Cooke, Andy Scott, Patrick Brennan, Dale Coke, Stuart Dickson, Robert Rammig, Jim George, John Bayer, Charles Belford, Alan Scott, Frank Maack, Degge Hays, Steve Decater, George Fohner, Oli Cantu, Jonathan Murphy, Steve Payne, Tom Kearney, Jennifer Greene, Frank Busch, Ida Bowers, Jered Lawson, Adam Wilson, Bob Adams, David Hoffman, Margaret Koski-Kent, Nan Rohan, Carol Cox, were willing to grow the seed even though we barely knew to whom we could market the wheat. More recently Lou Preston, Dan Primerano and Gene Richeson have joined in, to grow wheat especially for their locals. There are several farmers also in other states and in Canada, who have contributed to our progress: Clyde Goering, Randy Brence, Dan Jason, Beth Rasgorshek, Lahde Fesler, Kevin Park. Thank you all. Since writing this list in 2011, thankfully there have been yet more farmers who have purchased landrace seed for continual organic propagation, and made contributions to our knowledge of what is possible. There surely will always be a need for whole grain wheat for good health and therefore happiness.

Most important of all was my husband Gene Spiller who brought together all the key people in dietary fiber research, just at the time that I first met him in 1975. Their stories then and in the years that followed, convinced me then of this problem of presenting wheat primarily

in the refined form. All that I have been able to do since 1975 has been with Gene's help and encouragement. Without his help I could not have made any progress at all.

My heartfelt thanks to all who understand the need and are working to make whole grain foods available to everyone,

Monica Spiller

The *Whole Grain Connection* seed program is divided into three stages:

I. Experimental seed selection involves obtaining small amounts of seed for varieties of interest because of their history for food, their success in a comparable climate or for some serendipitous reason, and growing them in small plots. Seed is grown each year in increasing amounts until approximately 10 pounds is harvested. All the work is by hand, except perhaps the threshing and rough cleaning of the seed. During this time unsuccessful varieties in our conditions will have been eliminated.

Equipment used consists of a hoe for planting rows of hand placed seed, 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 work 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.

II. Propagation of select seed is the continued grow-out of the select seed from Stage I until reaching quantities of 100 pounds or more, and at the same time recognizing any problems with disease. Less handwork is involved at this stage and we have been able to use small-scale farm equipment.

Equipment for Stage II propagation is generally a tractor-drawn planter, or if the planting is by broadcasting, this is followed by a harrowing step using a tractor-drawn harrower. Harvesting can be done with a small combine harvester if one is available (Examples are the All-Crop harvesters, or research scale harvesters from Almaco, or the Wintersteiger machines famous for their easy clean-out between crops.

Alternatively, the wheat 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.

As mentioned in Stage I wheat heads can be cut and dropped into a bag, during hand harvesting. These harvested heads can also be sent through a small bundle thresher, but great care and good sense is needed because the threshing drum is easily exposed. A wooden pusher to ease the flow of heads past the threshing drum is essential; for safety the hands are kept high above the threshing action of the machine.

Threshing and winnowing by either the combine harvester or with the small bundle thresher does not produce fully clean grain that is free from chaff and straw debris. 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 for milling directly to a whole wheat flour. A

grain cleaner is used for this final cleaning of larger amounts of seed; it consists of shaking sieves and a fan that winnows or blows away the lightest debris. Clean seed drops into a collecting tray or box. To produce absolutely pure seed it is usually necessary to hand clean the seed even after passage through the seed cleaner.

III. Available seed (25# and more) through catalog sales. The purity for bulk seed is established primarily by the degree of care exercised in Stages I and II. Then at this final Stage III of propagation, the purity of the seed is dependent on the farmer's conscientious preparation of the field to minimize weed seed interference, and foreign wheat types. Walking through the field and removing any stray weed or foreign wheat types just before harvest also reduces the impurity level in the final seed. The farmer takes care to harvest with a thoroughly cleaned out harvester, and uses a larger scale grain cleaner* that in no way adds impurity. Thoroughly clean and dry bagging and storage are likewise essential. Compressed air and strong fan blowers are useful for cleanout, and steam cleaning should be used when contamination by fungal spores is suspected. **Grain cleaners are varied in type to accommodate differing impurity problems. The most basic grain cleaner has shaking sieves and a fan (e.g. Clipper brand). The gravity table cleaner is a secondary cleaner that is often called a de-stoner, and is used by millers to make certain that the grain is free from debris that would damage the mill. Other specialized cleaners include the spiral cleaner and the indent cleaner.*

Introduction to list of available seeds

Currently the *Whole Grain Connection* sells landrace wheat seed that can be grown organically. The *Whole Grain Connection* also researches whole wheat baking and cooking uses for each variety, so that the farmer can advise customers on pleasing ways to use their wheat. Please send your questions by telephone or e-mail.

The overall goal of our seed program is to supply locally appropriate non-proprietary seed to organic farmers, in starting amounts sufficient for the use of full scale planting and harvesting equipment (25 to 100 pounds). The expectation is that after a farmer has chosen a variety for their farm, they will be able to save their own seed and keep successfully propagating the same variety for many years. Hopefully our screening will eliminate those varieties that would be disease prone, under the local conditions. Most usually a farmer will grow only a single variety of wheat so that there is no on-farm mixing of wheat seed varieties. *Care is also needed to avoid contamination with oats, barley and rye and vetch.* Where a farmer grows more than one wheat variety, special care is necessary to keep the varieties well separated. This separation can be achieved if the planting and harvesting equipment is meticulously cleaned of any potentially contaminating seed. Similar cleaning is necessary for all equipment and bags brought into contact with the grain. Careful and detailed labeling including the variety name, farm name and crop year are essential. This care is important for the maintenance of the seed value, whether it will be for food use or as seed. A truly appropriate and well-established variety on a farm is unlikely to need replacement. This situation is perceived as advantageous to the farmer who can steadily learn to produce high quality (high protein) wheat by judicious fertilization, rotation or co-cropping with legumes, and other organic techniques over many years. Correspondingly local bakers and chefs will learn how to use a consistently well-produced variety of wheat.

Farmer responsibilities in the Whole Grain Connection seed program

Our wheat seed is intended primarily for Californian farmers who are already certified organic producers, but also for those farmers transitioning their land towards organic certification. Farmers are invited to enter any of the three stages of our program if they have the requisite land, planting, harvesting and grain cleaning equipment, and storage facilities. Our seed is in short supply, so farmers should always set aside and store 100 pounds (or an amount equal to their original purchase) of clean dry seed from their harvest of *Whole Grain Connection* seed. This seed stock should be stored in a sealed, rodent and insect-proof container, in a dry shady place; and it should be stored separately from the seed intended for the following year's planting. This reserve should be available for sale back to *Whole Grain Connection* in the event that it is needed to supply another farmer. In addition farmers should store a clean reserve amount of seed for their own use in the event of crop failure or accident.

Agricultural notes

Agriculturally all the varieties listed have been shown to grow well in the conditions of the Sacramento Valley of California, without irrigation. They have all been selected because they have been demonstrated to resist stripe rust disease under most circumstances, and also to yield reasonably well in this region. They are generally planted as late as possible in the fall, just before the second or third substantial rain of the winter season, usually between late November and mid-January. Planting should be before the ground is waterlogged so that equipment damage to the soil is minimized. Disking just before planting will minimize weed competition. Further North and near the coast, where winter rainfall is heavy then planting should be delayed until the early spring. The goal will be to use the accumulated ground moisture and the last few rains of the season to grow the plant to maturity; wheat should be ready to head up into the hotter dry season

Heading up is from the end of April onwards into the hotter dry summer season, in California, after planting between November and January. The varieties with the shortest season are *Sonora*, *Wit Wolkoring*, and the pasta (*T. turgidum ssp durum*) varieties *Blue Beard* and *Durum Iraq*; these are also the varieties with the greatest drought tolerance. The longest season is shown by *Foisy*, which is therefore recommended for the somewhat wetter regions of the Sacramento valley, or where the soil has the greatest water holding capacity.

The problem of lodging occurs when the stand of wheat is too dense for wind to blow through, or the initially heavy heads bow the wheat in a wall that cannot be righted because there is insufficient space between plants. The amount of seed to plant depends on the soil condition and whether the crop will be grazed or mowed to encourage tillers. A rich fertile soil and grazing or mowing before the crop heads up, will cause a dense stand of wheat that may lodge. Therefore under these projected conditions, the suggested planting rate is 50 pounds per acre. This is a much lower seeding rate for wheat than is usual for modern wheat varieties. An automatic wheat setting on a mechanical planter may plant seed at the rate commonly used for modern short wheat varieties and this would be too dense for these landrace wheat varieties. When sparser growth is expected because the soil drains quickly, no mowing or grazing is planned, and the soil is less fertile, then the planting rate recommended is 75 pounds per acre. It is better to plant sparsely than to risk lodging, and the sparser planting will also maximize the grain protein. Lodged wheat is difficult to harvest cleanly, free from weed seeds, grit and mud balls. One of the main advantages of these taller old-fashioned wheat varieties for organic farming is that they are

taller than most weeds, and can be harvested with the combine harvester sickle bar set high. The tallest of all the varieties listed are the pasta (*T. turgidum ssp durum*) wheat varieties *Blue Beard* and *Durum Iraq* and poulard (*T. turgidum ssp turgidum*) wheat varieties *Akmolinka* and *Maparcha*, which can grow up to 5 feet in height. The shortest are *Ethiopian Blue Tinge emmer* and *Chiddam Blanc de Mars* and these are usually at least 2-3 feet tall. Reduced rainfall, and late planting will reduce the height for all these varieties.

The main condition that favors both high yield and high protein in the grain, is adequate soil nitrogen content. The quality of the protein in terms of nutrition and whole wheat product is further optimized when there is plenty of available sulfur in the soil, presumably because the sulfur-containing amino acids can then be properly produced by the wheat. Sulfur supplementation is usually as calcium sulfate in the form of gypsum. Ideally the soil mineral content should be optimal for healthy plant growth. A depleted soil will produce a low yield and low grain protein values, in the wheat crop.

To avoid fungal disease on the wheat crop, and to increase soil fertility wheat should be rotated out of the field for at least 3 years to allow any excessive fungal spore build-up to die down again to background levels. Debris or plants that harbor fungal disease should also be removed at the end of each season.

We would like to encourage experimentation with crop rotation, and co-cropping with nitrogen fixing legumes and associated mycorrhizae, taking care to avoid varieties with seeds that are the same size as wheat, or that have tenacious tendrils that would bring the wheat plants to the ground. A suggested rotation of rainfed crops is Year 1: edible peas; Year 2: wheat; Year 3: grazing or fallow; Year 4: grazing or fallow. Throughout this rotation we would like to see a healthy growth of co-cropped small legumes, and other soil enhancing plants, preferably native varieties such as native clover, such that they do not interfere with the peas, or wheat and do not cause problems for the grazing animals. A well thought out rotation sequence has the potential to reduce disease and weeds and to increase soil fertility without resorting to large amounts of expensive purchased soil enhancers.

Marketing Notes

Market needs are such that wheat varieties can be sold individually, although most of the golden seeded *T. aestivum ssp aestivum* varieties can also be sold together since they can be broadly classified as soft white wheat and they have the common property of mellow gluten for baking. The exception is the variety *India-Jammu*, which has a harder kernel and stronger elastic gluten that is close to hard red wheat in baking performance.

Spelt is best sold as the specialty *spelt* wheat.

Ethiopian Blue Tinge Emmer (T. turgidum ssp. dicoccon) is the only emmer grain in this catalog, and is very unusual and worth selling as a unique grain.

The *T. turgidum ssp durum* varieties *Blue Beard* and *Durum-Iraq* can be sold as individual varieties. If combined they would sell as *durum wheat*.

Maparcha and *Akmolinka* are *T. turgidum ssp turgidum* and currently they are not of a type recognized on the commodity market. Currently they can be sold as specialty varieties of poulard and cone wheat, with unique character.

Specialty wheat whole grain product development

From time to time new recipes and methods for using whole wheat will be posted on www.wholegrainconnection.org. If you have questions or suggestions about whole wheat product development, we shall be glad to cooperate. Please write to barmbaker@aol.com or telephone: 650 938 2865.

List of available seeds

Common wheat (hexaploid, free threshing)

Triticum aestivum ssp aestivum

<i>Variety (WGC catalog number) USDA accession number</i>	<i>Bearded or beardless</i>	<i>Historical notes (year collected by USDA or other)</i>	<i>Seed color (white or red)</i>	<i>Spring (short season) or winter (long season) type</i>
Sonora (012) CItr 3036	beardless	Cultivar from landrace in Durango, Mexico. Perhaps the first successful wheat in Mexico from 1500. (1907)	Pale yellow (white)	Spring (shortest season)
Wit Wolkoring (013) PI 479660	beardless	Cultivar from South Africa. Presumed from landrace, but may be a cross.(1983)	Pale yellow (white)	Spring (shortest season)
Chiddam Blanc de Mars (032) CItr 7327; PI 58556	Bearded	Cultivar from Ville de Paris, France. Selected from English landrace. (1924)	Pale yellow (white)	Spring (short season)
India Jammu (044) CItr 7289; PI 57906	beardless	Landrace from Jammu and Kashmir, India. (1923)	Pale yellow (white)	Spring
Foisy (041) CItr 5246	beardless	Cultivar, selected by Mr Foisy in Oregon in 1865. (1916)	Pale yellow (white)	Spring (longer season)

Notes:

Common wheat varieties (hexaploid, free threshing) *Triticum aestivum ssp aestivum*

The common wheat varieties are generally used for making a wide range of wheat foods: bread, cookies, cakes and pastries, as well as breakfast cereals and pasta. The varieties possessing a pale yellow colored seed produce a whole wheat flour with unobtrusive bran coloration. For good breadmaking character the wheat grain needs to be 12% protein, or more on a 12% moisture basis. *Sonora*, *Wit Wolkoring*, *Foisy* and *Chiddam Blanc de Mars* have relatively soft grains, and they are broadly classified as soft wheat, and not normally expected to perform well in American style breads. However, when these varieties are grown with sufficient protein they can be made into beautiful bread, characterized by a light colored finely textured crumb and mild flavor. High protein soft white wheat was the popular type of wheat for whole grain bread before the change to roller milling.

Soft white wheat varieties are also popular for Asian noodles, and therefore also are very good for making Italian style pasta.

Sonora wheat

Sonora wheat especially, has been well tried here in California since it was first grown again in the early 1990s. Yields vary from barely 500 to 3,500 pounds per acre, according to the soil fertility and drainage, extent of fertilization and the winter rainfall. So far the seed has been kept satisfactorily pure, despite some mixing at times when farmers were growing more than one variety of wheat on their farms. We continue to work with the farmers on the quality control and identity preservation of our seed.

The market is open for direct marketing by growers at local farmers markets, through community supported agriculture projects, wholesale to grocery markets, and directly to miller-bakers of whole wheat breads, pasta makers and noodle makers.

Sonora wheat has a history here in the South Western United States, because it is a variety grown early by the agricultural Native Americans in Mexico. They used it to make their whole wheat tortillas, and apparently liked the way it could be ground to a whole wheat flour on their metate. *Sonora* wheat might be the very first wheat successfully introduced onto the American continent soon after Columbus's famous journey of discovery in 1492. It was grown in the South West continuously until about 1960.

The very light color of the whole wheat flour makes it ideal for all kinds of baked goods that have for over 125 years, been made with refined flour. Farmers are encouraged to work for the high protein level of 15% because the breads made will be extraordinarily desirable, and bakers should expect to pay a significant premium for such wheat. The *Sonora* wheat dough, and final bread texture is refreshingly different to that experienced with hard red wheat varieties. A pleasing open bread cell structure is achievable, but with a shortness of crust that is welcomed by the eater. Bakers, chefs and home bakers are invited to use the formulations available on the website: www.wholegrainconnection.org.

Sonora is particularly good for making whole wheat pasta. Dried pasta from *Sonora* wheat is very quick cooking.

Wit Wolkoring

Wit Wolkoring (white woolly wheat) was selected as an alternative to *Sonora* wheat, from a similar climate region in South Africa, and has proved to be quite similar to the *Sonora*. The difference is most readily seen in the field. The heads of *Wit Wolkoring* are cream colored like the straw, whereas those of the *Sonora* are bronze. Like the *Sonora* the heads are also woolly, or velvety, in appearance.

Chiddam Blanc de Mars

The variety *Chiddam Blanc de Mars* from Ville de Paris in France was chosen originally because the French have such a wonderful reputation for good bread - thinking of Poilane's whole wheat country loaf. It is often more prolific than *Sonora* wheat. We have continued to propagate *Chiddam Blanc de Mars* even though it is relatively short in stature, because we expect that it will yield well in areas further north in California, and where there is a higher rainfall, or on soils with good water retention.

India Jammu

This *India Jammu* variety was selected to be another alternative to *Sonora* wheat, both from the agricultural and from the end use viewpoint. The yield is often lower than for *Sonora* wheat. However when grown in the San Joaquin Valley after planting early in the year and

applying a small amount of irrigation in this arid region, *India-Jammu* produced well. It seems that *India-Jammu* needs a relatively warm growing season to yield well.

India-Jammu is an exception and possesses elastic gluten similar to hard red wheat varieties and is likely to become a variety favored by whole wheat breadmakers, provided that it is grown to have a grain protein content of 12% or more, on a 12% moisture basis..

Foisy

Foisy is a historical West Coast wheat variety that was selected originally in Oregon, in 1865. *Foisy* heads up and ripens nearly a month later, in California, than the other varieties of white wheat listed here. Perhaps because of this, it is relatively high yielding and the protein value is generally higher than for the other varieties, under the same circumstances. *Foisy* is recommended for planting in slower draining soil and in the wetter regions of California.

Spelt wheat (hexaploid, not free threshing and harvested as spikelets)

Triticum aestivum ssp spelta

<i>Variety (WGC catalog number) USDA accession number</i>	<i>Bearded or beardless</i>	<i>Historical notes (year collected by USDA or other)</i>	<i>Seed color</i>	<i>Spring (short season) or winter (long season) type</i>
Spanish Spelt (009/0058) PI 348428	bearded	Landrace from Oviedo, Spain. (1970)	Russet red	Winter
Swiss Spelt (042) PI 347864	beardless	Landrace from Bern, Switzerland. (1970)	Russet red	Winter

Notes:

In California, the regions where spelt would grow as a preferred variety are wetter regions near the coast, and at higher elevations where a snowy winter is experienced.

Spelt is the wheat type that found great favor in Hungary and much of Eastern Europe and Germany, and also in the agricultural Alpine regions, for many centuries, but which was supplanted by hard red winter wheat when roller milling to refined flour became widespread after 1880. The advantageous agricultural properties of spelt are winter hardiness, disease resistance, and toughness of chaff that discourages attack by birds and insects. Spelt also is unlikely to sprout in the ear during a rainy summer. A long season of growth is required for spelt, and it is therefore regarded as a winter type; it should be planted during October through early November, or just before the first major rain of the season. Ideally, the grain is planted in the spikelets. A possible method seems to be to use a mechanical seed broadcaster for the spikelets and then to harrow them into the soil. Experience so far suggests that the germinating grain is protected inside the spikelet and seems to give a more robust start to the crop. If a suitable planter is not available then the grain can be carefully hulled, so as not to damage the germ with a rice or oat huller, and used as seed in a regular planter. The grain has thin red bran, and a relatively soft endosperm that gives interesting and characteristic whole grain flour. Spelt gluten is generally strongly elastic, like hard red wheat, so making it a very good alternative to hard red wheat varieties, for American style breads.

Rye is often grown in the same places as spelt. The regional bakers in the South Tyrolean Alps, for example, make some very inspiring mixed spelt and rye breads, and crackers, flavored with their native blue flowered fenugreek, fennel, anise and cumin.

In order to fully process spelt for the whole grain miller, an intermediate step is required following combine harvesting. This is the process of de-hulling the spelt spikelets. Rice or oat hullers can be used, but it is advisable to consult with other growers of spelt in the USA, and there are just a few, before purchasing de-hulling equipment. Suitable hullers originally designed for rice, are sold by www.calibrationplus.com.

Pasta wheat (tetraploid, free threshing)

Triticum turgidum ssp durum

<i>Variety (WGC catalog number) USDA accession number</i>	<i>Bearded or beardless</i>	<i>Historical notes (year collected by USDA or other)</i>	<i>Seed color</i>	<i>Spring (short season) or winter (long season) type</i>
Durum Iraq (062) P I 481581	bearded	Landrace from Iraq. (1983)	Pale yellow	Spring
Blue Beard (063)	bearded	Unknown. Possibly landrace from Iran, via UC Davis and Jim George. (1990s)	Pale yellow	Spring

Notes on pasta wheat varieties

Among farmers in California there is an unwritten rule that durum wheat varieties should only be grown in the San Joaquin Valley. The reason is that they tend to develop a blackening of the germ (black point) when grown through a cooler wetter winter, as is experienced in the Sacramento Valley. However the two varieties of durum wheat selected here grow well in the Sacramento Valley, especially during the current drier and hotter seasons. They offer the possibility of a supply for whole wheat pasta makers as well as bakers who know how to make pleasing whole durum wheat breads, as they do in Apulia in Italy and Sicily.

These varieties grow to five feet when rainfall is good, but they also are highly drought tolerant and still grow to a good height for combine harvesting when rainfall is low. Planting should be at a time that will favor a good rain for germination. These varieties have the reputation of being capable of growing to full fruition after a single inundation when planted.

The durum grain is the hardest of all wheat varieties, and can be stone ground to flour with a characteristic sandy feel. Even so this whole grain flour can be the starting point for beautiful golden whole wheat pasta and breads.

Both varieties are appealing to wheat weavers and straw artists, as well as florists.

Blue Beard has a spectacular dark blue black head, and always attracts attention in the field.

Durum Iraq has proved to be a suitable variety for the Sacramento conditions and produces well, even in the region not normally expected to support durum wheat. The long black beard gives this wheat a typical durum wheat appearance. Whole wheat Pasta made from both varieties is

gaining in popularity with its pleasing flavor and light golden color. It also appears that these durum wheat varieties produce a quicker cooking pasta than varieties related to hard red wheat, perhaps by breeding.

Poulard & Cone wheat (tetraploid, free threshing)

Triticum turgidum ssp turgidum

<i>Variety (WGC catalog number) USDA accession number</i>	<i>Bearded or beardless</i>	<i>Historical notes (year collected by USDA or other)</i>	<i>Seed color</i>	<i>Spring (short season) or winter (long season) type</i>
Maparcha (048) PI 125343	bearded	Landrace from Laghman, Afghanistan (1937)	Pale yellow	Spring
Akmolinka (049) PI 438971	bearded	Cultivar from landrace North Kazakhstan. (1980)	Pale yellow	Spring

Notes on poulard wheat:

The poulard wheat varieties are closely related to durum wheat, the main distinction being that the grain of poulard wheat is much softer in texture. It is this softness that most likely caused their near extinction, because the bran and endosperm are not so easily separated in the roller milling system developed in the 1880s. Until that time poulard wheat varieties were important in England, France, Italy, and all the countries bordering the Mediterranean. Now that whole wheat products are appreciated for their health benefits it is time to grow these varieties again, for whole wheat milling in a stone mill. For the farmer this is a great opportunity because poulard wheat varieties are the most prolific of all, and produce long strong straw. Pasta and breads, cookies and crackers from poulard wheat will have a taste and texture that few of us have ever experienced. We can look forward to some historical as well as some highly original and exciting whole grain products from these poulard wheat varieties.

Maparcha and *Akmolinka* have been grown successfully when planted in late November through early December, in the Sacramento Valley. However they seem to have been most successful in wetter years, which suggests that planting should not be delayed beyond December, the soil should not drain too rapidly, and the rainfall needed for success may be somewhat greater than is needed for the durum wheat varieties. Our experience is limited with poulard wheat and we look forward to learning more with the farmers who decide to grow it.

Akmolinka should perhaps be called *cone wheat* because the head is branched at the base so giving the head (or spike) a cone-shaped appearance.

Emmer wheat (Tetraploid, not generally free threshing. Ethiopian emmer is exceptional in that it is almost totally free threshing.)

Triticum turgidum ssp. dicoccon

<i>Variety (WGC catalog number) USDA accession number</i>	<i>Bearded or beardless</i>	<i>Historical notes (year collected by USDA or other)</i>	<i>Seed color</i>	<i>Spring (short season) or winter (long season) type</i>
Ethiopian Blue Tinge (069)	bearded	From Ethiopia by Dan Jason (1990s)	Purple / brown	Spring

Ethiopian Blue Tinge Emmer

This is very unusual emmer wheat in that it is practically free threshing. Most emmer wheat threshes into spikelets, such that the grain must be released with a de-hulling machine. It should be harvested with this in mind, since in a particular season the grain may be more tightly held in the spikelets and will need to be de-hulled to yield the expected amount of grain.

The grain color of *Ethiopian Blue Tinge Emmer* is an intriguing dark purple brown, and the seeds are relatively large; it has a tea like aroma and it is prolific in favored conditions. The variety was continued for these reasons, even though it is somewhat short in stature and threshing is sometimes incomplete through a normal thresher. The shorter stature may be due to intolerance to drought, so this variety is recommended for planting in slower draining soil or wetter regions in California, and to supply those who enjoy dark richly flavored whole wheat breads and pasta.

The gluten is mellow and breads are possibly best made up in the same manner as rye breads.

Purchasing seed

Seed Price: \$2.00 per pound, plus packaging and shipping

Where to place an order for seed

Wheat seed (25 pounds or more) can be ordered from the *Whole Grain Connection* (Telephone: 650 938 2865; e-mail: barmbaker@aol.com).

Variety choice

Try to choose a variety most appropriate to your area rather than for a particular style of baking. Bakers and chefs are versatile, and should be encouraged to be inventive. After all they were the inventors of localized foods from localized grains, through the centuries. The best local bakers and chefs will look for high quality in the grain, which is only attainable when a variety is properly suited to its environment.

Seeding amounts

The recommended seeding amount is 50-100 pounds per acre.

Use 50 pounds wheat seed per acre when the soil is richly fertile and has good water retention, and also if the plan is to graze or mow the crop before it heads up. Whenever there is concern that the wheat might lodge because the growth could be too dense, then the seeding rate should be reduced to 50 pounds per acre.

Use 100 pounds per acre when the soil is fast draining and less fertile.

Optimizing protein content of wheat grain

Protein content of wheat is favorably influenced by sparse planting, high soil nitrogen, medium fast draining soil, rain-watering without additional irrigation, variety selection to head up just as the rainy season is ending, growing wheat where the summer is hot and dry, and generally using good farming practices.

Ground preparation

Ideally wheat should follow a legume crop and the soil should have at least a normal concentration of nutrients. To ensure optimal protein levels in the grain, all nutrients including available nitrogen should be present in recommended normal amounts.

Light disking of the soil before planting will reduce weed pressure.

When to plant

The best planting time is as late as possible in the fall before the ground becomes waterlogged, just before a significant rainfall is forecast. In some years it is possible to wait for a drier, brighter time in January.

Crop care and harvesting

These wheat varieties are naturally taller than many modern varieties, so they can be harvested with the combine harvester sickle bar set very high. This should reduce the weed seed collected. Cutting down tall weeds in the field immediately before harvesting will also help ensure a clean crop.

Lodging should not be a problem if the seeding amount was chosen to match the farm conditions. If lodging does occur, the lodged section of the field should be harvested separately because the low position of the combine harvester sickle bar will pick up more dirt and weed seed. The lodged crop will not be so easily cleaned and may only be suitable for animal feed.

Books

WHAT'S WITH FIBER? Gene and Monica Spiller.

All plant foods contain fiber. Here is a description with stories, of the health-giving components that come with the fiber of plant foods: whole grains, fruits, vegetables, legumes, seeds, nuts, mushrooms, seaweeds.

Published by Basic Health Publications, 2005.

Paperback, 230 pages.

Price: \$20.0, includes packaging and postage within the USA

POWER OF ANCIENT FOODS Gene A. Spiller and Rowena Hubbard.

Healthful foods from around the world including whole grains; history and recipes.

Book Publishing Company, 2003.

Paperback, 373 pages.

Price: \$20.00, includes packaging and postage within the USA.

To order books, please send note listing items requested, your shipping address and telephone number, plus payment by check in US Dollars to:

Whole Grain Connection, 500 W. Middlefield Road #2, Mountain View, CA 94043.

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