

Western Region



Sustainable Agriculture
Research and Extension

Alternative Crops for Dryland Agriculture in the Intermountain Pacific Northwest

GROWER EXPERIENCES WITH ALTERNATE CEREAL CROPS IN EASTERN WASHINGTON, 1997–2000

By Norm Herdrich, Agricultural Writer

The information for this bulletin was gathered from a seminar on alternate cereals in Washington State in January 2000. Workshop speakers included Bill Gulhke, oats producer; Curtis Hennings, triticale producer; Matt Kolding, Oregon State University barley, triticale and oat breeder; Howard Nelson, Central WA Grain Growers; Mark Sheffels, barley producer; and Steve Ullrich, WSU barley breeder.

In eastern Washington's dryland crop production area, wheat is the primary economic crop. Other small-grain cereals have been grown as alternate crops in rotation with wheat. These include barley, triticale and oats. These were frequently planted on allotment ground when wheat acreage was limited. Barley and oats qualified for payments under the feed grain program. Growing triticale, a man-made cereal created by crossing wheat and rye, is a more recent development in the Pacific Northwest. Triticale has been around as long as farming in the Pacific Northwest. It was reported around 1870 in Europe and developed as a crop in the early 1900s.

BARLEY

Barley comes in a variety of types. First, there are both winter and spring growth types. Then, there are feed and malting types, which may be either 2- or 6-row types. In addition to these variations, there are also hulled and hullless types, although hulled barleys are much more common, and there are awned, awnless and hooded ones as well. The awnless and hooded types are most commonly used for livestock forage. Hullless types may also be waxy. The hullless types are used for livestock and poultry feed and sometimes for human food, and use of barley for human food is increasing, according to Steve Ullrich.

Data from the Washington Barley Commission shows that 92% of the 1999 Washington barley crop was feed-type, and 8% was malting type. Currently, the most commonly grown feed barley variety is Baronesse at nearly 75% of the crop. Other feed cultivars grown included Camelot, Gallatin and Steptoe. Harrington was the most commonly grown malting cultivar, followed by Morex.

The standard for hooded or awnless barleys is Belford, although a newer release from WSU is Washford, which has shown higher productivity and more resistance to lodging. Bear is a hullless barley.

Barley is probably the most widely adapted of all the small-grain cereals, according to Ullrich. He says that it can be found growing farther north than any other cereal crop in North America and Europe, and also into drier areas than any other crop in the Mediterranean and North African regions.

The Pacific Northwest can and does grow virtually every type of barley. Growing winter barleys is the most risky, due to a moderate level of winter hardiness. WSU's Kamiak and Hundred have the greatest winter hardiness among current Pacific Northwest winter types.

Characteristics of barley are rapid emergence and competitive early growth. Early maturity is seen as a positive characteristic as well since it allows flexibility at harvest time. The multiple types available provide marketing alternatives.

Ullrich says that barley has somewhat weak and rapidly decomposing straw. The two-row barleys have higher test weights than do the six-row barleys. The kernel uniformity of the two-row barleys is also higher than for the six-row barleys.

Marketing options for feed barley include the open market or forward contracting based on quality. Forward contracting may provide a premium for growers. The marketing options for



Barley
(*Hordeum vulgare*)

malting barley are the same as for feed barley, although a premium is more commonly paid for high-quality malting barley, and malting barley is more commonly grown under contract, as identity preserved approved varieties.

Barley types grown for human consumption may be grown under contract and growers can expect a premium for high quality. For example, the organic food market may provide premium prices. Barley grown for seed is sold on the open market, or it can be contracted. Again, a premium may be paid for high quality.

There are also specialty and niche cultivars, such as the waxy hulless types, as well as the hooded forage types. Some of the hulless types are used for both food and feed for non-ruminant animals. Food uses include cereal products and baked goods; as well as pearled, rolled and flaked products; and the organic market. The export market for Pacific Northwest barley is typically East Asia. Hulless barley is grown more extensively in western Canada where it is finding a market with swine producers and finishers.

Barley can be planted using direct seeding techniques. Research by Ullrich examined field performance of varieties planted using direct-seed techniques compared with conventional tillage and seeding methods. Based on the results of this work, seeding rates using conventional methods may be higher than needed, although seeding rates for direct seeding may need to be higher than for conventional systems. Ullrich notes that barley is quite flexible and will tiller more if seeding rates are low given adequate growing conditions. Two-row tillers are better than 6-row types.

Nitrogen fertility requirements for direct seeding are usually 10 to 20% more than for conventional seeds. The sulfur to nitrogen ratio should be 1 to 4 or 1 to 5, and nitrogen and phosphorus may be applied at seeding below the seed as starter fertilizer.

As for varieties, the best yielding varieties under conventional tillage appear to be the best yielding under direct seeding as well. However, yields have consistently been lower under direct seeding than under conventional tillage in WSU trials. Heading date and plant height characteristics tended to be the same for

both systems, while test weight tended to be slightly higher for barley planted using conventional methods.

BARLEY DISEASES AND INSECTS

The newest disease of barley is barley stripe rust. Other important diseases are soilborne diseases caused by *rhizoctonia*, *pythium* and *fusarium*. Insect pests include the Russian wheat aphid, which is decreasing, and then the Hessian fly, which is now showing up in barley fields, according to Ullrich. Moved in from eastern regions, the cereal leaf beetle is a new pest to the area. It may be controlled using biological agents.

Barley stripe rust is also relatively new to the Pacific Northwest. Ullrich says that infestations of it have not been devastating yet, but it is probably here to stay. It shows up as yellow stripes on the leaves of barley plants. The biggest years for barley stripe rust to date have been 1996 and 1998. Ullrich says barley stripe rust only came into the Americas (Colombia) in 1975, and came into the Pacific Northwest in 1995. He notes that good sources of resistance to barley stripe rust are available for breeding work. Like the rusts of wheat, there are many races of barley stripe rust.

Rhizoctonia is a soilborne disease organism that causes root pruning. This inhibits nutrient uptake and results in stunted, if not killed, plants. Finding sources of resistance to the disease for use in breeding programs has been a problem.

Barley is more susceptible to the Russian wheat aphid than wheat. Very little resistance is available, but biological controls seem to be working quite well. A few breeding lines that originated in Afghanistan and Iran have some resistance.

Hessian fly, yet another import from Europe, stunting plants by infesting the hollow stems and disrupting nutrient flow. Barroness appears to have some resistance.

TRITICALE

Triticale is a synthetic crop species developed by crossing wheat and cereal rye. According to Matt Kolding, a retired Oregon State

University plant breeder, triticale probably occurred naturally due to crossing between wheat and rye, but likely did not produce much, if any, second generation seeds. In the early 1900s, durum wheat and rye were crossed, but not developed commercially.

One of the first North American commercial varieties was Rosner, a spring triticale that was released by the University of Manitoba. However, it had a very narrow range of adaptation.

Triticale was introduced to the Pacific Northwest in the late 1960s and early 1970s, but it got a black eye because growers couldn't find a market for their crop. In addition, rye in the parentage prejudiced some growers and seed personnel. Triticale germplasm was and is shared worldwide among the 150 to 200 breeders who are working on the crop. Ideally, triticale should have plump, hard, amber kernels, but most lines are brown, soft-seeded types. It has higher lysine content than wheat. As a forage crop, triticale has been reported to be superior to rye with a higher tolerance to lower fertility levels.

In Morocco, triticale is reported to yield higher than common wheat, durum wheat, and barley, especially in areas infested with Hessian fly and under saline conditions. In that country, it is used for livestock and poultry feed. The variety Flora has proven to be very tolerant to alkaline conditions and is an excellent poultry feed. It is also reported that flour from shriveled seeds of triticale appear to have two to five times more water soluble free sugars than those with plumper seeds.

In India, triticale flour has low dough development time, low water absorption capacity, and stability. Mixtures of triticale and wheat flour at a 1:1 ratio, produce bread and chapatias as good as their wheats. Cookies from triticale flour are reported to be crisper and better liked than those from the mixed flours.

In feeding trials in India, chickens fed triticale had a higher rate of gain than did those fed wheat and corn. Triticale also improved egg yield and mass, but not egg weight. Triticale was found to be more efficient than wheat in utilizing and absorbing nitrogen from the soil. It also produced a 30% higher yield on acid soils, and was superior to wheat on copper-deficient soil.

Agronomically, triticale production is much like wheat production, and the same practices are used. Kolding suggests getting into the crop slowly if you have not grown it before. Some triticale kernels may have dormancy, so caution is needed if following triticale with a crop grown for certified seed wheat. One triticale plant in the field will be cause to have the field rejected in Washington.

Herbicides are nearly the same as those for wheat or rye. Caution is advised, and reading labels is strongly recommended. Don't assume that just because a material is registered for either wheat and/or rye, it is labeled for triticale.

In a forage test, Kolding harvested triticale at three growth stages: late boot, anthesis and between 25–75% grain fill. Early cutting produced the highest protein levels in the forage. Cutting at flowering or anthesis produced the most protein per acre; cutting after the heads had started to fill produced the highest nutrient levels. The varieties used in this trial were Pika, Bobcat, KT940488 and KT941864. According to Kolding, a thick stand is better for triticale planted as a forage crop.

A beardless triticale variety has been developed in Canada especially for use as a forage crop. It actually has awnlets. The Canadians have also developed a triticale variety that is extra leafy.

One of the drawbacks of triticale grown for grain is that some are prone to shatter. There is a spot about a quarter to a third of the way down from the tip on the rachis that is very weak. This is genetically controlled and some varieties are stronger than others.

Growth patterns of triticale plants are either flat, prostrate, or a vertical type. The vertical types are better for fall grazing.

Kolding says varieties developed in Poland are doing very well in parts of the United States. One of these is Bogo, which did very well in trials at Corvallis. In the United States, Nelson said that Resource Seeds has a breeding program.

DISEASE PROBLEMS OF TRITICALE

Several diseases can affect triticale. One of these is *fusarium* head blight, or scab. Kolding said it appears more frequently on the

winter triticales he has studied in North Dakota. They appear to have nearly a zero tolerance to the disease, he notes. Some spring varieties developed in Manitoba do appear to have some tolerance to the disease. This disease has not been a problem in Washington because of our dry summers.

Leaf rust can be a problem in some triticales. He says breeders have sometimes inadvertently used a susceptible variety of rye when developing the new variety of triticale, and then found they have a problem later.

Cephalosporium stripe is found in winter triticale when there is damage to the roots in the fall and winter. Kolding said one experimental variety that is a cross between a Chinese white octaploid type and a hexaploid triticale has either resistance or tolerance to *Cephalosporium*, or has a superior root system.

As for viral diseases, some triticale lines appear to have resistance to Barley Yellow Dwarf Virus. The variety Flora does not exhibit symptoms for Wheat Streak Mosaic Virus, but it is a carrier of the disease and may serve as a reservoir.

Rhizoctonia can be a problem in triticale, and bacterial blight will cause white heads.

HULLESS OATS

Kolding notes that there are two new varieties of hulless oats—Lamont and Provena—developed at Aberdeen, Idaho, which are proposed for release. Provena is shorter strawed than Lamont and is 93% hulless. Lamont has a five-year average yield of 178 bushels per acre under irrigation at Aberdeen. The five-year average yield was 101 at Tetonian under dryland conditions. Provena had an average yield of 77 bushels per acre under dryland conditions.

Kolding has been involved in oat breeding and developed a winter oat that yielded well at Corvallis. However, in trials in Aberdeen last year, it was wiped out 100%, he said.



Oats
(*Avena sativa*)

MARKETING

Marketing is more than just selling the commodities, says Howard Nelson, of the Central Washington Grain Growers. It begins before the decision on what crops to plant is made, and a critical part of this process is the market outlook. If the price is below the anticipated cost of production, growers should look at alternate crops.

Nelson points out that all farmers are speculators as soon as they plant the seed for a crop. At this time, a farmer is in a long position in the market and has become a speculator. Because of this, farmers must start thinking as speculators.

Speculators, according to Nelson, have some general rules that help them. One of these is the “the trend is your friend,” Nelson says, and don’t trade against the trend. Watch the trend of the market and trade with the trend.

Another general rule is to “limit your losses and let your profits run.” Once the market turns and goes down, putting farmers in a loss position, they should cut their losses short and sell their crop. Don’t sit there and hold your crop and hope for the market to turn back around, Nelson says.

The third rule, he says, is “discipline, discipline, discipline.” This means making a marketing plan and sticking with it.

Farmers need to develop a marketing plan to reach their financial goals, such as replacing equipment, or reach personal goals, such as retirement. A marketing plan changes a farmer from being reactive to proactive. This means that instead of every day looking at the market and trying to figure out what to do, if you have a marketing plan you have something in place so that when the market reaches a point determined by the marketing plan, you are going to do something. A plan reduces the pressure which can result from selling at a bad time. It also provides the tools to help reduce price risk.

MARKETING BARLEY

Barley is a native of Western and Central Asia. It is the fourth largest crop in the world in terms of acres grown. It follows wheat, rice and corn. Barley prices will tend to follow the corn market.

U.S. production of barley has dropped in recent years. A lot of barley is imported from Canada. Most of these are malt types.

In the Pacific Northwest, two-row, six-row, and hullless types are grown. Regional barley production trends have generally followed national trends in a gradual decline. In the Pacific Northwest, Idaho is the largest barley producer, mostly of the malt type.

The feed market accounts for 70–75% of the usage. The food market accounts for 2% of the usage; 25–30% is for malting barley. Most of this is used to produce beer. While the feed market is based on a federal standard of 47 pounds per bushel with good color, the malt market is based on a company grade, Nelson says. When you grow malt barley, you submit a sample for evaluation. Factors that affect grade include plumpness, skinned and broken kernels, protein content, foreign matter, and other crops.

Feed barley is sold on the cash market. This market is determined to a large extent by availability and price of competing feeds. The rules of economics apply for the feed market. Nelson says this means that feeders will substitute the grain that is least expensive in terms of total nutrient content when factors such as transportation and quality are figured into the equation. The feeders work with nutritionists who provide them with different combinations of ingredients, and the feeders will then buy the product to meet the nutritional needs at the lowest price.

Malt barley is generally sold under contract. These contracts often pay a premium if the grain meets the specifications, for example, plumpness. In early 2000, Nelson said the premium for plumpness was \$40 per ton for six-row barley that exceeded the 70% plumpness specification. At the same time, the premium for two-row was \$25 per ton if it met a 75% plump specification.

Barley has a big market in Washington, which is a feed deficient state meaning that more feed is used than is grown in the state. Nelson pointed out that the non-recourse government loan, which is available, is a marketing alternative for barley producers.

MARKETING OATS

Oats are a native of the Middle East and Europe and are widely grown in cooler climates. In Washington and Oregon, much of the oat crop is produced in mountain valleys where it is a little cooler.

Oat groats are highly digestible with a highly indigestible hull. It is a relative of the wild oat, Nelson says. U.S. production trends for oats are similar to those for barley in that production has declined over recent years. The U.S. imports significant amounts of oats. The primary suppliers are Canada, Finland, and Sweden. There are not a lot of oats grown in the Pacific Northwest, and the bulk of these are produced in Idaho and Oregon.

Oats are grown for both forage and grain. The grain contains about 12% protein, 58% carbohydrates, 10% moisture, 12% fiber, 4% fat and 3% ash. The feed market accounts for about 60.5% of the usage of oats. For this market, the federal test weight standard is 38 pounds per bushel with a bright white color and less than 1% wild oats. The food market accounts for 38.7% of oat production. Nelson says most of this market is in the Midwest, and that the Pacific Northwest is basically too far away to get into it. This market is mainly in breakfast products.

There is a local cash market for oats, and there is a futures contract for oats on the Chicago Board of Trade. This can be watched to determine probable future prices locally, Nelson says.

The local cash market is very susceptible to the impact of oats imported from Canada. Nelson says a lot of the Canadian oats come in with a test weight of 40 pounds per bushel. These have fairly good color. On the other hand, Nelson says most oats produced locally have better color than those imported from Canada, but PNW producers have a real problem matching the weight of the Canadian oats. In early 2000, the local market for oats was \$75 per ton for 38- to 40-pound oats. For oats weighing more than 40 pounds per bushel, there was generally a premium of \$2 per ton, while the market for light oats was severely discounted to about \$65 per ton. These would be oats weighing between 35 and 38 pounds per bushel.

For oats between 30 and 35 pounds per bushel, the market is real questionable, and it is likely a farmer would only be able to get about \$35 per ton. There is a non-recourse loan for oats that might be a viable marketing alternative, especially for lighter oats.

MARKETING TRITICALE

Triticale is grown for both forage and grain, although growers in Washington are looking at it more from the grain aspect, Nelson says. The high lysine content of triticale grain, compared with other cereal grains, is a plus for livestock feeders. It means they don't have to buy supplemental lysine to add to their formulated rations. Triticale is used most in the poultry, swine, and dairy industries. While triticale is used mostly for animal feed, there is an organic and health food market as well.

There is very little triticale grown in the United States at present, and this means that most of the triticale used in this country is imported from Canada. As far as marketing of triticale goes, Nelson says they really haven't really figured out how it will be done, but the price will likely follow the corn price.

One of the problems with a new crop, Nelson says, is getting a market established. To do this, generally large quantities of product are needed so livestock or poultry producers can work it into their rations. Nelson points out that the poultry industry wants ration ingredients on an around-the-clock basis. They want to get these products on a regular basis. When a ration is changed in the poultry industry, a lot of times the birds will not gain weight for a period of time.

The bottom line is that livestock producers need large quantities with which to work. However, growers are reluctant to plant the crop unless they have a good return. This means that the triticale market will probably start with the swine industry because ration changes are not as critical for pigs.

GROWER EXPERIENCES

Barley—*Mark Sheffels, Wilbur*: Sheffels produces almost all barley on operations north of Wilbur and near Davenport in Lincoln County. He does produce some recrop winter wheat. Sheffels said barley works well at both locations, but especially at Davenport.

He said successful no-till barley production starts with the combine. Good residue spreading is essential, and he said the IH-Case machines he uses have good straw choppers. He has equipped his machines with hydraulically driven straw spreaders.

Sheffels harrows heave residue in the fall to spread it out, and goes fast. In the fall, if conditions have been wet, he uses Roundup to keep the green bridge down and reduce root mass. Doing this helps with spring weed control.

In the spring, he sprays first, then harrows and sprays again if necessary. For wild oat control, especially at the Davenport operation, he uses FarGo and incorporates it with the harrow. He notes that rainfall helps get the FarGo incorporated.

Sheffels uses a high-disturbance drill and says this helps incorporate the FarGo as well. The no-till drill is equipped with Anderson openers. He says the conservation advantages of using no-till are incredible. He has seen very significant reductions in soil erosion where no-till has been used.

Sheffels says his yields run between two and two and a half tons at the Davenport operation, and usually between a ton and a half and two tons at the Wilbur operation.

Before he began using a direct-seed system, he used a three-year rotation of wheat/barley/summer fallow. Now, his rotation is three spring barley crops followed by recrop winter wheat. He recognizes the fact that continual use of FarGo for wild oat control runs the risk of developing a herbicide resistance problem. Because of this, he plans to start rotating control products when he gets his wild oat problem under control. He may also change the time of application. His worst wild oat problems are on his recrop winter wheat.

Sheffels will consider incorporating spring wheat into his rotation. Economically, he says a rotation of spring barley and spring wheat may be viable.

He reports that his weed pressure is low, and he has been able to spot-spray to reduce problems. Cheatgrass is a non-issue for him, he says. Wild oats will be a major problem for a while. At the Wilbur operation, Russian thistle is a problem on conservation

terraces. Another weed that has required control is mayweed. He has also seen increases in populations of prickly lettuce.

Sheffels has been watching water penetration from the direct-seeded fields and has seen losses of clean water from frozen ground. He is considering the use of a rotary subsoiler of some type to reduce these losses.

Triticale—*Curtis Hennings, Ritzville* Curtis Hennings has been growing some triticale for several years. The varieties have included Stan 1 and 6600 from the Resource Seeds operation in Sacramento, California. For Hennings, the 6600 always outyielded the highest-yielding winter wheat, and always by a significant amount, he says. He did his calculations using a 60-pound test weight, and the triticale yields were usually 8 to 10 bushels per acre higher than the winter wheat. Hennings has also noticed that no matter how cold the weather gets in the fall, the winter triticale stays green after the winter wheat turns brown. He said that the triticale seems to be more winter-hardy. Part of Hennings' operation is a conventional small grain-fallow rotation and the rest is direct-seeded. He was looking for a winter crop he could plant late in the fall that had the vigor to compete with jointed goatgrass and other weeds, including cheatgrass. At the same time, he wants a marketable crop.

Hennings said that it is all starting to come together for him right now, but he still isn't sure of all the aspects. He notes that 60 acres of fall triticale is the most he has had. Hennings says there are some new markets for triticale, which are coming into the area. One of these is the new poultry operation in Lind, Washington—National Food Corporation. When it is up and running at full capacity, it will use a million pounds of feed a day. With a reliable supply, they would consider using triticale. If the triticale were 20% of the ration, this would mean a requirement of 100 tons per day.

In addition to the operation at Lind, Hennings says Foster Farms of California is one of the largest poultry operations on the West Coast, and they are considering putting in a feed plant somewhere in the Northwest, probably around Portland. As of right now, there is not enough corn grown in the Pacific Northwest to supply the new poultry operations, let alone any swine operations that might start up. Hog operations now using corn would

probably consider switching to triticale if it is available, partly because of the higher lysine content. Hennings says triticale prices are or will likely be based on corn, hopefully with a premium for the higher lysine content.

He says two winter varieties developed in the Pacific Northwest—Bogo and Alzo—have produced significantly higher yields than winter wheat in trials in Oregon. In one trial at Corvallis, Bogo yielded 141 bushels per acre while the yield of Madsen winter wheat was 68 bushels per acre. The Bogo has yielded a lot higher than the varieties Hennings grew himself, and Alzo is reported to have an even higher yield potential than Bogo. Hennings said that yields at this level could offset lower prices compared to wheat.

Bogo and Alzo have been licensed to Wilbur-Ellis Company, which contracted with growers to increase seed stocks. There will be somewhere between 10,000 and 14,000 acres of Bogo winter triticale grown in the Inland Northwest in the fall of 2000, and it will be marketed through Wilbur-Ellis. The objective is to develop a commercial supply large enough to supply National Food Corporation.

Hennings notes that for National Food Corporation to accept and use triticale in their rations, they need a guaranteed three-month supply at a minimum 100 tons per day. It takes some type of entity in the middle to guarantee that kind of reliability, and Wilbur-Ellis apparently is serving in this capacity. If a supply is not guaranteed, Hennings says he suspects the poultry operation would shift away from the triticale to some other grain, probably imported corn, because it can't afford to keep shifting rations for the birds on a regular basis.

Wilbur-Ellis is going to handle the marketing of the Bogo triticale to the poultry operation. A grower interested in this market will likely need on-farm storage. Hennings said arrangements need to be made to get commercial elevators involved in this project. Wilbur-Ellis is also working on finding herbicides to use on triticale.

Spring varieties of triticale are also available. In trials at the WSU Prosser Irrigated Agriculture Research and Extension Center, it appears they have a yield potential much higher than that of

barley. These are under development by Pro-Gene, Othello, Washington, which is also working with hog operations, and have several feeding trials under way.

Triticale seems to have good emergence, and the straw seems to be tougher than that of wheat. The straw is more like rye straw. This, Hennings says, can vary with variety. For farmers using on-farm storage, it is essential that the crop be dry going into storage to maintain quality.

Oats—Curtis Hennings, Ritzville. Hennings also has some experience producing oats. He had a crop he couldn't sell. The yield was good, but the test weight was only 36 pounds per bushel. Because he couldn't sell the crop, he took a government loan against the oats and then ended up forfeiting on the loan.

Oats—Bill Gulhke, Davenport. Bill Gulhke has some experience growing oats for the Midwest cereal market. He said that to send a shipment of oats to Quaker Oats, a minimum shipment of three rail cars is needed. Also, the minimum test weight is 40 pounds. *(Please note the difference in regions.)*

As for varieties, Gulhke feels the new variety Ajay will be a good grain oat for his region. It is bright, white and heavy. He cautions that oats can lose their bright, white color with a couple of heavy dews. He has also found that weather can have a heavy impact on oats yield and quality. Hot weather will have a negative impact on kernel filling and thus decrease yield as well as quality.

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