EB1920

Western Region
Sustainable Agriculture Research and Extension

Alternative Crops for Dryland Agriculture in the Intermountain Pacific Northwest

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

By Norm Herdrich, Agricultural Writer

The information for this bulletin was gathered from a seminar on alternative wheat crops in Washington State in January 2000. Speakers included Steve Dofing, former WSU Cooperative Extension specialist; Aaron Esser, WSU project associate; Karl Felgenhaur and Gary Galbreath, producers; Dan McKay, McKay Seed Company; and Howard Nelson, Central Washington Grain Growers.

In the dryland small-grain producing areas of eastern Washington, alternate crops often are thought of as nontraditional crops for the region. These include safflower, corn, mustard, sunflower, and flax. However, alternate nontraditional crops may be any crop other than soft white and white club wheats, either winter or spring types, which are normally produced in the region.

Alternate wheat types that fall into this category and that have shown potential for the region include hard white spring wheat, dark northern spring wheat, and durum. The advantage—alternate types of wheat can be produced using the equipment used to produce the soft white and white club wheats.

PRODUCTION INFORMATION

Hard White Wheat

The hard white wheats produce flour that makes good bread, and they perform well in Asian noodles. The white bran tends to produce better noodle color, and the noodle brightness is the best criterion of color. When used for breads, white bran results in higher flour yields for millers. Interest is increasing in producing hard white wheats. Australia is producing a hard white wheat sold in Japan for noodle production.

Hard white wheats can produce good bread and noodles, making them a good dual purpose wheat with an export advantage. The Asian noodle market is the ultimate end use for hard white wheats, but local bread making may present a viable initial market for this class of wheat.

In the category of agronomics, management for hard white wheat and soft white wheat is the same. The desired protein levels are intermediate between those of the hard red and soft white wheats.

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WASHINGTON STATE UNIVERSITY

Funded by Western Region SARE Program #USU 99-057

Dofing advises that when soil nitrogen levels are low, adding small amounts of nitrogen (N) will produce large increases in yield and small changes in grain protein levels. If soil N levels are high, additional N will produce smaller yield increases and greater increases in grain protein levels.

A general rule is that a soft white wheat requires 2.4 to 2.7 pounds of N per bushel of grain produced. Hard red wheats require 2.5 to 3.6 pounds of N per bushel of grain. The N fertilizer requirements for the hard white wheats are somewhere between these two rates, according to Dofing.

Total available N is residual N plus mineralized N plus fertilizer N in the root zone.

Hard white spring wheat varieties tested at Washington State University include ID377S, ID533, ML455, and Winsome. ID377S was developed by plant breeders at the University of Idaho and is available through ProMar Select. ML455 will also be available through ProMar Select. Winsome was developed by the Oregon State University wheat breeding program.

These hard white spring wheats generally have produced yields equal to or approaching the yields of the top soft white spring wheats in WSU Variety Testing program trials across all precipitation zones in eastern Washington. Protein levels have ranged from 9+% at Dusty, to as high as 15.4% in the Horse Heaven Hills area in south-central Washington. Protein levels tend to be higher in the lower rainfall zones, while yields have been less under the same zones.

In the intermediate and higher rainfall zones, protein levels for the hard white spring wheats have ranged from about 10% to about 13.5%. Again, higher yields generally equate with lower protein levels.

Dark Northern Spring Wheat

Dark Northern Spring Wheat is a market subclass of Hard Red Spring Wheat, which is one of eight market classes of wheat. To qualify as DNS, the grading standards require 75% dark, hard, vitreous (DHV) kernels.

Compared with producing Hard White Spring Wheat, the risk factors are higher for producing Dark Northern Spring Wheat. The yields for hard white spring wheat tend to be slightly higher than for Dark Northern Spring. The price can be higher, but input costs in the form of seed and fertilizer can also be higher for DNS. Over the past 20 years,

prices have mostly averaged higher than for soft white wheat, and at times this difference has been fairly substantial—as much as $2 per bushel.

DNS producers are subject to both protein premiums and discounts when selling their crops. These can be quite volatile. In general, any DNS with a protein level below 14% may be subject to a discount, while a premium will be paid for protein levels above 14%.

On September 14, 1999, the market price for DNS at 14% was $3.67 a bushel. The premium for protein was 7 cents for each .25% protein above 14%. The discount was 12 cents a bushel for each .25% protein below 14%. On the same day, the market price for soft white was $2.89.

Fertility tests conducted at Pullman investigated three types of fertilizer applications—fall, spring, and split. These trials evaluated nitrogen fertility rates of 40, 80, 120, and 160 pounds per acre. Protein levels were significantly different for the fall; split fertilizer applications compared with the spring fertilizer application. However, the timing of the application did not significantly affect grain yield. In general, fall and split fertilizer applications, under the different application rates, resulted in about 1% more protein than the spring fertilizer application.

On the other hand, WSU Cooperative Extension researcher Aaron Esser conducted yield trials in 1999 that compared returns from different fertilizer treatments using three DNS varieties and one soft white spring wheat (SWSW) variety. In these, the spring fertilizer application produced higher protein levels than the fall and split fertilizer applications for the DNS. However, in these trials, the higher yields from the soft white wheat produced a greater economic return than any of the DNS treatments.

The tests showed a protein level of 12% required 3.1 pounds of N/ bushel of grain produced. For 14% protein, the requirement was 2.6 lbs. of N, and for 16%, the requirement was 4.2 lbs. of N. This can be compared with a requirement of 2.3 lbs. of N per bushel of grain for soft white spring wheat in a precipitation zone of less than 21 inches annually, or 2.4 lbs. of N when precipitation is above 21 inches annually.

Some would conjecture that DNS requires higher levels of sulfur than soft white wheat. Trials conducted at Ralston found no significant differences in yield, protein levels, or test weight. However, the trends were toward higher yield, protein, and test weights with the additional S. This research will be repeated.

Anyone considering producing DNS should ensure he or she has 90 to 120 pounds of N available for the crop. For crops following DNS, producers are advised to soil test before making fertility decisions. Frequently, residual N levels are higher after harvest in fields where DNS was produced.

When it comes to producing Dark Northern Spring Wheat, researchers conclude that producers must make sure their anticipated price for DNS will justify the potential yield loss compared with soft white, as well as the additional costs of the inputs. They summarize it is hard to beat yield when producing these wheats. Even given premiums for protein, varieties with higher yields will gross more than varieties having low yields.

Durum

Durum is a separate species of wheat containing 28 chromosomes, compared with 48 chromosomes in other market classes of wheat. One winter cultivar and several spring cultivars are grown. Durum is usually grown under contract in the Pacific Northwest.

Durum wheat is ground into semolina, which is used to produce pasta products. Processors can be very particular about the quality of the semolina. Pasta producers in Italy are very picky about the quality of the durum.

In general, durum is a relatively short plant with good straw strength. It has a compact spike, long awns, and a very large seed. The yield potential of durum is within 10% of the commonly grown soft white wheats, plus or minus.

Quality is judged by a hard, vitreous, amber color (HVAC). This is a red amber transparent appearing color in the grain, related to protein content. Quality concerns include other crop seeds—mainly wheat and wild oats—and black point, caused by Fusarium head scab. Wild oats and black point will leave black specks on the pasta. A kernel has excessive black point when more than a third of the kernel is affected. Other wheat contaminants have a detrimental effect on pasta quality.

Durum is a difficult crop to establish and is one of the weaker crops in terms of vigor. It is a difficult crop to get out of the ground, so compaction and seeding depth are important. Seeding rates are generally 7% to 10% higher than those used for hard red or soft white wheat. Timing of seeding is also important. Compared with Alpowa

soft white spring wheat, emergence for durum is poorer. The maturity date for durum is about the same as for other wheat varieties. Protein levels are important in durum. Environment and weather, which growers cannot control, heavily influence protein. However, a fertility program can influence protein levels. In this regard, both nitrogen and sulfur are important building blocks for amino acids that later form the proteins for the grain. Sulfur is important for many of the enzymatic systems within the plant. N and S uptake are closely interrelated.

Growers should determine fertilizer application rates on soil test results on an individual field basis. Production goals should be matched to a fertilizer program. Grower commitment is needed to successfully grow durum.

In general, 3.8 pounds of N are needed to produce a bushel of durum. This is in the 4-foot depth and includes both residual and applied N. A 3:1 nitrogen to sulfur ratio is considered optimum.

Durum is more sensitive to late fertilizer applications. The plant goes through its physiological changes earlier than other types of wheat. For this reason, the advice is to apply three-quarters of the fertilizer preplant. The plant requires adequate fertility at the third-leaf stage. If fertility is not adequate at this time, proper tillering of the plant may not occur.

Tissue testing is recommended to track plant fertility. McKay Seed Company, which contracts spring durum production, is developing guidelines for tissue test results. If growers apply three-quarters of the fertilizer preplant, they must apply the remainder before the plants flower. Applying fertilizer after this point will not influence the plants in any way, and will waste time and money, according to Brian Van Pelt, an agronomist for McKay Seed Company. It is essential to get the fertility on the crop up front, he emphasizes.

In a trial that compared Penawawa SWSW and WPB 936 DNS wheat with the spring durum variety Kronos, the respective yields were 119, 117, and 106 bushels per acre. The protein levels were 11.4%, 13.4%, and 13% respectively, and the HVAC for the Kronos was 97.8%. In another trial using the same varieties, but with a cool, damp spring, the respective yields were 130, 123, and 113 bushels per acre. The respective protein levels were 10.5%, 12%, and 12.3%, and the HVAC count for the durum was 88.8%. This, Van Pelt says, shows the influence climate and environment can have on protein, which is related

to HVAC. A condition called yellow berry reduces HVAC. Yellow berry refers to kernels that do not meet HVAC standards.

Van Pelt says McKay Seed Company has several spring varieties coming along that show promise. One of these is called Amass.

Durum was produced last year near Almira, Washington, under dryland conditions. It yielded 50 bushels per acre with about 14 inches of precipitation.

If durum is produced using no-till practices, the key is the amount of pressure above the seed. Compaction inhibits germination and emergence. Also, the recommendation is to wait before planting durum if there is any chance of a rainstorm immediately following planting.

Hessian fly is a potential problem for durum, as are rusts. Breeding programs are in place to develop resistance to these two problems. In general, herbicides labeled for wheat can be used for durum, but growers must read the labels.

MARKETING

Dark Northern Spring

The three market subclasses for red spring wheat are Dark Northern Spring Wheat, which contains 75% or more DHV; Northern Spring Wheat, which contains between 25% and 75% DHV; and Red Spring Wheat, which contains less than 25% DHV. Grades in all three classes are Nos. 1, 2, 3, 4, 5, and Sample. The factors that determine grade are test weight, heat damage, total damage, foreign material, shrunken and broken kernels, total defects, contrasting classes, and total wheat of other classes. Contrasting classes in DNS are durum, hard white wheat, and soft white wheat.

Discount schedules also will apply to dockage and percent DHV. Dockage may be 3 cents each for each .5% from 1.1% to 3%, and 5 cents each for each .5% over 3%. The discount for DHV will be a loss of 3 cents a bushel for DHV between 51% and 75%, 6 cents a bushel for DHV between 26% and 50%, and 9 cents a bushel for DHV of 25% or less. Premiums and discounts are figured at the time the grain is marketed or delivered.

Producing DNS has profit potential. At the time the Portland price for soft white was $2.98 per bushel, the DNS price was $3.97. Since

the mid 1990s, according to Howard Nelson of Central Washington Grain Growers, the average price premium for DNS has been 98.31 cents more than soft white at Portland. The minimum price premium has been 16 cents per bushel, and the maximum price premium has been $2.52 per bushel.

Producing DNS can generate additional costs in terms of fertilizer, seed, and reduced yield potential. Price risks are associated with not making 13% to 14% protein. These risks should be assessed according to a grower's past history of producing DNS, and the potential price for seed compared with the discounted price.

Storage and handling factors to consider include where the crop will be stored and how it will be shipped. In commercial storage there is no segregation by protein, and all classes are commingled. When shipping, DNS should be shipped by quality factors to limit discounts. This generally means shipping in truckload or railcar-load quantities.

In summary, Nelson says growers should consider producing DNS if they have been successful in the past at making 14% protein. He advises them not to skimp on inputs because failure to make 13% will be costly. If they do grow DNS and do not make 12% protein, they should consider alternative markets, such as the feed market or taking a market loan on the crop.

Durum

Durum production in the United States is between 2 and 3 million metric tons. Durum markets tend to be variety specific. Certain pasta producers prefer specific varieties. Presently, domestic use of durum is increasing and exports are decreasing. In the Pacific Northwest, between 3,500 and 5,000 acres were contracted in 1998. In 1999, the acreage was down sharply.

There is a market for high-quality durum. U.S. pasta producers are importing durum from Canada. Traditionally durum is higher priced than the other classes of wheat, but yields are lower. On January 3, 2000, the Portland price for durum was $4.65 per bushel, 14% DNS was $3.87 per bushel, SW was $2.91 per bushel, and 11.5% Hard Red Winter (HRW) was $3.26 per bushel.

For Pacific Northwest growers, a high potential exists for variety specific marketing. However, the Pacific Northwest durum program is only 5 years old, which makes it relatively new. Van Pelt says durum processors are still looking at varieties produced here and how they perform in their mills. This will impact future market development.

One of the factors processors look at is percent moisture because wet durum deteriorates in storage. Presently, the durum coming out of Canada is wet durum that runs around 13% moisture. A moisture content of 8% is desirable, and the Pacific Northwest can produce 8% moisture durum.

Other grain quality factors are protein content, test weight, hardness—because hardness affects absorption levels—1,000 kernel weight, which provides an indication of the potential yield during the milling process, HVAC, and kernel uniformity.

After the grain is ground, semolina quality also is evaluated. Quality factors for semolina include moisture content, percent protein, ash content, falling numbers to test for sprout, wet and dry gluten, speck, and color value. Ash content is an important indication of the end-product color because a higher ash content indicates a darker flour. Wet and dry gluten indicate the percentage of gluten, speck indicates contaminants, and color value measures the yellowness of the pasta product.

After the semolina is evaluated, it is milled to evaluate the resulting product. Quality factors checked at this step include total extract. Total extract is a measure of total flour, semolina extract, alveograph, which analyses dough strength, the W value, which measures elasticity, and a P/L ratio, which is another measure of elasticity. The final analysis is the pasta analysis. Factors evaluated here include color, cooked weight, cooking loss, and firmness.

Kronos is the variety grown most widely in the Pacific Northwest. This can be compared with Connie, the winter variety grown around Pendleton, Oregon. Presently, Kronos provides a nice blend of yield and quality. In the other quality factors, Kronos compares quite favorably with Canadian varieties. Connie compares quite well in terms of ash content.

The future of durum production in the Pacific Northwest will depend on developing a positive relationship with foreign markets. The durum industry is old and tight, Van Pelt points out. The advantages for the Pacific Northwest are high protein levels and low moisture content.

For producers, the risk of not making quality does not appear to be great. In 4 years, producers under contract to McKay Seed Company have always made quality. The key is for the grower to be committed and ready to provide needed inputs.

GROWER EXPERIENCES

Karl Felgenhauer—Hard White Spring

Felgenhauer is a Pro-Mar Select shareholder. In the 1998 crop year, which was settled in the fall of 1999, he received $3.27 per bushel plus 16 cents. He sold his Soft White Wheat crop for $2.90 per bushel. It is essential to identify and preserve the identity of the crop grown. This begins with planting and harvesting clean seed, Felgenhauer says. The mindset is the same as for growing certified seed. This means ensuring that the trucks, combines, storage bins, and grain handling equipment are clean and free from other varieties before handling the Pro-Mar variety. Growers must take reasonable care to keep the product clean.

Agronomically, Felgenhauer says the ID377S has good test weight and the yields are comparable to Alpowa. He also says the ML455 variety that Pro-Mar is just now bringing on-line will have better end use qualities and slightly lower yields.

The seeding rate for ID377S is about 10% higher than for soft white wheats. Felgenhauer seeded 90 pounds per acre. The fertility program he used is similar to the one he used for his soft white wheat—95 to 100 lbs. of available N. Yields on four fields ranged from 55 to 70 bushels per acre.

In May 2000, Pro-Mar fell into financial hard times. The 1999 pool was settled at approximately $2/bushel. Because the growers had already planted the 2000 crop, marketing of this crop is again the responsibility of Pro-Mar. As of April 2001, Felgenhauer's crop had not been marketed. Because of his inability to produce high protein, he is not planting any Pro-Mar varieties in 2001.

Gary Galbreath—DNS

The Galbreaths have grown DNS for nine years, always on a re-crop basis in Ritzville, Washington. They have grown Butte 86 and Kulm in the past and are now growing Spillman. They began growing DNS primarily because of the price advantage.

Galbreath said he is still searching for the magic formula to ensure protein. They apply N at a rate of 3.7 lbs. per projected bushel of yield and use a 3:1 N to S ratio.

They did make protein last year at 15.1%, and Galbreath thinks the real dry spring may have been a factor in accomplishing this. They

have had mixed results on protein over the years. In 1997, he said they grew mustard and followed it with DNS, resulting in good protein levels.

He thinks fertilizer placement can affect protein levels. They use a Yielder No-Till Drill, which places the fertilizer accurately; with it they put all the N on with the drill. They fertilized for a 35-bushel crop. Compared with the DNS, Galbreath said their white wheat yields were about 7 bushels higher. Their DNS yields have been average or slightly above with good protein.

Galbreath said they use a seeding rate 10 to 20 pounds per acre higher than they use for white wheat. He said they will have DNS next year. They will stick with the 3.7 lbs. of N fertilizer rate and the 3:1 N to S ratio. They do not fall-fertilize.

Mike Carstensen—Durum

In 1998, Mike Carstensen grew durum under contract in Almira. The durum averaged 49.1 bushels per acre.

The field has mostly a southern exposure. It was subsoiled in the fall and then harrowed and disked in the spring. Fertilizer was shanked in at a rate of 80 pounds of N and 20 pounds of S. The field was cultivated and packed to make a firm seedbed. The durum was planted with a John Deere 9350 with points and round packer wheels.

Carstensen seeded at a rate of 80 pounds per acre, which is at the low- end of the recommended rate of 80 to 100 pounds. He said he normally uses a seeding rate of 70 to 75 pounds for his spring wheat. He put down 16-20-0-14 with the seed and the crop came up “real good.”

Carstensen said he had some scattered wild oats, but they were not a factor, and he did not spray. Cosmetically, he said, the crop did not look good and it did not seem to stool out as much as it should have. Because of this, he thinks maybe he should have seeded at a higher rate.

The durum was planted after he planted his barley about May 1. He feels soil temperature might be a factor for germination and emergence if it is cold.

The durum graded No. 1 at harvest. He said the durum is “a fun crop to cut.” It threshed nicely and stood up well. It left a heavy residue.

His HVAC was 97 and dockage was low. Carstensen said he wanted to raise the crop in 1999, but was unable to. He hopes it will become a viable crop for the Pacific Northwest.

This publication was supported by Grant 12W-4146-2029, OGRD #90494/01048, USU, Subcontract #99-057.

Co-sponsored by Western Region Sustainable Agriculture Research and Education (SARE), and Washington State University Center for Sustaining Agriculture and Natural Resources. Series Editor: Edward B. Adams, Agriculture and Natural Resources Program Leader.

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