FROM THE GROUND UP

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AGRONOMY NEWS

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CAN QUINOA GAIN NEW LIFE AS A COSMETIC, A VEGETABLE...AND A PLASTIC?

The best known of the seed Chenopods is quinoa, Chenopodium quinoa Willd. The estimated date of origin of this "pseudo cereal" is around 5000 B.C. Quinoa is considered a pseudo cereal because it is not a grain produced from a grass. With the invasion of Europeans into the Andean region, quinoa remained a staple food of remote indigenous populations. Quinoas were consumed as whole grains, as flour and for babyfood. The saponins from the grain became shampoo and laundry detergent and the stover became forage for their llamas. European settlers and subsequent generations preferred the true cereals with which they had become accustomed to eating. Quinoa became synonymous with a "poverty food". This bias remains today in the coastal Andean region from Columbia to Chile. Germplasm collection from Western Europe to North America reported failure in production. Poor adaptation to humid, temperate and humid, subtemperate climatic zones reduced interest in quinoa until the 1980's.

Chenopodium species are widespread throughout the world. They have frequently been used as a food source from ancient North and South America to India and the Himalayas. The types best adapted to Colorado originated in Chile, where day length is similar to Colorado. While most of these chenopods were and still are used as a high protein seed, some are used as vegetables. Huazontle (C. berlandieri ssp. nutalliae) is harvested in the vegetative stage, dipped in a tempura and fried.

A recent test market in Santa Fe of Colorado quinoa harvested in the vegetative stage found them to be very marketable in the Farmers' market with no haggling at $1.25/lb. There may be real potential here for quinoa flowerbuds (much like broccoli florets). Initial tests indicate good freezability (at - 25 F) as well.

Experiments with quinoa in the San Luis Valley of Colorado have given consistent nursery average yields of 1020 lbs/a for the past three years. One constraint is the tough pericarp

which contains the bitter saponins. The pericarp is resistant and is best removed with abrasion rather than by washing. New washing technologies may make this process more environmentally friendly and it could open up quinoa production outside of Colorado. New Colorado lines have incorporated a "sweet" or low saponin trait and a white, opaque endosperm. This is more acceptable to the whole grain market than prior Chilean accessions. Yields of these new quinoas also appear to be superior to lines and accessions commercially grown in Colorado at the present (Table 1).

Table 1. Field observations of quinoas in Colorado

Landraces/ lines	Yield Lbs/a	Yield Kg/ha	Panicle Color	Height Meters
CO94-016	1948.6	1739.8	W [1]	1.3
CO93-210	1895.4	1692.3	W	1.3
CO94-108	1893.1	1690.6	W	1.4
CO407-260	1893.1	1690.3	Y	1.4
Milahue	1830.8	1634.6	R & W	2.1
Isluga	1678.9	1499.0	mix	1.7
Faro	1592.2	1421.6	mix	2.0
CO407	1350.9	1206.2	mix	1.3

LSD (05) = 56 lbs CV = 9.0

[1] mix = multiple colors; Y = yellow or cream; R = red or W=white

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Nutrition

Quinoa is one of the world's most perfect foods. The United Nations Food and Agriculture Organization (FAO) states its quality is "equal to... the protein of whole dried milk." Table 2 illustrates the nutritional value of Quinoa and Table 3 shows the composition of proteins in quinoa.

On the downside of quinoa is our total dependence on use as a whole grain and as an additive in upscale dry cereals and pastas. While world markets are growing at a rate of 5 to 6 % per year, Colorado production has remained flat and in fact we no longer enjoy ownership of 30% of the world market. In fact, when I asked other countries to give me an idea of grain being sold, I estimate we now control about 5% of the world market. So how do we become competitive?

Additional New Uses

South American quinoas differ from the types being grown in the United States, Canada and Europe. The seed is 30-40% larger, a brighter white color and has a softer, easily removable pericarp. South Americans market their quinoas in Europe and North America. Products range from the gourmet whole grain to puffed quinoa breakfast cereals. Within South America, quinoa is marketed as baby food, as a component of candy bars and in pastries. NASA is looking at quinoa as a crop to grow in space.

Recent research by the Nestle Corporation has found the minute size of quinoa starch is highly adaptable to production of fat substitutes. The Europeans are studying cream replacement. Additional fat substitutes derived from quinoa starch are under study in the United States. Quinoa starch is among the smallest in granule size and provides a very smooth, creamy texture to food products, mimicking fats. This same property allows the starch, when mixed with alcohols, to become a very smooth, biodegradable plastic.

So quinoa is taking some very interesting turns. From an ancient grain to a space age grain and from babyfood to a new vegetable, a new fat substitute and a new plastic.

Table 2. Nutritional analyses of various cereals and pseudo cereals

Crop	% Water	% Crude Prot	% Fat	% CHO	% Fiber	% Ash
Barley*	9.0	14.7	1.1	67.8	2.0	5.5
Buckwheat*	0.7	18.5	4.9	43.5	8.2	4.2
Corn*	13.5	8.7	3.9	70.9	1.7	1.2
Millet (Pearl)*	11.0	11.9	4.0	68.6	2.0	2.0
Oats*	13.5	11.1	4.6	57.6	10.3	2.9
*Quinoa***	*12.6*	*13.8*	*5.0*	*59.7*	*4.1*	*3.4*
Rice*	11.0	7.3	0.4	80.4	0.4	0.5
Rye*	13.5	11.5	1.2	69.6	2.6	1.5
Wheat (HRW)*	10.9	13.0	1.6	70.0	2.7	1.8

*Crampton, E.W. and L.E. Harris. 1969. Applied Animal Nutrition, Second Edition, San Francisco, W. H. Freeman and Company. 753 pp.

**Cardoza, A and M. Tapia. 1979. Valor nutrivia. In Quinoa y Kaniwa. M. Tapia, ed. Serie Libros y Materiales Educativos No. 49. As cited by J. Risi and H.W. Galway. 1984. The Chenopodium Grains of the Andes. Adv. Appl. Biol. (10):145-207.

Table 3. Essential amino acid patterns (g/16g N) of quinoa compared to wheat, soy and FAO reference patterns for human dietary needs (1973)

	Quinoa	Wheat	Soy	FAO
Isoleucine	4.0	3.8	4.7	4.0
Leucine	6.8	6.6	7.0	7.0
Lysine	5.1	2.5	6.3	5.5
Phenylalanine	4.6	4.5	4.6	-
Tyrosine	3.8	3.0	3.6	-
Phen plus Tyr*	8.4	7.5	8.2	6.0
Cystine	2.4	2.2	1.4	-
Methionine	2.2	1.7	1.4	-
Cys plus Met**	4.6	3.9	2.8	3.5
Threonine	3.7	2.9	3.9	4.0
Tryptophan	1.2	1.3	1.2	1.0
Valine	4.8	4.7	4.9	5.0

*Phenylalanine plus Tyrosine.
**Cystine plus Methionine.
Source: Koziol, M. 1992.☛DJohnson

EPA PROPOSES TO RESTRICT USE OF FIVE HERBICIDES DUE TO WATER QUALITY CONCERNS

On June 26, 1996, the EPA published a proposed rule which would establish State Management Plans (SMPs) as a new regulatory mechanism under FIFRA to help prevent contamination of the nations ground water resources.

We encourage farm organizations, commodity groups, and affected individual parties to comment on the proposed rule on or before October 24, 1996.

EPA is proposing to restrict the legal sale and use of five pesticides: alachlor, atrazine, cyanazine, metolachlor, and simazine through State Management Plans approved by EPA. Because of their potential to contaminate ground water, EPA has determined that these pesticides may cause unreasonable adverse effects on the environment in the absence of effective management measures provided by a State Management Plan. The labels of these pesticides would be changed to require use in accordance with an EPA-approved SMP, and to prohibit sale and use in those States without such an EPA-approved SMP.

EPA proposes that once it finalizes the rule, the state-lead agency (Colorado Department of Agriculture) will have 33 months to develop the plans, obtain EPA approval and implement the plans. Since these five herbicides have substantial use in Colorado on a wide range of crops, it will be crucial that SMP plans be developed and approved so that producers do not lose the use of these herbicides. Some of the common trade names that these herbicides are sold in the state include: atrazine - Aatrex; alachlor - Lasso, Bullet, and Partner; cyanazine - Bladex; metolachlor - Dual and Pennant; and cyanazine - Princep and Caliber.

The proposed rule, Environmental Protection Agency, 40 CFR Parts 152 and 156, Pesticides and Ground Water State Management Plan Regulation; Proposed Rule, was published in the June 26, 1996 issue of the Federal Register (pages 33259 - 33301). In addition, the Colorado Department of Agriculture has a limited supply of copies available by calling the number listed below.

We encourage farm organizations, commodity groups, and affected individual parties to comment on the proposed rule on or before October 24, 1996. The Colorado Department of Agriculture also is developing the comments they will submit to EPA. Issues that you think the Department should consider in their response should be submitted by September 1, 1996 to: Mitch Yergert, Colorado Department of Agriculture, Division of Plant Industry, 700 Kipling Street, Suite 4000, Lakewood, CO 80215-5894, fax 303/239-4177, phone (303) 239-4151.
☛Mortvedt

WATER QUALITY EDUCATIONAL MATERIALS AVAILABLE

Several water quality publications have recently been published and are available to Extension staff members for educational program needs. A new video, entitled "Best Management Practices for Colorado Agriculture" has been produced by Greg O'Malia of the CSU Public Relations Department for Cooperative Extension. This video is approximately 18 minutes long and details some of the practices that farmers are using to protect water quality. It would be appropriate for producer audiences, as well as non-farm groups interested in this topic. Extension staff desiring a copy of this video can obtain a free copy (on a first come - first served basis) by contacting Extension Soil & Crop Sciences. Those wishing to check out a copy from Audio Visual Services at CSU should request media # 6038.

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Several new fact sheets on urban water quality issues have been published this summer to address misuse of home chemicals and pollution from urban runoff. These fact sheets contain basic information for the lay audience on how to select, apply, store and dispose of lawn and garden chemicals. The titles are:

"Homeowner's Guide To Protecting Water Quality and the Environment"
"Homeowner's Guide To Pesticide Use Around the Home and Garden"
"Homeowner's Guide To Alternative Pest Management"
"Homeowner's Guide To Fertilizing Your Lawn and Garden".

You may request copies of these four fact sheets through Extension Soil & Crop Sciences. A new SIA, "Friendly pesticides for home gardens" (no.2.945) written by Laura Pottorff also addresses some of these issues.

Three excellent new publications have been produced by field staff on localized Best Management Practices. While the content of these guides may not be specifically applicable to your area, the content and quality of these publications merit a look by all field staff working in agriculture or natural resources. Richard Antonio collaborated with a group of local producers in the Montrose area to develop "Best Management Practices for Agriculture in the Uncompahgre Valley". Randy Ristau and his colleagues at the San Luis Valley Water Quality Demonstration Project have just published two excellent field references: "Best Management Practices for Integrated Pest Management in the San Luis Valley - Potato" and "Best Management Practices for Integrated Pest Management in the San Luis Valley - Small Grains." These guides contain good pictures of common pests and emphasize an IPM approach. I do not know how many copies of these publications are available for statewide distribution, but I encourage you to have a look at the fine work these groups have produced.
☛Waskom/Mortvedt

NO KARNAL BUNT IN COLORADO CERTIFIED WHEAT SEED

Karnal Bunt has been the catch-phrase that all wheat people have been talking about since it was found in Arizona in February. Much of Arizona, along with a few counties in Southern New Mexico and California and Western Texas have been quarantined, but more importantly, the entire U.S. wheat industry has been unsure about what to do about this problem..

As you probably know, Karnal Bunt was first identified in India and later found in Mexico. It can damage individual grains of wheat, turning them into a mass of spores. The fungus is not harmful to animals or humans, and economically speaking, not even an agricultural production problem. The dilemma is that Karnal Bunt has historically been found in only a few areas of the world and is quarantined by most wheat producing countries.

As you can imagine, an excellent way to contaminated a field with Karnal Bunt would be to plant it with infected seed. But, even if spores are present in the field, the resulting wheat crop will not necessarily be infected. A combination of climate conditions not common in the Eastern Colorado wheat production region must be present during wheat flowering for the disease to occur.

Certified seed producers in Colorado are concerned about the spread of Karnal Bunt through seed and

The Blue tag on wheat seed bags or the Blue bulk sales certificate provided by the seller of bulk wheat seed is your guarantee that the seed purchased is clean, vigorous and Karnal Bunt free Colorado Certified Seed.

therefore are cooperating with the Colorado Department of Agriculture and the USDA Animal and Plant Health Inspection Service (APHIS) in monitoring seed lots for Karnal Bunt. Each certified seed lot is being tested for the presence of Karnal Bunt spores and any lots where the spores are found will be quarantined. The testing is funded by APHIS and therefore testing costs are not being passed on to certified seed buyers. Since private labs are not yet accredited to test for Karnal Bunt, certified seed is the only wheat seed in Colorado tested for the disease.

In addition to Karnal Bunt testing, certified seed is also field inspected for varietal purity and presence of weeds, laboratory tested for germination and purity, and backed by the reputation of the Colorado Seed Growers Association and its member growers. The Blue tag on wheat seed bags or the Blue bulk sales certificate provided by the seller of bulk wheat seed is your guarantee that the seed purchased is clean, vigorous and Karnal Bunt free Colorado Certified Seed. ☛Stannelle

SHOULD I PLANT HALT?? COLLABORATIVE ON-FARM TEST (COFT) RESULTS FOR 1996

In the fall of 1995, twenty-eight collaborative on-farm tests (COFT) of two winter wheat varieties were planted by eastern Colorado wheat producers in Baca, Prowers, Kiowa, Adams, Arapahoe, Washington, and Weld counties to compare the performance of the newly-released, Russian Wheat Aphid-resistant variety, Halt, with the performance of Colorado's most popular, but susceptible variety, TAM 107. The varieties were planted by growers (with grower equipment) side-by-side in long, narrow strips in the producer's field and most producers planted additional varieties e.g. Akron, Yuma, Lamar, beside the Halt and TAM 107 strips. The yield of Halt and TAM 107 are given below, in bu/ac, and corrected to 12% grain moisture.

County Location	Halt	TAM 107
Northwest Weld	23.8	28.7
Northcentral Weld	33.1	37.2
Central Washington II.	51.9	46.1
Central Washington I.	56.9	51.5
Southeast Weld I.	29.2	28.1
Southeast Weld II.	24.9	24.7
West Adams	42.3	42.2
East Adams	45.1	40.5
Southwest Washington II	40.0	38.1
Southwest Washington I.	72.7	72.8
Southeast Adams	50.0	48.3
Northeast Arapahoe	33.9	35.4
Southeast Arapahoe I.	52.0	53.6
Southeast Arapahoe II.	44.4	48.0
Northeast Prowers	6.0	14.2
Northcentral Prowers I.	10.5	13.2
Northcentral Prowers II.	17.3	26.8
Average Yields	37.3	38.2
Average Test Weights (Lb/bu)	57.4	58.0

Discussion: There is very little difference in yield between the two varieties when all test results are used in the comparison. If we exclude the results from the three locations in Southeast Colorado, then Halt averaged 42.9 bu/ac and TAM 107 averaged 42.5 bu/ac. Russian Wheat Aphid (RWA) infestation levels were very low or non-existent in all COFT strips in 1996. Some might think that the value of the COFT research was compromised by the lack of serious RWA infestations. I would assert that yield comparisons without RWA infestations answered the most important question for producers trying to decide whether to plant Halt or not. They might reason that if the have any risk of RWA infestation then

All Colorado wheat producers have benefitted from the generosity of the volunteers who conducted these on-farm tests.

they should plant Halt because it is likely to yield as much as TAM 107 even when there is no RWA infestation. If serious aphid infestations develop then resistance in Halt might save the crop, maybe even save the farm. Perhaps more significant than the yield information under large-scale farm conditions was the demonstration of real collaboration involved in carrying out the COFT95 program. Nearly 30 Colorado growers volunteered the use of their land, machinery, and time to plant, cultivate, and harvest the strips. All Colorado wheat producers have benefitted from the generosity of the volunteers who conducted these on-farm tests. Cooperative Extension agents in the above counties fully participated in the coordination of COFT activities and extension entomologists in Lamar, Akron, and Fort Collins helped in all aspects of the COFT program. ☛Jjohnson

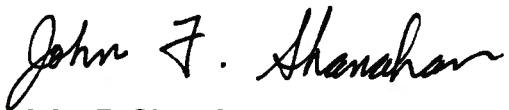
NEWSLETTER AVAILABLE ON WEB

As of now, our Newsletter will also be available on our department Web page. The address for this page is:

http//www.colostate.edu/Depts/Soil Crop/.

It can be found under Extension information on this page. The file is in the Adobe Acrobat PDF format and can be viewed and printed with the same software as used fpr SIAs.

Sincerely,



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