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KERNEL TRAITS, HULL PERCENTAGE AND TEST WEIGHT IN BARLEY

by JOHN WIERSMA, RESEARCH AGRONOMIST

Consumer preferences in competitive markets provide impetus for improving end-use values of malting and feed barleys. Test weight, the weight of grain which fills a volume measure under standard packing conditions, is widely used as a rapid, practical index of the physical quality of grain and as an estimate of end-use value. In addition to direct premiums or discounts, test weight derives value from its effect on transportation costs, its association with protein concentration and percent plump kernels, and its relationship with feed efficiency and energy values.

Accurate prediction of the end-use value of malting or feed barley is difficult and no single test consistently provides a rapid, reliable estimate. Grading factors used to establish official, commercial standards provide limited information for judging end-use value of malting or feed barley. Traditionally, test weight has been used in local, national and international markets to estimate overall grain quality and to determine premiums or discounts. An exact estimate of the barley produced each year in the tri-state area of Minnesota, and North and South Dakota that is subject to discounts because of low test weight is not readily available. This lack of information reflects the complex system used to determine prices. Prices paid for malting barley are based primarily on supply, demand, variety, percent protein, and percent plump kernels. Barley that does not grade U.S. No. 1, 2, or 3 malting barley is sold as nonmalting or feed barley.

Although test weight discounts apply primarily to feed barley, at least one-half of the total annual U.S. production is purchased for feed uses. Feed efficiency and energy values generally increase with increasing test weight in barley and discounts for low test weight barley reflect differences in end-use value. A typical discount for low test weight feed barley is 4¢ per bushel in local and international markets.

Both assumptions and data are required to derive an estimate of the economic value of test weight for midwestern malting and feed barleys. Assumptions required include (i) that all barley graded as malting barley is subsequently sold as malting barley; and (ii) only

feed barley is subject to test weight discounts. Data required include (i) the average percentage of total barley production that fails to meet malting specifications, i.e., the amount of feed barley produced; and (ii) the discount for low test weight. Using the data given in Table 1, it is reasonable to suggest that at least one-quarter of the annual production in the tri-state area fails to grade as malting barley. Applying a 4¢ per bushel discount to one-quarter of the average annual production of 203 million bushels for the tri-state area provides an estimate of the annual economic value of test weight of about \$2 million.

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Plant population and tillering influence kernel size and test weight as well as grain yield.

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Current information available from University of Minnesota Extension: <http://www.extension.umn.edu>.

Smith's Comments



Another growing season has begun. The drought conditions of the past four years and lack of subsoil moisture in the Crookston area enabled planting to begin on April 6. This early planting date will contrast with the wet conditions in northern Marshall and Kittson counties where water is still standing in many fields, and will delay planting there for at least two and possibly three weeks. Strong wheat prices and some modest precipitation in this area has increased the optimism for 1992 being a profitable year in both farming and agribusiness.

Dealing with budget cuts has occupied much of the past year. The University received an additional \$15.7 million reduction in its operating budget this past week. This cut, added to previous cuts of \$27 million, has resulted in the loss of 850 jobs within the University, with a potential loss of another 400 jobs, as well as numerous programmatic cuts and reductions. All units within the University system have been affected by these reductions. At the Northwest Experiment Station three support positions have been cut, an academic position in soils research will be left open and will possibly be eliminated, and the Station's remaining researchers have had their operating budgets reduced. On the programmatic side, sheep research will be reduced and possibly eliminated in 1995. The next issue of the newsletter will further detail the effects of these cuts and those that will be mandated by the latest round of reductions, on both the Station and the Departments at St. Paul that serve the agriculture industry of northwest Minnesota.

THE AMERICAN BITTERN

A Special Concern About An Interesting Bird

by Dan Svedarsky, Professor, Natural Resources



© 1988 State of Minnesota, Department of Natural Resources Drawing by Vera Ming

A master of marsh camouflage, the American Bittern is a bird easy to miss along the edge of a wetland as it points its head skyward and its vertical markings blend in perfectly with its surroundings. However, if recent trends continue, it may become hard to see because it just isn't there! Since 1966 the bird has declined about 4% per year in Minnesota, Wisconsin and Michigan and nesting records have become quite rare in Iowa. It has been added to the list of "special concern" species in Minnesota which means it is not presently endangered or threatened with extinction but is uncommon and deserves special monitoring of its status.

In a two-year study of a multi-purpose impoundment conducted by Station Wildlife Biologist Dan Svedarsky, the bird was found nesting both in 1990 and 1991. (See general article of study in NW Exp. Sta. News, April 1991).

Unlike most members of the heron family which nest in trees, the American Bittern nests on the ground in dense cover along with Mallards and Blue-winged Teal. The Burnham Creek Wildlife Management Area study site, located 15 miles southeast of Crookston, has been nest-searched each summer by dragging a cable-chain through the grass with 2 all-terrain vehicles. Birds are harmlessly flushed from their nests which are then marked to determine if nests hatch and if young survive.

Three nests were found in 1990 and 4 in 1991 in a 200-acre portion of the study area including a restored bulrush marsh. This is a high density of nests considering the precarious status of the species. One nest hatched in 1990 and 3 in 1991 producing a total of 14 young. Unlike ducks, grouse, and pheasants, which complete laying before they begin incubation resulting in all young hatching on the same day, American Bitterns begin incubation soon after they begin laying eggs. Thus, eggs hatch over a period of days and nests contain young of different sizes.

Adults may vigorously defend newly hatched young with an unnerving "gasping-hissing" sound and rapid strikes with a very sharp beak. Young soon develop defensive behavior and strike with their beak and release a substantial glob of foul-smelling excreta if they're handled.

Adults and young feed on a variety of marsh animals including fish, small mammals, snakes, salamanders, grasshoppers, and frogs with frogs probably being the most important food item. In fact, the shortage of frogs has been suggested as a probable cause in the wide-spread decline of American Bitterns. Frogs, particularly leopard frogs,

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Marx Reports On Rwanda Visit

by George D. Marx, Dairy Scientist

This past fall I had the opportunity to spend several weeks in Rwanda Africa with the Agricultural Adoptive Research under the USAID-University of Minnesota Project.

Rwanda, located in East Central Africa, is a small, landlocked country about the size of Maryland. Also, called the Republic of Rwanda, it is located just two degrees south of the equator and is bordered by Zaire, Burundi, Tanzania and Uganda. The land consists of grassy uplands and hills with forests in the north. The climate is warm to temperate with two rainy seasons averaging 41 inches of rainfall annually. Two crops can be grown annually, especially in the fertile valleys between the hills. Major food crops produced are beans, sorghum, rice, millet, cassava, maize, taro, sweet potatoes, Irish potatoes and fruits, primarily bananas.

Rwanda has the highest population density of any country in Africa with 7 million people in a 10,000 sq. mi. area. Families average 7.5 children, with a 10.2% infant mortality rate. The population has doubled in the past 20 years.

The economy is based on agriculture and animal husbandry. The agriculture sector provides work for 93% of the 3.6 million available work force. Coffee and tea produce 90% of their export revenues.

Most of the 634,000 head of cattle are dairy animals. The beef industry is virtually nonexistent in Rwanda as very few people can afford to buy beef. There are 885,000 goats, 295,000 sheep, 120,000 pigs, 1,020,000 chickens and 134,000 rabbits in the country. Meat consumption per capita is only 8.1 lbs/yr and people eat meat only on special holidays.

Milk production levels are very low with the native breeds (Ankoli and Sahiwal) producing 2 to 3 quarts/day. A number of Zebu, Jersey, Brown

Swiss and Holstein have been imported and sires of these breeds are used for cross breeding to upgrade the native breeds. The native breeds are more resistant to ticks, a major problem with imported breeds. To control ticks, animals swim through a dip tank twice weekly. Some new pour-on and spray treatments are replacing traditional dipping treatment.

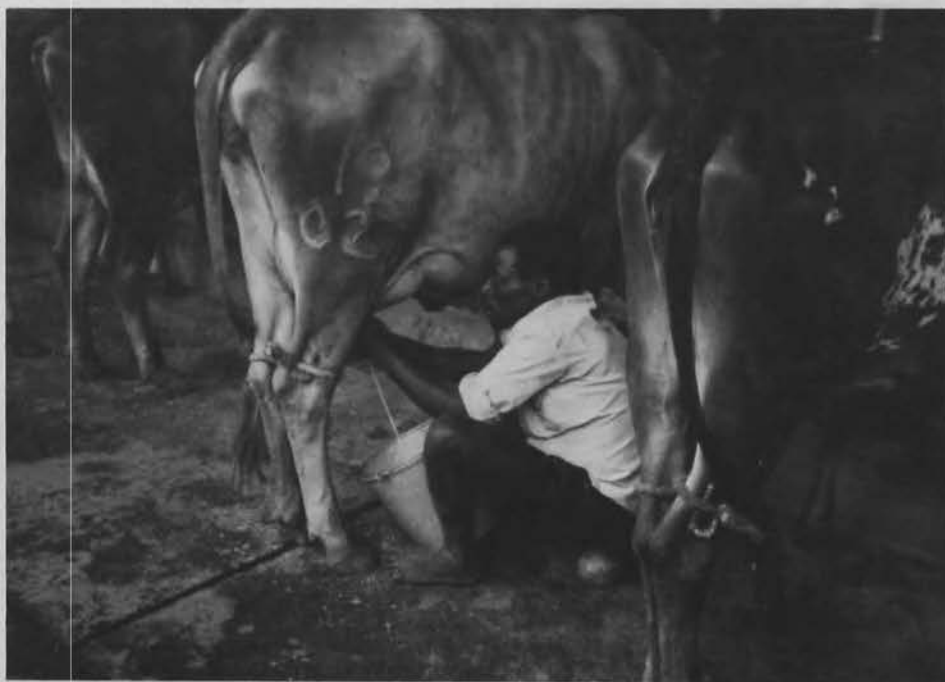
The best herd I visited was an imported Holstein-Friesians that produced 40 lbs/cow at the Four Season's Dairy. All milking in Rwanda is done by hand. The first mechanical milking machine was imported from Belgium while I was in the country. At this time it is still in the original shipping crate waiting for someone from the manufacturer to install it at the Rubilizi Dairy Farm. This is one of the few farms with electricity. It processes its own milk as fresh pasteurized bottled milk and fermented milk, and uses the cream to make butter and buttermilk. The products are then hauled to Kigali (capital city about 40 miles away) and sold in a dairy bar. There are not enough milk or milk products to supply

the needs of the people. The people crave and enjoy milk and know it is a healthy food which can increase the quality of the human diet. Most cheeses are imported because of a lack of domestic milk supplies.

Very few farmers use artificial insemination. There is one A.I. organization in the country which primarily imports, stores and distributes semen. They do not have any sires or any sire-testing improvement programs at this time. Distribution is a problem as side roads are very poor for travel.

Most farms have two to five cows with a few larger dairies being developed that have 30 to 70 cows. Milk quality is a problem, especially without electricity to cool the milk in warm weather. Water is used to cool milk. A lot of milk sours before it reaches the market, and is then used for sour cream butter and a type of fermented milk.

One of my objectives was to study and evaluate the crop residues, commodity and food by-products as potential livestock feeds. Many of these products are now being composted and used as fertilizer, but could be fed to animals to produce human food with the ma-



Dairy cows in Rwanda are all milked by hand. This photo was taken at the ISAR Dairy Cattle Breeding Research Center in Butare, Rwanda.

nure utilized for fertilizer. I visited a large banana factory that makes wine and nectar. All of the scraps and meal are composted, both have high nutritional value and could be fed to livestock. Products available for livestock feed include: potato waste, cannery wastes, bran from rice and wheat, brewers grains from both sorghum and corn, legume residues, stovers, screenings, sugarcane processing wastes (molasses and bagasse), poultry wastes such as egg shells and feathers, fish meal and associated residues.

I had the opportunity to present seminars to the National University of Rwanda faculty and students on animal science research conducted at the Northwest Experiment Station that focus on the utilization of crop residues and commodity byproducts for livestock feed. I also presented the dissertation project proposal of Jean Marie Akayezu, a Ph. D graduate student from Rwanda studying at the University of Minnesota, who I co-advise with Dr. Donald Otterby.

In summary, the trip to Africa this fall

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Although test weight is an important character, the chemical and physical factors of grains that determine test weight have received limited emphasis in small grains research. The two primary components of test weight are kernel density and packing efficiency. Kernel dimensions (length, width, thickness) and composition (starch, protein) determine kernel density, whereas kernel size, shape and uniformity determine packing efficiency. Plump kernels, seed weight, hull percentage, genotype, and environment also are important factors that influence test weight. A barley breeding program designed to increase test weight will first require identification of appropriate selection criteria and an assessment of genetic diversity available in improved and unimproved germplasm. Identifying strategies that will enhance test weight is a worthwhile goal for barley breeding programs. External funding is being sought to support additional research.



In Rwanda some limited research is being conducted on silages for dairy cattle. This photo depicts a trench silo with sorghum silage at the National University of Rwanda Agriculture Research Station.

was a real learning experience. I hope my knowledge was useful to the primitive dairy industry in Rwanda. Both the farmers and industry people need help and advice. Some progress is being made in feeding, breeding and management, but much more improvement is needed. A feed industry and feed centers need to be developed so

farmers can obtain the proper supplements for livestock feeding. The use of artificial insemination needs to be expanded to speed up genetic progress and upgrade the native breeds. Milk testing and quality control is also needed in the dairy industry. Much work remains if these countries are to become more self sufficient in the future.

Malting and Feed Barley Table

Table 1. Annual total production, average yield and percentage of production that failed to grade as malting barley in Minnesota, and North and South Dakota from 1982 through 1991.

Year	Total Production [†]			Average Yield			Feed Barley [‡]		
	Minnesota	North Dakota	South Dakota	Minnesota	North Dakota	South Dakota	Minnesota	North Dakota	South Dakota
	---- thousand bushels ----			---- bushels per acre ----			----- percent -----		
1991	43,750	138,670	17,940	50	49	39	41	33	48
1990	50,400	129,850	24,500	63	53	49	20	8	38
1989	44,000	98,050	19,250	55	37	35	13	48	70
1988	27,200	45,150	8,100	32	21	18	56	56	100
1987	49,590	139,200	34,000	57	48	40	-	-	-
1986	55,000	175,950	35,910	55	51	42	-	-	-
1985	70,950	184,250	32,400	66	55	45	-	-	-
1984	61,750	153,700	30,345	65	53	51	-	-	-
1983	43,460	114,660	23,100	53	46	42	-	-	-
1982	51,040	103,350	23,435	58	53	43	-	-	-
Average	49,714	128,283	24,898	55	47	40	32	36	64

[†] Production and yield data were provided by the Agricultural Statistics Service of each state's Department of Agriculture (personal communications).

[‡] Grade information and percentage of production that graded feed barley was available only for 1988 through 1991. This information was taken from the 1988 through 1991 Regional Barley Crop Quality Reports published by the North Dakota Barley Council, Fargo, ND.



American Bittern young at The Burnham Creek Wildlife Management Area. Note newly-hatched young by egg in the process of hatching on June 24, 1991.

Svedarsky continued

declined in the U.S. by as much as 50% in the 1960's, apparently due to a bacterial disease called redleg.

Leopard frogs were abundant during both years of the study and adult tadpoles were estimated at 8 per square meter in more open parts of the 80-acre restored bulrush marsh. The study area apparently provides ideal habitat for leopard frogs with the shallow, bulrush-cattail marsh serving as a breeding pond, a deeper flood water storage pool serving as an overwintering site, and nearby upland vegetation serving as summer foraging habitat for young and adult frogs.

In addition to American Bitterns, the following "special concern" bird species were found to breed on the study site: Sandhill Crane, Sharp-tailed Sparrow,

Greater Prairie-Chicken, Wilson's Phalarope and Upland Sandpiper. A total of 137 bird species were recorded on site with 60 documented to breed.

The final report of the study details observations of migratory and breeding bird use of the site, water levels in pools, water quality characteristics, aquatic invertebrates, and vegetation with a special emphasis on aquatic

plants. This information will provide a basis for understanding changes in plants, animals and water quality at this area as well as information useful in designing future multi-purpose impoundments.

Although not specifically planned for American Bitterns, this project seems

CALENDAR OF EVENTS

1991-1992

Crop and Soils Day
July 15

Beef Cattlemen's Institute
October 22

to have provided ideal habitat for them during the study and the possible effects of water level manipulation on leopard frog reproduction are being evaluated. Water level management effects on other breeding and migratory bird species are also being evaluated as are other management and design factors.



Young-of-the-year leopard frogs along a wetland at The Burnham Creek Wildlife Management Area on Aug. 22, 1990.



TIM DANIELSON NAMED EMPLOYEE OF THE YEAR

Tim Danielson, maintenance and operations mechanic at the Northwest Experiment Station, was the recipient of the 6th Annual Employee of the Year Award.

Tim started working in the maintenance department on June 16, 1983. He was promoted to his present position in 1985.

Tim is directly responsible for all vehicles and also in working with other maintenance crews on equipment and building repairs on the Experiment Station.

Tim was nominated by his co-workers to receive this award because of his positive attitude toward his job, his willingness to help other employees and his friendliness toward his co-workers.

The Employee of the Year Award was designed to promote and recognize excellence in job performance among Civil Service and Bargaining Unit personnel. Funds for this award come from a President's Club donation designated for this purpose.

Congratulations, Tim, on receiving the 1991 Employee of the Year Award.



Cheryl and Tim Danielson and Supt. Larry Smith

JOHN OTTERNESS RESIGNS - WE WISH THEM WELL

John and Julie Otterness were honored at a farewell party in February. John has been employed in the Meat Animal Department at the Northwest Experiment Station since 1986.

The Otterness family moved to southeast Minnesota where John and Julie will begin their own dairy operation.

We wish John, Julie, Sam, Kaysie and Jessica the very best of luck in their new venture.



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The Northwest Experiment Station News
Patti Malme, Associate Editor

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