Approved _____
Date

MINUTES OF THE House COMMITTEE ON Agriculture and Livestock.

The meeting was called to order by the Chairman, Bill Fuller at
Chairperson

9:00 a.m./~~p.m.~~ on January 23, 1984 in room 423-S of the Capitol.

All members were present except: Representatives Long, Niles and Solbach who were excused.

Committee staff present:

Raney Gilliland, Legislative Research Department
Kathleen Moss, Committee Secretary

Conferees appearing before the committee:

Bill Phillips, Director, Kansas Agriculture Experiment Station, Hays
Joe Martin, Hays Experiment Station
Dr. Charles Deyoe, Manhattan Agriculture Experiment Station

The meeting was called to order by the Chairman, Bill Fuller, who announced that members were welcome to invite any group to come before the committee on Thursday with requests for legislation. He urged members to notify him if it was necessary to be absent, in order to expedite attendance records.

The Chairman announced that representatives from the Federal Grain Inspection Service would appear before the committee at the next meeting. He introduced Bill Phillips from the Hays Experiment Station to discuss the controversial classification of newer wheat varieties.

Mr. Phillips distributed a prepared statement (See Attachment 1.) to which he made reference during his presentation. He told the committee that research is very important in the development of better agriculture. He also emphasized that it is important to keep farmers and the public informed of developments.

Dr. Charles Deyoe, Manhattan Experiment Station, distributed his prepared statement. (See Attachment 2.) He stated that experimentation had begun in the winter of 1970-71 with different varieties. He discussed the milling and baking qualities and the characteristics of Arkan variety.

There were questions on the procedure of grading wheat by the Federal Grain Inspection Service, and classifications were discussed. Dr. Deyoe said that improper classification is costly. He commented on the high quality of bread overseas and explained that is because they use our hard red winter wheat. There were questions about the glutemate content and the effects of removing glutemate. Dr. Deyoe said that while it is important, that comes under marketing and is not in their line. He told the committee that they are working on a variety of wheat that can withstand the hot summer weather.

The Chairman suggested the conferees could return the next day for additional questions after the scheduled presentation.

The meeting was adjourned at 10:05 A.M. The next meeting will be at 9:00 A.M., Room 423-S.

Attachment No. 1

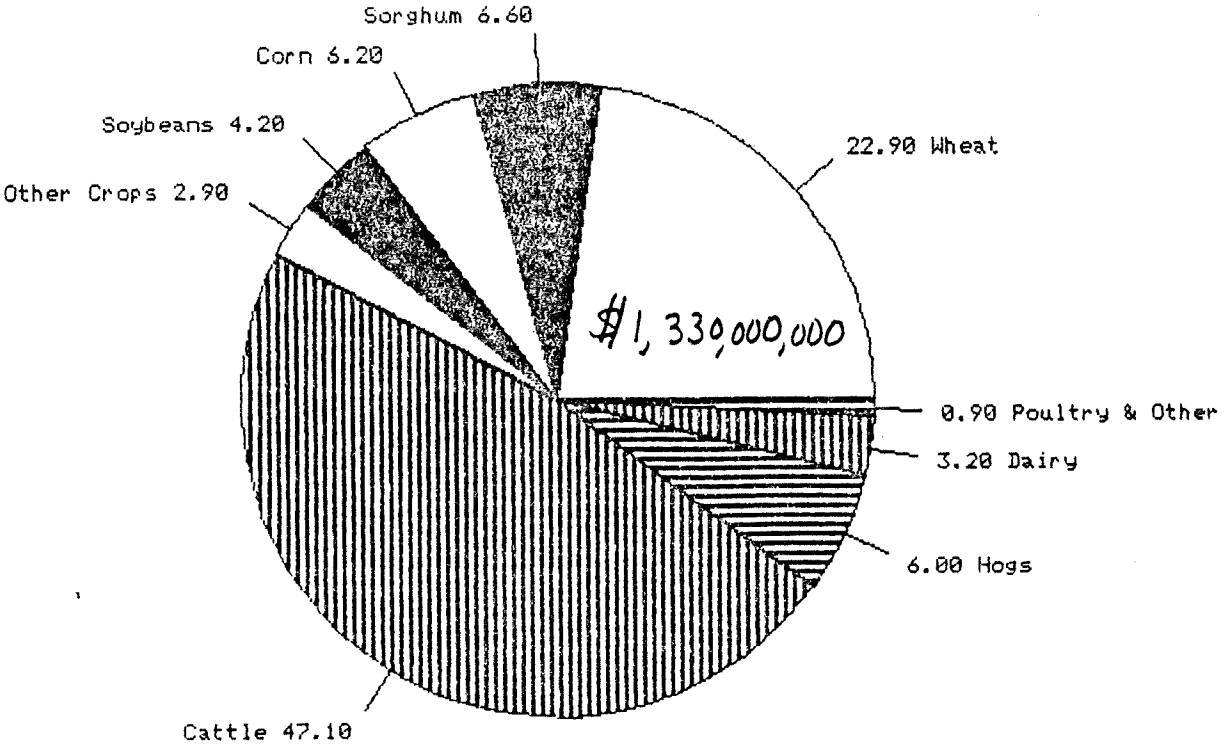
MISSION - KANSAS AGRICULTURAL EXPERIMENT STATION

THE MISSION OF THE KANSAS AGRICULTURAL EXPERIMENT STATION IS TO CONDUCT BASIC AND APPLIED RESEARCH IN AGRICULTURE AND RELATED FIELDS, TO HELP INSURE AN ADEQUATE SUPPLY OF WHOLESOME FOOD AND FIBER FOR AN INCREASING WORLD POPULATION WHILE PROVIDING REASONABLE INCOMES FOR PRODUCERS AND RELATED AGRIBUSINESSES IN KANSAS. RESEARCH ALSO IS AIMED AT CONSERVING NATURAL RESOURCES (LAND, WATER, AND SOIL) AND AT PROTECTING THE ENVIRONMENT FOR FUTURE GENERATIONS.

Atch. 1

Cash Receipts
1982

(pct.)



$ 5,809,323,000

Milling and Baking Quality

Arkan has excellent hard wheat milling and bread-making qualities. The shape of Arkan's berry results in high flour yields and Arkan's flour protein has consistently exceeded Newton's by 1 percent.

T. Joe Martin
Wheat Breeder
Ft. Hays Branch Experiment Station

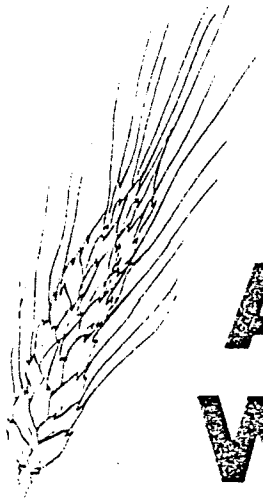
James P. Shroyer
Extension Specialist, Crop Production

KANSAS STATE UNIVERSITY COOPERATIVE EXTENSION SERVICE MANHATTAN, KANSAS

L-671 March 1983

Issued in furtherance of Cooperative Extension Work, acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, and United States Department of Agriculture Cooperating, Fred D. Sobering, Director. All educational programs and materials available without discrimination on the basis of race, color, national origin, sex, or handicap. 4-83—2M

File Code: Crops & Soils 1-1



Arkan Wheat

Arkan is a new hard red winter wheat variety developed cooperatively by the Kansas Agricultural Experiment Station and the Agricultural Research Service, United States Department of Agriculture. Foundation seed of Arkan was distributed to Kansas registered seed growers for fall planting in 1982.

Origin and Development

Arkan is a selection from the Sage/Arthur cross made by the late Dr. R.W. Livers in 1970 at the Fort Hays Branch Kansas Agricultural Experiment Station, Hays, Kansas. Financial support from the Kansas Crop Improvement Association and the Kansas Wheat Commission partially offset the cost of testing early generation selections from this cross at Columbus or Parsons, Kansas from 1977 through 1979. Arkan is an increase from a F6 plant row selection made at Columbus in 1977. Arkan has been tested state wide in the Kansas Interstate Nurseries (1980-82), the 1982 Kansas Variety Performance tests and the Southern Regional Performance Nursery (1981-82), which is grown throughout the hard winter wheat growing areas.

COOPERATIVE EXTENSION SERVICE
Kansas State University, Manhattan

Agronomic Characteristics

Arkan is a Triumph maturity, semidwarf wheat (Table 1). It has excellent straw strength and lodging resistance. Arkan's protein content exceeds Newton by 1 percent. Arkan is capable of emerging from deeper plantings than other semidwarf wheats currently available because of its long coleoptile. Arkan's coleoptile length is equal to that of Larned's. Winterhardiness is similar to Scout, and is more winterhardy than Newton and Triumph.

Resistance to Pests

Arkan carries effective levels of resistance to several pests prevalent in its area of adaptation (Table 1). In addition to resistance to wheat soilborne mosaic virus, leaf rust and Hessian fly, it also effectively resists Cephalosporium leaf stripe, stem rust, Septoria leaf blotch and powdery mildew. Arkan is susceptible to greenbugs and wheat streak mosaic virus.

Area of Adaption

Arkan is best adapted to Southeast Kansas and the continuously cropped areas of Southcentral Kansas. Yields have been equal or better than Newton or TAM 105 in these areas (Table 2). Arkan's yield potential, early maturity, short stature, and disease resistance make it an excellent wheat for use in double crop rotations with soybeans in Southeast Kansas. Because of its early maturity, high level of susceptibility to wheat streak mosaic virus, and its tendency to shatter under Western Kansas conditions, Arkan's performance in that area compares less favorably with Newton and TAM 105. Yields of the three varieties have been similar in Northcentral and Northeast Kansas (Table 2).

Table 1. Agronomic and pest resistance characters of Arkan wheat.*

	Agronomic Characteristics				Reaction to Pests			
Variety	Maturity	Test Weight	Winter hardiness	Coleoptile length**	Soilborne wheat mosaic	Leaf Rust	Cephalosporium Stripe	Hessian fly
Arkan	2	4	4	2	1	1	5	1
Newton	3	4	6	6	1	8	6	8
TAM 105	3	6	3	5	6	3	7	8

*Rated on a scale of 0 to 9. Except for maturity (where 0 is earliest and 9 latest. 0 is best and 9 poorest. Zero means excellent or exceptional; 1 to 3, good; 4 to 6, average or moderately resistant; and 7 to 9, poor or susceptible.

**Coleoptile length is a measure of the maximum length that the coleoptile (or shoot) can elongate. The coleoptile length is an important determinant of the maximum depth wheat seed can be planted and still emerge.

Table 2. Yield (bushels/acre) of Arkan wheat at various locations in Kansas from 1980 to 1982.

	Southeast and Southcentral Kansas					Northeast and* Northcentral Kansas 1980-82	Western** Kansas 1980-82
Variety	Parsons 1980-82	Oxford 1981-82	Hutchinson 1980-82	Hesston 1981-82	4-station Average		
Arkan	43	42	51	36	43	60	48
Newton	41	39	47	33	40	62	51
TAM 105	43	37	50	37	42	59	57

*Includes data from Manhattan, Powhattan, and Belleville.

**Includes data from Hays, Colby, and Garden City.

KSU KANSAS STATE UNIVERSITY

EXTENSION NEWS & FEATURES

Department of Extension Information
Umberger Hall 129
Manhattan, Kan. 66506
913-532-5804

Potential Problems Found in Classifying Wheat

MAILED: August 29, 1983

By Steve Morgan
Kansas Ag Experiment Station Editor

MANHATTAN--The Federal Grain Inspection Service (FGIS) may be misclassifying some of the newest wheat varieties and hybrids, according to information just received by the Kansas Agricultural Experiment Station.

Dr. Kurt Feltner, associate director of the Agricultural Experiment Station at Kansas State University, said the FGIS classification system being used could place some new hard red winter wheat varieties into the soft red winter wheat category. An example is Arkan, the latest variety developed by Kansas scientists and jointly released in 1983 with the Nebraska Agricultural Experiment Station, University of Nebraska.

"Arkan is already a popular variety with Kansas farmers, has been well accepted by the milling industry and is expected to play a prominent role in next year's wheat crop," said Feltner. "Most of the 130,000 bushels of seed wheat available to Kansas farmers for planting this fall have already been sold."

He added that "Arkan is a legitimate hard red winter wheat. To misclassify it would be unfortunate because of the significant impact it could have on Kansas agriculture and Kansas farm income." He explained that hard red winter wheats in general sell at higher prices than soft red winter wheats.

Feltner stressed these points:

1--Arkan is a hard red winter wheat variety. Proper procedures were followed for its classification and release last year, including submitting it for clearance through the experiment station's variety release committee, the National Certified Small Grain Variety review board and the Plant Variety Protection office (Agricultural Marketing Service).

2--Arkan was screened and classified in tests at the USDA Grain Marketing Research Laboratory in Manhattan and in subsequent large-scale milling and baking tests by the KSU Department of Grain Science and Industry in cooperation with the Kansas Wheat Quality Council.

-more-

2--Wheat Classification

3--Arkan should become an important contribution to wheat production in its area of adaptation. It has high protein content and high yield characteristics and resists such important pests and diseases as Hessian fly, soilborne mosaic virus, leaf rust, Cephalosporium leaf stripe, stem rust, Septoria leaf blotch and powdery mildew. It also has superior winter hardiness and excellent baking and milling properties.

According to Feltner, a wheat is classified hard or soft depending on the composition of the kernels and how they are separated during the process of milling.

Feltner noted that samples of Arkan were submitted to the FGIS in August of 1982 but that the agency had not expressed its concern about being able to properly classify it until just recently. Further, said Feltner, the FGIS classification criteria apparently have to do with kernel morphology only and do not include a test for actual "hardness."

"It is puzzling and frustrating that FGIS classification criteria do not consider the identification of those quality characteristics in wheat that guide its utilization," remarked Feltner.

-30-

Agronomy--Wheat
A-C-E-G-H-M-P-S-T-U-X

KANSAS STATE UNIVERSITY

EXTENSION NEWS & FEATURES

Department of Extension Information
Umberger Hall 129
Manhattan, Kan. 66506
913-532-5804

MAILED: September 15, 1983

Wheat Classification Problem To Be Reviewed

By Steve Morgan
Kansas Ag Experiment Station Editor

MANHATTAN--Indications are some progress is possible toward solving potential problems of classifying some of the newest wheats, according to Dr. Kurt Feltner, associate director of the Agricultural Experiment Station at Kansas State University.

Feltner noted that the problem began last month when the Federal Grain Inspection Service (FGIS) said that its visual tests put Arkan wheat into the soft red winter wheat category. Arkan was developed after 10 years of work by the Agricultural Experiment Station and released last year as a hard red winter wheat. Other than in appearance, it meets all the qualities and characteristics of a hard red winter wheat.

A telephone conversation Sept. 14 between Feltner and John Marshall, Washington, D.C.-based FGIS administrator, led to an agreement that efforts will be made to schedule a meeting at K-State sometime before the first of October.

Feltner noted the half-day meeting of KSU scientists and FGIS officials will provide a review of existing technology and instrumentation for determining "hardness" of wheat and how that technology might be incorporated into the FGIS classification system.

"If we find the technology and instrumentation do not exist, then we will investigate whether the Ag Experiment Station can redirect some of its research effort into developing such technology and instrumentation which can then be used by the FGIS to develop new guidelines and criteria for wheat classification," said Feltner.

Feltner indicated that the upcoming meeting between the FGIS and the Ag Experiment Station is the first positive sign that the classification dispute can be settled.

-more-

In the meantime, he said, it can't be predicted what kind of lifespan the variety Arkan will have. "We encourage ag community members to review Arkan's characteristics and qualities and make their own judgment about including it in farming plans," Feltner said.

He also noted that the classification of Arkan is not now a mammoth problem. If the 130,000 bushels of Arkan seed available are planted for harvest in 1984, that would represent less than one percent of next year's total Kansas wheat crop. But Feltner stressed that if the problem is not solved, it could have potentially enormous implications for farmers and scientific wheat development programs of the near future.

-30-

Agronomy--Wheat

A-C-E-M-P-S-N

KSU KANSAS STATE UNIVERSITY

EXTENSION NEWS & FEATURES

Department of Extension Information
Umberger Hall 129
Manhattan, Kan. 66506
913-532-5804

MAILED: September 26, 1983

Progress Possible in Solving Wheat Classification Problems

By Steve Morgan
Kansas Agricultural Experiment Station editor

MANHATTAN--The Federal Grain Inspection Service (FGIS) has agreed to work with Kansas Agricultural Experiment Station (KAES) scientists and other scientists to solve problems of classifying some of the newest wheats.

That word came after a Sept. 23 meeting of 15 KAES and FGIS scientists and administrators at Kansas State University

As a result of the meeting, Kurt Feltner, associate director of the KAES, said he was hopeful that within a year objective tests can be used as a supplement or backup to visual tests for classifying samples of wheat now difficult to classify.

The need for a top-level meeting became apparent after the FGIS said that visual tests might place Arkan as a soft red winter wheat. Arkan was released last year by the KAES, after exhaustive testing, as a hard red winter wheat.

Feltner explained: "It meets all the objective characteristics of a hard red winter wheat, which includes composition of the kernel and milling and baking qualities, but it doesn't look like a hard red winter wheat." The FGIS until now has classed wheat solely on visual characteristics of kernels.

John Marshall, head FGIS official at the meeting, said the group agreed on three key points:

-more-

1. Objective tests would be better than, or a good supplement to, current visual tests for classifying wheat.

2. Wheat variety and hybrid development programs will increasingly involve crosses between existing market classes that will make visual classification impossible.

3. Objective tests exist that measure "hardness" of pure classes of wheat but have not been refined for mixed classes. Sophisticated tests exist but require expensive equipment and are time-consuming, which is why such tests haven't been routinely adopted by FGIS. FGIS needs tests that are quick and repeatable.

"The FGIS, for its part, will work toward adopting existing technology for objective tests. We will work with researchers by evaluating new approaches, supplying coded samples and by adopting new technologies as they are developed by the researchers," said Marshall.

Feltner said for its part the KAES will alert researchers to the need for more information on such physical properties of wheat as light scattering, granulation and grinding properties. In addition, researchers will be urged to study chemical components that govern physical properties and other characteristics in wheat. This could lead to reliable, fast, objective tests for classifying wheats for the proper market channels.

What does this mean specifically for Arkan wheat?

According to Feltner, developing techniques for properly classifying the newer varieties is possible, but it isn't going to happen overnight. The agencies involved are cooperating, and in the long run this means new wheat hybrids and varieties like Arkan should be able to be properly classified when new procedures and technologies can be adopted by FGIS.

-30-

Crops--Special
A-C-E-F-G-M-P-S-T-U-X

KANSAS STATE UNIVERSITY

Office of Dean of Agriculture
and Director of Agricultural Experiment Station

Waters Hall
Manhattan, Kansas 66506
913-532-6147

September 29, 1983

TO: KAES Department Heads and Branch Station Heads

FROM: Kurt C. Feltner Kurt

RE: Objective Tests for Characteristics in Wheat Important to Its End Use

You are probably familiar with concerns about the Federal Grain Inspection Service (FGIS) being able to properly classify some of the newer wheat varieties and hybrids solely on the basis of visual kernel characteristics. Hybridization techniques and crosses between market classes are becoming common, so the problem will get larger unless objective tests can be developed to supplement (or eventually replace) visual ones.

Some tests exist that can probably be adapted in the short run as back-up to visual tests. However, research is needed that will lead to quick, reliable tests for characteristics important to end use (hardness or other things related to milling).

Please assess the expertise in your unit to determine if research can be reprioritized or if new research can be accommodated to contribute toward this need.

The following are examples of objective tests that might have application:

Physical Properties

Light Scattering
- Near Infrared (NIR)
- Other

Granulation Phenomena
- Particle Size Index
- Other

Physical Mortification
- Grinding Time
- Resistance to Grinding
- Energy Required to Grind
- Other

Chemical Moieties That Govern Physical Properties

Other Related, Suitable Methods

-over-

The need to solve this increasing problem is great, and it is appropriate that the Kansas Agricultural Experiment Station contribute to its solution. Please give this request high priority.

Thank you.

cc: Dunbar, Leland, Rathbone, Stamey, Pomeranz

KCF/pl

KANSAS STATE UNIVERSITY

Office of Dean of Agriculture
and Director of Agricultural Experiment Station

Waters Hall
Manhattan, Kansas 66506
913-532-6147

September 28, 1983

Experiment Station Directors
All Regions

Dear Experiment Station Directors:

You are perhaps aware of a serious concern of the Federal Grain Inspection Service about being able to correctly classify some of the newer wheat varieties and hybrids using the traditional visual kernel characteristics.

Attached is a copy of a recent news release regarding a meeting we (KAES) had with FGIS on the matter. Also enclosed is a copy of a memo sent to our department heads asking them to consider reprioritizing research in order to contribute towards solution of the problem.

The entire wheat industry will eventually be negatively affected if the problem is not solved. Hence, I bring it to your attention in case you have expertise at your station that might appropriately contribute towards solving this growing problem.

I would be happy to provide you with additional background on the issue. Please feel free to call or write me.

Sincerely,

Kurt

Kurt C. Feltner
Associate Director
Agricultural Experiment Station

enc.

KCF/pl

KSU
KANSAS STATE UNIVERSITY

**Office of Dean of Agriculture
and Director of Agricultural Experiment Station**

Waters Hall
Manhattan, Kansas 66506
913-532-6147

September 28, 1983

Orville G. Bentley
Assistant Secretary
Science and Education
USDA
Room 217 W
Administration Building
Washington D.C. 20250

Dear Secretary Bentley:

You are perhaps aware of a serious concern of the Federal Grain Inspection Service about being able to correctly classify some of the newer wheat varieties and hybrids using the traditional visual kernel characteristics.

Attached is a copy of a recent news release regarding a meeting we (KAES) had with FGIS on the matter. Also enclosed is a copy of a memo sent to our department heads asking them to consider reprioritizing research in order to contribute towards solution of the problem.

The entire wheat industry will eventually be negatively affected if the problem is not solved. Hence, I bring it to your attention in the hope that some of the research expertise in the Agricultural Research Service might be redirected toward this growing problem.

I would be happy to provide you with additional background on the issue. Please feel free to call or write me.

Sincerely,

Kurt

Kurt C. Feltner
Associate Director
Agricultural Experiment Station

enc.

KCF/pl

KANSAS STATE UNIVERSITY

Office of Dean of Agriculture
and Director of Agricultural Experiment Station

Waters Hall
Manhattan, Kansas 66506
913-532-6147

fil

September 28, 1983

C.W. Donoho, Jr.
Administrative Advisor, NC-151
Ohio Agricultural Research and Development Center
Wooster, Ohio 44691

Dear Director Donoho:

You are perhaps aware of a serious concern of the Federal Grain Inspection Service about being able to correctly classify some of the newer wheat varieties and hybrids using the traditional visual kernel characteristics.

Attached is a copy of a recent news release regarding a meeting we (KAES) had with FGIS on the matter. Also enclosed is a copy of a memo sent to our department heads asking them to consider reprioritizing research in order to contribute towards solution of the problem.

The entire wheat industry will eventually be negatively affected if the problem is not solved. Hence, I bring it to your attention in the hope that your regional research committee might want to consider revisions in their objectives and research priorities.

I would be happy to provide you with additional background on the issue. Please feel free to call or write me.

Sincerely,

Kurt

Kurt C. Feltner
Associate Director
Agricultural Experiment Station

enc.

KCF/pl

Attachment No. 2

KS79H69
SAGE/ARTHUR

KS79H69 is a selection from the cross Sage/Arthur. This cross was made by Dr. Ronald W. Livers at Hays the winter of 1970-71. KS79H69 is an increase of an F_6 plant row grown at Columbus, Kansas in 1977.

KS79H69 was tested in replicated performance tests at Columbus in 1978 and Parsons in 1979. It was tested in the KIN in 1980 and the KIN, SRPN, and Eastern Kansas variety tests in 1981 (see attached performance data, Table 1-3).

Agronomic Characteristics

Height: short with good straw strength, normally same height as Newton.

Coleoptile Length: 118% of Eagle and 139% of Newton (3-year average)

Maturity: early, same as Triumph 64. In 1981 it was 3-5 days earlier than Newton in Eastern Kansas.

Winterhardiness: between Tascosa and Scout, probably closer to Scout hardiness. The following are the average survival percentages recorded at Fargo, ND in 1980: KS79H69, 80%; Scout, 90%; Newton, 50%; and Tascosa, 50%.

Test Weight: lower than Newton in 1981 but this would be expected as a result of the advantage later varieties had. In the 1980 KIN, KS79H69 equaled Newton in test weight (7 station average).

Seed Size: 1000 kernel weights determined on samples from Hays and Hesston in 1980, and Hays and Oxford in 1981 averaged 30.6 g for KS79H69 and 28.4 g for Newton.

Milling and Baking Quality

KS79H69 has very good hard wheat milling and baking quality (Table 4). It has averaged 1% more grain protein than Newton. It has a medium to slightly longer than medium mixing time with an excellent loaf volume. KS79H69 in the 1980 KIN was rated as having particularly promising overall quality characteristics.

Disease and Insect Resistance

KS79H69 is resistant to soilborne mosaic virus, leaf rust (Lr 24), stem rust (Sr 24 and possibly Sr 2, Sr 9d, and Sr 17), powdery mildew (Pm 2), Cephalosporium leaf stripe, and Hessian fly (H_3). It is susceptible to barley yellow dwarf mosaic virus and very susceptible to wheat streak mosaic virus.

Area of Adaptation

KS79H69 is best adapted to Southeast and the continuously cropped area of Southcentral Kansas. With its improved yield, short stature, early maturity, disease and insect resistance it should be a logical choice in areas where early maturing varieties have traditionally done well. It may also be important in areas that have experienced emergence problems with semidwarf wheats or Hessian fly infestations.

It should not be recommended in Western Kansas due to its increased shattering tendency and its susceptibility to wheat streak mosaic virus.

50 bu. 54# (WSMV) but high gram... Atch. 2

Table 1. Yield and test weight of KS79H69 and checks in Southeast Kansas from 1978 to 1980.

	Columbus 1978		Parsons 1979		Parsons 1980 (KIN)	
	bu/ac	lbs/bu	bu/ac	lbs/bu	bu/ac	lbs/bu
KS79H69	47	59.1	67	63.0	34	56.6
Newton	--	----	69	62.0	30	57.4
Tmp 64	44	60.8	64	65.1	--	----

Table 2. Yields of KS79H69 and other early wheat varieties compared to Newton grown in the 1981 variety tests in continuous wheat growing areas of SE and SC Kansas.

	Parsons yield % of avg	Oxford yield % of avg	Hesston yield % of avg	Hutchinson yield % of avg	4-Station Avg yield % of avg	lbs/bu
KS79H69	103	104	112	107	107	57.7
Tmp 64	92	95	106	92	96	60.0
Trison	88	81	105	96	93	59.1
Parker 76	93	95	89	105	96	59.8
Wings	106	86	77	108	94	59.3
Vona	107	80	106	108	100	58.8
HW1001	104	92	95	109	100	59.0
SR4685	93	95	89	105	96	57.7
Newton	111	133	103	101	112	59.3

Table 3. Yield (as percent of average yield) of KS79H69 and Newton in SE and SC Kansas in the 1980 and 81 KIN.

	1980 Parsons	1980 Hutchinson	1981 Oxford	1981 Caldwell	1981 Hutchinson	Average
KS79H69	125	150	112	116	89	118
Newton	110	82	117	97	122	106
LSD (.05)	19%	34%	18%	20%	---	---

Table 4. Chemical, Milling, and Baking Data for KS79H69 Collected by Karl Finney in in 1979 and 1980.

	Wheat			Flour		Bread-baking Data			
	Wt per bu lbs	Protein %	Flour Yield &	Ash	Protein %	Absorption %	Mixing time corrected Min	Crumb grain	Loaf volume cc
Parsons, 1979									(Corrected to 11% P)
Newton	63.2	11.4	73.6	.43	10.1	55.4	2 3/4	S	931
KS79H69	63.1	12.2	76.5	.41	10.9	55.1	2 5/8	S	931
KIN Eastern Kansas, 1980									(Corrected to 14% P)
Eagle	59.3	15.1	73.5	.38	14.1	59.0	5 3/4		1098
Newton	59.2	13.9	74.1	.35	12.8	56.7	4 3/4		1151
KS79H69	59.6	14.7	76.6	.41	13.9	57.3	4		1117*
KIN Western Kansas, 1980									(Corrected to 12.5% P)
Eagle	60.7	13.3	76.4	.39	12.5	61.1	5 7/8		985
Newton	60.5	12.4	74.5	.38	11.3	57.6	4 1/4		1034
KS79H69	59.9	13.5	77.0	.43	12.5	56.5	3 3/4		1028*

* Dr. K. F. Finney (Hard Winter Wheat Quality Laboratory) rated KS79H69 as having particularly promising overall quality characteristics.

Yield (percent of average) and test weight of KS79H69 compared with four early varieties and Newton in wheat performance tests in SE and SC Kansas in 1981[1/].

	Parsons	Oxford[2/]	Hesston	Hutchinson	4 sta. avg.
			Yield, % test avg.		
KS79H69	103	104	112	107	107
Tmp 64	92	95	106	92	96
Trison	88	81	105	96	93
Wings	106	86	77	108	94
Vona	107	80	106	108	100
Newton	111	133	103	101	112
			Test weight, pounds per bushel		
KS79H69	57.8	58.1	55.0	59.8	57.7
Tmp 64	60.0	61.2	56.8	61.9	60.0
Trison	59.8	58.8	57.3	60.3	59.1
Wings	60.0	60.8	54.3	61.0	59.3
Vona	59.3	57.8	56.0	62.1	58.8
Newton	59.0	61.2	54.3	62.8	59.3

[1/] See 1981 Kansas Wheat Performance tests for more information

[2/] WSBM affected the results at this location

Chemical, milling, and baking data of KS79H69 compared with Eagle and Newton for 1979 and 1980. Data from USDA Hard Wheat Quality Laboratory, Manhattan.

	Wheat			Flour		Bread-baking data		
	Test wt. ppb	Protein %	Flour yield	Ash %	Protein %	Absorption %	Mixing time corrected min.	Loaf volume cc (corrected for protein)
Parsons, 1979								
Newton	63.2	11.4	73.6	.43	10.1	55.4	2 3/4	931 (11%)
KS79H69	63.1	12.2	76.5	.41	10.9	55.1	2 5/8	931
KIN Eastern Kansas, 1980								
Eagle	59.3	15.1	73.5	.38	14.1	59.0	5 3/4	1098 (14%)
Newton	59.2	13.9	74.1	.35	12.8	56.7	4 3/4	1151
KS79H69	59.6	14.7	76.6	.41	13.9	57.3	4	1117
KIN Western Kansas, 1980								
Eagle	60.7	13.3	76.4	.39	12.5	61.1	5 7/8	985 (12.5%)
Newton	60.5	12.4	74.5	.38	11.3	57.6	4 1/4	1034
KS79H69	59.9	13.5	77.0	.43	12.5	56.5	3 3/4	1028

* * * * *

Joe Martin

KS79H69 is a selection of Sage/Arthur cross made in 1970-71. KS79H69 is an increase of an F_6 plant in 1977. It has been tested since 1978. It was in the 1980 and 1981 KIN trial, 1981 SRPN, and eastern KS performance tests.

KS79H69 has a short stiff straw with a long coleoptile (118% of Eagle and 139% of Newton for a three-year average). It matures about the same time as Triumph 64. It is nearly as winterhardy as Scout. The test weight may be below average - it was good in 1980 but did not have a good test weight in 1981. Kernel weight exceeds Newton - 1000 kernel weight for 1980 and 1981 at Hays and Hesston was 30.6 g compared with 28.4 g for Newton.

KS79H69 has good hard wheat milling and baking properties. It appears to have higher protein content than Newton, slightly shorter mixing time and about the same loaf volume potential.

KS79H69 resists WSBM, leaf rust (race LR24) and stem rust (SR24 and perhaps others), powdery mildew (Pm2), Cephalosporium leaf stripe, and Hessian fly (H3). It is susceptible to BYDV and WSM.

Because of its early maturity, it should replace types like Triumph. The short, stiff straw and pest resistance are added features.

Performance data are given in the following tables.

Yield and test weight of KS79H69 and checks in Southeast KS 1978 to 1980.

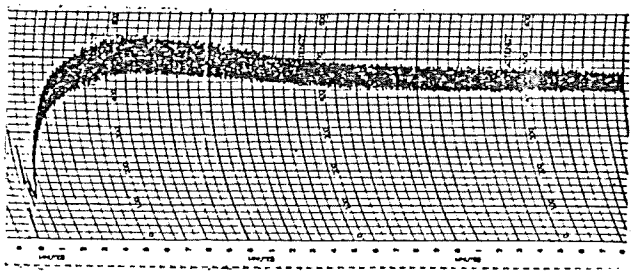
	Columbus 1978		Parsons 1979		Parsons 1980 (KIN)	
	bpa	ppb	bpa	ppb	bpa	ppb
KS79H69	47	59.1	67	63.0	34	56.6
Newton	--	--	69	62.0	30	57.4
Tmp 64	44	60.8	64	65.1	--	--

Yield (percent of average) at selected sites for KS79H69 and Newton in the KIN trials. 1/

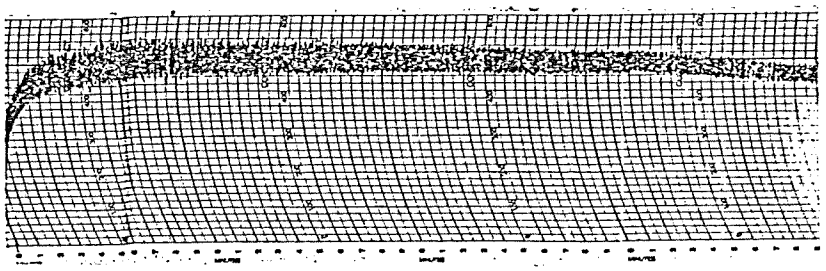
	1980 Parsons	1980 Hutchinson	1981 Oxford	1981 Caldwell	1981 Hutchinson	Avg.
KS79H69	125	150	112	116	89	118
Newton	110	82	117	97	122	106
LSD (.05)	19	34	18	20	23	---

1/ For statewide performance see the 1980 and 1981 KIN reports.

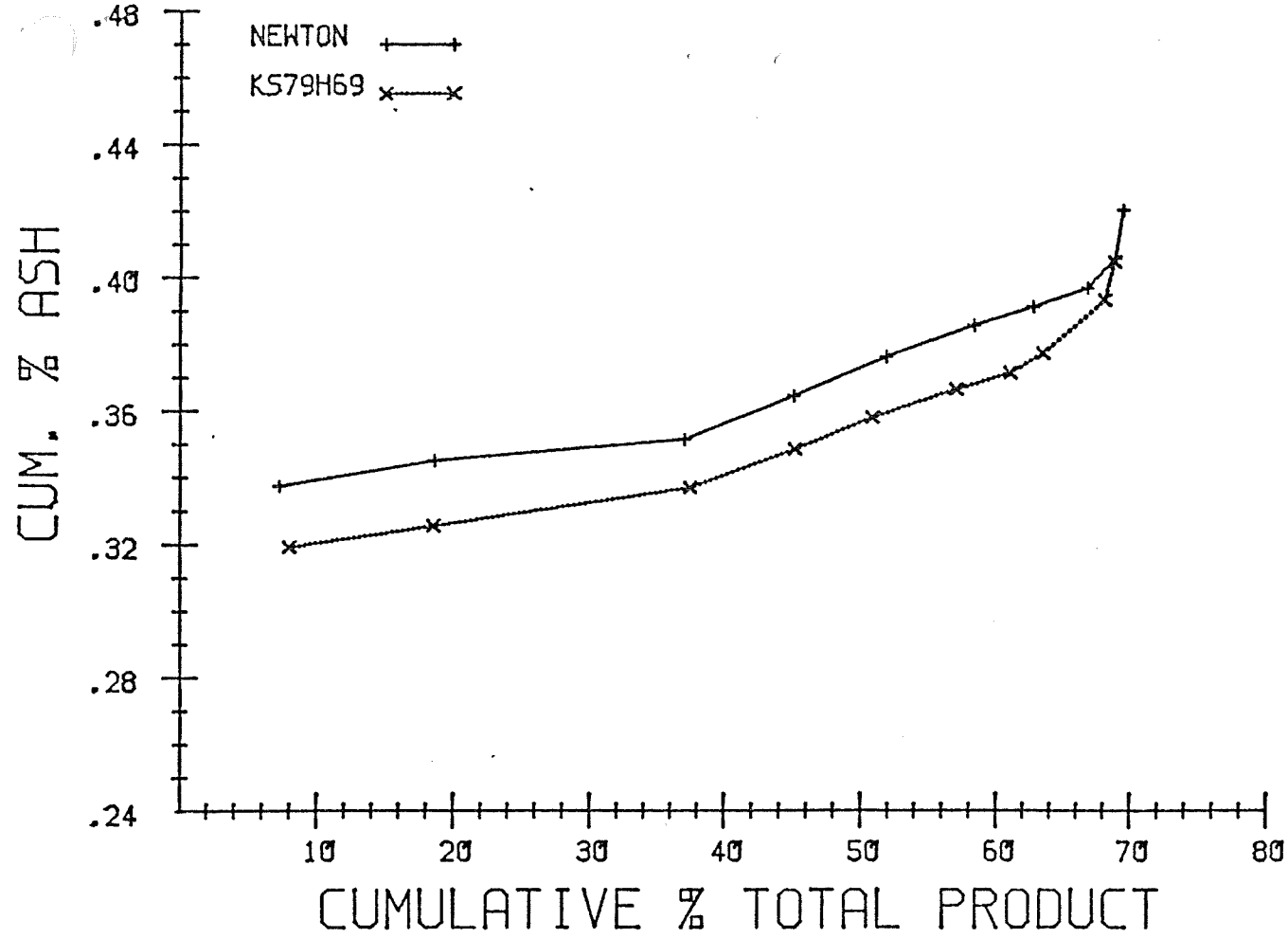
Variety	Newton	KS 79H69
Wheat Data		
Protein (14% M.B. & N x 5.7)	13.3	15.0
Ash (%) (14% M.B.)	1.5	1.5
Straight Grade Flour Data		
Extraction %	69.58	68.94
Protein % (14% M.B.)	12.1	13.7
Ash % (14% M.B.)	.44	.41
Farinograph Data		
Arrival Time, Min.	3.5	3.0
Peak Time, Min.	8.0	10.5
Stability, Min.	10.5	34.0
M.T.I.	45	10
Absorption, %	62.17	62.86
Valorimeter	71	97

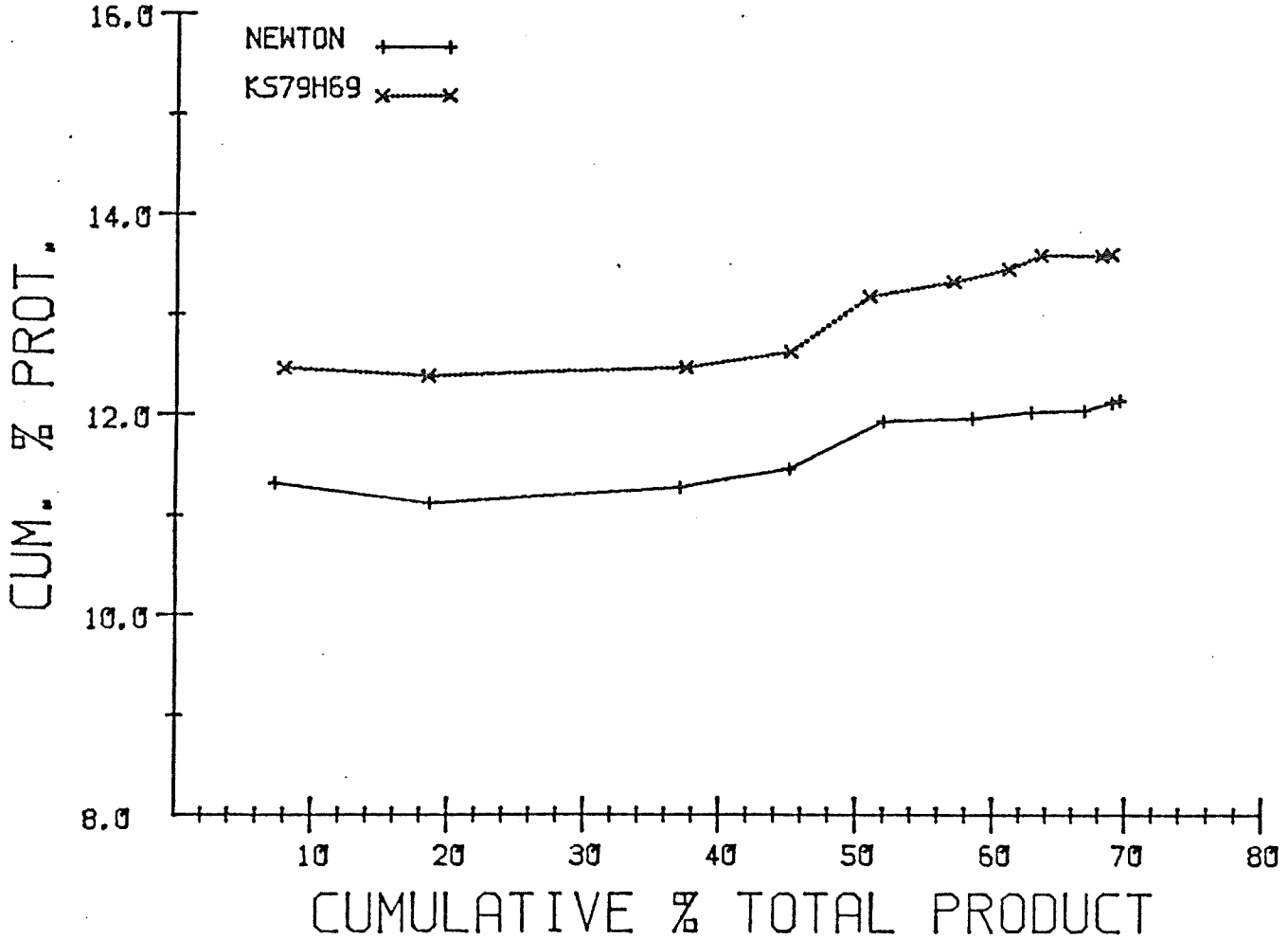


Newton



KS 79H69


NEWTON
KS79H69
.48
.44
.40
.36
.32
.28
.24
CUM. % ASH
10
20
30
40
50
60
70
80
CUMULATIVE % TOTAL PRODUCT


NEWTON
KS79H69
16.0
14.0
12.0
10.0
8.0
CUM. % PROT.
10
20
30
40
50
60
70
80
CUMULATIVE % TOTAL PRODUCT

CODE NUMBER				
VARIETY		NEWTON	KS79H69	
1 WHEAT PROTEIN %		13.3	15.0	
2 FLOUR PROTEIN %		12.1	13.7	
3 TEST WEIGHT (LBS./BU)		- - -	- - -	
4 1000 KERNEL WEIGHT (GRAMS)		- - -	- - -	
5 FLOUR EXTRACTION %		69.58	68.94	
6 FLOUR ASH %		.44	.41	
7 FARINOGRAPH	ABSORPTION %	62.17	62.86	
	ARRIVAL TIME	3.5	3.0	
	PEAK	8.0	10.5	
	STABILITY	10.5	34.0	

8 BAKE MIXING TIME Very Long Long Medium Short Very Short	3.25	4.75	
9 DOUGH CHARACTERISTICS Bucky-Tough Strong-Elastic Medium-Pliable Mellow-Very-Pliable Weak-Short or Sticky	3.25	4.25	
10 BAKE ABSORPTION Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.50	
11 LOAF VOLUME Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.50	
12 GRAIN AND TEXTURE Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.00	
13 MIXING TOLERANCE Much More Tolerance Than Check More Tolerance Than Check Tolerance Equivalent to Check Less Tolerance Than Check Much Less Tolerance Than Check	3.00	3.50	
14 OVER ALL BAKING QUALITY Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.25	

*Significant at 5% Level
**Significant at 1% Level

1982 KANSAS PRELIMINARY

Two large scale samples were submitted in 1982, Newton and Arkan (KS79H69). Samples were composites of equal amounts of grain harvested at Hutchinson, Hays, Colby and Garden City.

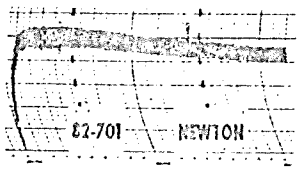
Arkan is a hard red winter wheat selected from the cross Sage/Arthur. The cross was made by Dr. R. W. Livers in 1970 at the Fort Hays Branch Agricultural Experiment Station, Hays, Kansas.

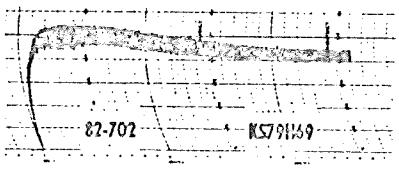
Arkan is a early maturing semidwarf wheat, primarily adapted to the continuously cropped regions of Southeast and South Central Kansas. Within Arkan's area of adaptation, its grain yield and test weight have been equal to that of Newton. Based on composite grain samples from the regional and state performance tests, Arkan has very good overall hard-wheat milling and bread-making properties. It has a somewhat longer than medium mixing time and a very good loaf volume potential. Grain and flour protein contents of Arkan have averaged 1% more than those of Newton.

Arkan has a number of important advantages over currently grown varieties. It is almost equal to Scout in winter hardiness, it has a coleoptile length equal to most standard height wheats, and it carries resistance to soilborne mosaic virus, leaf rust, stem rust, Cephalosporium leaf stripe, powdery mildew, and Hessian fly.

Arkan was distributed to Kansas registered seed growers in 1982.

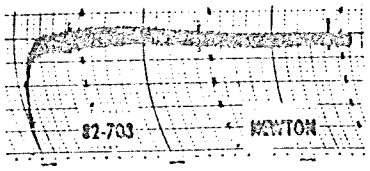
LOCATION	HAYS	
Code No.	82-701	82-702
Variety	Newton	KS79H69
Wheat Data		
U. S. Bushel Weight (lbs.)	61.9	60.0
Hectoliter Weight (KG)	79.73	77.28
1000 Kernel Weight (G) (14% M.B.)	28.44	28.78
Density (g/cc)	1.396	1.383
Pearling Value	78.95	74.30
Overs 7W (%)	51.5	65.5
9W (%)	48.0	34.0
12W (%)	0.5	0.5
Theoretical yield %	75.55	76.25
Protein (14% M.B. & N x 5.7)	10.0	11.7
Ash (%) (14% M.B.)	1.6	1.5
Straight Grade Flour Data		
Extraction %	71.45	71.80
Protein % (14% M.B.)	8.9	10.5
Ash% (14% M.B.)	0.41	0.42
Farinograph Data		
Arrival Time, Min.	1.0	1.5
Peak Time, Min.	5.5	5.5
Stability, Min.	11.0	11.5
M.T.I.	20	35
Absorption, %	56.8	58.2
Valorimeter	64	69

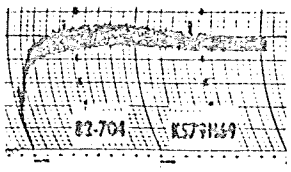




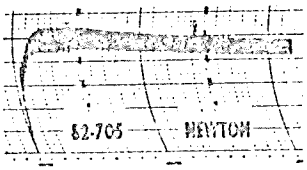
KANSAS PRELIMINARY SAMPLES

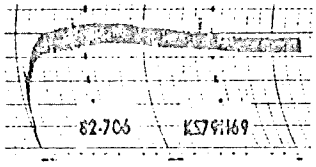
LOCATION	GARDEN CITY	
Code No.	82-703	82-704
Variety	Newton	KS79H69
Wheat Data		
U. S. Bushel Weight (lbs.)	60.6	58.5
Hectoliter Weight (KG)	78.05	75.35
1000 Kernel Weight (G) (14% M.B.)	33.84	28.90
Density (g/cc)	1.400	1.378
Pearling Value	76.60	75.70
Overs 7W (%)	71.5	53.0
9W (%)	28.0	46.5
12W (%)	0.5	0.5
Theoretical yield %	76.55	75.62
Protein (14% M.B. & N x 5.7)	11.7	12.5
Ash (%) (14% M.B.)	1.7	1.7
Straight Grade Flour Data		
Extraction %	70.28	70.78
Protein % (14% M.B.)	10.8	11.9
Ash % (14% M.B.)	0.48	0.51
Farinograph Data		
Arrival Time, Min.	2.0	3.0
Peak Time, Min.	8.0	8.0
Stability, Min.	24.0	15.0
M.T.I.	20	25
Absorption, %	60.6	59.8
Valorimeter	74	74



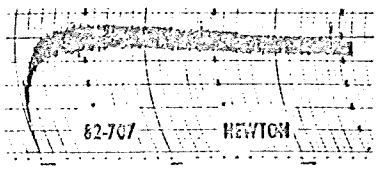


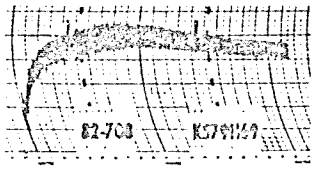
LOCATION	COLBY	
Code No.	82-705	82-706
Variety	Newton	KS79H69
Wheat Data		
U. S. Bushel Weight (lbs.)	58.2	58.5
Hectoliter Weight (KG)	74.96	75.35
1000 Kernel Weight (G) (14% M.B.)	28.71	29.04
Density (g/cc)	1.402	1.406
Pearling Value	75.10	72.72
Overs 7W (%)	50.5	62.0
9W (%)	48.5	37.5
12W (%)	1.0	0.5
Theoretical yield %	75.47	76.07
Protein (14% M.B. & N x 5.7)	10.2	11.8
Ash (%) (14% M.B.)	1.7	1.7
Straight Grade Flour Data		
Extraction %	70.72	72.32
Protein % (14% M.B.)	9.2	10.7
Ash % (14% M.B.)	0.40	0.43
Farinograph Data		
Arrival Time, Min.	1.5	2.0
Peak Time, Min.	5.5	7.0
Stability, Min.	12.5	13.5
M.T.I.	30	25
Absorption, %	54.0	56.6
Valorimeter	64	73



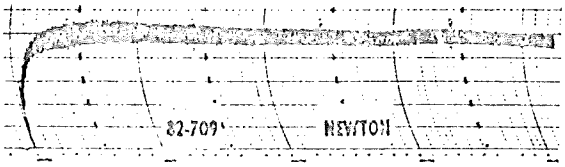


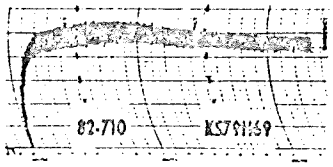
LOCATION	HESSTON	
Code No.	82-707	82-708
Variety	Newton	KS79H69
Wheat Data		
U. S. Bushel Weight (lbs.)	50.6	56.8
Hectoliter Weight (KG)	65.17	73.16
1000 Kernel Weight (G) (14% M.B.)	19.29	24.40
Density (g/cc)	1.385	1.383
Pearling Value	80.18	70.35
Overs 7W (%)	11.0	45.5
9W (%)	80.5	52.5
12W (%)	8.5	2.0
Theoretical yield %	73.04	75.16
Protein (14% M.B. & N x 5.7)	13.8	14.0
Ash (%) (14% M.B.)	2.0	1.8
Straight Grade Flour Data		
Extraction %	65.16	70.74
Protein % (14% M.B.)	13.1	13.0
Ash % (14% M.B.)	0.53	0.45
Farinograph Data		
Arrival Time, Min.	2.5	4.5
Peak Time, Min.	8.5	9.0
Stability, Min.	20.0	11.0
M.T.I.	15	35
Absorption, %	59.0	61.8
Valorimeter	74	77



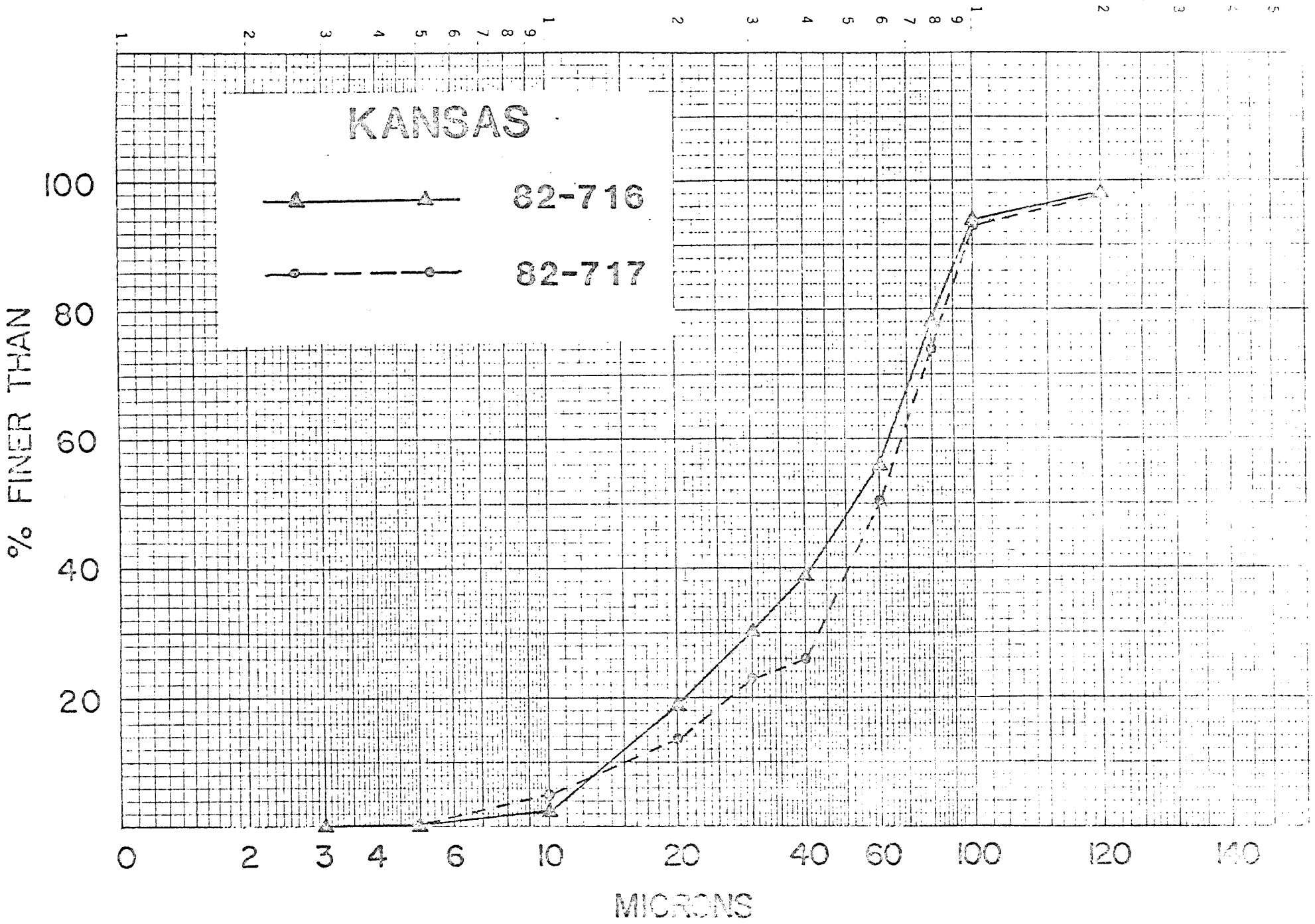


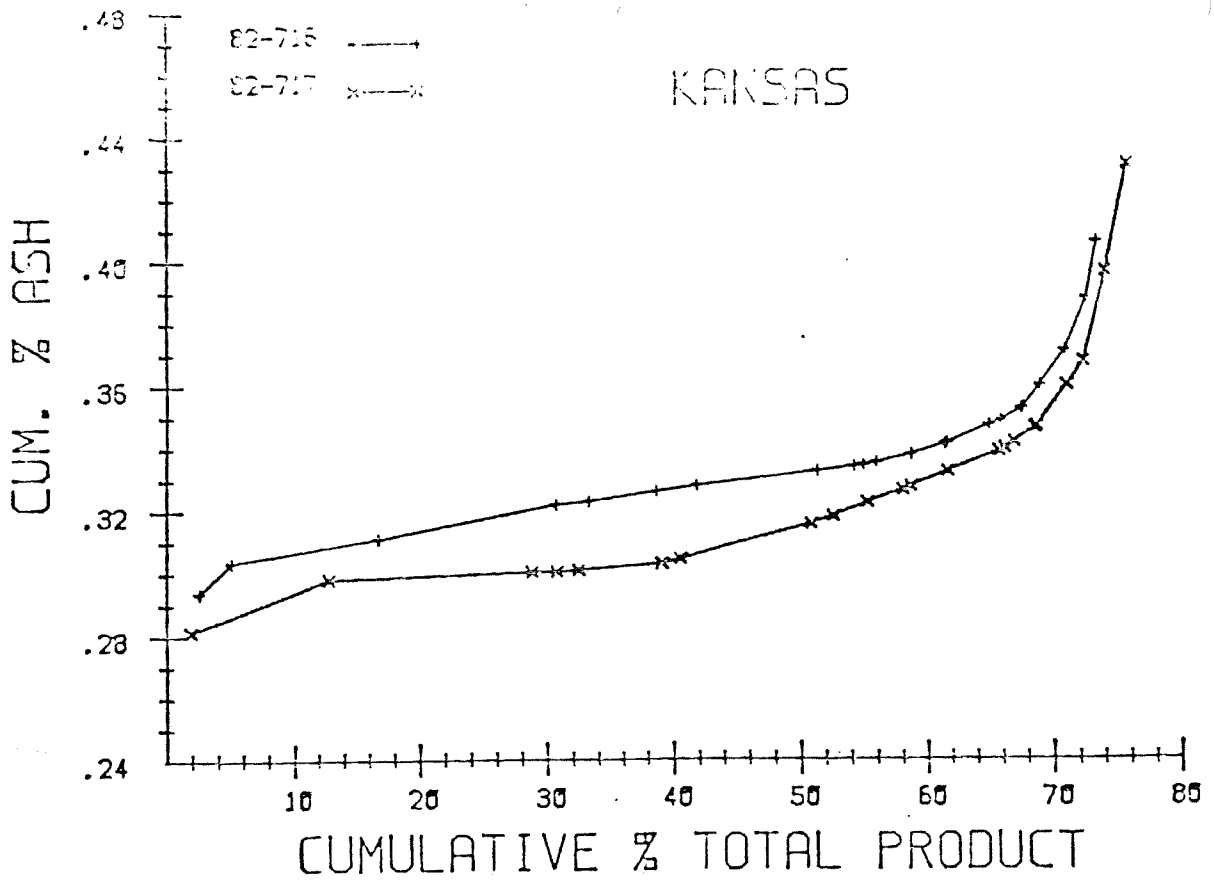
LOCATION	HUTCHINSON	
Code No.	82-709	82-710
Variety	Newton	KS79H69
Wheat Data		
U. S. Bushel Weight (lbs.)	57.1	59.8
Hectoliter Weight (KG)	73.55	77.02
1000 Kernel Weight (G) (14% M.B.)	22.17	30.57
Density (g/cc)	1.373	1.364
Pearling Value	77.00	57.82
Overs 7W (%)	10.5	79.5
9W (%)	85.0	20.0
12W (%)	4.5	0.5
Theoretical yield %	73.26	76.95
Protein (14% M.B. & N x 5.7)	12.2	13.2
Ash (%) (14% M.B.)	1.6	1.6
Straight Grade Flour Data		
Extraction %	68.43	70.75
Protein % (14% M.B.)	11.3	12.1
Ash % (14% M.B.)	0.43	0.42
Farinograph Data		
Arrival Time, Min.	2.0	2.5
Peak Time, Min.	8.0	8.5
Stability, Min.	39.5	15.0
M.T.I.	10	30
Absorption, %	58.4	61.6
Valorimeter	76	78

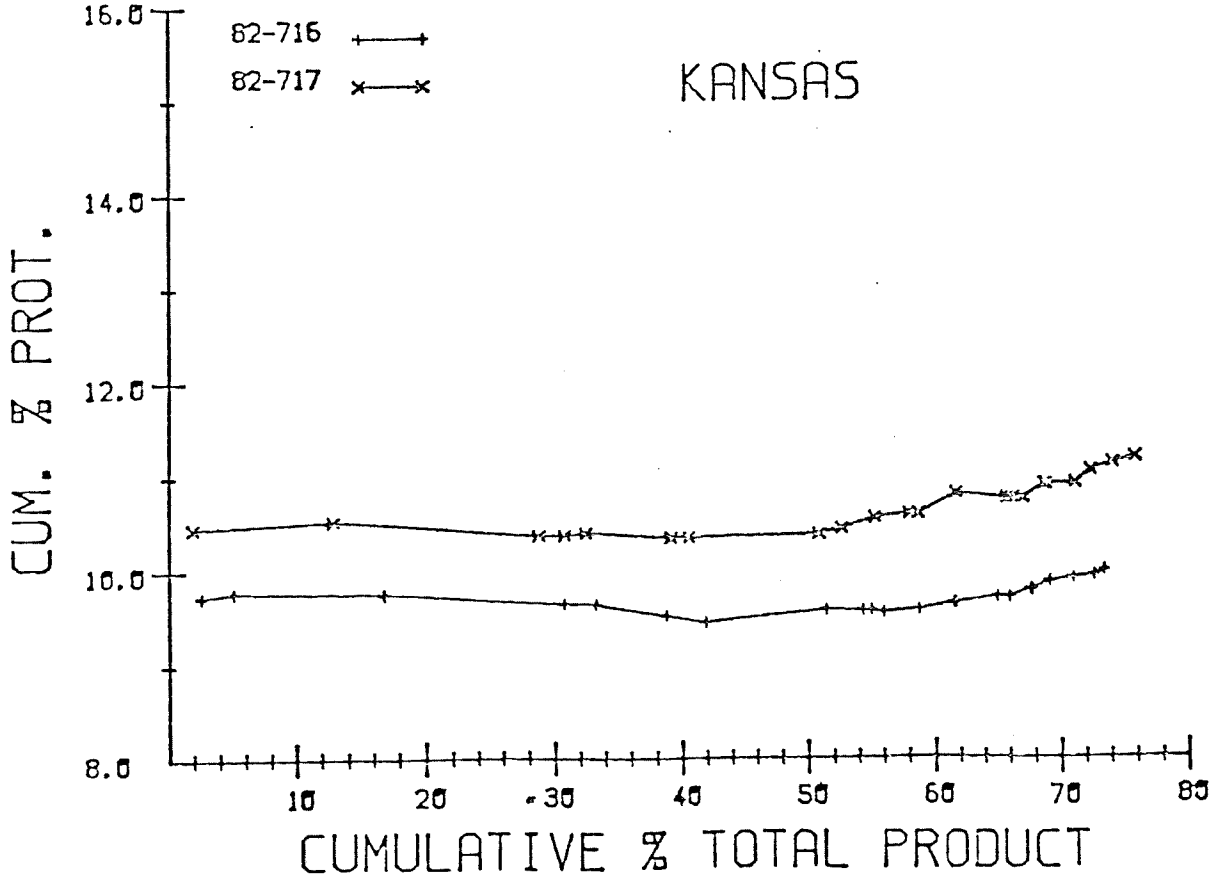


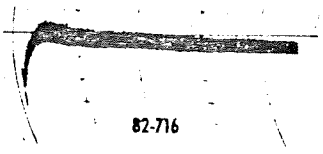
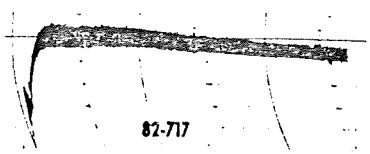
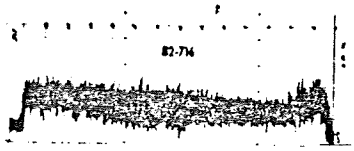
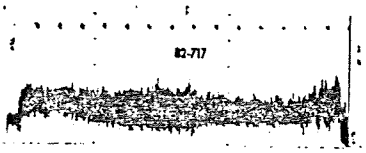
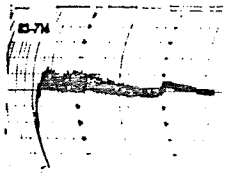
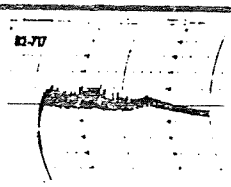
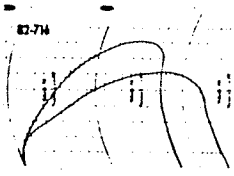
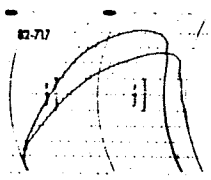
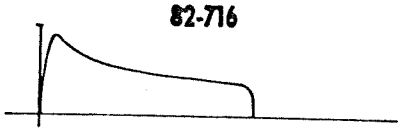
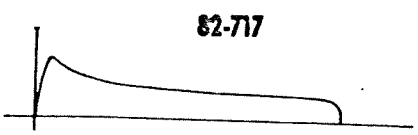


Code No. / Variety	82-716 (Control) Newton	82-717 KS 79H69
Wheat Data		
U.S. Bushel Weight (lbs.)	61.2	60.7
Hectoliter Weight (kg)	78.83	78.18
1000 Kernel Weight (g) (14% M.B.)	27.87	29.07
Density (gm/cc)	1.397	1.404
Pearling Value	74.92	69.13
Overs 7W (%)	49.0	64.5
9W (%)	49.5	35.5
12W (%)	1.5	0
Theoretical Yield (%)	75.36	76.23
Sedimentation (14% M.B.)	52.9	58.8
Protein (%) (14% M.B. & N x 5.7)	11.2	12.1
Ash (%) (14% M.B.)	1.5	1.5
Milling Data - Cal. Grades & Values		
Patent (%)	60.806	66.391
Ash (%)	.34	.34
Value/cwt.	$10.00	$10.00
Value	$ 6.081	$ 6.639
1st Clear (%)	12.066	2.536
Ash (%)	.70	.70
Value/cwt.	$ 8.40	$ 8.40
Value	$ 1.014	$ 0.213
2nd Clear (%)	0.529	6.893
Ash (%)	1.20	1.20
Value/cwt.	$ 7.80	$ 7.80
Value	$ 0.041	$ 0.538
Remaining Clear (%)	-	-
Ash (%)	-	-
Value/cwt.	-	-
Value	-	-
Millfeed (%)	26.596	24.180
Value/cwt.	$ 5.00	$ 5.00
Value	$ 1.330	$ 1.209
Total Value/100 lbs. Wheat	$ 8.466	$ 8.599
Straight Grade Flour Data		
Extraction (%)	73.40	75.82
Protein (%) (14% M.B.)	10.0	11.3
Ash (%) (14% M.B.)	.40	.42
Glutomatic (wet)	23.8	28.8
Glutomatic (dry)	9.3	11.1
K.J. Color		
Agtron Color (green)	67.0	62.0
Starch Damage		
Farrand Units		
Modified AACC	8.45	8.95
Falling Number (Sec.) Untreated	413	431
Maltose	134	146
Average Micron Size		
Fisher S.S.S.	17.50	19.33
M.S.A. Sedimentation	52	59
% Between 17 & 35 Microns	22.0	20.0


KANSAS
82-716
82-717
% FINER THAN
100
80
60
40
20
0
2
3
4
6
10
20
40
60
100
120
140
MICRONS


82-716
82-717
KANSAS
CUM. % ASH
.48
.44
.40
.36
.32
.28
.24
10
20
30
40
50
60
70
80
CUMULATIVE % TOTAL PRODUCT


82-716
82-717
KANSAS
CUM. % PROT.
16.0
14.0
12.0
10.0
8.0
10
20
30
40
50
60
70
80
CUMULATIVE % TOTAL PRODUCT

		82-716	82-717
			
FARINOGRAM	Arrival Time, min.	1.5	2.0
	Peak Time, min.	3.0	7.0
	MTI	40	30
	Valorimeter	58	79
	Absorption, %	57.5	58.2
	Stability, min.	12.5	16.0
			
MIXOGRAM	Point of Minimum Mobility		
	Peak Time, min.	5 3/4	5 1/2
			
RHEOGRAM	Absorption, %	60.0	61.0
	Fatigue Time, min.	27.8	29.6
			
RESISTOGRAM	Optimum Time, min.	15.5	13.0
	Absorption, % (14 M.B.)	55.4	56.7
	Time: 45 min. (lower) 135 min. (upper)		
EXTENSIGRAM	Data: (135 min. curve)	186.04	214.42
	Area - cm^2	600.00	700.00
	Resis. - 5 cm B.U.	810.00	960.00
	Resis. Peak B.U.	18.00	18.00
	Extensibility cm		
		 82-716	 82-717
ALVEOGRAM	Resis. x 1.6 mm	70.1	53.1
	Alveo. Area cm^2	32.8	30.2
	Extensibility, mm	118.0	167.4
	W, x 10^3 ERGS	214.5	197.5

CODE NUMBER		82-716	82-717	
VARIETY		NEWTON	KS79H69	
1 WHEAT PROTEIN %		11.2	12.1	
2 FLOUR PROTEIN %		10.0	11.3	
3 TEST WEIGHT (LBS./BU)		61.2	60.7	
4 1000 KERNEL WEIGHT (GRAMS)		27.87	29.07	
5 FLOUR EXTRACTION %		73.40	75.82	
6 FLOUR ASH %		.40	.42	
7 FARINOGRAPH	ABSORPTION %	57.5	58.2	
	ARRIVAL TIME	1.5	2.0	
	PEAK	3.0	7.0	
	STABILITY	12.5	16.0	

8 BAKE MIXING TIME Very Long Long Medium Short Very Short	3.32	3.08	
9 DOUGH CHARACTERISTICS Bucky-Tough Strong-Elastic Medium-Pliable Mellow-Very-Pliable Weak-Short or Sticky	3.27	3.04	
10 BAKE ABSORPTION Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.73 **	
11 LOAF VOLUME Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.85 **	
12 GRAIN AND TEXTURE Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.42 **	
13 MIXING TOLERANCE Much More Tolerance Than Check More Tolerance Than Check Tolerance Equivalent to Check Less Tolerance Than Check Much Less Tolerance Than Check	3.00	3.08	
14 OVER ALL BAKING QUALITY Much Better Than Check Better Than Check Equivalent to Check Poorer Than Check Much Poorer Than Check	3.00	3.65 **	

*Significant at 5% Level
**Significant at 1% Level

Comments of the Collaborators

KANSAS

Control	82-716	Newton
Exp	82-717	KS79H69

Milling

Experimental 82-717 was found to have good milling properties with a lower cumulative flour ash and good protein recovery. The experimental was also shown to have a larger kernel size than the Newton control.

Baking

The experimental 82-717 was found to have significantly better bake absorption, loaf volume, grain and texture and over-all baking quality. However, it should be noted that the protein content of the experimental was approximately one percent higher and may have influenced the results.

SUPPLEMENTAL STUDY OF ARKAN WHEAT

Purpose:

The purpose of this study was to make a preliminary investigation of the wheat variety, Arkan, when compared to existing Hard Red Winter Wheat varieties grown at the same location.

Methods:

Samples of Arkan wheat were collected from various locations in Kansas, as well as samples of several existing Hard Red Winter varieties grown at the same locations. Physical wheat tests were first performed on each sample according to the approved methods for these tests.

All samples were tempered to 16% moisture for approximately 24 hours prior to milling on a Buhler Experimental Mill. Straight grade flour samples obtained were coded and sent to a private milling company laboratory for moisture, protein and ash analysis. Agtron color, farinograph and test baking analysis was also performed by the lab.

Each of the wheat samples tested were also coded and sent to the Federal Grain Inspection Service for a determination of wheat class.

Results:

Results of sample testing are given in the attached tables. The mill control laboratory judged the flours as to how well they would each bake a white pan bread. Ratings were given as follows:

A = Excellent characteristics
B = Good quality for bakers mix
C = Deficient quality in one or more areas
X = Undesirable characteristics for baking

Conclusions:

All samples of Arkan tested were found to have comparable physical qualities and milling characteristics when compared with the other Hard Red Winter Wheats.

In examining the farinograph data and baking data, it is difficult to make comparisons between the Arkan variety and some of the other Hard Red Winter Wheat varieties tested due to wide spreads in protein control. Overall, Arkan's performance in the bake tests was as good as or better than the other varieties tested at virtually all protein levels.

RESULTS OF THE GRADING OF THE SAMPLES
FOR CLASS IDENTIFICATION PERFORMED BY
F.G.I.S ARE AS FOLLOWS:

CODE	VARIETY	CLASSIFICATION
AR 10	Newton	H.R.W.
AR 11	ARkan	Predominate S.R.W. with some H.R.W.
AR 12	Newton	H.R.W.
AR 13	TAM 105	H.R.W.
AR 14	Akan	Predominate S.R.W. with some H.R.W.
AR 15	Brule	H.R.W.
AR 16	TAM 101	H.R.W.
AR 17	Newton	H.R.W.
AR 18	Arkan	S.R.W.
AR 19	TAM 105	H.R.W.
AR 20	Arkan	Predominate S.R.W. with some H.R.W.
AR 21	Newton	H.R.W.
AR 22	Newton	H.R.W.
AR 23	ARkan	Predominate S.R.W. with some H.R.W.
AR 24	Newton	H.R.W.
AR 25	Arkan	Predominate S.R.W. with some H.R.W.
AR 26	Arkan	Predominate S.R.W. with some H.R.W.
AR 27	Newton	H.R.W.
AR 28	TAM 105	H.R.W.
AR 29	Newton	H.R.W.
AR 30	Arkan	Predominate S.R.W. with some H.R.W.

Location	Franklin County	
Variety	Newton	Arkan
Code	AR 24	AR 25
Wheat Data		
Protein (14% MB)	10.3	9.28
Ash(14% MB)	1.7	
Test Weight	61.0	59.1
1000 K. Weight (14%MB)		29.24
Pearling Value	71.65	69.00
Wheat Size %OV7	53.5	59.0
%OV9	46.5	41.0
%OV12	0.0	0.0
Theo. Yield	75.68	75.95
Flour Data		
Flour Extraction	70.93	70.04
Ave. Particle Size	17.0	18.0
Protein (14% MB)	9.64	8.46
Ash (14% MB)	.463	.395
Color	64	74
Farinograph-Data		
Absorption	57.4	52.5
Peak Time	5.75	5.0
Stability	10.25	20.75
M.T.I.	25	10
Bake Data		
Absorption	61.0	55.5
Mix Time	5-5.5	4-4.5
Volume	2890-2800	2555-2585
Crumb Color	OK+	OK
Grain	G/G-	G-/G
Texture	Silky/Sl. Silky	Sl. Weak
Bake Rating	B-	C-
Remarks	Sl. Short Mix	V. Poor Volume Short Mix & Sl. Weak Texture

Location	Marshall County	Sumner County
Variety	Brule	Tam 101
Code	AR 15	AR 16
Wheat Data		
Protein (14% MB)	9.81	11.37
Ash(14% MB)	1.43	1.61
Test Weight	60.8	61.5
1000 K. Weight (14%MB)	32.01	35.76
Pearling Value	69.10	71.60
Wheat Size %OV7	72.5	74.0
%OV9	27.5	26.0
%OV12	0.0	0.0
Theo. Yield	76.63	76.70
Flour Data		
Flour Extraction	75.40	69.60
Ave. Particle Size	25.0	15.4
Protein (14% MB)	8.19	10.36
Ash (14% MB)	.457	.455
Color	67	70
Farinograph Data		
Absorption	53.3	64.7
Peak Time	6.0	23.5
Stability	11.5	25.0
M.T.I.	30	5
Bake Data		
Absorption	56.0	69.5
Mix Time	4-4.5	6.5-7.0
Volume	2450-2445	2845-2920
Crumb Color	OK-	OK+
Grain	Fair to Poor	G- to OK
Texture	Firm to Weak	Sl. Silky to Harsh
Bake Rating	X	C+
Remarks	Poor Bake with V. Low Volume and Short Mix	Sl. Open Grain

Location	McPherson County	
Variety	Newton	Arkan
Code	AR 29	AR 30
Wheat Data		
Protein (14% MB)	9.99	11.33
Ash(14% MB)	1.71	1.63
Test Weight	60.0	58.9
1000 K. Weight (14%MB)	29.72	28.07
Pearling Value	74.75	72.80
Wheat Size %OV7	43.5	55.0
%OV9	56.0	44.5
%OV12	0.5	0.5
Theo. Yield	75.15	75.72
Flour Data		
Flour Extraction	70.75	70.83
Ave. Particle Size	17.6	17.5
Protein (14% MB)	9.05	9.80
Ash (14% MB)	.446	.388
Color	66	69
Farinograph Data		
Absorption	56.9	58.6
Peak Time	4.5	10.5
Stability	10.25	25.0
M.T.I.	25	15
Bake Data		
Absorption	60.0	62.5
Mix Time	4-4.5	6-6.5
Volume	2590-2545	2800-2750
Crumb Color	OK	OK
Grain	G- to OK	G to G-
Texture	Sl. Silky to Sl. Harsh	Silky to Sl. Silky
Bake Rating	C-	B
Remarks	V. Poor Volume, Short Mix & Sl. Open Grain	

Location		McPherson County	
Variety	Arkan	Newton	Tam 105
Code	AR 26	AR 27	AR 28
Wheat Data			
Protein (14% MB)	14.98	10.01	9.31
Ash(14% MB)	1.71	1.52	1.43
Test Weight	58.9	60.7	59.9
1000 K. Weight (14%MB)	28.37	32.00	28.81
Pearling Value	72.75	74.30	75.45
Wheat Size %OV7	49.0	55.5	55.0
%OV9	50.5	44.5	44.5
%OV12	0.5	0.0	0.5
Theo. Yield	75.42	75.78	75.72
Flour Data			
Flour Extraction	70.32	71.16	69.24
Ave. Particle Size	18.7	17.0	19.7
Protein (14% MB)	13.11	9.06	8.22
Ash (14% MB)	.436	.423	.396
Color	65	72	70
Farinograph Data			
Absorption	62.7	54.2	56.9
Peak Time	14.0	6.25	3.75
Stability	18.0	22.0	7.75
M.T.I.	20	10	35
Bake Data			
Absorption	67.5	57.5	59.5
Mix Time	11.5-12.5	4-4.5	4-4.5
Volume	2775-2755	2650-2725	2330-2320
Crumb Color	Sl. Dull	Good	Dull
Grain	Fair to Fair-	Good-	V. Poor
Texture	Sl. Gummy	Sl. Weak	V. Harsh
Bake Rating	C-	C	X
Remarks	Sl. Dull Crumb, Open Grain Sl. Gummy Text., Only Fair Volume & V. Long Mix	Only Fair Volume, Short Mix & Sl. Weak Texture	Very Poor Bake

Location	Dickinson County	
Variety	Newton	Arkan
Code	AR 12	AR 14

Wheat Data

Protein (14% MB)	11.99	11.62
Ash(14% MB)	1.79	1.52
Test Weight	59.6	60.6
1000 K. Weight (14%MB)	29.26	29.83
Pearling Value	72.40	70.65
Wheat Size %OV7	41.5	61.0
%OV9	57.5	39.0
%OV12	1.0	0.0
Theo. Yield	75.02	76.05

Flour Data

Flour Extraction	70.70	71.10
Ave. Particle Size	16.0	19.4
Protein (14% MB)	10.64	10.22
Ash (14% MB)	.431	.431
Color	69	69

Farinograph Data

Absorption	58.3	58.4
Peak Time	7.5	8.25
Stability	15.0	14.25
M.T.I.	25	30

Bake Data

Absorption	61.5	61.5
Mix Time	6.5-7.0	6-6.5
Volume	2915-2825	2850-2975
Crumb Color	OK+	OK
Grain	G	G-
Texture	Silky	Sl. Silky-Silky
Bake Rating	B	B
Remarks		

Location		Osage County	
Variety	Newton	Arkan	Tam 105
Code	AR 10	AR 11	AR 13
Wheat Data			
Protein (14% MB)	10.74	12.25	9.77
Ash(14% MB)	1.71	1.61	1.61
Test Weight	60.2	59.8	57.5
1000 K. Weight (14%MB)	31.41	29.20	26.90
Pearling Value	73.75	70.15	74.55
Wheat Size %OV7	56.0	59.0	46.0
%OV9	44.0	41.0	53.5
%OV12	0.0	0.0	0.5
Theo. Yield	75.80	75.95	75.27
Flour Data			
Flour Extraction	69.94	70.57	70.35
Ave. Particle Size	17.5	17.4	17.6
Protein (14% MB)	9.46	11.02	8.56
Ash (14% MB)	.451	.434	.425
Color	67	67	66
Farinograph Data			
Absorption	55.6	58.0	54.9
Peak Time	5.5	10.0	4.5
Stability	13.0	14.0	11.5
M.T.I.	20	35	25
Bake Data			
Absorption	59.0	62.0	57.5
Mix Time	5.5-6.0	6.5-7	4-4.5
Volume	2845-2695	2935-2895	2550-2535
Crumb Color	OK	Ok-Creamy	Sl. Dull
Grain	G-	G	Poor
Texture	Sl. Silky-Sl. Weak	Silky	Harsh
Bake Rating	C+	B	X
Remarks	Sl. Open Grain & Sl. Short Mix		Poor Bake - Low Volume + Short Mix

Location	Labette County	
Variety	Arkan	Newton
Code	AR 20	AR 21
Wheat Data		
Protein (14% MB)	11.06	10.03
Ash(14% MB)	1.69	1.62
Test Weight	58.7	58.9
1000 K. Weight (14%MB)	23.94	25.51
Pearling Value	77.50	77.90
Wheat Size %OV7	12.0	25.5
%OV9	88.0	75.0
%OV12	0.0	1.5
Theo. Yield	73.60	74.45
Flour Data		
Flour Extraction	70.77	68.05
Ave. Particle Size	18.6	18.1
Protein (14% MB)	9.84	8.95
Ash (14% MB)	.426	.426
Color	70	75
Farinograph Data		
Absorption	55.7	54.2
Peak Time	13.0	6.0
Stability	25.0	25+
M.T.I.	20	10
Bake Data		
Absorption	59.0	57.0
Mix Time	7-7.5	4-4.5
Volume	2805-2800	2620-2550
Crumb Color	OK	OK+
Grain	G	G to G-
Texture	Silky	Sl. Weak
Bake Rating	B	C-
Remarks		Poor Volume, Sh. Mix Sl. Weak Texture.

Location		Rice County	
Variety	Newton	Arkan	Tam 105
Code	AR 17	AR 18	AR 19
Wheat Data			
Protein (14% MB)	13.53	12.30	12.70
Ash(14% MB)	1.61	1.61	1.60
Test Weight	59.5	63.1	60.1
1000 K. Weight (14%MB)	25.81	37.22	28.49
Pearling Value	78.85	70.65	77.65
Wheat Size %OV7	11.0	88.0	33.0
%OV9	88.5	12.0	67.0
%OV12	0.05	0.00	0.0
Theo. Yield	73.52	77.40	74.65
Flour Data			
Flour Extraction	70.07	70.04	71.40
Ave. Particle Size	17.5	19.0	19.1
Protein (14% MB)	11.95	10.97	11.28
Ash (14% MB)	.399	.409	.413
Color	71	71	66
Farinograph Data			
Absorption	59.4	62.2	61.3
Peak Time	25.25	10.0	18.25
Stability	25+	13.0	25+
M.T.I.	15	30	10
Bake Data			
Absorption	64.5	65.5	66.5
Mix Time	13.0-14.0	7.5-8	9.0-10.0
Volume	3140-3120	2600-2480	3100-3075
Crumb Color	OK	OK-	OK+
Grain	G+ - G	G- - OK-	OK+ - OK-
Texture	Silky	Sl. Silky-Harsh	Sl. Harsh
Bake Rating	B+	C-	C
Remarks	Very Good Bake But Very Long Mix	Poor Volume & Sl. Open Grain	Long Mix with Open Grain

Location	Reno County	
Variety	Newton	Arkan
Code	AR 22	AR 23

Wheat Data

Protein (14% MB)	10.21	11.30
Ash(14% MB)	1.62	1.70
Test Weight	63.0	59.3
1000 K. Weight (14%MB)	34.12	26.59
Pearling Value	72.90	75.90
Wheat Size %OV7	71.5	33.5
%OV9	28.5	66.0
%OV12	0.0	0.5
Theo. Yield	76.58	74.65

Flour Data

Flour Extraction	72.52	70.62
Ave. Particle Size	16.3	18.0
Protein (14% MB)	8.82	10.28
Ash (14% MB)	.449	.412
Color	67	69

Farinograph-Data

Absorption	55.9	57.5
Peak Time	4.75	9.0
Stability	9.25	14.0
M.T.I.	35	30

Bake Data

Absorption	58.5	61.0
Mix Time	4-4.5	7.5-8.0
Volume	2580-2550	3050-3000
Crumb Color	OK	OK
Grain	G- to OK	G+ to G
Texture	Sl. Silky to Sl. Harsh	Silky
Bake Rating	C-	B+
Remarks	V. Poor Volume, Short Mix + Sl. Open Grain	

1982 Quad. Sr.

Hard Red Winter Wheat Grown in Southeast Kansas

	NEWTON LABETTE	PL 145 LABETTE	TRIUMPH 64 LABETTE	PL 145 CHEROKEE	DEKALB 579 LABETTE	TAM 105 NEOSHO	PL 145 NEOSHO	VONA WILSON	NEWTON NEOSHO	VONA LABETTE
Moisture	11.6	11.5	11.5	10.8	10.4	10.5	10.6	10.8	10.3	11.0
Protein 11% MB	13.8	13.6	14.1	14.1	12.9	13.6	13.0	11.9	13.1	13.4
Test Weight	52.3	53.3	60.1	51.6	58.7	52.0	53.2	58.4	55.6	54.6
Hecto Liter Weight	67.36	68.65	77.41	66.46	75.61	66.98	68.52	75.22	69.04	70.32
1000 Kernel Weight as is	18.57	21.08	32.23	20.16	32.41	20.76	21.85	24.01	20.42	19.58
1000 Kernel Weight 11% MB	18.44	20.97	32.05	20.21	32.63	20.97	21.95	24.06	20.58	19.58
% Wheat Size ov 7w	10.5	16.5	72.5	18.0	77.5	27.0	20.5	47.0	15.5	15.5
% Wheat size ov 9w	82.5	79.5	27.0	77.5	22.0	71.0	77.0	50.0	81.5	79.5
% Wheat size thru 9w	7.0	4.0	0.5	4.5	0.5	2.0	2.5	3.0	3.0	5.0
Theoretical Yield	73.11	73.59	76.60	73.63	76.85	74.23	73.88	75.17	73.60	73.48
Flour Protein 11% M.B.	12.8	12.3	12.9	13.2	11.3	12.6	12.1	10.4	11.6	12.3
Milling Rating	15.2	17.73	29.72	13.87	23.17	22.23		26.48	20.80	22.73
Absorption	60.4	60.0	60.0	57.6	58.2	58.4	57.6	56.8	56.8	59.8
Peak Time	19.5	15.5	9.0	11.0	14.0	20.0	16.5	2.5/20	21.0	20.0
Stability	23.5	22.5	17.0	20.0	24.5	34.0	21.5	32.0	32.5	39.5
Valorimeter	95	91	78	82	89	96	92	62	97	96
Falling Number	518	470	446	523	391	547	516	355	478	603
Wet Gluten	27.3	28.3	31.8	29.1	26.2	28.2	27.2	24.8	26.4	30.0
Dry Gluten	11.4	11.6	12.5	11.0	10.6	11.1	11.2	9.7	10.9	12.3
Pearling Value	81.70	79.40	67.35	77.25	71.85	75.20	72.00	72.25	76.45	79.30
Flour Ash 11% M.B.	.46	.44	.38	.48	.44	.40		.39	.40	.39
Fisher S.S.S.	23.5	21.33	21.0	21.83	22.67	20.50	17.67	20.25	21.17	21.83
% Farina	46.97	49.14	52.96	50.33	55.94	45.93	49.96	49.22	48.28	47.19

1982 Quad. Sr.

Soft Red Winter Wheat Grown in Southeast Kansas

	PIKE LABETTE	McNAIR 1003 N/A	PIKE CHEROKEE	2550 WILSON	2553 LABETTE	S-76 NEOSHO	HART LABETTE	HART CHEROKEE		
›isture	11.2	11.0	11.0	11.0	11.3	10.7	11.1	10.1		
·otein 11% MB	12.6	12.4	12.5	12.0	11.3	12.6	13.3	13.6		
·st Weight	56.4	51.7	51.9	56.1	59.5	53.7	53.8	44.7		
·cto Liter Weight	72.64	66.59	66.85	72.26	76.64	69.17	69.29	57.57		
100 Kernel Weight as is	23.72	25.54	21.62	28.37	36.80	23.13	25.33	16.21		
100 Kernel Weight 11% MB	23.67	25.54	21.62	28.37	36.67	23.21	25.30	16.37		
Wheat Size ov 7w	47.0	55.0	43.5	68.5	90.0	44.5	46.5	17.0		
Wheat size ov 9w	51.0	43.0	54.0	29.5	10.0	54.5	52.0	74.0		
Wheat size thru 9w	2.0	2.0	2.5	2.0	0	1.0	1.5	9.0		
eoretical Yield	75.23	75.63	75.03	76.31	77.50	75.17	75.24	73.31		
our Protein 11% M.B.	11.8	10.8	10.7	10.3	10.0	10.5	11.5	11.7		
lling Rating	15.85	18.30	10.00	24.68	26.89	23.84	22.27	3.06		
sorption	54.6	54.6	52.2	52.0	51.2	52.6	56.4	56.8		
ak Time	5.5	2.0	2.5	3.0	2.5	1.5	6.0	4.5		
ability	28.5	9.0	13.0	4.5	24.0	7.5	14.5	9.5		
lorimeter	88	48	54.0	46	56	52	66	66		
lling Number	463	427	447	344	380	433	459	474		
t Gluten	25.8	24.8	25.4	25.8	24.8	27.9	30.7	30.2		
y Gluten	10.5	9.9	9.9	9.3	9.6	9.9	12.0	11.7		
arling Value	69.90	68.45	64.45	65.65	56.10	65.30	71.15	73.35		
our Ash 11% M.B.	.40	.41	.43	.36	.31	.34	.35	.48		
sher S.S.S.	14.33	13.33	13.92	15.25	13.50	14.75	14.83	13.83		
Farina	48.34	40.95	48.42	47.35	50.92	47.19	47.81	42.14		

P = Protein NIRS - Technicon - Log 6

Dickey Joh
Tech Corp
Neol..h

	Mark Twain		Ottawa		Parsons		Heston		Minneola	
	P	Log 6	P	Log 6	P	Log 6	P	Log 6	P	Log 6
ExKan	10.7	180	9.6	194	13.3	184	14.3	202	13.8	218
Tam 105	10.2	203	8.7	209	14.3	196	13.7	213		
Tuf 64	11.6	164	9.9	199	14.7	171	14.5	210		
Hart	10.3	131	10.0	145	13.0	146			12.8	147
Pike	10.3	111	9.0	128	12.0	130				
HW 3006	11.0	133	9.7	127	12.3	124				
HW 3007	11.1	128	9.1	123	12.2	117				-

10/20/83

1982 Crop

CODE	VARIETY	EXTRACTION	FISHER
AR10	Newton	69.94	17.1
AR11	Arkan	70.57	17.1
AR12	Newton	70.70	16.3
AR13	Taml05	70.35	17.9
AR14	Arkan	71.10	18.9
AR15	Brule	75.40	21.7
AR16	Taml01	69.60	15.4
AR17	Newton	70.07	17.2
AR18	Arkan	70.04	18.7
AR19	Taml05	71.40	19.0
AR20	Arkan	70.77	17.4
AR21	Newton	68.05	17.4
AR25	Arkan	70.04	18.0
AR26	Arkan	70.32	18.7
AR27	Newton	71.16	16.8
AR28	Taml05	69.24	18.3
AR30	Arkan	70.83	17.0

Soft wheat numbers would be around 14 or less

STATUS OF WHEAT HARDNESS RESEARCH

This report briefly summarizes the wheat hardness objective test topic here at KSU. At least a dozen scientists from three (3) departments, Grain Science, Agricultural Engineering and Physics are involved in an advisory or active role.

There are three (3) on-going approaches to the problem of objectively determining the functional and performance properties of wheat known as "hardness." These involve light scattering of ground samples, chemical cause and measurement of hardness and individual kernel automated testing.

1. Adaptation of existing test equipment (grinders and near infrared analyzers) to aid in objective descrimination between hard and soft classes independent of visual appearance or shape. This involves particle size distribution upon grinding measured indirectly by light scattering effect or by sieving (considerable data has been accumulated in this area at present, but more is required to assess the variables and limitations of light scatter by NIR related to hardness).

2. Chemical definition of hardness. Basic research into the chemical composition, chemical structure and chemical interactions which cause the physical properties and structure known as "hardness." Once these causes are defined on a molecular basis then subsequently a test may be developed to objectively quantitate them. (Dr. Hoseney directed a Ph.D. student's thesis work on hardness (extraction, reconstitution and testing) of other grains. This wealth of experience is being tapped).

3. Individual kernel (GO/NO GO) automated test of the hardness effect based on one of a number of suggested measurements. These include thermal, optical or kinetic responses as well as mechanical resistance to deformation or permeability measurement. (The delivery system is being developed and many measurement ideas have been put forth as suggested above. Work on a mechanical prototype has begun). A Tag-Hepenstall moisture meter has been modified by placing a strain gauge and hinge on the free wheel normally used as one side of the conductance bridge. Strain data from individual wheat kernels crushed between the rolls will be collected as an electrical signal and sent to an oscilloscope for viewing and to a recording device for collection. Accidental damage to a part of the Tag-Hepenstall frame has delayed initial work with actual wheat samples by about one week while replacement parts are located. We anticipate running our first samples through the system later this month.

Of the three appraches the light scattering using existing NIR instruments and grinders appears to be primarily a stop-gap measure not because of lack of probably of success, but because it does not measure individual kernels as some would like and it measures the effect of "hardness" not the cause.

A test based upon the chemical cause of "hardness" and its manifestation on the micro scale which controls the macro effects appears to be the long-term scientifically sound solution in my opinion. Unfortunately, the research in this may be more long-term also.

Intermediate to the light scattering and chemical cause approaches is automating the physical manifestations of "hardness" in the hopes that clear-cut distinctions can be made rapidly on individual kernels which will yield statistically valid classification which accurately reflects the functional (end use) definition of "hardness" of wheat.

I personally believe that all these avenues need to be pursued. Of the variety of actual measurements suggested thus far, the most promising techniques will likely emerge from preliminary experiments or calculations. They are the ones which will be developed. I also believe that when using either of the "effects" of hardness measurements more than one type of measurement may be required. This allows the application of descriminant analysis (statistical) techniques which may be helpful in objective classification.

Attached is a list of KSU faculty with their involvement at present to the best of my knowledge.

	individual kernel auto delivery system 3a)	individual kernel measurement 3b)	chemical definition (isolation & reconstitution) 2a)	chemical definition (characterization & insitu measurement) 2b)	ground sample scatter of light NIR 1)
Ward	X	X			
Posner	X	X			
Curran	X	X			
Behnke	X	X			
Davis	X	X			
Eckhof*	X	X			
Lee**		X			
Wetzel		X		X	X
Wingfield	X				
Hoseney			X	X	
Seib				X	
Faubian			X	X	

Grain Science faculty unless otherwise indicated

* Agricultural Engineering

** Physics

[ ] represents different approaches to individual kernel measurement

uary 9, 1984

JAN 12 1984

Mr. Lowell Burchett
Kansas Crop Improvement Assoc.
Call Hall 205
Kansas State University
Manhattan, KS 66502

Dear Lowell:

I hope your holiday season has gone well. I have finally finished the FGIS report we discussed over the phone a few weeks ago. I have copied the portion of the report that attempts to explain how we are viewing the FGIS situation and the results of the grading test I put together here. I think you may find it interesting. There is a lot of data generated on those two tables and is a little hard to understand until you spend some time looking at it. If you have any questions about the test or results, give me a buzz or maybe we can visit during the Quality Council's meetings on the 17th.

I mentioned to Bob [redacted] that you might be interested in using this data at some future point. We discussed it shortly and felt that as long as you kept us anonymous it would be fine. This would probably also apply to the information concerning any of our new releases ([redacted], and [redacted]). Again, if you have any questions, please discuss it with either Bob or myself. I don't know if this information can be of any use to you, but you are welcome if you desire.

See you in Manhattan,

[redacted]
Winter Wheat Breeder

RB/nc

[redacted] Research Position

The grain grading situation has been somewhat of a surprise to [redacted] breeders. We have been working on the assumption that the FGIS has the ability to identify our varieties based on their uniqueness of characters. This was a valid assumption until February of 1983. Because of the Arkan situation and confusing signals being sent out by the FGIS, we really don't know what to expect.

In order to understand the FGIS's point of view, we have had to start with the basics. Since I have no experience in grain grading and kernel classification, I attempted to educate myself. I contacted the FGIS and they graciously sent me a very large stack of guidelines to use in grain grading. After reviewing the material and looking at samples, it became obvious that there was a problem in one of three areas. Either I had very poor vision, a learning disability, or these characters were very subjective. In order to eliminate this variable, a test was put together to see if the other breeders at the location faired better. I collected seed samples of the top 10 varieties grown the past 20 years and a few new varieties of HRS, HRW, and SRW wheats. All but one of these samples were grown under Berthoud conditions so character expression was fully expressed and fairly uniform. These samples were coded and each person was given a set of hand drawn illustrations from the FGIS showing nine basic kernel characters used to identify classes. These characters included kernel length, shoulder shape, back slope, germ angle, germ size, brush size, shape of cheeks, type of crease and texture of the back. Dr. [redacted] (breeder), Rob [redacted] (breeder), Joe [redacted] (breeder), Jim [redacted] (hybrid manager), Chris [redacted] (botonical specialist), Bruce [redacted] (quality specialist), and Leo [redacted] (breeding asst.) were given a brief explanation of the illustrations and asked to do the following:

1. Identify each of nine characters for the 42 varieties.
2. Identify the correct class for each character by using FGIS comparison charts.
3. Give each variety an overall class by summarizing the character results.
4. Give each variety a class by visually inspecting each sample and using the kernel character classification.

The results of this test are summarized on Tables 1 and 2. After reviewing the test and results, there are several observations that can be made. Trying to identify these commonly grown varieties is highly subjective. The main reason for this subjectiveness was a glaring lack of uniformity of characters in these samples. All of us became very frustrated trying to identify a majority type for many of the characters we were attempting to identify. Many characters identified as a type by one person were seen differently by another. Less than 11% of the characters identified were unaminous by all eight people and conversely over 30% of the characters received no majority from the group.

None of the varieties in this test had more than six of nine characters that conformed to its designated class. Many varieties had two or less. The average number of characters identified as being in the proper class was 3.5 of nine or 39%. There appeared to be very little difference between the groups of soft reds, hard reds, and hard red springs. Some of the worst offenders of kernel classification were some of the oldest varieties in this test. This certainly implies that classification problems are not new.

It should be noted that this test is limited to its scope. None of these people were FGIS trained and we only concentrated our test on the basic characters used by the FGIS and the trade. The FGIS uses several other specific characters to identify classes and often specific varieties. With more training, I am certain that our scores would be significantly higher on this test. I am also certain that a few super-trained FGIS graders could get 90%+ of these samples correct.

In defense of this test as an indicator of the situation, several things should be noted:

1. These were pure seed samples, not mixtures of many varieties as seen in the trade.
2. These were grown under uniform and ideal conditions. The only sample grown from another location was Mustang from Lyons, KS. Six of nine characters and the overall class were identified as being different on the pooled data when compared to the Berthoud sample. This, along with other observations certainly suggests that environment plays a major role in kernel development.
3. The high level of mixtures of characters within these pure samples cannot be cured with more education. The same applies to the high number of characteristics that are in the wrong designated class.
4. Most of the grain grading problems originate at the local bulk handling point. Many of these people have no more education than we do concerning kernel classification and therefore, we would expect them to do at least as poor as we did on this test.

The most concerning aspect of this test is that it failed to clarify the FGIS position on kernel classification. Instead of making it clear that Arkan was an obvious kernel character criminal, it only made us ask "why Arkan"? We will need more information and possibly training to be able to predict their classing judgements on many of our new varieties. This especially applies to the group of varieties Mustang, Wrangler, HR 53 and HR 64. All of these sister lines have several characters normally associated with soft reds and hard springs. These include a shorter kernel, a larger germ with a lower germ angle, a large brush and a tendancy towards a rough back. They also have several HRW characteristics including a straight back, parallel shoulders, semi-round cheeks and tight creases. We hope that they consider these traits as being identifiable in the bulk channels.

Possible Solutions

It is entirely possible that the last variety the FGIS assasinates is Arkan. They are receiving a lot of political pressure over this variety and they may back off their strong position on the next group of releases. This has its good and bad points. This solution would allow Mustang, Wrangler, HR 53, and HR 64 into the market place. Unfortunately, we would always have the possibility of rejection hanging over our new releases. I feel this is an undesirable situation when you consider our present lack of kernel classification knowledge.

The most likely situation to develop in the short term is for the FGIS to re-grade only the most obvious violations of kernel type. This would be a status-quo type of approach by the FGIS. The only way this could have anv hope of working is for the FGIS to come out and explain clearly what criterion they plan to use when establishing their kernel classes. This will be difficult for them to do fairly and properly. When they establish these criteria, we can integrate the proper screening into our programs.

Perhaps the most undesirable solution to the current situation would be a hard line approach on all new varieties by the FGIS. This would create havoc with all the breeders, including [redacted] It would be difficult to release any variety that totally conforms to the "established" kernel characters. Hybrid development in this system would be very difficult because of the segregating nature of the F_2 grain. The more limitations put on kernel types, the harder it would be to develop a conforming hybrid. This hard-line approach would be similar to the current Canadian system. I think the political pressure would be too great to allow this to happen, but it is possible.

The most desirable solution to the grain grading problem would be a rapid and inexpensive qualitative test to class wheats according to its end use value. There are several tests currently available that come very close to satisfying the needs but have some critical drawbacks. Several hardness tests are available that are reasonably accurate in separating lots of hard and soft wheats. A grinding test, a pearling test, a sedimentation test, and a NIR particle size reflectance are capable of separating hard and soft wheats very reliably. Unfortunately, none currently are accurate in identifying certain ranges of mixtures because all require more quantity than a single kernel of grain. The FGIS seems unwilling to look at anything that is incapable of assessing small mixtures. Ultimately, I feel someone will develop a system that will be able to quantify on a single kernel basis. The time table of development and the cost effectiveness are the big questions concerning this idea.

A short term desirable solution would be to implement the hardness tests at the local level. This could help eliminate many of the grading problems at the local level and ultimately drastically reduce the quantity of bulk mixtures the FGIS is currently dealing with. I feel this is an interesting solution that has not been publically considered yet.

Table 1.

VARIETY	YR. REL.	Class Identified by Characters: SRW Ind.	SRW Pooled Avg.	HRW Ind.	HRW Pooled Avg.	HRS Ind.	HRS Pooled Avg.	Classed by Visual and Characters: SRW	HRW	HRS	Individual Character Breakdown (of nine): In Class Ind. Avg.	In Class Pooled Avg.	Out of Class Ind. Avg.	Out of Class Pooled Avg.	Mixture (No Majority) Pooled	Mixture (No Majority) Avg.
SOFT RED WINTER																
Knox	58	3	X	3		2		6	1	1	3.87	3	5.13	2	4	
Monon	59	7	X	0		1		6	1	1	4.62	3	4.38	2	4	
Benhur	66	7	X	1		0		5	3	0	5.25	6	3.75	3	0	
Blue Boy	67	4		3	X	1		6	1	1	3.62	3	5.38	4	2	
Arthur	68	5	X	0		3		7	0	1	5.0	5	4.0	3	1	
Arthur 71	71	8	X	0		0		6	0	2	5.37	4	3.63	2	3	
Abe	75	6	X	0		2		5	1	2	4.5	5	4.5	3	1	
Double Crop	75	2		2		4	X	6	0	2	3.62	2	5.38	6	1	
S-76	76	3		4	X	1		3	5	0	3.37	2	5.63	4	2	
McNair 1003	78	4		4	X	0		4	4	0	3.75	3	5.25	4	1	
Delta Queen	81	2		5	X	1		1	6	1	3.5	3	5.5	4	2	
Hunter	83	3	X	1		4		7	1	0	3.75	3	5.25	1	5	
AVERAGES		4.5	7	2.0	4	1.5	1	5.17	1.92	.92	4.18	3.5	4.82	3.17	2.17	
		56%	58%	25%	33%	19%	8%	65%	24%	12%	46%	39%	54%	35%	24%	
HARD RED SPRING WHEAT																
Lee	58	1		2		5	X	0	3	5	4.25	2	4.75	2	5	
Selkirk	60	4	X	1		3		0	2	6	3.0	0	6.0	2	6	
Justin	62	2		0		6	X	0	0	8	5.37	5	3.63	1	3	
Manitou	65	2		0		6	X	0	0	8	4.87	5	4.13	2	2	
Chris	65	1		0		7	X	0	1	7	5.0	5	4.0	2	2	
Fortuna	66	1		5	X	2		0	6	2	4.75	2	5.25	4	3	
Waldron	69	3		0		5	X	1	0	7	5.25	6	3.75	1	2	
Era	70	2		0		6	X	0	4	4	5.12	5	3.88	1	3	
Olaf	73	3	X	0		5		0	2	6	4.0	2	5.0	6	1	
Len	79	6	X	0		2		2	0	6	3.5	2	5.5	4	3	
Oslo	82	0		5	X	3		1	6	1	2.75	1	6.25	4	4	
Marshall	82	3		0		5	X	1	1	6	4.87	4	4.13	1	4	
Wheaton	84	1		1		6	X	2	0	6	4.87	6	4.13	2	1	
Erik	84	3	X	2		3		0	1	7	3.87	3	5.13	2	4	
AVERAGES		2.28	4	1.14	2	4.57	8	.44	1.88	5.64	4.39	3.5	4.61	2.43	3.07	

ıble 2.

VARIETY	YR. REL.	Class Identified by Characters: SRW Ind.	SRW Pooled Avg.	HRW Ind.	HRW Pooled Avg.	HRS Ind.	HRS Pooled Avg.	Classed by Visual and Characters: SRW	HRW	HRS	Individual Character Breakdown (of nine): In Class Ind. Avg.	In Class Pooled Avg.	Out of Class Ind. Avg.	Out of Class Pooled Avg.	Mixture (No Majority) Pooled	Mixture (No Majority) Avg.
HARD RED. NTER WHEAT																
ıwnee	43	1		1		6	X	5	2	1	3.12	1	5.88	4	4	
ichita	45	1		5	X	2		2	6	0	4.75	5	4.25	2	2	
ɔncho	55	2		6	X	0		2	5	1	4.12	3	4.88	0	6	
ırrior	60	2		0		6	X	3	4	1	1.12	1	6.88	5	3	
ıw	60	0		6	X	2		0	7	1	5.0	4	4.0	1	4	
·iumph 64	64	0		8	X	0		1	6	1	5.12	4	3.88	2	3	
ɔout	64	0		7	X	1		1	6	1	5.0	5	4.0	2	2	
ɛnturk	71	1		5	X	2		4	4	0	3.5	4	5.5	3	2	
ım W101	71	1		6	X	1		1	7	0	4.37	6	4.63	3	0	
ɔna	76	0		4		4	X	2	3	3	4.25	4	4.75	4	1	
ɛwton	77	0		5	X	3		2	6	0	5.12	5	3.88	1	3	
ım 105	81	1		6	X	1		2	5	1	4.75	4	4.25	1	4	
ıwk	81	2		5	X	1		0	8	0	4.25	3	4.75	2	4	
·kan	83	4		1		3	X	2	4	2	3.12	3	5.88	4	2	
ıstang - ɛrthoud	84	3		3		2	X	4	2	2	2.62	0	6.38	4	5	
ıstang - ·ons	84	3		4	X	1		0	7	1	3.37	3	5.63	6	0	
EREAGES		1.31	0	4.5	11	2.19	5	1.94	5.13	.94	4.04	3.44	4.96	2.75	2.81	
		16%	0	56%	69%	27%	31%	24%	64%	12%	45%	38%	55%	31%	31%	

SUMMARY

- average of individuals using characters - 56% correct
- pooled average of individuals using characters - 62% correct
- average of individuals using character identification sheets and visual inspection - 66% correct
- best individual using characters - 67% correct
- worst individual using characters - 52% correct
- best individual using sheets and visual - 83% correct