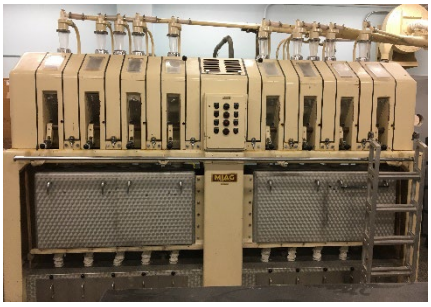
Milling and Baking Test Results for Eastern Soft Wheats
Harvested in 2024



Soft Wheat Quality Council of the Wheat Quality Council

March 18, 2025

Our Mission is to advocate the development of new wheat varieties that improve the value of wheat to all parties in the U.S. supply chain.

Our Goal is to improve the value of all U.S. wheat classes for producers, millers, and processors of wheat.

Membership in the Wheat Quality Council is a wise investment if wheat or flour quality has any influence on your business.

Uniform grow-outs are an extremely important part of the Wheat Quality Council efforts to improve wheat and flour quality.

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Acknowledgments

We thank the Wheat Quality Council for providing this forum to improve the quality of wheat. Thank you to the Soft Wheat Quality Laboratory staff and the collaborators in industry for their professional analysis and suggestions. Also, we are thankful for the cooperation from all the wheat breeding programs involved with this year's project. Great communication and cooperation among the breeding programs, growers, state foundation seeds programs, wheat seed companies and wheat quality laboratories in milling and baking companies make this project a continued success.

This program was carried out in cooperation with and funded by the Wheat Quality Council.

Collaborators for 2024 Crop Year

ADM Milling	Vickie Correll, Jessica Lehman
Ardent Mills	Caroline Smith, Amanda Smith, Miriam Dubin
Kellanova	Michaelia Papranec, YuLai Jin
Mennel Milling Company	Cyprian Syeunda, Jim Beauregard, Michelle Titus
Mondeléz International	David Stevenson, Juan Calle-Bellido, Gerardo Gracia-Gonzalez
Star of the West	James Janson, Jenny Weiss
Wheat Marketing Center	Liman Liu, Jayne Bock
USDA-ARS Western Wheat Quality Laboratory	Alecia Kiszonas
USDA-ARS Soft Wheat Quality Laboratory	Amy Bugaj, Tom Donelson, Taehyun Ji, Tony Karcher

Soft Wheat Quality Council

Mission, Policy, and Operating Procedure

The Soft Wheat Quality Council (SWQC) will provide an organizational structure to evaluate the quality of soft wheat experimental lines and varieties grown in the Eastern regions of the United States. The SWQC also will establish other activities as requested by the membership. The SWQC operates under the direction and supervision of the Wheat Quality Council (WQC). The mission of the SWQC is to provide a forum for leadership and communication in promoting continuous quality improvement among the various elements of the community of soft wheat.

Objectives

- Encourage wide participation by all members of the soft wheat industry.
- Determine, through technical consulting expertise, the parameters which adequately describe the performance characteristics which soft wheat industries seek in new varieties.
- Promote the enhancement of soft wheat quality in new varieties.
- Emphasize the importance of communication across all sectors and provide resources for education on the continuous improvement of soft wheat quality.
- Encourage the organizations vital to soft wheat quality enhancement to continue to make positive contributions through research and communications.
- Offer advice and support for the USDA-ARS Soft Wheat Quality Laboratory in Wooster, Ohio.

Membership

- The membership of the SWQC will consist of members of the WQC.

SWQC Technical Board

- The Technical Board shall be the administrative unit responsible for managing the functions of the council.
- The Technical Board shall consist of three officers elected from the membership.
- Officers of the Technical Board shall consist of a chair, vice-chair, and secretary.
- Each officer serves one year in his/her office.
- Terms start the day after the annual meeting of the SWQC.
- The vice-chair replaces the chair at the conclusion of the chair's term and the secretary replaces the vice-chair at the conclusion of the vice-chair's term.
- Officers (normally only the secretary) shall be elected annually at the annual meeting of the SWQC by nomination and majority vote.
- Any eligible member may be reelected after being out of office for one year.
- Vacancies that occur during the term of office of the members of the Technical Board shall be filled by nomination and majority vote of the remaining members of the board and the WQC Executive Vice President. The appointee will serve the remaining term of the vacancy (up to 3 years).
- Exceptions to the above may be granted if voted on by Technical Board or by majority vote of the SWQC at the annual meeting.

Duties of the Technical Board

- The chair shall be responsible to establish a meeting place and preside at all meetings of the Technical Board and SWQC (selected elements of the General Meeting WQC).
- The vice-chair shall preside at meetings in absence of the chair and assume such duties as may be assigned by the chair of the Technical Board.
- The secretary shall be responsible for taking minutes of the Technical Board and the SWQC meetings.

• The Technical Board will direct the Executive Vice President of the WQC on disbursement of allocated funds.
• The chair shall be responsible for communicating budget needs to the Executive Vice President.
• The Technical Board is responsible for presenting budget updates to the general membership at the annual meeting.

Compensation

• Technical Board members shall serve without compensation.

Expenses

• Certain paid expenses may be authorized for some technical board functions.

Quality Evaluation Committee of the SWQC

Committee Purpose

A technical committee entitled "Quality Evaluation Committee" shall be established consisting of the three Technical Board officers and other key members working on soft wheat. Those other key members should include, but are not limited to:

• The Lead Scientist of the USDA Soft Wheat Quality Laboratory, Wooster, OH.
• A grow-out coordinator who is a soft wheat breeder.
• Technical collaborators from soft wheat milling and baking laboratories.
• Collaborating soft wheat breeders.

Evaluation and Responsibilities

• Establish procedures and requirements for the annual grow-out, handling, evaluation and reporting of the experimental test line quality evaluation program.
• Annual approval of the samples and check varieties submitted by soft wheat breeders.
• Milling of the experimental and check samples.
• Distribution of samples to collaborators (member companies willing to conduct testing and baking evaluations on the samples prepared).
• Preparation of a quality report.

Sample/Locations

• Each breeder entity shall have the privilege of submitting experimental test lines and a check variety each year for evaluation. (maximum 10 samples annually)

Annual Meeting

• The annual meeting of the SWQC shall coincide with the annual meeting of the WQC. If for some reason the WQC annual meeting is not held, it shall be the duty of the Technical Board chair to establish an annual meeting time and place.
• The purpose of the meeting shall be to discuss the results of the test line quality testing program, elect board members and carry on other business as required by the SWQC.
• Other meetings determined to be necessary may be established by the Technical Board.

Finances and Budget

• The finances required to meet the operating expenses of the council shall be designated by the Executive Board of the WQC.
• The budget shall be presented for membership approval at the annual meeting.

Amendments

• Amendments to the policy and operation procedure of the SWQC can be made by majority vote of the council members present.
• The proposed changes must be submitted in writing and must be in the hands of the membership two weeks prior to voting on the change.

WQC 2024 Crop Year Entries and Contributing Breeding Programs

Group	Entry Name	Location	Breeder/Contact	Institution/Company	Class
1	Beck 705	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
1	Beck 720	Wooster, OH			SRW
1	Beck 722	Wooster, OH			SRW
1	Beck 724	Wooster, OH			SRW
1	Beck 725	Wooster, OH			SRW
1	Beck 727	Wooster, OH			SRW
1	Beck 732	Wooster, OH			SRW
	Branson*	Wooster, OH			SRW
	Hilliard*	Wooster, OH			SRW
2	MI20R0012	Michigan	Eric Olson	Michigan State U.	SRW
3	OK21428F	Oklahoma	Brett Carver	Oklahoma State U.	SRW
3	OK2189178WF	Oklahoma	Brett Carver		SWW

*Check varieties.

Description of Entries

Beck 705

705 BRAND

SOFT RED WINTER WHEAT

Ultra-Early

STRENGTHS

This new double-crop specialist offers exceptional fall establishment and world-class winterhardiness for every acre. This versatile option has an outstanding disease package for dependable yield and quality at harvest.

MANAGEMENT TIPS

- Excellent head scab tolerance
- Tremendous winterhardiness
- Minimal residue for double crop

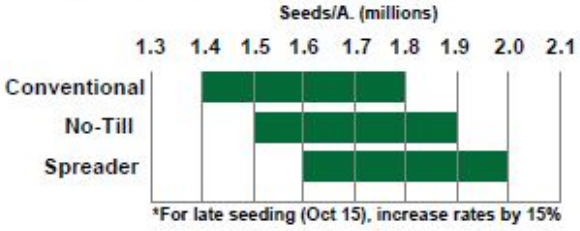
GENERAL CHARACTERISTICS	
Exp #	5903
15" Row Adaptability	7
Rel. Maturity (to Clark)	-2
Seed Size	12,000
Fungicide Resp.	Med.
Test Weight	7
Awns	Awns (Bearded)
Double Crop	9

POSITIONING AND ADAPTABILITY - BY SOIL			
Irrigated		■	
High		■	
Medium	■		
Low	■		
Poorly Drained	■		
	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	7
Tillering	7
Plant Height	Medium
Winterhardiness	9
Fall Growth	9
Plant Uniformity	8
Plant Color	Dark Green
Straw Yield	6

RECOMMENDED SEEDING POPULATION



*For late seeding (Oct 15), increase rates by 15%

PLANT HEALTH TRAITS	
Stripe Rust	8
Septoria Leaf Blotch	8
Septoria Glume Blotch	7
Powdery Mildew	6
Leaf Rust	8
Head Scab	9
BYDV	7
SBWMV	7

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A	Test Wt.
2	33	BECK 705	86.7	58.1
		BECK 702	80.9	59.4
1	22	BECK 705	89.1	57.3
		BECK 120	88.6	56.6
1	8	BECK 705	79.2	55.5
		Pioneer P25R50	78.2	55.8

New **720** BRAND

SOFT RED WINTER WHEAT

Early

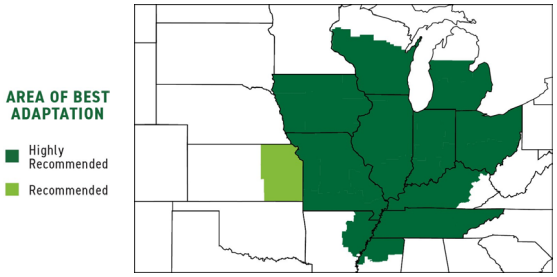
STRENGTHS

BECK 720 takes versatility to a whole new level across Beck's entire marketing area. This variety delivers high disease resistance from start to finish for all productivity levels. Trust this variety to deliver a yield punch and high grain quality for any acre or management style.

MANAGEMENT TIPS

- Excellent for wet-natured soils
- Tremendous fall establishment
- Stout agronomic disease package

GENERAL CHARACTERISTICS	
Exp #	**5001**
15" Row Adaptability	**9**
Relative Maturity (to Clark)	**+1**
Seed Size	**11,900**
Fungicide Response	**Med.**
Test Weight	**8**
Awns	**Awns (Bearded)**
Double Crop	**8**

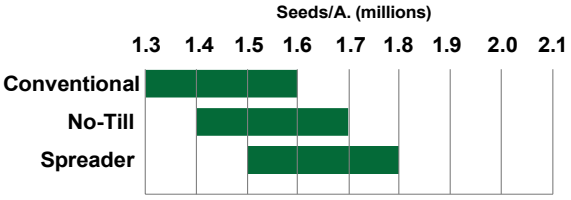


POSITIONING AND ADAPTABILITY - BY SOIL			
Irrigated			
High			
Medium			
Low			
Poorly Drained			
	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	**7**
Tillering	**9**
Plant Height	**Med. Tall**
Winterhardiness	**9**
Fall Growth	**9**
Plant Uniformity	**8**
Plant Color	**Med. Green**
Straw Yield	**8**

RECOMMENDED SEEDING POPULATION



***For late seeding (Oct 15), increase rates by 15%**

PLANT HEALTH TRAITS	
Stripe Rust	**7**
Septoria Leaf Blotch	**7**
Septoria Glume Blotch	**8**
Powdery Mildew	**9**
Leaf Rust	**6**
Head Scab	**9**
BYDV	**8**
SBWMV	**9**

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A	Test Wt.
2	32	BECK 720	93.3	58.3
		BECK 726	90.4	56.1
2	32	BECK 720	94.9	58.3
		BECK 727	91.1	58.0
1	12	BECK 720	92.3	58.3
		Pioneer P25R50	88.2	56.4

Beck 722

722 BRAND

SOFT RED WINTER WHEAT

Early

STRENGTHS

This awnless variety offers high straw tonnage and great yield potential for multiple revenue streams. This variety has excellent head scab tolerance and high test weight as an ease-of-use type of product.

MANAGEMENT TIPS

- Consider a growth regulator in +100 Bu./A environments
- Excellent straw option with a smooth head type
- Low management type with strong head scab tolerance

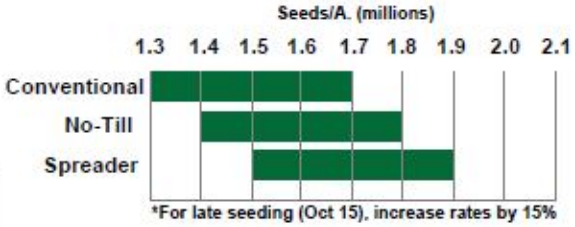
GENERAL CHARACTERISTICS	
Exp #	5901
15" Row Adaptability	7
Rel. Maturity (to Clark)	+1
Seed Size	13,000
Fungicide Resp.	Low
Test Weight	9
Awns	No Awns
Double Crop	8

POSITIONING AND ADAPTABILITY - BY SOIL			
Irrigated		■	
High		■	
Medium	■		
Low	■		
Poorly Drained	■		
	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	7
Tillering	7
Plant Height	Med. Tall
Winterhardiness	8
Fall Growth	8
Plant Uniformity	8
Plant Color	Med. Green
Straw Yield	9

RECOMMENDED SEEDING POPULATION



*For late seeding (Oct 15), increase rates by 15%

PLANT HEALTH TRAITS	
Stripe Rust	8
Septoria Leaf Blotch	7
Septoria Glume Blotch	8
Powdery Mildew	7
Leaf Rust	7
Head Scab	9
BYDV	8
SBWMV	6

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A	Test Wt.
3	56	BECK 722	89.7	58.8
		BECK 721	87.1	57.7
2	40	BECK 722	90.6	58.0
		BECK 120	86.8	55.5
1	24	BECK 722	91.2	58.5
		BECK 730	87.9	57.0

Beck 724

724 BRAND

SOFT RED WINTER WHEAT

Medium-Early

STRENGTHS

This new variety offers a competitive edge across acres and thrives in the heat of the southern portion of our marketing area. This versatility leader delivers the triple threat of standability, head scab tolerance, and top tier test weight.

MANAGEMENT TIPS

- Industry-leading test weight
- Incredible consistency across acres
- 15 inch row adaptability

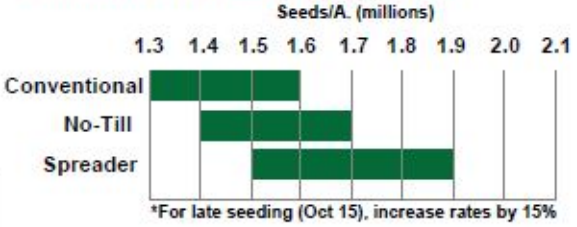
GENERAL CHARACTERISTICS	
Exp #	5817
15" Row Adaptability	9
Rel. Maturity (to Clark)	+2
Seed Size	13,000
Fungicide Resp.	Med.
Test Weight	9
Awns	Awns (Bearded)
Double Crop	7

POSITIONING AND ADAPTABILITY - BY SOIL	Excellent	Good	Not Recommended
Irrigated	■		
High	■		
Medium	■		
Low	■		
Poorly Drained	■		

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	8
Tillering	9
Plant Height	Med. Tall
Winterhardiness	7
Fall Growth	8
Plant Uniformity	8
Plant Color	Med. Green
Straw Yield	9

RECOMMENDED SEEDING POPULATION



*For late seeding (Oct 15), increase rates by 15%

PLANT HEALTH TRAITS	
Stripe Rust	8
Septoria Leaf Blotch	8
Septoria Glume Blotch	8
Powdery Mildew	7
Leaf Rust	6
Head Scab	9
BYDV	8
SBWMV	8

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A	Test Wt.
3	57	BECK 724	89.8	59.4
		BECK 721	87.8	57.9
2	56	BECK 724	89.7	57.7
		BECK 726	87.3	55.7
1	6	BECK 724	81.9	55.1
		Pioneer P26R36	78.5	54.9

Beck 725

NEW **725** BRAND

SOFT RED WINTER WHEAT

Medium

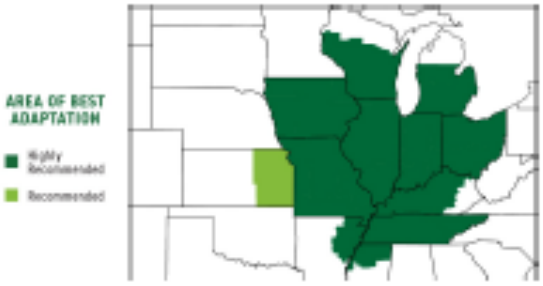
STRENGTHS

BECK 725 has an incredible yield punch tailored to higher management growers. This new outstanding variety brings enough heat to deliver potential new farm averages.

MANAGEMENT TIPS

- Prefers additional nitrogen
- Excellent response to a foliar fungicide application
- Wide footprint across Beck's entire marketing area

GENERAL CHARACTERISTICS	
Exp #	5101
15" Row Adaptability	7
Relative Maturity (to Clark)	+3
Seed Size	12,500
Fungicide Response	High
Test Weight	7
Awns	Awns (Bearded)
Double Crop	7



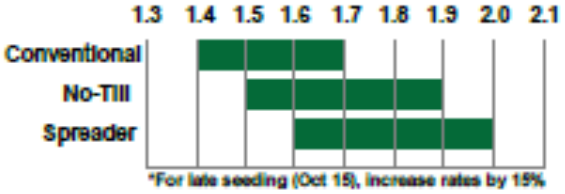
POSITIONING AND ADAPTABILITY - BY SOIL			
Irrigated	■		
High	■		
Medium	■		
Low		■	
Poorly Drained		■	
	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	8
Tillering	7
Plant Height	Medium
Winterhardiness	8
Fall Growth	7
Plant Uniformity	7
Plant Color	Med. Green
Straw Yield	7

RECOMMENDED SEEDING POPULATION

Seeds/A. (millions)



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PLANT HEALTH TRAITS	
Stripe Rust	5
Septoria Leaf Blotch	7
Septoria Glume Blotch	9
Powdery Mildew	7
Leaf Rust	5
Head Scab	9
BYDV	7
SBWMV	8

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A.	Test Wt.
2	34	BECK 725	101.5	58.2
		BECK 120	96.0	58.4
1	12	BECK 725	95.0	57.8
		AgriMAXX 505	93.7	60.0
1	12	BECK 725	95.0	57.8
		Pioneer P25R36	91.2	58.3

Beck 727

727

SOFT RED WINTER WHEAT

DOWNLOAD A PDF FACTSHEET

STRENGTHS

This new home run hitting variety brings an exceptional yield punch in all yield environments with a gorgeous harvest look. This variety possesses quick canopy closure, dependable early growth, as well as excellent plant health for a wide range of management styles, bringing in bin busting yields.

MANAGMENT TIPS

- Versatile performer across soils
- Low response to a fungicide application
- Flexible harvest window

Beck 732

732 BRAND

SOFT RED WINTER WHEAT

Medium-Late

STRENGTHS

This new agronomic all-star has it all. BECK 732 blends reliable yields in all productivity levels and management styles in our marketing area. This variety's winter hardiness combined with an extremely desirable disease package is ready for all adverse growing conditions.

MANAGEMENT TIPS

- Excellent foliar disease package
- Season-long standability
- Consistent performer in all acres

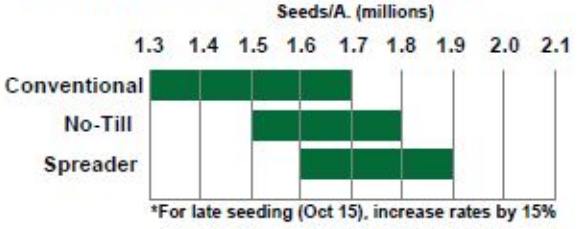
GENERAL CHARACTERISTICS	
Exp #	5902
15" Row Adaptability	9
Rel. Maturity (to Clark)	+4
Seed Size	13,000
Fungicide Resp.	Low
Test Weight	8
Awns	Awns (Bearded)
Double Crop	6

POSITIONING AND ADAPTABILITY - BY SOIL			
Irrigated			
High			
Medium			
Low			
Poorly Drained			
	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

PLANT TRAITS	
Standability	8
Tillering	8
Plant Height	Medium
Winterhardiness	9
Fall Growth	8
Plant Uniformity	8
Plant Color	Dark Green
Straw Yield	7

RECOMMENDED SEEDING POPULATION



*For late seeding (Oct 15), increase rates by 15%

PLANT HEALTH TRAITS	
Stripe Rust	8
Septoria Leaf Blotch	7
Septoria Glume Blotch	7
Powdery Mildew	7
Leaf Rust	8
Head Scab	9
BYDV	8
SBWMV	8

Rating: 9 = Best

YIELD COMPARISONS

Years	Plots	Brand	Bu./A	Test Wt.
2	20	BECK 732	91.5	57.4
		BECK 730	89.1	57.1
1	6	BECK 732	80.1	55.1
		Pioneer P25R50	78.2	55.8
1	6	BECK 732	83.3	53.2
		Pioneer P26R59	80.3	53.0

Branson
Branson is a soft red winter wheat bred and developed by AgriPro Wheat. Branson is a medium height semi dwarf variety with good straw strength. Branson is moderately resistant to Septoria Leaf Blotch and Stripe rust and Powdery Mildew. Intermediate resistance to Soil borne Mosaic virus and Leaf rust. Primary adaptation is the wheat growing regions of Missouri, Illinois, Indiana, Michigan, and Ohio. Juvenile growth habit is semi erect. Plant color at boot stage is dark green. Flag leaf at boot stage is erect and twisted. Waxy bloom is present on the head, stem and flag leaf sheath. Anther color is yellow. Head shape is strap, mid-dense and awnletted. Glumes are glabrous, narrow in width and long in length with oblique shoulders and obtuse beaks. Seed shape is ovate. Brush hairs are mid-long in length and occupy a large area of the seed tip. Seed crease depth is shallow and width is narrow. Seed cheeks are rounded. Branson has been uniform and stable since 2003. Less than 0.8% of the plants were rouged from the Breeders Seed increase in 2004. Approximately 90% of the rouged variant plants were taller height wheat plants (8 to 15 cm) and 10% were awned plants. AgriPro Wheat maintains seed stock and certified classes of Foundation, Registered and Certified. Certified seed stocks of Branson will be available in the fall of 2005. Certified acreage is not to be published by AOSCA and certifying agencies. Plant Variety Protection is anticipated and Branson may only be sold as a class of certified seed.

Hilliard
Soft red winter (SRW) wheat cultivar Hilliard (VA11W-108) was derived from the cross Pioneer Brand '25R47' (PI 631473) / 'Jamestown' (PI 653731). Hilliard was derived as a bulk of an F5:6 headrow selected in 2010 and has been evaluated over five years (2013 – 2017) in Virginia's State Variety Trials and throughout the soft red winter (SRW) wheat region in the 2014, 2016, and 2017 USDA-ARS Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries.

Hilliard is a broadly adapted, high yielding, mid-season, medium height, awned, semi-dwarf (gene Rht2) SRW wheat. In the southern SRW wheat region, head emergence of Hilliard (121d) has been similar to that of 'USG 3555' and 3 days later than Jamestown. In the eastern SRW wheat region, head emergence of Hilliard (136 d) was 1 day later than 'Branson' and 1.5 d earlier than 'Shirley'. Average mature plant height of Hilliard throughout the SRW wheat region has varied from 34 to 38 inches. In the 2014 Uniform Southern and Uniform Eastern nurseries, plant height of Hilliard (34 inches) was 2 inches shorter than checks 'AGS 2000' and MO_080104 and 2.5 to 3.5 inches taller than Shirley. Straw strength (0=erect to 9=completely lodged) of Hilliard (0.2 – 2.3) is very good and similar to that of Shirley (0.6 – 2.5). In the Uniform Eastern Nursery, winter hardiness (0 = no injury to 9 = severe injury) of Hilliard (2.2) was similar to that of the checks (1.8 – 2.9), while in the Uniform Southern Nursery, its winter injury (4.0) was less than that of the checks (5.4 – 6.5).

Hilliard was evaluated at 21 sites in the 2014 USDA-ARS Uniform Southern SRW Wheat Nursery and ranked second among 33 entries for grain yield (84 bu/ac). Average test weight of Hilliard (55.8 lb/bu) was similar to the overall trial mean and significantly ($P < 0.05$) higher than that of USG 3555 (54.4 lb/bu). Hilliard also was evaluated at 21 locations in the 2014 USDA-ARS Uniform Eastern SRW Wheat Nursery, and ranked first in grain yield within the eastern wheat region (87.6 lb/bu) and second over all test sites (86.9 lb/bu). Average test weight of

Hilliard (56.9 lb/bu) was similar to the overall trial mean, and significantly ($P < 0.05$) higher than those of Branson (55.8 lb/bu) and Shirley (54.7 lb/bu).

Grain samples of Hilliard produced in five crop environments (2012 – 2014) were evaluated for end use quality by the USDA-ARS Soft Wheat Quality Lab. Hilliard has exhibited milling and baking qualities that are intermediate between those of Jamestown and USG 3555. Jamestown has better milling quality attributes than Hilliard or USG 3555, while both Jamestown and Hilliard have superior baking quality compared to USG 3555. While flour of Hilliard has the lowest grain protein content, it has slightly stronger gluten strength than Jamestown or USG 3555.

Hilliard is a widely adapted, mid-season wheat variety with good winter hardiness. It has high grain yield potential, good straw strength, and has performed well over most of the eastern SRW wheat production areas. With the exception of stem rust, Hilliard has expressed moderate to high levels of resistance to diseases prevalent in the SRW wheat region. These include powdery mildew, leaf rust, stripe rust, leaf and glume blotch, bacterial leaf streak, Soil Borne Mosaic Virus, Barley and Cereal Yellow Dwarf Viruses, Fusarium head blight, and Hessian fly.

MI20R0012

'MI20R0012' is a soft red winter wheat variety released by Michigan State University with broad adaptation across the Midwest and Eastern soft wheat production environments of the United States. MI20R0012 demonstrates high grain yield and test weight across a range of testing environments in the Eastern US and Canda. MI20R0012 is resistant to stripe rust (Puccinia striiformis f.sp. tritici Westend.) and leaf rust (Puccinia triticina Eriks.) and moderately resistant to Fusarium head blight caused primarily by Fusarium graminearum Schwabe. MI20R0012 has exceptional milling and baking quality.

MI20R0012 has the pedigree Jupiter/VA11W-106. Jupiter is a soft white winter wheat released by Michigan State University. VA11W-106 is an experimental line developed by Virginia Polytechnic Institute which is a sibling line of the broadly adapted variety 'Hilliard' (VA11W-108).

OK21428F

As a product of long-standing collaboration with Corteva, OK21428F is a SRW progeny from a single cross of soft x hard wheat (25FR34/OK12621). It is above-average for test weight even among contemporary HRW wheat cultivars, averaging >61 lb/bu statewide in 2024 with large kernel size. It would be targeted for northcentral and eastern Oklahoma, where yields would be highest. It is a double wild-type for Rht1/Rht2 but with excellent straw strength. OK21428F has a broad disease package, with resistance to the WSBM/WSSM complex, BYD (Bdv2), stripe rust, leaf rust, powdery mildew, and tan spot. Dough strength is quite mellow, though carries Dx5+Dy10.

OK2189178WF

This Dx2+Dy12 soft white is highly adapted to northcentral and eastern OK with a higher yield ceiling than OK21428F but lower test weight potential. Despite a 75% HRW background from 2*OK12621 (HRW)/WA8183 (soft white). OK2189178WF has low protein and low gluten strength with a very soft endosperm. It provides excellent protection to stripe rust, leaf rust (all-season resistance), powdery mildew (APR), tan spot and other leaf spotters common in Oklahoma. A shattering tendency would keep this candidate east of I35. Sprouting has not been observed in Oklahoma environments, even in high-moisture harvest conditions.

Milling and Baking Results Reported by Collaborators and SWQL

Mill Stream Distribution by SWQL

Table 1. Miag Multomat mill stream yields (%) of the WQC 2024 crop year entries by SWQL

Mill Stream	Group 1								
	Beck 705	Beck 720	Beck 722	Beck 724	Beck 725	Beck 727	Beck 732	Branson*	Hilliard*
1st Break	5.9	7.8	6.5	6.8	8.3	7.9	8.1	6.7	7.8
2nd Break	8.3	8.2	7.3	9.3	8.6	7.8	9.6	7.7	7.8
Grader	3.9	3.8	3.9	3.8	4.0	4.2	4.2	3.6	3.9
3rd Break	7.3	8.2	7.4	10.2	8.5	7.5	8.7	7.9	8.3
Total Break	**25.4**	**28.1**	**25.1**	**30.1**	**29.5**	**27.5**	**30.6**	**26.0**	**27.7**
1st Reduction	11.8	11.6	10.4	8.9	10.8	11.0	11.7	10.3	11.3
2nd Reduction	13.8	11.5	12.6	8.8	11.1	12.3	11.2	11.5	11.3
3rd Reduction	7.6	6.6	8.2	7.9	6.9	6.6	6.3	7.7	7.1
Duster	8.8	7.4	8.1	5.4	6.8	8.3	7.9	6.9	7.4
4th Reduction	4.3	3.6	4.8	4.3	3.8	3.6	3.3	4.4	3.6
5th Reduction	2.8	2.4	3.4	3.6	2.8	2.1	2.3	3.1	2.8
Total Reduction	49.1	43.1	47.6	38.9	42.3	43.9	42.6	43.8	43.4
Straight Grade	**74.5**	**71.2**	**72.7**	**69.0**	**71.7**	**71.4**	**73.2**	**69.7**	**71.1**
Head Shorts	6.3	6.9	6.2	7.5	6.8	5.7	6.2	6.8	6.7
Red Dog	1.5	1.8	1.9	3.3	2.0	1.5	1.2	3.0	1.9
Tail Shorts	0.7	0.5	0.6	0.7	0.6	0.4	0.5	0.6	0.6
Bran	17.0	19.6	18.6	19.5	19.0	21.0	18.9	19.9	19.7
Total Byproduct	25.5	28.8	27.3	31.0	28.3	28.6	26.8	30.3	28.9

*Check varieties.

Table 1-continued

Mill Stream	Group 2	Group 3	
	MI20R0012	OK21428F	OK2189178WF
1st Break	8.4	6.4	6.2
2nd Break	8.2	7.8	6.8
Grader	4.2	3.8	4.1
3rd Break	7.9	7.9	8.5
Total Break	**28.6**	**26.0**	**25.6**
1st Reduction	11.7	10.6	8.9
2nd Reduction	11.9	11.8	10.6
3rd Reduction	6.7	7.9	8.6
Duster	7.9	8.1	7.0
4th Reduction	3.6	4.4	4.7
5th Reduction	2.4	3.4	3.8
Total Reduction	**44.1**	**46.2**	**43.6**
Straight Grade	**72.7**	**72.2**	**69.2**
Head Shorts	6.4	6.2	6.9
Red Dog	1.8	2.2	3.3
Tail Shorts	0.5	0.7	0.8
Bran	18.6	18.7	19.9
Total Byproduct	27.3	27.8	30.8

*Check varieties.

Wheat Grain and Flour Quality Characteristics

Table 2. Grain characteristics and SKCS parameters of the 2024 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Test Weight (lb/bu)	Grain Falling Number	Grain Protein (%, 12% mb)	SKCS Parameter		
					Kernel Hardness	Kernel Diameter (mm)	Kernel Weight (mg)
1	Beck 705	58.6	389	11.0	26.9	2.7	31.2
1	Beck 720	60.0	390	10.5	20.5	2.6	33.3
1	Beck 722	60.6	387	10.3	24.1	2.7	35.1
1	Beck 724	61.0	456	10.2	19.6	2.6	34.5
1	Beck 725	59.9	329	8.5	21.3	2.6	31.7
1	Beck 727	60.6	398	10.0	20.6	2.5	30.0
1	Beck 732	58.8	365	10.4	21.3	2.5	29.6
1	Branson*	59.9	436	11.0	25.7	2.7	33.7
1	Hilliard*	60.6	403	10.0	25.4	2.6	32.0
2	MI20R0012	60.9	344	9.6	15.3	2.7	34.1
3	OK21428F	62.1	394	11.6	18.3	2.7	35.8
3	OK2189178WF	56.1	428	13.4	19.4	2.7	34.0

*Check varieties.

Table 3. Miag and Quadrumat milling parameters of the 2024 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Miag Milling		Quadrumat Milling	
		Break Flour Yield (%)	Straight Grade Flour Yield (%)	Softness Equivalence (%)	Flour Yield (%)
1	Beck 705	25.4	74.5	52.7	70.8
1	Beck 720	28.1	71.2	57.6	68.4
1	Beck 722	25.1	72.7	53.0	69.5
1	Beck 724	30.1	69.0	57.1	65.5
1	Beck 725	29.5	71.7	59.7	69.3
1	Beck 727	27.5	71.4	60.0	69.2
1	Beck 732	30.6	73.2	59.5	69.5
1	Branson*	26.0	69.7	53.9	66.6
1	Hilliard*	27.7	71.1	56.4	68.0
2	MI20R0012	28.6	72.7	58.1	70.3
3	OK21428F	26.0	72.2	51.5	68.9
3	OK2189178WF	25.6	69.2	52.5	67.0

*Check varieties.

Table 4. Flour quality parameters of the 2024 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Moisture (%)	Protein (%, 14% mb)	Flour Ash (%, 14% mb)	Starch Damage (%)
1	Beck 705	14.2	9.4	0.37	3.3
1	Beck 720	14.1	8.8	0.31	3.3
1	Beck 722	14.0	8.6	0.36	3.2
1	Beck 724	14.2	8.5	0.32	3.9
1	Beck 725	14.0	7.0	0.34	3.1
1	Beck 727	13.9	8.3	0.31	3.0
1	Beck 732	14.1	8.6	0.33	3.1
1	Branson*	14.0	9.1	0.35	3.4
1	Hilliard*	13.9	8.2	0.35	3.2
2	MI20R0012	14.0	7.8	0.33	3.4
3	OK21428F	14.0	9.6	0.36	2.4
3	OK2189178WF	14.1	11.2	0.42	3.2

*Check varieties.

Summaries and Statistics of Combined Cooperator Test Parameters

Table 5. Mean SRC test parameters and overall flour quality scores by six cooperators (n=7)[a]

Group	Entry	Solvent Retention Capacity (%)			
		Water	Sodium Carbonate	Sucrose	Lactic Acid
1	Beck 705	50.8 e	67.4 d	87.8 d	98.4 e
1	Beck 720	53.6 bc	73.9 b	101.8 a	122.2 b
1	Beck 722	52.0 d	70.7 c	95.3 bc	117.5 b
1	Beck 724	57.0 a	78.2 a	103.9 a	142.2 a
1	Beck 725	53.6 bc	69.5 cd	88.7 d	96.2 e
1	Beck 727	51.7 de	69.0 cd	89.8 cd	116.3 bc
1	Beck 732	52.7 cd	69.6 cd	91.1 cd	119.4 b
1	Branson*	54.4 b	76.2 ab	100.5 ab	102.6 de
1	Hilliard*	54.3 b	75.4 ab	97.8 ab	109.5 cd
2	MI20R0012	51.8	70.9	91.1	100.7
3	OK21428F	51.3 b	71.5 a	98.1 a	107.7 a
3	OK2189178WF	53.6 a	75.8 a	102.8 a	111.1 a

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 6. Damaged starch content (n=2), flour falling number (n=2) and amylograph peak viscosity (n=1)[a]

Group	Entry	Damaged Starch Content (%)	Falling Number	Amylograph Peak Viscosity (BU)
1	Beck 705	3.90 a	397 a	554
1	Beck 720	3.95 a	395 a	654
1	Beck 722	3.75 a	380 a	679
1	Beck 724	4.40 a	412 a	717
1	Beck 725	3.75 a	325 b	587
1	Beck 727	3.75 a	376 a	672
1	Beck 732	3.70 a	375 a	707
1	Branson*	4.00 a	388 a	675
1	Hilliard*	3.75 a	375 a	676
2	MI20R0012	3.95	351	438
3	OK21428F	3.15 a	365 a	751
3	OK2189178WF	3.65 a	406 a	479

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 7. Alveograph test parameters by a collaborator (n=1)

Group	Entry	Alveograph				
		P	L	P/L Ratio	W	le
1	Beck 705	23	120	0.19	31	33.9
1	Beck 720	39	116	0.34	59	43.3
1	Beck 722	30	107	0.28	43	39.0
1	Beck 724	53	74	0.72	67	52.6
1	Beck 725	54	76	0.71	88	52.4
1	Beck 727	31	100	0.31	47	44.3
1	Beck 732	36	82	0.44	57	49.9
1	Branson*	39	89	0.44	55	34.6
1	Hilliard*	44	66	0.67	65	40.0
2	MI20R0012	29	79	0.37	40	35.4
3	OK21428F	28	126	0.22	40	38.6
3	OK2189178WF	31	132	0.23	44	37.8

*Check varieties.

Table 8. Mean farinograph test parameters by two collaborators (n=1)[a]

Group	Entry	Farinograph			
		Water Absorption	Development Time	Stability	Mixing Tolerance
1	Beck 705	52.7	1.9	2.4	140
1	Beck 720	53.7	1.8	5.2	80
1	Beck 722	52.4	1.5	3.1	113
1	Beck 724	55.4	1.3	1.7	62
1	Beck 725	52.5	1.0	<1.0	154
1	Beck 727	53	1.1	1.8	124
1	Beck 732	53.5	1.2	1.2	113
1	Branson*	56.4	1.7	2.5	115
1	Hilliard*	54.8	1.4	3.2	107
2	MI20R0012	53.2	1.0	1.0	141
3	OK21428F	53.7	1.7	3.7	107
3	OK2189178WF	55.7	2.2	3.3	110

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 9. Mean mixograph test parameters by two collaborators (n=2)[a]

Group	Entry	Mixograph	
		Absorption (%)	Peak Time (min)
1	Beck 705	53.1 a	2.7 bc
1	Beck 720	52.8 a	4.1 a
1	Beck 722	52.4 a	3.8 ab
1	Beck 724	54.5 a	4.4 a
1	Beck 725	51.3 a	1.1 d
1	Beck 727	52.1 a	3.9 ab
1	Beck 732	52.8 a	4.1 a
1	Branson*	52.8 a	1.4vcd
1	Hilliard*	53.0 a	1.6 cd
2	MI20R0012	52.0	1.8
3	OK21428F	52.3 a	2.7 a
3	OK2189178WF	55.8 a	1.7 a

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 10. Mean (n=2) Rapid Visco-Analyzer (RVA) test parameters[a]

Group	Entry	Rapid Visco-Analyzer						
		Peak Time (min)	Peak (cP)	Trough (cP)	Break-down (cP)	Setback (cP)	Final (cP)	Pasting Temperature (°C)
1	Beck 705	6.0 a	2733 d	1593 c	1140 b	1380 d	2973 cd	76.3 a
1	Beck 720	6.1 a	2926 bcd	1917 b	1009 c	1529 b	3446 b	75.9 a
1	Beck 722	6.1 a	3075 abc	1831 bc	1244 a	1417 cd	3248 bc	75.9 a
1	Beck 724	6.2 a	3054 abc	2200 a	854 d	1699 a	3899 a	77.1 a
1	Beck 725	6.1 a	2894 cd	1623 c	1271 a	1281 e	2904 d	75.9 a
1	Beck 727	6.2 a	3083abc	1930 ab	1154 b	1417 cd	3347 b	75.9 a
1	Beck 732	6.1 a	3131 ab	1864 bc	1267 a	1447 bc	3310 b	75.0 a
1	Branson*	6.2 a	3164 a	2047 ab	1117 b	1505 bc	3552 b	75.8 a
1	Hilliard*	6.1 a	3085 abc	1944 ab	1142 b	1491 bc	3434 b	75.4 a
2	MI20R0012	6.1	2647	1606	1042	1363	2969	75.4
3	OK21428F	6.1 a	3189 a	1778 a	1411 a	1404 a	3182 a	76.6 a
3	OK2189178WF	6.1 a	2691 b	1639 a	1052 b	1392 a	3030 a	75.9 a

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 11. Mean sugar-snap cookie test (AACCI Approved Methods 10-50D (n=4) & 10-52 (n=2)) parameters[a]

Group	Entry	Sugar-snap Cookie (10-50D)				Sugar-snap Cookie (10-52)	
		Width (mm)	Thickness (mm)	W/T Ratio (mm)	Spread Factor	Width (cm)	Top Grain Score
1	Beck 705	495 ab	54 a	9.4 a	88 abc	9.2 a	7.0 a
1	Beck 720	492 ab	54 a	9.4 a	88 abc	9.1 a	5.5 a
1	Beck 722	495 ab	54 a	9.4 a	88 abc	9.2 a	6.0 a
1	Beck 724	477 b	60 a	8.2 a	76 c	9.0 a	5.0 a
1	Beck 725	503 a	50 a	10.3 a	96 a	9.3 a	6.0 a
1	Beck 727	499 ab	52 a	9.9 a	92 ab	9.4 a	6.0 a
1	Beck 732	490 ab	54 a	9.3 a	87 abc	9.2 a	6.0 a
1	Branson*	486 ab	59 a	8.4 a	79 bc	9.0 a	6.0 a
1	Hilliard*	492 ab	56 a	9.1 a	85 abc	9.0 a	6.0 a
2	MI20R0012	494	54	9.3	87	9.4	6.5
3	OK21428F	493 a	54 a	9.4 a	88 a	9.2 a	5.0 a
3	OK2189178WF	488 a	56 a	8.9 a	84 a	9.0 a	6.0 a

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 12. Biscuit quality parameters by a collaborator (n=1)[a]

Group	Entry	Biscuit		
		Width (mm)	Height (mm)	Weight (g)
1	Beck 705	421	304	204
1	Beck 720	417	287	210
1	Beck 722	412	329	227
1	Beck 724	411	287	230
1	Beck 725	428	297	217
1	Beck 727	415	318	228
1	Beck 732	408	304	224
1	Branson*	413	328	222
1	Hilliard*	405	303	208
2	MI20R0012	414	293	216
3	OK21428F	417	318	224
3	OK2189178WF	423	368	256

*Check varieties.

Table 13. Mean (n=2) sponge cake baking test parameters[a]

Group	Entry	Sponge Cake	
		Volume (mL)	Texture Score
1	Beck 705	1074 a	17
1	Beck 720	1147 a	17
1	Beck 722	1094 a	22
1	Beck 724	1077 a	17
1	Beck 725	1132 a	21
1	Beck 727	1123 a	22
1	Beck 732	1046 a	21
1	Branson*	1092 a	18
1	Hilliard*	1126 a	21
2	MI20R0012	1115	20
3	OK21428F	1142 a	23
3	OK2189178WF	1075 a	20

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Table 14. Mean flour (n=7), cookie (n=5) and sponge cake (n=2) quality scores[a]

Group	Entry	Flour Score	Cookie Score	Sponge Cake Score
1	Beck 705	7.6 a	7.4 ab	5.3 b
1	Beck 720	7.1 ab	7.0 ab	7.0 ab
1	Beck 722	7.4 a	6.8 ab	6.3 ab
1	Beck 724	6.3 b	5.8 b	6.0 ab
1	Beck 725	6.6 ab	7.8 a	6.5 ab
1	Beck 727	7.6 a	7.2 ab	7.5 a
1	Beck 732	7.4 a	6.4 ab	5.8 ab
1	Branson*	6.2 b	6.0 b	6.3 ab
1	Hilliard*	6.3 b	7.2 ab	7.0 ab
2	MI20R0012	6.9	7.6	6.0
3	OK21428F	6.7 a	6.4 a	6.8 a
3	OK2189178WF	6.4 a	6.0 a	5.8 a

*Check varieties.

[a]Means with different letters within the same group are significantly different at $P<0.05$.

Cooperator Data for Each Quality Test Parameter

Table 15. Water SRC (%) of 2024 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Kellanova	Mondelez	Star of West	SWQL	WWQL	**Mean**	**STDEV**
1	Beck 705	50.9	51.8	49.9	50.3	51.5	51.6	49.8	50.8	0.81
1	Beck 720	52.7	55.6	52.4	54.0	53.3	54.3	52.6	53.5	1.14
1	Beck 722	51.6	52.1	51.9	51.3	52.4	52.5	52.1	52.0	0.43
1	Beck 724	56.3	58.5	57.1	56.4	58.2	57.3	55.3	57.0	1.12
1	Beck 725	52.7	55.1	53.9	52.7	53.9	55.1	51.5	53.6	1.34
1	Beck 727	51.8	51.7	51.9	50.3	52.0	53.4	51.0	51.7	0.95
1	Beck 732	52.0	53.3	53.2	50.0	54.0	54.3	52.0	52.7	1.48
1	Branson*	54.2	56.2	53.8	53.9	54.0	55.0	53.6	54.4	0.91
1	Hilliard*	53.8	54.4	53.9	54.7	53.6	55.3	54.1	54.2	0.59
2	MI20R0012	51.4	51.4	52.4	49.4	52.6	53.6	51.8	51.8	1.32
3	OK21428F	51.4	50.5	51.6	51.4	51.1	52.4	50.7	51.3	0.63
3	OK2189178WF	53.8	53.1	54.0	51.2	53.5	55.1	54.5	53.6	1.25

*Check varieties.

Table 16. Sodium Carbonate SRC (%) of 2024 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Kellanova	Mondelez	Star of West	SWQL	WWQL	**Mean**	**STDEV**
1	Beck 705	64.4	68.7	64.9	72.0	66.7	68.7	66.3	67.4	2.64
1	Beck 720	70.6	74.6	71.9	79.2	72.3	75.1	73.9	73.9	2.80
1	Beck 722	66.8	70.7	67.5	79.2	68.5	71.4	70.7	70.7	4.15
1	Beck 724	74.7	77.9	75.9	84.3	77.1	79.4	78.1	78.2	3.09
1	Beck 725	67.4	69.3	67.7	72.5	69.1	71.0	69.3	69.5	1.78
1	Beck 727	65.7	67.9	66.1	76.5	67.6	70.3	69.1	69.0	3.66
1	Beck 732	67.4	68.9	67.9	73.1	68.9	71.4	69.8	69.6	2.00
1	Branson*	73.4	78.2	73.8	79.8	75.3	76.9	76.3	76.2	2.31
1	Hilliard*	73.1	76.8	73.8	78.8	74.3	75.9	75.3	75.4	1.96
2	MI20R0012	67.9	73.8	68.6	74.2	69.6	71.9	70.2	70.9	2.49
3	OK21428F	67.9	71.2	69.6	82.5	69.6	71.1	68.4	71.5	5.03
3	OK2189178WF	73.8	76.3	74.6	81.1	74.6	75.3	75.2	75.8	2.44

*Check varieties.

Table 17. Sucrose SRC (%) of 2024 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Kellanova	Mondelez	Star of West	SWQL	WWQL	**Mean**	**STDEV**
1	Beck 705	84.5	90.1	85.4	94.9	86.0	86.3	87.2	87.8	3.59
1	Beck 720	94.6	103.9	96.9	119.6	97.5	99.1	101.2	101.8	8.39
1	Beck 722	89.7	96.6	91.1	114.1	90.9	91.8	92.7	95.3	8.57
1	Beck 724	95.7	108.9	98.6	121.0	99.9	100.9	102.5	103.9	8.56
1	Beck 725	86.0	92.8	85.6	93.9	86.8	86.0	89.8	88.7	3.48
1	Beck 727	88.0	92.3	86.7	94.9	87.8	88.2	90.8	89.8	2.96
1	Beck 732	86.5	96.5	89.3	94.1	89.6	90.1	91.8	91.1	3.33
1	Branson*	97.1	104.9	95.3	108.7	98.7	98.3	100.3	100.5	4.70
1	Hilliard*	91.4	101.5	96.4	104.4	96.9	95.2	98.6	97.8	4.25
2	MI20R0012	86.5	97.5	88.5	98.3	88.8	86.9	90.9	91.0	4.90
3	OK21428F	91.5	99.5	93.4	120.0	93.9	93.4	95.3	98.1	9.95
3	OK2189178WF	93.5	107.5	99.3	116.8	99.8	100.3	102.4	102.8	7.46

*Check varieties.

Table 18. Lactic acid SRC (%) of 2024 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Kellanova	Mondelez	Star of West	SWQL	WWQL	**Mean**	**STDEV**
1	Beck 705	102.7	105.0	104.2	88.7	100.8	95.4	92.2	98.4	6.38
1	Beck 720	125.0	124.4	130.9	113.0	130.9	114.5	116.4	122.2	7.54
1	Beck 722	118.1	121.6	125.9	107.9	123.9	112.5	112.6	117.5	6.70
1	Beck 724	139.7	147.6	147.6	140.0	150.3	130.2	140.0	142.2	6.88
1	Beck 725	96.9	100.6	100.6	92.6	97.9	90.5	94.4	96.2	3.89
1	Beck 727	114.6	121.2	121.6	116.7	124.6	106.5	108.9	116.3	6.78
1	Beck 732	113.1	122.3	124.8	119.9	129.1	109.8	116.5	119.3	6.73
1	Branson*	110.9	111.2	109.5	88.6	106.8	99.0	92.2	102.6	9.37
1	Hilliard*	115.5	116.0	113.2	101.4	115.1	105.8	99.2	109.5	7.17
2	MI20R0012	101.6	105.3	106.8	97.4	106.3	95.0	92.7	100.7	5.73
3	OK21428F	110.0	114.5	113.9	104.4	109.6	103.5	98.2	107.7	5.96
3	OK2189178WF	121.1	118.1	122.4	92.5	120.5	108.1	94.9	111.1	12.80

*Check varieties.

Table 19. Sugar-snap cookie (10-50) diameter (mm) of 2024 WQC entries by cooperators

Group	Entry	ADM	Ardent	Mennel	Star of West	**Mean**	**STDEV**
1	Beck 705	512	498.7	493.0	476.0	494.9	14.92
1	Beck 720	501	502.0	502.0	463.5	492.1	19.09
1	Beck 722	507	497.7	502.5	470.0	494.3	16.64
1	Beck 724	493	484.0	484.0	447.0	477.0	20.44
1	Beck 725	519	494.7	507.5	487.5	502.2	13.93
1	Beck 727	516	494.2	503.0	484.0	499.3	13.57
1	Beck 732	509	493.1	487.0	469.0	489.5	16.53
1	Branson*	507	485.7	490.0	459.0	485.4	19.87
1	Hilliard*	504	495.4	499.5	469.0	491.9	15.59
2	MI20R0012	504	496.0	496.0	479.5	493.9	10.30
3	OK21428F	509	489.9	494.5	477.5	492.7	13.01
3	OK2189178WF	498	494.9	490.5	468.7	487.9	13.12

*Check varieties.

Table 20. Sugar-snap cookie (10-52) diameter (cm) of 2024 WQC entries by cooperators

Group	Entry	SWQL	WWQL	**Mean**	**STDEV**
1	Beck 705	9.1	9.3	9.2	0.16
1	Beck 720	9.0	9.1	9.1	0.12
1	Beck 722	9.2	9.2	9.2	0.03
1	Beck 724	8.8	9.2	9.0	0.31
1	Beck 725	9.4	9.1	9.2	0.17
1	Beck 727	9.3	9.4	9.3	0.03
1	Beck 732	9.3	9.0	9.1	0.20
1	Branson*	8.8	9.2	9.0	0.26
1	Hilliard*	9.2	8.8	9.0	0.26
2	MI20R0012	9.5	9.2	9.3	0.22
3	OK21428F	9.3	9.0	9.1	0.20
3	OK2189178WF	8.7	9.3	9.0	0.42

*Check varieties.

Table 21. Sponge cake volume (mL) of 2024 WQC entries by cooperators

Group	Entry	WMC	WWQL	**Mean**	**STDEV**
1	Beck 705	1132	1016	1074	82
1	Beck 720	1199	1095	1147	74
1	Beck 722	1155	1033	1094	86
1	Beck 724	1117	1036	1077	57
1	Beck 725	1196	1067	1132	91
1	Beck 727	1146	1099	1123	33
1	Beck 732	1094	997	1046	69
1	Branson*	1090	1093	1092	2
1	Hilliard*	1163	1088	1126	53
2	MI20R0012	1151	1078	1115	52
3	OK21428F	1188	1096	1142	65
3	OK2189178WF	1120	1029	1075	64

*Check varieties.

Table 22. Flour quality scores of 2024 WQC entries by cooperators

Group	Entry	ADM	Ardent	Kellanova	Mennel	Star of West	WMC	WWQL	**Mean**	**STDEV**
1	Beck 705	8	7	7	8	9	6	8	7.6	1.0
1	Beck 720	8	8	6	8	6	7	7	7.1	0.9
1	Beck 722	8	8	8	7	8	7	6	7.4	0.8
1	Beck 724	8	7	5	7	5	7	5	6.3	1.3
1	Beck 725	7	6	5	8	7	6	7	6.6	1.0
1	Beck 727	8	7	8	8	8	7	7	7.6	0.5
1	Beck 732	8	8	7	7	8	7	7	7.4	0.5
1	Branson*	8	7	4.5	7	6	7	4	6.2	1.5
1	Hilliard*	8	7	5	7	6	7	4	6.3	1.4
2	MI20R0012	8	7	5	7	8	6	7	6.9	1.1
3	OK21428F	8	6	6	7	8	6	6	6.7	1.0
3	OK2189178WF	8	8	4.5	8	7	6	3	6.4	2.0

*Check varieties.

Table 23. Cookie quality scores of 2024 WQC entries by cooperators

Group	Entry	ADM	Ardent	Mennel	Star of West	WWQL	**Mean**	**STDEV**
1	Beck 705	8	8	7	8	6	7.4	0.9
1	Beck 720	8	7	7	7	6	7.0	0.7
1	Beck 722	8	6	8	7	5	6.8	1.3
1	Beck 724	8	5	6	5	5	5.8	1.3
1	Beck 725	8	8	6	9	8	7.8	1.1
1	Beck 727	8	4	8	8	8	7.2	1.8
1	Beck 732	8	4	7	7	6	6.4	1.5
1	Branson*	8	6	7	5	4	6.0	1.6
1	Hilliard*	8	7	7	6	8	7.2	0.8
2	MI20R0012	8	8	7	8	7	7.6	0.5
3	OK21428F	8	6	7	5	6	6.4	1.1
3	OK2189178WF	8	4	7	6	5	6.0	1.6

*Check varieties.

Table 24. Sponge cake quality scores of 2024 WQC entries by cooperators

Group	Entry	WMC	WWQL	Mean	STDEV
1	Beck 705	5.5	5	5.3	0.4
1	Beck 720	6	8	7.0	1.4
1	Beck 722	6.5	6	6.3	0.4
1	Beck 724	6	6	6.0	0.0
1	Beck 725	7	6	6.5	0.7
1	Beck 727	7	8	7.5	0.7
1	Beck 732	6.5	5	5.8	1.1
1	Branson*	5.5	7		
1	Hilliard*	7	7	7.0	0.0
2	MI20R0012	6	6	6.0	0.0
3	OK21428F	7.5	6	6.8	1.1
3	OK2189178WF	6.5	5	5.8	1.1

*Check varieties.

Table 25. Average wheat grain and flour quality characteristics of the 2024 crop Soft Wheat Quality Council entries between 2009 and 2023 crop years

Group	Entry	N	Test Weight (LB/BU)	Grain Protein (%)	Kernel Hard.	Flour Yield (%)	Softness Equiv. (%)	Flour Protein (%)	Water SRC (%)	Sodium Carb. SRC (%)	Sucrose SRC (%)	Lactic Acid SRC (%)	Cookie Diameter (cm)
1	Beck 705	3	58.2	9.3	12.9	70.6	60.1	8.0	51.2	69.7	84.8	100.3	9.5
1	Beck 720	2	57.8	10.2	9.0	67.5	63.3	8.3	55.5	78.4	102.0	122.1	9.1
1	Beck 722	3	60.4	10.1	15.5	69.3	57.0	8.5	52.3	70.9	89.6	110.6	9.3
1	Beck 724	3	59.7	10.1	9.4	66.6	61.9	8.4	56.4	78.0	96.9	128.9	9.2
1	Beck 725	1	61.0	7.9	20.2	69.2	60.0	6.6	56.6	76.5	87.9	107.9	9.4
1	Beck 727	3	59.0	10.1	7.7	68.8	64.6	8.5	52.2	72.0	89.7	118.4	9.4
1	Beck 732	3	57.5	9.0	8.6	69.2	65.1	7.6	54.5	73.3	87.4	112.4	9.4
1	Branson*	70-321	59.7	10.6	5.8	69.2	61.6	8.3	52.4	67.0	91.2	109.0	9.4
1	Hilliard*	15-174	60.0	10.3	14.4	67.1	59.6	8.1	55.3	73.1	98.4	118.1	9.3
2	MI20R0012	4	60.9	9.1	10.8	69.6	63.8	7.4	55.0	70.8	93.0	103.8	9.9
3	OK21428F												
3	OK2189178WF												

*Check varieties.

Cooperator Data

ADM Milling Quality Evaluations

Table 26. Sugar-snap cookie baking test parameters by ADM Milling

Group	Entry	Cookie (10-50D)			
		Width (cm)	Thickness (cm)	W/T Ratio	Spread Factor
1	Beck 705	512	56	9.14	88.0
1	Beck 720	501	57	8.79	85.0
1	Beck 722	507	57	8.89	86.0
1	Beck 724	493	63	7.83	75.0
1	Beck 725	519	56	9.27	90.0
1	Beck 727	516	56	9.21	89.0
1	Beck 732	509	58	8.78	85.0
1	Branson*	507	58	8.74	84.0
1	Hilliard*	504	60	8.39	81.0
2	MI20R0012	504	59	8.54	82.0
3	OK21428F	509	55	9.25	89.0
3	OK2189178WF	498	59	8.43	81.0

*Check varieties.

Table 27. Evaluation comments on flour quality and baked product performance by ADM Milling

		Analytical Flour Qualities				End Product Performance				
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent				Aditional Comments
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	Beck 705	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ Nice spread
1	Beck 720	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ good dough/ good spread
1	Beck 722	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ performed well
1	Beck 724	Average protein & ash		Primary Analysis	8	Cookie	Lowest spread		8	No checking/ good dough/ lowest spread in group
1	Beck 725	Lower protein		Primary Analysis	7	Cookie	Good spread		8	Checking / Nice spread/ performed well
1	Beck 727	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No Checking / Nice spread/ performed well
1	Beck 732	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ good dough
1	Branson*	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ average spread
1	Hilliard*	Average protein & ash		Primary Analysis	8	Cookie	Good spread	All samples performed well	8	No checking/ average spread
2	MI20R0012	Lower protein		Primary Analysis	8	Cookie	Good spread		8	Checking/ Good dough/ average spread
3	OK21428F	Average protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ good dough/ performed good
3	OK2189178WF	Highest protein & ash		Primary Analysis	8	Cookie	Good spread		8	No checking/ average spread

*Check varieties.

Ardent Mills Quality Evaluations

Table 28. Solvent retention capacity and cookie baking test parameters by Ardent Mills

Group	Entry	Solvent Retention Capacity (%)				Cookies (10-50D)			
		Water	Sodium Carbonate	Sucrose	Lactic Acid	Width (mm)	Thickness (mm)	W/T Ratio	Spread Factor
1	Beck 705	50.9	64.4	84.5	102.7	498.7	41.9	11.9	101.3
1	Beck 720	52.7	70.6	94.6	125.0	502.0	39.4	12.8	109.3
1	Beck 722	51.6	66.8	89.7	118.1	497.7	41.3	12.1	102.6
1	Beck 724	56.3	74.7	95.7	139.7	484.0	44.0	11.0	93.5
1	Beck 725	52.7	67.4	86.0	96.9	494.7	39.0	12.7	107.9
1	Beck 727	51.8	65.7	88.0	114.6	494.2	39.0	12.7	107.9
1	Beck 732	52.0	67.4	86.5	113.1	493.1	41.6	11.9	100.9
1	Branson*	54.2	73.4	97.1	110.9	485.7	46.3	10.5	89.3
1	Hilliard*	53.8	73.1	91.4	115.5	495.4	41.3	12.0	102.1
2	MI20R0012	51.4	67.9	86.5	101.6	496.0	43.5	11.4	97.1
3	OK21428F	51.4	67.9	91.5	110.0	489.9	40.7	12.0	102.3
3	OK2189178WF	53.8	73.8	93.5	121.1	494.9	43.1	11.5	98.4

*Check varieties.

Table 29. Evaluation comments on flour quality and baked product performance by Ardent Mills

		Analytical Flour Qualities					End Product Performance				
		Score: 1 Poor - 9 Excellent					Score: 1 Poor - 9 Excellent				Aditional Comments
Group	Entry	Likes	Dislikes	Basis	Score		Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	Beck 705	High Lactic Acid, NIR values in line with check samples.	Slightly higher ash, Low Water	SRC, NIR MAP	7		Sugar Snap Cookie	Even texture across cookies, good surface cracking		8	This cookie could work in a cookie application
1	Beck 720	High Lactic Acid, NIR values in line with check samples.	Low Water	SRC, NIR MAP	8		Sugar Snap Cookie	High Spread Factor	stiff and sl crumbly dough, uneven browning	7	This sample might be useful in a cracker appliction.
1	Beck 722	High Lactic Acid, NIR values in line with check samples.	Low Water	SRC, NIR MAP	8		Sugar Snap Cookie	Even texture across cookies, good surface cracking, high spread factor	stiff and sl crumbly dough	6	This cookie could work in a cookie application
1	Beck 724	High Lactic Acid, NIR values in line with check samples.	Slightly Low Water	SRC, NIR MAP	7		Sugar Snap Cookie	Even browning, good cracking	stiff and crumbly dough, needed to be manually brought together before rolling, low spread factor	5	This sample might be useful in a cracker appliction.
1	Beck 725	Comparable Ash Value	Low Lactic Value, Slightly Low Protein	SRC, NIR MAP	6		Sugar Snap Cookie	Even texture across cookies, good surface cracking		8	This cookie could work in a cookie application
1	Beck 727	High Lactic Acid,	Low Water	SRC, NIR MAP	7		Sugar Snap Cookie		Uneven thickness, uneven browning	4	
1	Beck 732	NIR values Comparable to Checks	Low Water	SRC, NIR MAP	8		Sugar Snap Cookie	Even texture across cookies, good surface cracking	stiff and crumbly dough, had to bring together manually to be able to roll, smoother surface	4	This sample might be useful in a cracker or pie flour application, where the higher protein is an asset
1	Branson*	Higher Sucrose	Low Water	SRC, NIR MAP	7		Sugar Snap Cookie		Low Spread Factor, less cracking	6	check
1	Hilliard*	High Lactic Acid	Low Water	SRC, NIR MAP	7		Sugar Snap Cookie	Even texture across cookies, good surface cracking	slightly less cracking	7	check
2	MI20R0012		Slightly low Lactic Value	SRC, NIR MAP	7		Sugar Snap Cookie		Slightly Low Spread factor, Less cracking	8	This sample might be useful in a cracker appliction.
3	OK21428I	High Lactic Acid,	Slightly High Ash	SRC, NIR MAP	6		Sugar Snap Cookie		Uneven browning, uneven spread	6	This sample might be useful in a cracker appliction.
3	OK218917	High lactic acid	High Ash, High Protein	SRC, NIR MAP	8		Sugar Snap Cookie		crumbly and stiff dough, pea sized chunks. Needed to be manually brought together to roll, uneven surface texture, prominent bone, uneven thickness	4	This sample might be useful in a cracker or pie flour application, where the higher protein is an asset

*Check varieties.

Kellanova Quality Evaluations

Table 30. Solvent retention capacity and alveograph parameters by Kellanova

Group	Entry	Solvent Retention Capacity (%)				Alveograph				
		Water	Sodium Carbonate	Sucrose	Lactic Acid	P	L	P/L	le	W
1	Beck 705	49.9	64.9	85.4	104.2	23	120	0.19	33.9	31
1	Beck 720	52.4	71.9	96.9	130.9	39	116	0.34	43.3	59
1	Beck 722	51.9	67.5	91.1	125.9	30	107	0.28	39	43
1	Beck 724	57.1	75.9	98.6	147.6	53	74	0.72	52.6	67
1	Beck 725	53.9	67.7	85.6	100.6	54	76	0.71	52.4	88
1	Beck 727	51.9	66.1	86.7	121.6	31	100	0.31	44.3	47
1	Beck 732	53.2	67.9	89.3	124.8	36	82	0.44	49.9	57
1	Branson*	53.8	73.8	95.3	109.5	39	89	0.44	34.6	55
1	Hilliard*	53.9	73.8	96.4	113.2	44	66	0.67	40	65
2	MI20R0012	52.4	68.6	88.5	106.8	29	79	0.37	35.4	40
3	OK21428F	51.6	69.6	93.4	113.9	28	126	0.22	38.6	40
3	OK2189178WF	54.0	74.6	99.3	122.4	31	132	0.23	37.8	44

*Check varieties.

Table 31. Farinograph and rapid visco-analyzer parameters by Kellanova

Group	Entry	Farinograph					Rapid Visco-Analyzer							
		Water Absorption (%)	Develop-ment Time (min)	Stab-ility (min)	MTI	Degree of Softening	Peak Time (min)	Peak (cP)	Trough (cP)	Break-down (cP)	Setback (cP)	Final (cP)	Pasting Temp (°C)	Peak/Final Ratio
1	Beck 705	52.7	1.9	2.4	124	140	5.93	2685	1527	1158	1407	2934	66.1	0.92
1	Beck 720	53.7	1.8	5.2	50	80	6.07	2815	1810	1005	1522	3332	66.05	0.84
1	Beck 722	52.4	1.5	3.1	84	113	6.00	2997	1727	1270	1419	3146	65.3	0.95
1	Beck 724	55.4	1.3	1.7	72	62	6.13	3001	2101	900	1736	3837	67.6	0.78
1	Beck 725	52.5	1	<1.0	131	154	6.07	2840	1581	1259	1261	2842	66.1	1.00
1	Beck 727	53	1.1	1.8	140	124	6.13	3006	1863	1143	1390	3253	65.2	0.92
1	Beck 732	53.5	1.2	1.2	130	113	6.07	3069	1792	1277	1389	3181	66	0.96
1	Branson*	56.4	1.7	2.5	120	115	6.13	3094	1929	1165	1480	3409	65.15	0.91
1	Hilliard*	54.8	1.4	3.2	80	107	6.07	3003	1860	1143	1471	3331	65.25	0.90
2	MI20R0012	53.2	1	1	150	141	6.00	2605	1562	1043	1352	2914	65.15	0.89
3	OK21428F	53.7	1.7	3.7	120	107	6.07	3156	1719	1437	1411	3130	66.8	1.01
3	OK2189178WF	55.7	2.2	3.3	120	110	6.00	2677	1580	1097	1391	2971	66.1	0.90

*Check varieties.

Table 32. Flour moisture and protein content of the entries by Kellanova

Group	Entry	Moisture (%)	Protein (%)	Damage Starch (%)	Falling Number
1	Beck 705	13.95	9.52	4.5	419
1	Beck 720	13.75	9.01	4.6	393
1	Beck 722	13.84	8.84	4.3	417
1	Beck 724	13.91	8.72	4.9	427
1	Beck 725	13.77	7.18	4.4	354
1	Beck 727	13.62	8.55	4.5	377
1	Beck 732	13.86	8.78	4.3	389
1	Branson*	13.79	9.41	4.6	403
1	Hilliard*	13.72	8.38	4.3	399
2	MI20R0012	13.74	7.87	4.5	379
3	OK21428F	13.83	9.8	3.9	374
3	OK2189178WF	13.89	11.46	4.1	449

*Check varieties.

Table 33. Evaluation comments on analytical flour quality by Kellanova

		Analytical Flour Qualities					
		Score: 1 Poor - 9 Excellent					Additional Comments
Group	Entry	Likes	Dislikes	Basis	Score		Properties
1	Beck 705	High protein but lower sucrose SRC and dough water absorption	SRC-lactic acid is relatively low compared to some lines	Protein content and quality, water absorption (for cracker application)	7		
1	Beck 720	High protein, high SRC-LA, very strong soft dough	High water absorption; SRC-sucrose is slightly higher	Water absorption, protein content and quality	6		
1	Beck 722	High protein, high SRC-LA, lower water absorption		Protein content and quality, water abs	8		
1	Beck 724	Relatively high protein, very high SRC-LA	Water absorption is too high; high SRC-sucrose	Water absorption, protein content and quality (for cracker application)	5		Can consider blend with softer flour
1	Beck 725		Very low protein and SRC-LA, very soft dough	Dough strength (for cracker application)	5		Not suitable for crackers, but can be good for cookie application
1	Beck 727	Relatively high protein, fairly high SRC-LA	Slightly higher water absorption	Protein content and quality, water abs	8		
1	Beck 732	Relatively high protein, fairly high SRC-LA	Slightly higher water absorption	Protein content and quality, water abs	7		
1	Branson*	High protein	very high water absorption	water abs for cracker application	4.5		
1	Hilliard*	Average protein and SRC-LA	high water absorption	water abs for cracker application	5		
2	MI20R0012	Soft flour for cookie application	Slightly lower protein content and SRC-LA, slightly high water absorption	Protein content and quality, water abs, cracker application	5		
3	OK21428F	High protein	High water absorption; SRC-sucrose is slightly high	Protein content and quality, water abs, cracker application	6		
3	OK2189178WF	Very high protein, high SRC-LA	High SRC-sucrose and very high water absorption	water abs for cracker application	4.5		

*Check varieties.

Mennel Milling Quality Evaluations

Table 34. Solvent retention capacity by Mennel Milling

Group	Entry	Flour Moisture (%)	Flour Falling Number	Solvent Retention Capacity (%)			
				Water	Sodium Carbonate	Sucrose	Lactic Acid
1	Beck 705	13.70	362.50	51.75	68.73	90.06	105.04
1	Beck 720	13.50	385.00	55.55	74.55	103.93	124.39
1	Beck 722	13.70	367.50	52.14	70.67	96.62	121.62
1	Beck 724	13.70	399.50	58.52	77.88	108.88	147.61
1	Beck 725	13.60	336.00	55.12	69.28	92.83	100.63
1	Beck 727	13.40	363.50	51.67	67.91	92.27	121.24
1	Beck 732	13.70	373.00	53.29	68.89	96.53	122.26
1	Branson*	13.70	379.50	56.17	78.20	104.87	111.22
1	Hilliard*	13.70	351.00	54.38	76.81	101.47	116.00
2	MI20R0012	13.70	326.50	51.38	73.81	97.46	105.26
3	OK21428F	13.70	347.00	50.48	71.18	99.47	114.53
3	OK2189178WF	13.60	376.50	53.09	76.28	107.46	118.09

*Check varieties.

Table 35. Sugar-snap cookie baking test (10-50D) and biscuit test parameters by Mennel Milling

		Cookies (10-50D)				Biscuit		
Group	Entry	Width (mm)	Thickness (mm)	W/T Ratio	Spread Factor	Width (mm)	Height (mm)	Weight (g)
1	Beck 705	493	59	8	81	421	304	204
1	Beck 720	502	59	8	83	417	287	210
1	Beck 722	503	59	9	83	412	329	227
1	Beck 724	484	63	8	75	411	287	230
1	Beck 725	508	52	10	95	428	297	217
1	Beck 727	503	56	9	88	415	318	228
1	Beck 732	487	57	9	84	408	304	224
1	Branson*	490	66	7	73	413	328	222
1	Hilliard*	500	60	8	82	405	303	208
2	MI20R0012	496	57	9	85	414	293	216
3	OK21428F	495	55	9	88	417	318	224
3	OK2189178WF	491	61	8	79	423	368	256

*Check varieties.

Table 36. Rapid Visco-Analyzer parameters by Mennel Milling

Group	Entry	Peak Time (min)	Peak (cP)	Trough (cP)	Break-down (cP)	Setback (cP)	Final (cP)	Pasting Temp. (°C)	Peak/Final Ratio
1	Beck 705	6.1	2780	1658	1122	1353	3011	86.4	0.92
1	Beck 720	6.2	3036	2023	1013	1536	3559	85.6	0.85
1	Beck 722	6.2	3152	1935	1217	1415	3350	86.4	0.94
1	Beck 724	6.3	3107	2299	808	1662	3961	86.5	0.78
1	Beck 725	6.1	2947	1665	1282	1301	2966	85.6	0.99
1	Beck 727	6.2	3160	1996	1164	1444	3440	86.5	0.92
1	Beck 732	6.1	3192	1935	1257	1504	3439	84.0	0.93
1	Branson*	6.3	3233	2165	1068	1529	3694	86.4	0.88
1	Hilliard*	6.2	3167	2027	1140	1510	3537	85.6	0.90
2	MI20R0012	6.1	2689	1649	1040	1374	3023	85.5	0.89
3	OK21428F	6.1	3222	1837	1385	1396	3233	86.4	1.00
3	OK2189178WF	6.1	2704	1697	1007	1392	3089	85.6	0.88

*Check varieties.

Table 37. Evaluation comments on flour quality and baked product performance by Mennel Milling

		Analytical Flour Qualities				End Product Performance				
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent				Aditional Comments
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	Beck 705	Above average Pr. Low water SRC%	High sucrose SRC %, low peak viscosity	Protein, SRC, RVA	8	Cookies	Pale colored top, edges sealed up, no cracks observed on edges	Low spread factor	7	Light colored, small height and slightly above average width
1	Beck 720	Above average Setback Viscosity	High water %, sodium carbonate %, sucrose %, and lactic acid % SRC values.	SRC, RVA	8	Cookies	Light colored, edges sealed,	Wrinkles observed	7	Small height, and slightly above average width
1	Beck 722	Great breakdown and peak viscosities	Below average Pr. High lactic acid % SRC	SRC, RVA	7	Cookies	Smooth surface, less cracking, light colored		8	Great rise, slightly dark colored top, but below average width
1	Beck 724	High final paste viscosity	Low Pr, High water %, sodium carbonate %, sucrose %, and lactic acid % SRC values.	Protein, SRC, RVA	7	Cookies	Light colored	Cracks observed. Low spread factor	6	low height with dark spots
1	Beck 725	low sucrose % and sodium carbonate % SRC values	lowest Pr. low final peak viscosity	Protein, SRC, RVA	8	Cookies	Highest spread factor	Brittle, cracks observed, dark cookie with L* of 60.0	6	Good rise, light colored with slightly below average height
1	Beck 727	Low water %, sodium carbonate %, sucrose % SRC's. High final peak viscosity	Below average Pr. High lactic acid % SRC	Protein, SRC, RVA	8	Cookies	High spread factor	Snaps easily, cracks observd on the surface	8	Good rise, has dark spots
1	Beck 732	Low water %, sodium carbonate %, sucrose % SRC's. High final peak viscosity	Below average Pr. High lactic acid % SRC	Protein, SRC, RVA	7	Cookies	Tough, appearance. Edges sealed	Dark cookie with L* of 60	7	low wdith and height with light colored top
1	Branson*	High Pr and final peak viscosity	High sucrose % SRC	Protein, SRC, RVA	7	Cookies	Light colored with less spotting	Rough surface. Low spread factor	7	Light colored with less spots. Good rise
1	Hilliard*	High Pr and final peak viscosity		Protein, RVA	7	Cookies		Deep cracks, more spotting. Low spread factor	7	Dark colored with slightly below average width
2	MI20R0012	Low water % and sodium carbonate% SRC	Low Pr. Low trough viscosity	Protein, SRC, RVA	7	Cookies		Deep cracks observed. Dark cookie	7	low rise (height), with below average width
3	OK21428F	High Pr. Low water % and sodium carbonate % SRC's		Protein, SRC	7	Cookies	Easy to snap	Cracks observed	7	Uniform rise, with no spots
3	OK2189178WF	High Pr. Low water % and Sodium carbonate % SRC's	High sucrose % SRC	Protein, SRC	8	Cookies	Pale light colored top, no cracks observed on edges	Low cookie spread factor	7	great rise, with uniform width but has some spots

*Check varieties.

Mondelez Quality Evaluations

Table 38. Solvent retention capacity parameters by Mondelez

Group	Entry	Flour Moisture (%)	Solvent Retention Capacity (%)				Comments
			Water	Sodium Carbonate	Sucrose	Lactic Acid	
1	Beck 705	13.5	50.3	72.0	94.9	88.7	good for cookies, but lactic could be higher
1	Beck 720	13.1	54.0	79.2	119.6	113.0	high sucrose/carbonate
1	Beck 722	13.2	51.3	79.2	114.1	107.9	high sucrose/carbonate
1	Beck 724	13.2	56.4	84.3	121.0	140.0	high lactic/sucrose
1	Beck 725	13.4	52.7	72.5	93.9	92.6	well suited for cookies
1	Beck 727	13.3	50.3	76.5	94.9	116.7	well suited for crackers
1	Beck 732	13.4	50.0	73.1	94.1	119.9	well suited for crackers
1	Branson*	13.4	53.9	79.8	108.7	88.6	
1	Hilliard*	13.4	54.7	78.8	104.4	101.4	
2	MI20R0012	13.4	49.4	74.2	98.3	97.4	well suited for crackers
3	OK21428F	13.4	51.4	82.5	120.0	104.4	high sucrose/carbonate
3	OK2189178WF	13.4	51.2	81.1	116.8	92.5	high sucrose/carbonate

*Check varieties.

Star of the West Milling Evaluations

Table 39. Solvent retention capacity, cookie baking test and amyloviscograph test parameters by Star of the West Milling

Group	Entry	Solvent Retention Capacity (%)					Cookies (10-50D)				Flour FN	Amylograph Peak Peak Viscosity (BU)
		Water	Sodium Carbonate	Sucrose	Lactic Acid	LA/SC+S	Width (mm)	Thick-ness (mm)	W/T Ratio	Spread Factor		
1	Beck 705	51.5	66.7	86.0	100.8	0.66	476.0	56.5	8.42	82.7	409	554
1	Beck 720	53.3	72.3	97.5	130.9	0.77	463.5	61.0	7.60	74.2	407	654
1	Beck 722	52.4	68.5	90.9	123.9	0.78	470.0	57.0	8.24	80.5	355	679
1	Beck 724	58.2	77.1	99.9	150.3	0.85	447.0	70.5	6.34	61.9	408	717
1	Beck 725	53.9	69.1	86.8	97.9	0.63	487.5	52.0	9.38	91.5	286	587
1	Beck 727	52.0	67.6	87.8	124.6	0.80	484.0	56.0	8.64	84.4	387	672
1	Beck 732	54.0	68.9	89.6	129.1	0.81	469.0	58.0	8.09	80.4	363	707
1	Branson*	54.0	75.3	98.7	106.8	0.61	459.0	67.0	6.85	68.1	382	675
1	Hilliard*	53.6	74.3	96.9	115.1	0.67	469.0	62.0	7.56	75.2	374	676
2	MI20R0012	52.6	69.6	88.8	106.3	0.67	479.5	56.0	8.56	85.1	347	438
3	OK21428F	51.1	69.6	93.9	109.6	0.67	477.5	65.0	7.35	73.0	374	751
3	OK2189178WF	53.5	74.6	99.8	120.5	0.69	468.7	60.5	7.75	77.0	392	479

*Check varieties.

Table 40. Evaluation comments on flour quality and baked product performance by Star of the West Milling

		Analytical Flour Qualities				End Product Performance				
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent				Additional Comments
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	Beck 705	Low sodium carb and low sucrose SRC		SRC	9	Sugar snap cookies			8	
1	Beck 720	Strong flour high lactic acid	relatively high starch damage as indicated by the sodium carbonate	SRC	6	Sugar snap cookies		relatively tight spread.	7	
1	Beck 722	Fairly strong flour with fairly low starch damage.		SRC	8	Sugar snap cookies			7	
1	Beck 724		High starch damage as indicated by the Sodium Carb SRC, High sucrose	SRC	5	Sugar snap cookies		Very tight cookies	5	High water absorption would make it a good fit for batters and coatings. Not as good for cookies.
1	Beck 725	Good SRC profile.	Lowest lactic acid of all samples	SRC	7	Sugar snap cookies	Best spread of all samples. Good top pattern		9	Good flour for cookies. May be a bit weak for applications requiring a strong flour.
1	Beck 727	Strong flour with a good SRC profile		SRC	8	Sugar snap cookies	Good spread considering the strength of the flour		8	
1	Beck 732	Strong flour with a good SRC profile		SRC	8	Sugar snap cookies			7	
1	Branson*		Higher sodium carbonate	SRC	6	Sugar snap cookies		tight cookies	5	
1	Hilliard*		Higher sodium carbonate	SRC	6	Sugar snap cookies			6	
2	MI20R0012	Good SRC profile.		SRC	8	Sugar snap cookies	Very good spread		8	
3	OK21428F	decent SRC profile with relatively high protein		SRC	8	Sugar snap cookies		Tighter cookies than expected given SRC profile	5	
3	OK2189178WF	Very strong flour with higher protein	high sucrose and relatively high sodium carbonate	SRC	7	Sugar snap cookies	better cookies than expected given the SRC profile	Not a great top paaten	6	may not work for all applications due to the higher protein

*Check varieties.

Wheat Marketing Center Quality Evaluations

Table 41. Sponge cake baking test parameters by Wheat Marketing Center

Group	Entry	Sponge Cake					
		External Score	Crumb Grain Score	Texture Score	Volume (ml)	Total Score	Ranking
1	Beck 705	15	18	17	1132	50	12
1	Beck 720	16	19	17	1199	52	10
1	Beck 722	17	18	22	1155	57	5
1	Beck 724	16	19	17	1117	52	11
1	Beck 725	16	20	21	1196	57	4
1	Beck 727	17	20	22	1146	59	2
1	Beck 732	16	19	21	1094	56	7
1	Branson*	17	18	18	1090	53	9
1	Hilliard*	17	20	21	1163	58	3
2	MI20R0012	15	19	20	1151	54	8
3	OK21428F	16	20	23	1188	59	1
3	OK2189178WF	17	20	20	1120	57	6

*Check varieties.

Table 42. Evaluation comments on flour quality and sponge cake baking test performance by Wheat Marketing Center

		Analytical Flour Qualities				End Product Performance			
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent			
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score
1	Beck 705		High protein		6	Japanese Sponge Cake		Firm texture and domed shape	5.5
1	Beck 720	Good flour protein			7	Japanese Sponge Cake		Firm texture	6
1	Beck 722	Good flour protein			7	Japanese Sponge Cake	Soft texture		6.5
1	Beck 724	Good flour protein			7	Japanese Sponge Cake		Firm texture	6
1	Beck 725		Low flour protein		6	Japanese Sponge Cake	Soft texture and fine crumb structure		7
1	Beck 727	Good flour protein			7	Japanese Sponge Cake	Soft texture and fine crumb structure		7
1	Beck 732	Good flour protein			7	Japanese Sponge Cake	Soft texture		6.5
1	Branson*	Good flour protein			7	Japanese Sponge Cake		Firm texture and small volume	5.5
1	Hilliard*	Good flour protein			7	Japanese Sponge Cake	Soft texture and fine crumb structure		7
2	MI20R0012		Low flour protein		6	Japanese Sponge Cake	Soft texture	Domed shape	6
3	OK21428F		High flour protein		6	Japanese Sponge Cake	Large volume, soft texture and fine crumb structure		7.5
3	OK2189178WF		High flour protein, high ash		6	Japanese Sponge Cake	Soft texture		6.5

*Check varieties.

USDA-ARS Western Wheat Quality Laboratory Quality Evaluations

Table 43. Solvent retention capacity and mixograph test parameters by USDA-ARS Western Wheat Quality Laboratory

		Solvent Retention Capacity (%)				Mixograph				
Group	Entry	Water	Sodium Carb	Sucrose	Lactic Acid	Water Abs. (%)	Mid-point Time (min)	Mid-Point Height	Mid-point Work	Mid-point Width+2 min
1	Beck 705	49.8	66.3	87.2	92.2	53.0	2.8	48.8	118.1	6.3
1	Beck 720	52.6	73.9	101.2	116.4	51.5	3.9	47.1	166.7	7.8
1	Beck 722	52.1	70.7	92.7	112.6	51.5	4.0	48.8	172.3	11.1
1	Beck 724	55.3	78.1	102.5	140.0	53.0	4.8	47.0	202.4	12.7
1	Beck 725	51.5	69.3	89.8	94.4	50.0	1.2	43.2	40.6	14.1
1	Beck 727	51.0	69.1	90.8	108.9	51.5	4.4	47.2	189.6	7.8
1	Beck 732	52.0	69.8	91.8	116.5	51.5	4.3	46.8	178.0	16.8
1	Branson*	53.6	76.3	100.3	92.2	51.5	2.0	50.5	86.1	11.2
1	Hilliard*	54.1	75.3	98.6	99.2	51.0	2.3	48.6	97.8	12.0
2	MI20R0012	51.8	70.2	90.9	92.7	50.5	2.7	41.8	105.9	12.0
3	OK21428F	50.7	68.4	95.3	98.2	52.0	3.4	51.1	155.3	7.1
3	OK2189178WF	54.5	75.2	102.4	94.9	53.5	1.6	56.1	75.1	9.9

*Check varieties.

Table 44. Sugar-snap cookie and sponge cake baking test parameters by USDA-ARS Western Wheat Quality Laboratory

Group	Entry	Cookies (10-52)		Sponge Cake	
		Diameter (cm)	Top Grain Score	Volume (mL)	Texture Score
1	Beck 705	9.0		1016	
1	Beck 720	9.0		1095	
1	Beck 722	8.9		1033	
1	Beck 724	8.7		1036	
1	Beck 725	9.3		1067	
1	Beck 727	9.2		1099	
1	Beck 732	9.0		997	
1	Branson*	8.6		1093	
1	Hilliard*	9.0		1088	
2	MI20R0012	9.2		1078	
3	OK21428F	9.0		1096	
3	OK2189178WF	8.7		1029	

*Check varieties.

Table 45. Evaluation comments on flour quality and baked product performance by USDA-ARS Western Wheat Quality Laboratory

		Analytical Flour Qualities				End Product Performance			
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent			
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score
1	Beck 705	Nice SRCs			8		Good top grain	Small	6
1	Beck 720	Nice cracker-type flour			7		Good top grain	Small	6
1	Beck 722				6		Nice color	Small	5
1	Beck 724		High Carbonate SRC		5		Nice color	Small	5
1	Beck 725	Nice SRCs			7		Excellent top grain		8
1	Beck 727	Nice low ash			7		Excellent top grain		8
1	Beck 732	Nice SRC profile for stronger gluten material			7		Good color	Small	6
1	Branson*		High Carbonate and Sucrose SRCs		4		Nice color	Small, Minimal top grain	4
1	Hilliard*		High Carbonate and Sucrose SRCs		4		Excellent top grain		8
2	MI20R0012	Good SRCs			7		Good size	Uneven top grain	7
3	OK21428F				6		Nice color	Small	6
3	OK2189178WF		High protein, High ash, High SRCs		3		Nice color	Small, Minimal top grain	5

*Check varieties.

USDA-ARS Soft Wheat Quality Laboratory Soft Wheat Quality Evaluations

Table 46. Solvent retention capacity and cookie baking test parameters by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Solvent Retention Capacity (%)				Cookie (10-52)	
		Water	Sodium	Sucrose	Lactic	Width	Top Grain
1	Beck 705	51.6	68.7	86.3	95.4	18.2	6
1	Beck 720	54.3	75.1	99.1	114.5	17.9	7
1	Beck 722	52.5	71.4	91.8	112.5	18.3	6
1	Beck 724	57.3	79.4	100.9	130.2	17.6	5
1	Beck 725	55.1	71.0	86.0	90.5	18.7	6
1	Beck 727	53.4	70.3	88.2	106.5	18.6	6
1	Beck 732	54.3	71.4	90.1	109.8	18.6	6
1	Branson*	55.0	76.9	98.3	99.0	17.7	5
1	Hilliard*	55.3	75.9	95.2	105.8	18.4	6
2	MI20R0012	53.6	71.9	86.9	95.0	19.0	6
3	OK21428F	52.4	71.1	93.4	103.5	18.5	7
3	OK2189178WF	55.1	75.3	100.3	108.1	17.3	5

*Check varieties.

Table 47. Mixograph parameters by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Mixing Absorption (%)	Peak Time (sec)	Peak Value (%)	Peak Width (%)	Width @7min (%)
1	Beck 705	53.2	2.6	51.8	18.4	4.9
1	Beck 720	54.0	4.2	47.4	14.7	7.2
1	Beck 722	53.3	3.6	45.8	14.9	7.1
1	Beck 724	56.0	4.0	48.0	19.5	13.4
1	Beck 725	52.5	1.0	44.2	28.8	7.6
1	Beck 727	52.7	3.3	45.3	16.7	9.0
1	Beck 732	54.0	3.9	46.7	19.3	12.3
1	Branson*	54.0	0.8	55.4	31.9	7.0
1	Hilliard*	55.0	0.8	47.6	26.0	7.5
2	MI20R0012	53.5	0.8	42.6	24.0	10.4
3	OK21428F	52.5	2.0	52.9	23.5	6.8
3	OK2189178WF	58.0	1.7	55.1	23.1	5.1

*Check varieties.

Table 48. ViscoQuick parameters by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Peak Time (min)	Peak Viscosity (BU)	Trough (BU)	Break-down (BU)	Setback (BU)	Final Viscosity (BU)	Pasting Temperature (°C)
1	Beck 705	3.6	395	257	137	160	482	79.4
1	Beck 720	3.7	434	304	128	179	555	78.5
1	Beck 722	3.6	466	296	168	179	549	79.2
1	Beck 724	3.8	444	327	115	191	594	79.7
1	Beck 725	3.6	425	262	161	159	487	78.8
1	Beck 727	3.7	458	294	161	174	540	79.7
1	Beck 732	3.6	433	287	145	173	531	77.6
1	Branson*	3.7	447	299	145	183	556	79.5
1	Hilliard*	3.6	435	291	141	175	538	80.2
2	MI20R0012	3.6	408	271	134	161	502	79.3
3	OK21428F	3.6	473	286	184	164	521	80.1
3	OK2189178WF	3.7	403	272	128	159	498	81.0

*Check varieties.

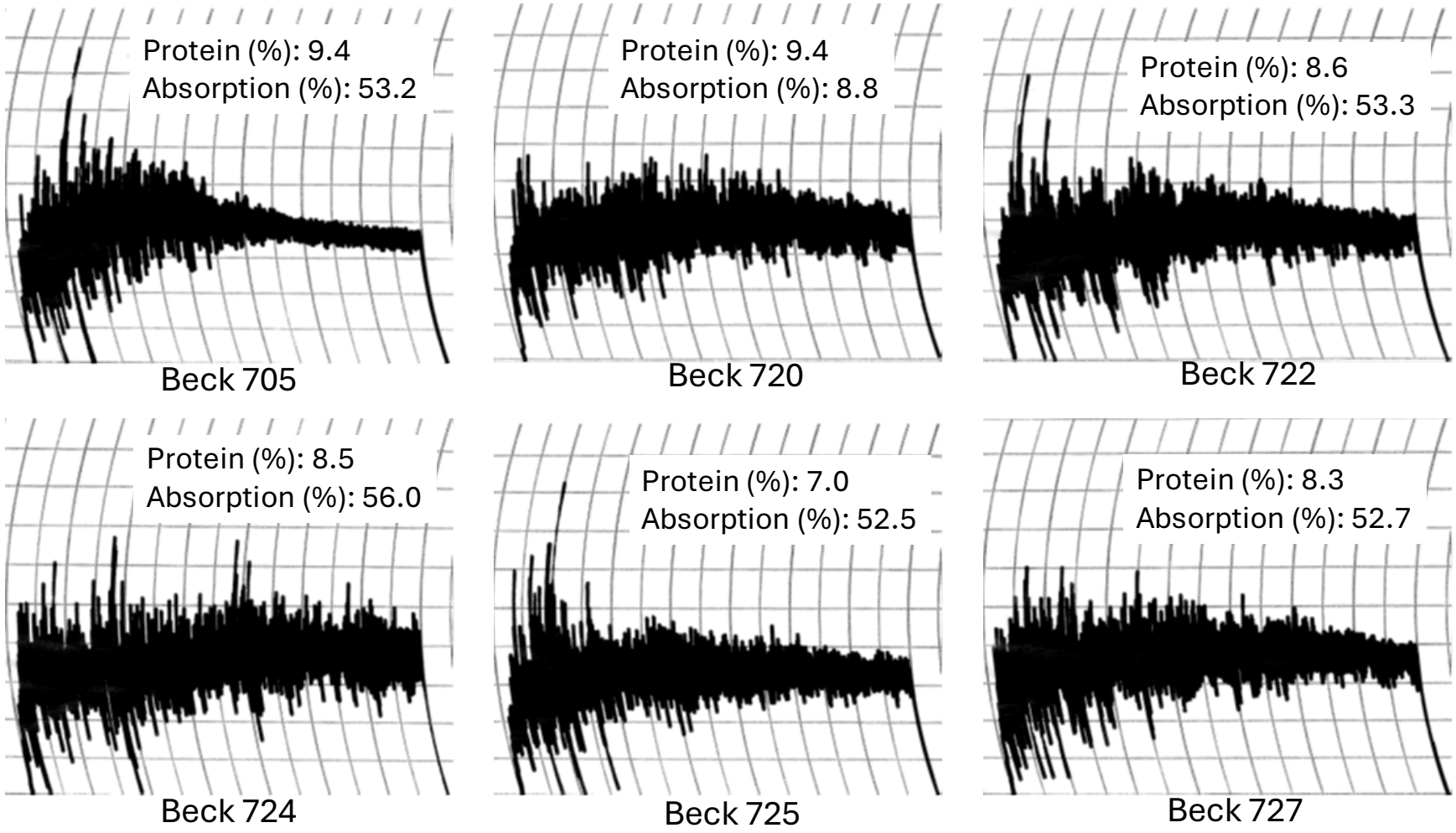
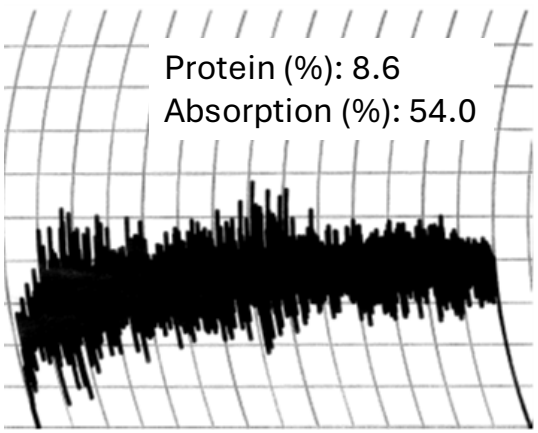
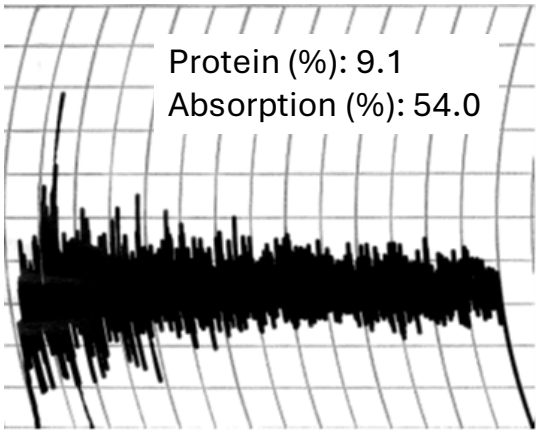


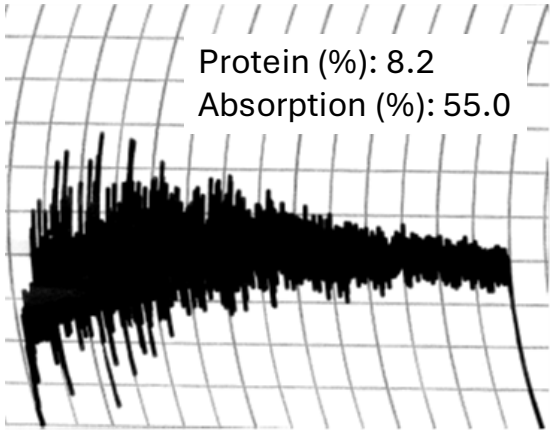
Figure 1. Mixograms of the WQC 2024 crop entries from Beck's Hybrids performed by USDA-ARS Soft Wheat Quality Laboratory.



Beck 732



Branson*



Hilliard*

Figure 1-Continued. *Check varieties.

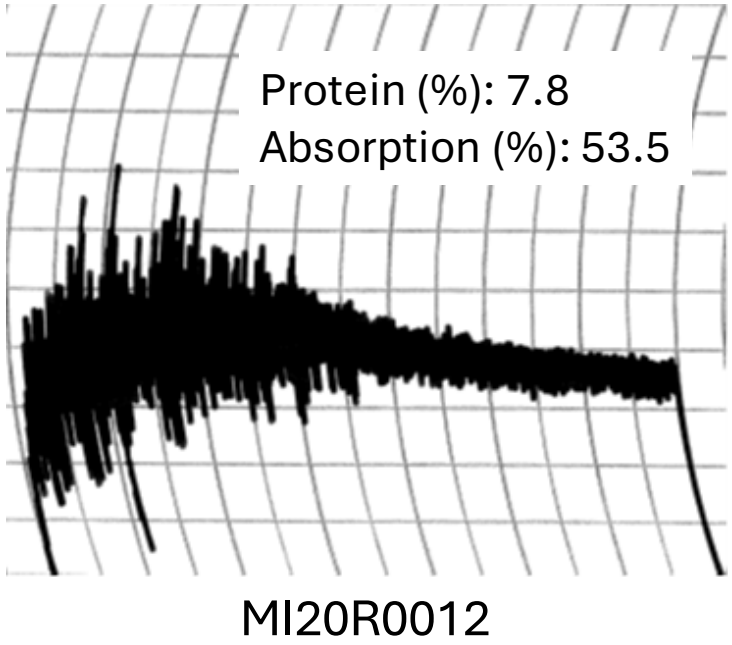


Figure 2. Mixogram of the WQC 2024 crop entry from Michigan State University performed by USDA-ARS Soft Wheat Quality Laboratory.

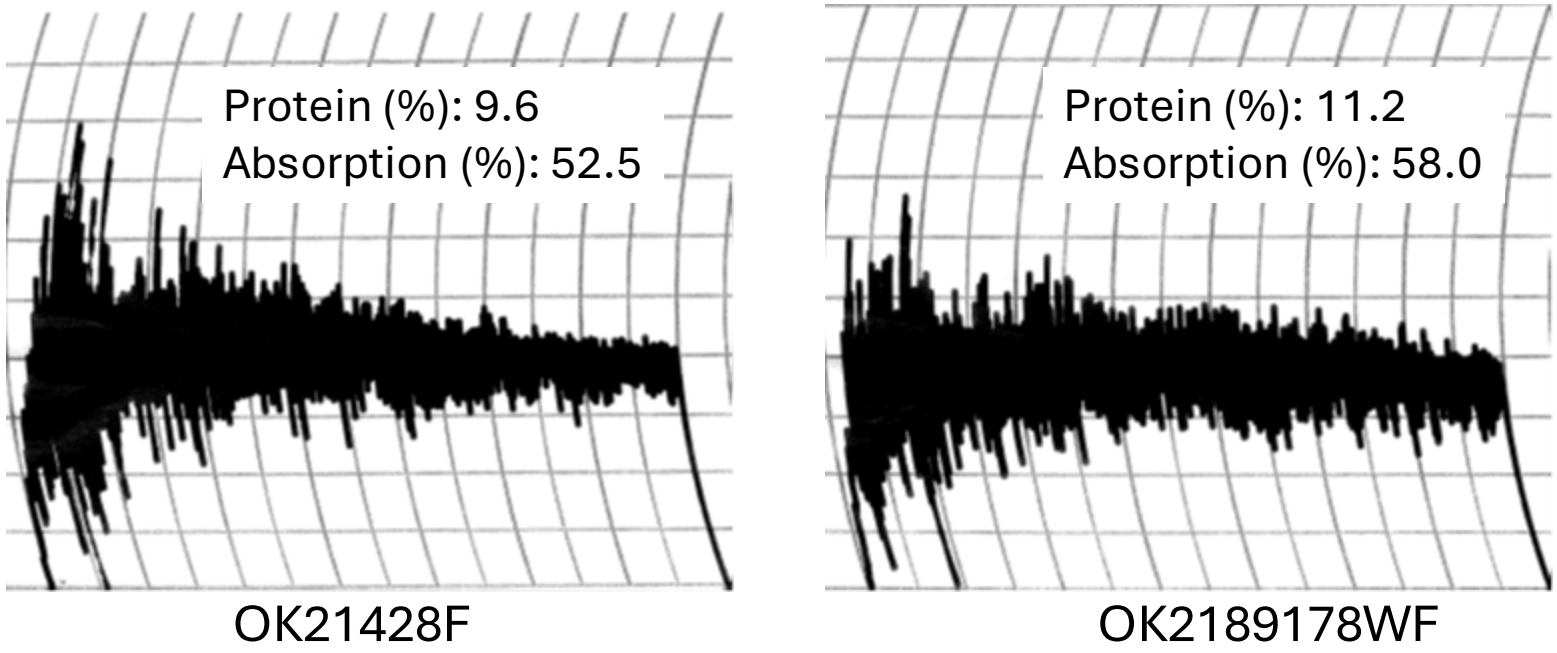


Figure 3. Mixograms of the WQC 2024 crop entries from Oklahoma State University performed by USDA-ARS Soft Wheat Quality Laboratory.

Appendix I. Materials and Methods of the USDA-ARS SWQL

Whole Kernel Protein Content

Whole wheat grain protein content is determined by a nitrogen combustion analysis using the Leco Nitrogen Analyzer for the whole grain meals ground using a Udy Cyclone mill. Protein content is calculated by nitrogen content x 5.7 and expressed on 12% moisture basis.

Falling Number, AACC Method 56-81B

The falling number test measures the travel time of the plunger in seconds (falling number) from the top to the bottom position in a glass tube filled with a suspension of whole grain meal or milled flour, immediately after being cooked in a boiling water jacket to produce gelatinized starch. The higher the viscosity of whole grain meal or flour paste in the glass tube, the longer the travel time of the plunger.

Amylase Activity, AACC Method 22-02-01

Alpha-amylase can be measured directly using a kit from Megazyme, International, Measurement of alpha-Amylase in Plant and Microbial Materials Using the Ceralpha Method. The SWQL uses a modified micro method of the Megazyme assay. Units are expressed in alpha-amylase activity as SKB units/gram (@ 25°C).

Test Weight, AACC Method 55-10

Test weight is measured per Winchester bushel of cleaned wheat subsequent to the removal of dockage using a Carter-Day dockage tester. Units are recorded as pounds/bushel (lb/bu) and kilograms/hectoliter (kg/hl).

1000-Kernel Weight

Units are recorded as grams/ 1000 kernels of cleaned wheat. There is little difference between 1000-kernel weight and milling quality when considering shriveled-free grain. However, small kernel cultivars that have 1000-kernel weight below 30 grams likely will have reduced milling yield of about 0.75%.

Single Kernel Characterization System (SKCS), AACC Method 55-31

SKCS distribution shows percent soft (A), semi-soft (B), semi-hard (C), and hard (D) SKCS hardness index; moisture content; kernel size; and kernel weight; along with standard deviations.

Miag Multomat Experimental Flour Mill Unit

The Miag Multomat Mill is a pneumatic conveyance system consisting of eight pairs of 254 mm diameter x 102 mm wide rolls, and ten sifting passages. Break rolls operate at 340 rpm for the fast rolls and 145 rpm for the slow rolls; 2.34:1 and reduction at 340 rpm fast and 250 rpm slow; 1.36:1. The first three rolls are break rolls; 1st break: 14 corrugations/inch, α 40, β 70, land 0.004”, 8% spiral; 2nd break: 20 corrugations/inch, α 40, β 75, land 0.002”, 10% spiral; 3rd break: 24 corrugations/inch, α 35, β 75, land 0.002”, 10% spiral. The five reduction rolls are smooth, not frosted. Following the second break is the grader and duster following the first reduction; allowing for more sifting surface area respectfully. Each mill run including the grader and duster precedes six sieves. Residue for this system includes head shorts, bran, red dog, and tail shorts.

Experimental Milling Procedure

The Miag Multomat Mill is a pneumatic conveyance system consisting of eight pairs of 254 mm diameter x 102 mm wide rolls, and ten sifting passages. Three of the pairs are corrugated break rolls and five are reduction rolls. Each sifting passage contains six separate sieves. The two top sieves for each of the break rolls are intended to be used as scalp screens for the bran.

Soft red and soft white winter wheat grain is tempered to 14.5% moisture. The tempered grain is held for 24 hours prior to milling and then introduced into the first break rolls at a rate of approximately 600g/min. Straight grade flour is a blend of three break flour streams, grader flour, five reduction streams and 1M re-duster flour. The straight grade flour is then re-bolted to remove any remaining residual by-products not removed by the mill using a stainless steel screen of 165 micron openings. The ash content of the straight grade flour usually ranges from 0.38 and 0.50%. Bran, head shorts, tail shorts and red dog are by-products, which are not included with the flour. Flour yield of eastern soft wheat varies from 70 to 78%. Flour yield depends on wheat variety and is influenced by environmental growing conditions. Sprouted and/or shriveled kernels negatively impact the flour yield. Recovery of all mill products is usually about 98%.

Flour Moisture, Air-oven Method, AACC Method 44-16.01

Wheat flour (~2 g) is dried on a hot aluminum plate in an air oven set at 140°C for 15 min. The moisture content is expressed as the percent loss of weight during drying.

Flour Protein

Protein is determined by a nitrogen combustion analysis using the Leco Nitrogen Analyzer. Protein content is calculated by nitrogen content x 5.7 and expressed on 14% moisture basis.

Flour protein differences among cultivars can be a reliable indicator of genetic variation provided the varieties are grown together, but can vary from year to year at any given location. Flour protein from a single, non-composite sample may not be representative. Based on the Soft Wheat Quality Laboratory grow-outs, protein can vary as much 1.5 % for a cultivar grown at various locations in the same half-acre field. Flour protein of 8% to 9% is representative for breeder's samples and SWQL grow-out cultivars.

Flour Ash, AACC Method 08-01

Flour ash is determined following the basic AACC method, expressed on 14% moisture basis.

Solvent Retention Capacity Test (SRC), AACC Method 56-11

Flour Lactic Acid, Sucrose, Water, and Sodium Carbonate Retention Capacities (SRC) results are expressed as percent solvent retained by weight.

Water SRC is a global measure of the water affinity of the macro-polymers (starch, arabinoxylans, gluten, and gliadins). It is often the best predictor of baked product performance. Lower water values are desired for cookies, cakes, and crackers, with target values below 51% on small experimental mills and 54% on commercial or long-flow experimental mills.

Sucrose SRC is a measure of arabinoxylan (also known as pentosans) content, which can strongly affect water absorption in baked products. Water soluble arabinoxylans are thought to be the

fraction that most greatly increases sucrose SRC. Sucrose SRC probably is the best predictor of cookie quality, with sugar snap cookie diameters decreasing by 0.07 cm for each percentage point increase in sucrose SRC. Soft wheat flours for cookies typically have a target of 95% or less when used by the US baking industry for biscuits and crackers. The 95% target value can be exceeded in flour samples where a higher lactic acid SRC is required for product manufacture since the higher sucrose SRC is due to gluten hydration and not to swelling of the water soluble arabinoxylans.

Sodium carbonate SRC employs a very alkaline solution that ionizes the ends of starch polymers increasing the water binding capacity of the molecule. Sodium carbonate SRC increases as starch damage due to milling increases. Normal values for good milling soft varieties are 68% or less.

Lactic acid SRC measures gluten strength. Typical values are below 85% for "weak" soft varieties and above 105% or 110% for "strong" gluten soft varieties. Lactic acid SRC results correlate to the SDS-sedimentation test. The lactic acid SRC is also correlated to flour protein concentration, but the effect is dependent on genotypes and growing conditions.

Flour Damaged Starch

As measured by the Chopin SDMatic starch damage instrument using the supplied AACC calibration. Starch damage is a measure of the damage to the starch granule occurring during the milling process.

Hot-paste viscosity, ViscoQuick Method

Viscosity units are in Brabender units, peak time in minutes, pasting temperature in degrees centigrade. The hot pasting viscosity/time analysis of starch and flour is accomplished using a ViscoQuick (Brabender GmbH &Co. KG, Duisburg, Germany). The "VQ-Starch" heating profile of that instrument's software is employed to produce pasting curves based on 10.0 g (14% moisture basis) flour and 105 mL deionized water. The pasting profile consists of five distinct segments: A premixing phase that preheats the mixture to 30°C, a 20°C/min heating ramp from 30 to 93°C, a 3 min hold at 93°C, a 15°C/min cooling ramp from 93 to 50°C, and finally a 1 min hold at 50°C. A fixed 250 rpm shear rate is used for all segments except the premixing, which is performed at 100 rpm. Pasting temperatures, peak viscosity, trough viscosity, and final viscosity values are extracted from the resulting viscosity versus time data. Maximum heating temperature is 93°C and minimum cooled temperature is 50°C. Peak pasting viscosity, peak time, trough viscosity during cooling, breakdown viscosity (difference between peak and trough viscosities), final viscosity at the conclusion of cooling, and setback (difference between viscosity when paste is cooled to 50°C and trough viscosity) are determined for each sample.

Sugar Snap Cookie, Micro Method, AACC Method 10-52

Diameter of two cookies expressed in cm, cookie top grain expressed in arbitrary units from unacceptable to outstanding from 1 to 9, respectively, are determined. Diameter and stack height of cookies baked according to this method are measured and used to evaluate flour baking quality.

Cultivars with larger cookie spreads tend to release moisture efficiently during the baking process due to lower water absorption while cultivars yielding smaller diameter cookies tend to be higher in water absorption and hold the moisture longer during baking.

Cookie spread determined within a location is a reliable indicator of the source cultivar's genetic characteristics. However, cookie spread, unlike milling quality, is greatly influenced by environmental conditions. An absolute single value for cookie spread could be misleading. Within a location the single value is significantly important in comparison to known standards. The average cookie spread for three different examples of a cultivar is representative of that wheat.