

Milling and Baking Test Results for Eastern Soft Wheats Harvested in 2021



**Soft Wheat Quality Council of the Wheat Quality
Council**



March 16, 2022

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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Collaborators for 2021 Crop Year

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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 2021 Crop Year Entries and Contributing Breeding Programs

Group	Entry Name	Location	Breeder/Contact	Institution/Company	Class
1	13VTK59-55	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
1	DH15SRW65-53	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
1	16VDH-SRW03-023	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
1	VA17W-75	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
1	Branson*	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
1	Hilliard*	Lanexa, VA	Nicholas Santantonio	Virginia Polytech	SRW
2	MI14W0190	Wooster, OH	Eric Olson	Michigan State U.	SWW
2	MI16R0898	Wooster, OH	Eric Olson	Michigan State U.	SRW
2	MI16W0133	Wooster, OH	Eric Olson	Michigan State U.	SWW
2	MI16W0528	Wooster, OH	Eric Olson	Michigan State U.	SWW
2	Whitetail*	Wooster, OH	Eric Olson	Michigan State U.	SWW
3	Beck 705	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Beck 722	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Beck 724	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Beck 727	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Beck 732	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Beck 721*	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
3	Hilliard*	Wooster, OH	Trek Murray	Beck's Hybrids	SRW
4	GA10127-18E26	Griffin, GA	Mohamed Mergoum	U. of Georgia	SRW
4	GA131246LDH-18E35	Griffin, GA	Mohamed Mergoum	U. of Georgia	SRW
4	GA15VDH-FHB-MAS23-18LE43F	Griffin, GA	Mohamed Mergoum	U. of Georgia	SRW
4	GA12505B14-18LE23F	Griffin, GA	Mohamed Mergoum	U. of Georgia	SRW
4	GW 2032 (14E19)*	Griffin, GA	Mohamed Mergoum	U. of Georgia	SRW

*Check varieties.

Description of Entries

13VTK59-55

DH15SRW65-53

16VDH-SRW03-023

VA17W-75

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.

MI14W0190

‘**MI14W0190**’ is a new **soft white winter** wheat variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. MI14W0190 demonstrates stable grain yield across Michigan and the Great Lakes region, particularly in Huron and Sanilac counties, the largest soft white wheat producing counties in Michigan. Fusarium head blight resistance in MI14W0190 is far superior to all soft winter wheat varieties available to Michigan wheat growers due in part to the *Fhb1* resistance gene. MI14W0190 also has excellent resistance to Stripe Rust. The disease resistance package of MI14W0190 makes it an ideal variety for organic wheat production. MI14W0190 flowers one day later than ‘Ambassador’ and one day earlier than ‘Jupiter’ early providing growers the opportunity to stagger variety maturities. MI14W0190 height is similar to the soft white winter wheat ‘Ambassador’.

MI16R0898

‘**MI16R0898**’ is a new **soft red winter wheat** variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. MI16R0898 has a high two-year grain yield comparable to the commercial soft red winter wheat varieties ‘DF112R’, ‘SY 100’ and

‘AgriMAXX 413’. In 2019, grain yield for MI16R0898 ranked in the top 25% of commercial wheat varieties tested in Michigan in 2019 and #4 out of 39 entries in the Uniform Eastern Soft Red Winter Wheat Nursery tested at Mason, MI. DON mycotoxin levels and visual FHB index are very low in MI16R0898 conferred by the Fhb1 gene. MI16R0898 has excellent resistance to Stagonospora Leaf Blotch due in part to the absence of the ToxA receptor Tsn1. Soilborne Mosaic Virus resistance in MI16R0898 is conferred by the Sbm1 gene. MI16R0898 has average flour yield and meets all soft wheat quality specifications. Flowering for MI16R0898 is two days later than DF112R and similar to SY100. MI16R0898 is three inches taller than the soft white winter wheat ‘Jupiter’ and similar to the soft white winter wheat ‘Ambassador’.

MI16W0133

‘MI16W0133’ is a new **soft white winter wheat** variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. MI16W0133 has a high two-year grain yield higher than the commercial soft white winter wheat varieties Dyna-Gro 9242W, Jupiter and Ambassador. In 2019, grain yield for MI16W0133 ranked in the top 10% of commercial wheat varieties tested in Michigan in 2019 and #2 out of 39 entries in the Uniform Eastern Soft White Winter Wheat Nursery tested in Richville, MI and New Haven, IN. MI16W0133 is susceptible to FHB and will require preventative fungicide applications. MI16W0133 has excellent resistance to Stagonospora Leaf Blotch due in part to the absence of the ToxA receptor Tsn1. Soilborne Mosaic Virus resistance in MI16W0133 is conferred by the Sbm1 gene. MI16W0133 has above average flour yield and meets all soft wheat quality specifications.

MI16W0528

‘MI16W0528’ is a new **soft white winter wheat** variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. MI16W0528 has a high two-year grain yield higher than the commercial soft white winter wheat varieties Dyna-Gro 9242W, Jupiter and Ambassador. In 2019, grain yield for MI16W0528 ranked in the top 30% of commercial wheat varieties tested in Michigan in 2019 and #1 out of 39 entries in the Uniform Eastern Soft White Winter Wheat Nursery tested in Richville, MI and New Haven, IN. MI16W0528 is moderately resistant to FHB evidenced by low DON levels and low visual FHB index. Soilborne Mosaic Virus resistance in MI16W0528 is conferred by the Sbm1 gene. MI16W0528 has above average flour yield and meets all soft wheat quality specifications.

Whitetail*

‘Whitetail’ is a **soft white winter wheat** variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. Whitetail has the highest multi year grain yield average of soft white winter wheat across all Michigan testing locations. DON (deoxynivalenol) mycotoxin levels are lower than any commercially available soft white winter wheat variety. Flowering date is similar to commercial wheat varieties grown in Michigan. A short plant architecture allows for intensive management for high yield potential. Strong gluten and high flour yield give this variety enhanced marketing potential.

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.

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

PLANT TRAITS

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

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

MANAGEMENT TIPS

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



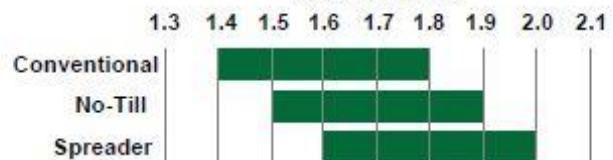
POSITIONING AND ADAPTABILITY - BY SOIL

	Excellent	Good	Not Recommended
Irrigated			
High			
Medium			
Low			
Poorly Drained			

SOIL PRODUCTIVITY

RECOMMENDED SEEDING POPULATION

Seeds/A. (millions)



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

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

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



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

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

POSITIONING AND ADAPTABILITY - BY SOIL

	Excellent	Good	Not Recommended
Irrigated			
High			
Medium			
Low			
Poorly Drained			

SOIL PRODUCTIVITY

RECOMMENDED SEEDING POPULATION

Seeds/A. (millions)

1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1



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

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	90.5	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



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

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

POSITIONING AND ADAPTABILITY - BY SOIL

Irrigated	Excellent	Good	Not Recommended
High	Excellent	Good	Not Recommended
Medium	Excellent	Good	Not Recommended
Low	Excellent	Good	Not Recommended
Poorly Drained	Excellent	Good	Not Recommended

SOIL PRODUCTIVITY

RECOMMENDED SEEDING POPULATION

Seeds/A. (millions)

1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1



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

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	5	BECK 724	81.9	55.1
		Pioneer P26R36	78.5	54.9

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.

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

PLANT TRAITS

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

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

MANAGEMENT TIPS

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



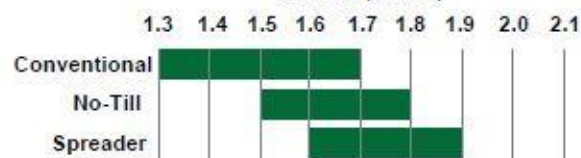
POSITIONING AND ADAPTABILITY - BY SOIL

	Excellent	Good	Not Recommended
Irrigated			
High			
Medium			
Low			
Poorly Drained			

SOIL PRODUCTIVITY

RECOMMENDED SEEDING POPULATION

Seeds/A. (millions)



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

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

Beck 721

721

BRAND

SOFT RED WINTER WHEAT

Early Maturity

STRENGTHS

This agronomic leader has strong performance across all soil types across our southern marketing area with stress tolerance and top end yield. It has excellent plant health, harvest looks, and a tremendous yield punch.

MANAGEMENT TIPS

- Allows for flexible placement across soil types
- Performs best in the I-70 corridor and south
- Low response to a fungicide applications

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.

MANAGEMENT TIPS

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

GA10127-18E26

GA10127-18E26 is derived from the cross of GA00219-8E45 /GA031238-7E34 //GA03388-16-4 made in 2010. GA00219-8E45 is an experimental line developed by UGA and was used in the cross as a parent with leaf rust resistance. GA031238-7E34 is also a UGA line and was used as a parent for reduced plant height and lodging resistance. Similarly, GA03388-16-4 is a UGA experimental line and was used as a parental line for its high yield and stripe rust resistance (Yr17). GA10127-18E26 is a high grain yielding, medium to late maturing, awned, with good test weight, and medium tall line. Its maturity is similar to Hilliard but 7 days later than Savoy and Jamestown. It has very good resistance to lodging and excellent resistance to major races of leaf rust and medium resistance to stem rust and wheat blast diseases. It is medium resistance to stripe rust, powdery mildew, bacteria and septoria blotch. GA10127-18E26 has good resistance to Hessian fly and improved fusarium head blight (FHB) (due to 1A_Neuse and 4A_Neuse QTLs) resistance than susceptible checks. It has a major QTL (Sbm1) for wheat soil-borne virus. GA10127-18E26 has excellent quality attributes with high flour extraction/yield and Cookie diameter.

GA131246LDH-18E35

GA131246LDH-146-18E35 is from the cross of GA04151-11E26/USG 3120 //GA041323-11E63 made in 2013. GA04151-11E26 is a UGA line and was used as a parent for Fusarium head blight (FHB) resistance (1B_JT QTL). USG 3120 is a 2009 UGA release (GA991209-6E33) was used as a parental line for its high yield, earliness, high test weight and rusts resistance (Yr17/Lr37/Sr38 genes). GA041323-11E63 is also an experimental line developed by UGA and was used in the cross as a parent with Hessian fly resistance. GA131246LDH-146-18E35 is relatively a high grain yielding wheat line, particularly in the Southern parts of GA and SE region, medium to late maturing, awned, with good test weight, and medium tall cultivar. GA131246LDH-146-18E35 matures the same time as Hilliard, 3 days earlier than PIO26R41 and 6 days later than Jamestown. It has medium resistant to lodging and good diseases resistance package. It is resistant to races of leaf rust, powdery mildew and bacteria and to wheat blast diseases. It is medium resistance to stripe rust, septoria and stem rust diseases. GA131246LDH-146-18E35 has improved FHB (due to 1B_JT QTL) resistance compared to susceptible checks. It is medium resistant to Hessian fly and has the major QTL (Sbm1) for wheat soil-borne virus. GA131246LDH-146-18E35 has excellent quality attributes with high flour extraction/yield and Cookie diameter.

GA15VDH-FHB-MAS23-18LE43F

GA23-18LE43F was selected from the cross of MD08-26-H2-7 / VA09W-73 // VA12W-150 made in 2015. MD08-26-H2-7 is an experimental line from Maryland program and was used in the cross as source of Fusarium head blight (FHB) resistance having Fhb1. VA09W-73 and VA12W-150 are two experimental lines that showed good adaptation to GA and the region and were used to transfer Hessian fly resistance and stripe rust resistance (Yr17), respectively. Overall, GA23-18LE43F is a high grain yielding, medium-late maturing with very good test weight. It has awned spikes and medium plant height. Its maturity is similar to AGS 2024 and Hilliard but 3-4 days later than Savoy and 6 days than Jamestown. GAMA23-18LE43F matures about 4 days earlier than PIO26R41. It is also medium resistant to lodging. GAMA23-18LE43F is one of the first UGA line that possess the major gene Fhb1 for FHB resistance. In addition, it has the 5A-Ning QTL for FHB resistance. Therefore, its medium resistance to FHB, which is significantly improved compared to previously released cultivars in GA and the Southeast region. It has excellent resistance to races of leaf rust and stem rust and wheat blast diseases. It is also resistant to Hessian fly; but medium resistant to stripe rust, powdery mildew, bacteria and septoria blotch. However, its reaction to stripe rust was medium to susceptible in 2018 in some LA tests. It has a major QTL (Sbm1) for wheat soil-borne virus that can protect it against the virus. GAMA23-18LE43F has good and acceptable milling and baking quality as a soft red winter wheat, including cookie diameter.

GA12505B14-18LE23F

GA12505B14-18LE23F is a derivative of the cross of SS8641 *2 / PIO26R32 made in 2012. SS8641 is a released cultivar (2006) developed by UGA and was used in the cross as the adapted parent with stripe and leaf rusts (Yr17/Lr37) resistances. PIO26R32 a released Pioneer cultivar was used as parent having Fhb1 gene providing good resistance to Fusarium head blight (FHB). GA12505B14-18LE23F is one of the first UGA cultivars that possess the major gene Fhb1 for FHB resistance. Therefore, its medium resistance to FHB is a significant improvement compared to previously released cultivars in GA and the region. GA12505B14-18LE23F is a high grain yielding, medium-late maturing, awned, with very good test weight, and medium plant height.

Its maturity is 6-13 days later than Savoy, and 5 days earlier than PIO26R41. It has excellent resistance to lodging and it is medium resistant to FHB (due to the major gene Fhb1), a significant improvement resistance compared to previously released cultivars in GA and the region. It has also excellent resistance to races of leaf and stripe rusts. It is medium resistance to powdery mildew, bacteria and septoria blotch, glumes in particular. GA12505B14-18LE23F has good resistance to Hessian fly and has the major QTL (Sbm1) for wheat soil-borne virus. GA12505B14-18LE23F has acceptable quality attributes with average flour extraction/yield and Cookie diameter.

GW 2032 (14E19)*

GA 07353-14E19 is from the cross of SS 8641 / Oglethorpe// 991371-6E13. SS 8641 was crossed due to its stripe rust (Yr17) and leaf rust (Lr37) resistance. Oglethorpe was used due to its Hessian fly resistance. 991371-6E13 was used due to its high grain yield. GA 07353-14E19 is a high grain yielding, early-medium maturing, awned, average test weight, and medium plant height cultivar. Its maturity is similar to AGS 2035 and is 2-3 days earlier than AGS 2024 and SH 5550. Juvenile plant growth is erect. At the boot stage, it is blue-green plant color and flag leaves are not erect and twisted. Spikes are strap and mid dense. GA 07353-14E19 has good resistance to leaf rust, stripe rust, powdery mildew and wheat soil-borne mosaic virus resistance. It has improved level of resistance to Fusarium head blight (FHB) and is resistant in the field to current biotypes of Hessian fly in Georgia. GA 07353-14E19 has acceptable milling and baking quality as a soft red winter wheat.

Milling and Baking Results Reported by Collaborators and SWQL

Mill Stream Distribution by SWQL

Table 1. Miag Multomat mill stream yields (%) of the WQC 2021 crop year entries by SWQL

Mill Stream	Group 1						Group 2				
	13VTK 59-55	DH15SR W65-53	16VDH- SRW03-023	VA17W- 75	Branson*	Hilliard*	MI14W 0190	MI16 R0898	MI16W 0133	MI16W 0528	Whitetail*
1st Break	7.5	8.0	9.0	7.2	10.4	9.7	6.6	8.6	9.6	11.2	9.4
2nd Break	7.0	7.3	7.3	7.0	7.9	7.4	8.1	9.6	9.2	9.9	9.4
Grader	3.7	4.1	3.9	4.0	5.3	4.6	4.2	4.2	4.5	4.8	4.6
3rd Break	7.8	7.7	8.0	7.7	7.2	8.4	7.0	8.5	7.7	8.5	8.0
Total Break	26.0	27.2	28.2	25.9	30.8	30.0	25.9	30.9	31.0	34.4	31.4
1st Reduction	12.8	11.5	11.5	10.0	11.8	10.9	11.6	10.5	11.3	12.1	10.5
2nd Reduction	11.0	11.1	10.4	10.5	8.7	8.8	12.3	8.9	9.9	8.3	9.4
3rd Reduction	5.2	5.3	5.5	6.1	4.6	5.2	6.0	5.8	5.3	4.9	5.9
Duster	9.0	8.8	7.7	8.0	8.8	7.4	9.4	7.1	7.9	8.0	7.4
4th Reduction	4.2	4.6	4.3	4.9	3.3	3.8	5.2	5.1	4.3	3.9	5.0
5th Reduction	2.8	2.5	2.7	3.0	1.7	2.1	2.7	3.1	2.4	2.1	2.8
Total Reduction	45.0	43.8	41.9	42.5	38.9	38.3	47.2	40.6	41.2	39.2	41.1
Straight	71.0	71.0	70.1	68.4	69.7	68.3	73.1	71.4	72.2	73.6	72.5
Head Shorts	6.8	6.8	6.9	6.1	6.4	7.1	6.2	6.8	5.5	6.4	5.7
Red Dog	1.7	1.4	1.8	1.8	1.3	1.7	1.6	2.4	1.6	1.8	2.2
Tail Shorts	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.4	0.5	0.4
Bran	19.9	20.2	20.7	23.2	22.0	22.4	18.7	18.8	20.4	17.6	19.2
Total	29.0	29.0	29.9	31.6	30.3	31.7	26.9	28.6	27.8	26.4	27.5

*Check varieties.

Table 1-continued

Mill Stream	Group 3							Group 4				
	Beck 705	Beck 722	Beck 724	Beck 727	Beck 732	Beck 721*	Hilliard*	GA10127- 18E26	GA131246LDH- 18E35	GA15VDH- FHB- MAS23- 18LE43F	GA12505B14- 18LE23F	GW 2032 (14E19)*
1st Break	9.7	7.9	9.7	11.2	11.2	7.6	10.0	10.5	9.4	8.2	7.1	7.3
2nd Break	8.9	7.6	9.4	9.2	10.8	7.9	8.7	8.8	8.1	8.2	7.2	7.0
Grader	4.9	4.1	4.2	5.3	4.3	3.8	4.7	5.0	4.6	4.0	3.4	3.9
3rd Break	8.2	7.0	10.4	8.6	10.2	6.8	9.1	8.4	8.0	7.9	8.4	7.2
Total Break	31.7	26.6	33.7	34.3	36.5	26.0	32.5	32.7	30.0	28.4	26.1	25.4
1st	11.8	11.1	8.6	11.0	10.8	11.4	10.8	10.9	11.9	10.7	12.0	11.4
2nd	9.9	10.9	6.2	7.5	7.3	11.3	7.7	9.1	10.7	9.6	10.3	11.2
3rd	5.5	6.1	5.9	4.8	5.0	6.2	5.5	5.3	5.6	6.2	6.3	6.6
Duster	8.5	8.6	5.0	7.6	6.2	8.3	7.2	7.3	8.5	6.9	7.5	8.6
4th	4.6	5.2	4.9	3.8	4.2	5.5	4.3	4.6	5.0	5.8	5.6	6.1
5th	2.3	3.1	3.4	2.0	2.4	3.2	2.4	2.3	2.6	3.6	3.5	3.3
Total Reduction	42.5	45.0	34.1	36.7	36.0	46.0	37.9	39.5	44.2	42.9	45.2	47.2
Straight Grade	74.3	71.6	67.8	71.0	72.4	72.0	70.4	72.3	74.3	71.3	71.3	72.5
Head	5.9	6.4	6.9	6.1	7.1	5.6	7.6	6.5	6.4	7.3	7.3	5.8
Red Dog	2.0	2.4	3.8	1.9	2.5	2.5	2.5	2.0	1.7	2.6	2.5	1.7
Tail Shorts	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.7	0.5
Bran	17.4	19.0	20.9	20.5	17.4	19.4	18.8	18.8	17.1	18.1	18.3	19.5
Total Byproduct	25.7	28.4	32.2	29.0	27.6	28.0	29.6	27.7	25.7	28.7	28.7	27.5

*Check varieties.

Wheat Grain and Flour Quality Characteristics

Table 2. Grain characteristics and SKCS parameters of the 2021 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Test Weight (lb/bu)	Grain Protein (%, 12% mb)	Grain Falling Number	SKCS Parameter		
					Kernel Hardness	Kernel Diameter (mm)	Kernel Weight (mg)
1	13VTK59-55	62.3	10.4	427	25.6	2.8	32.9
1	DH15SRW65-53	62.2	10.7	355	19.2	2.7	35.1
1	16VDH-SRW03-023	60.6	10.0	320	18.4	2.7	34.5
1	VA17W-75	61.5	10.7	348	26.8	2.6	33.1
1	Branson*	58.7	10.4	378	3.8	2.6	33.6
1	Hilliard*	60.2	10.4	327	12.0	2.6	34.3
2	MI14W0190	61.2	10.4	378	24.4	2.8	35.7
2	MI16R0898	59.9	9.0	366	18.9	2.6	30.7
2	MI16W0133	57.5	9.2	371	13.7	2.6	32.8
2	MI16W0528	58.4	9.0	339	7.1	2.6	30.4
2	Whitetail*	58.9	10.1	390	10.3	2.8	38.5
3	Beck 705	58.3	8.8	367	10.3	2.8	34.0
3	Beck 722	60.9	10.1	391	21.4	2.9	36.1
3	Beck 724	60.4	9.9	466	10.0	2.8	39.6
3	Beck 727	58.4	9.7	385	4.4	2.6	32.5
3	Beck 732	58.3	8.1	357	8.0	2.6	32.5
3	Beck 721*	60.0	9.7	379	25.2	2.7	36.2
3	Hilliard*	60.8	10.6	381	12.2	2.6	33.1
4	GA10127-18E26	62.2	7.7	329	15.6	2.8	32.2
4	GA131246LDH-18E35	61.8	7.6	323	19.0	3.0	42.2
4	GA15VDH-FHB-MAS23- 18LE43F	63.2	7.9	418	27.2	2.7	32.2
4	GA12505B14-18LE23F	64.4	8.3	360	33.6	2.7	36.8
4	GW 2032 (14E19)*	63.4	9.9	446	36.9	2.8	35.2

*Check varieties.

Table 3. Miag and Quadrumat milling parameters of the 2021 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Miag Milling		Quadrumat Milling	
		Break Flour Yield (%)	Straight Grade Flour Yield (%)	Flour Yield (%)	Softness Equivalence (%)
1	13VTK59-55	26.0	71.0	67.9	54.5
1	DH15SRW65-53	27.2	71.0	68.4	55.0
1	16VDH-SRW03-023	28.2	70.1	68.7	56.2
1	VA17W-75	25.9	68.4	66.8	56.1
1	Branson*	30.8	69.7	68.4	63.9
1	Hilliard*	30.0	68.3	66.7	60.4
2	MI14W0190	25.9	73.1	69.4	53.5
2	MI16R0898	30.9	71.4	69.1	59.9
2	MI16W0133	31.0	72.2	70.3	62.6
2	MI16W0528	34.4	73.6	71.1	64.2
2	Whitetail*	31.4	72.5	70.3	60.0
3	Beck 705	31.7	74.3	71.8	62.0
3	Beck 722	26.6	71.6	69.4	55.2
3	Beck 724	33.7	67.8	66.7	61.8
3	Beck 727	34.3	71.0	68.9	67.3
3	Beck 732	36.5	72.4	70.2	66.2
3	Beck 721*	26.0	72.0	69.7	55.6
3	Hilliard*	32.5	70.4	68.0	61.2
4	GA10127-18E26	32.7	72.3	69.9	61.9
4	GA131246LDH-18E35	30.0	74.3	71.1	59.1
4	GA15VDH-FHB-MAS23-18LE43F	28.4	71.3	68.7	54.8
4	GA12505B14-18LE23F	26.1	71.3	67.2	51.0
4	GW 2032 (14E19)*	25.4	72.5	69.4	53.6

*Check varieties.

Table 4. Flour quality parameters of the 2021 entries by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Moisture (%)	Protein (%, 14% mb)	Flour Ash (%, 14% mb)	α -amylase Activity	Starch Damage (%)
1	13VTK59-55	13.9	8.7	0.34	0.07	3.6
1	DH15SRW65-53	13.7	9.2	0.36	0.10	3.1
1	16VDH-SRW03-023	13.7	8.4	0.33	0.09	4.2
1	VA17W-75	13.8	8.9	0.33	0.08	2.9
1	Branson*	14.1	9.0	0.31	0.07	1.7
1	Hilliard*	13.8	8.8	0.32	0.08	2.6
2	MI14W0190	13.5	9.0	0.36	0.06	3.0
2	MI16R0898	13.6	7.8	0.35	0.05	2.9
2	MI16W0133	13.5	7.9	0.33	0.08	2.2
2	MI16W0528	13.7	7.5	0.34	0.05	1.3
2	Whitetail*	13.8	8.2	0.35	0.08	1.9
3	Beck 705	13.5	7.8	0.35	0.07	2.0
3	Beck 722	13.7	8.8	0.35	0.08	2.5
3	Beck 724	13.6	8.3	0.32	0.06	2.6
3	Beck 727	14.0	8.3	0.31	0.05	1.7
3	Beck 732	13.6	6.9	0.32	0.05	1.4
3	Beck 721*	13.8	8.3	0.34	0.07	3.2
3	Hilliard*	14.1	8.8	0.34	0.08	1.9
4	GA10127-18E26	13.6	6.8	0.37	0.08	2.5
4	GA131246LDH- 18E35	13.5	6.6	0.35	0.09	3.7
4	GA15VDH-FHB- MAS23-18LE43F	13.5	6.6	0.33	0.09	3.9
4	GA12505B14- 18LE23F	13.9	7.2	0.35	0.07	4.2
4	GW 2032 (14E19)*	14.0	8.5	0.40	0.10	4.0

*Check varieties.

Summaries and Statistics of Combined Cooperator Test Parameters

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

Group	Entry	Solvent Retention Capacity (%)			
		Water	Sodium Carbonate	Sucrose	Lactic Acid
1	13VTK59-55	54.0 b	73.0 b	93.0 cd	119.3 b
1	DH15SRW65-53	51.9 c	68.7 d	92.1 d	114.8 b
1	16VDH-SRW03-023	53.5 bc	72.7 b	96.3 cd	109.1 b
1	VA17W-75	56.0 a	78.1 a	110.7 a	144.2 a
1	Branson*	49.9 d	70.5 bc	101.0 bc	141.8 a
1	Hilliard*	54.0 b	76.5 a	106.7 ab	138.9 a
2	MI14W0190	50.1 b	65.4 d	84.7 bc	110.8 a
2	MI16R0898	52.1 a	70.5 ab	88.1 ab	109.7 a
2	MI16W0133	50.4 b	71.4 a	90.5 a	100.5 b
2	MI16W0528	49.1 b	67.3 cd	82.5 c	112.5 a
2	Whitetail*	49.1 b	68.4 bc	87.4 ab	109.9 a
3	Beck 705	48.3 d	65.4 d	83.0 b	101.8 e
3	Beck 722	49.4 d	65.9 d	88.9 b	112.3 cd
3	Beck 724	55.8 a	76.2 a	99.3 a	138.3 a
3	Beck 727	49.6 cd	68.8 c	89.4 b	123.2 b
3	Beck 732	54.4 a	70.7 bc	86.6 b	106.0 de
3	Beck 721*	51.6 bc	69.6 c	88.8 b	98.3 e
3	Hilliard*	52.4 b	73.0 b	97.6 a	116.5 bc
4	GA10127-18E26	53.6 a	73.3 a	99.1 a	106.9 a
4	GA131246LDH-18E35	53.5 a	67.8 b	93.8 a	97.8 b
4	GA15VDH-FHB-MAS23-18LE43F	53.3 a	71.1 ab	94.1 a	93.7 b
4	GA12505B14-18LE23F	53.8 a	72.0 ab	97.2 a	92.5 b
4	GW 2032 (14E19)*	53.8 a	72.4 ab	96.8 a	110.5 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 6. Mean alveograph test parameters by two collaborators (n=2)^a

Group	Entry	Alveograph			
		P	L	P/L Ratio	W
1	13VTK59-55	56 b	65 ab	0.88 ab	115 a
1	DH15SRW65-53	36 c	108 ab	0.34 b	89 a
1	16VDH-SRW03-023	54 b	53 b	1.07 a	104 a
1	VA17W-75	71 a	76 ab	0.95 a	164 a
1	Branson*	35 c	120 a	0.32 b	110 a
1	Hilliard*	50 b	81 ab	0.64 ab	119 a
2	MI14W0190	28 b	119 a	0.28 a	79 a
2	MI16R0898	36 a	74 a	0.55 a	83 a
2	MI16W0133	28 b	87 a	0.37 a	62 a
2	MI16W0528	23 b	67 a	0.35 a	56 a
2	Whitetail*	24 b	112 a	0.24 a	65 a
3	Beck 705	21 f	112 a	0.18 c	53 a
3	Beck 722	31 cd	100 a	0.32 bc	85 a
3	Beck 724	62 a	66 a	0.95 a	138 a
3	Beck 727	29 e	79 a	0.40 c	78 a
3	Beck 732	32 cd	61 a	0.56 b	73 a
3	Beck 721*	34 bc	89 a	0.40 bc	75 a
3	Hilliard*	39 b	90 a	0.43 b	102 a
4	GA10127-18E26	42 a	67 a	0.66 a	92 a
4	GA131246LDH-18E35	41 a	59 a	0.70 a	86 a
4	GA15VDH-FHB-MAS23-18LE43F	41 a	51 a	0.83 a	76 a
4	GA12505B14-18LE23F	52 a	56 a	0.97 a	99 a
4	GW 2032 (14E19)*	56 a	73 a	0.75 a	126 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 7. Mean farinograph test parameters by two collaborators (n=2)^a

Group	Entry	Farinograph			
		Water Absorption	Development Time	Stability	Mixing Tolerance
1	13VTK59-55	57 a	1.1 a	1.2 b	123 ab
1	DH15SRW65-53	53 a	0.9 a	2.4 a	113 ab
1	16VDH-SRW03-023	58 a	0.7 a	1.4 ab	132 a
1	VA17W-75	56 a	1.2 a	2.5 a	102 ab
1	Branson*	52 a	1.1 a	2.5 a	90 b
1	Hilliard*	55 a	0.9 a	2.2 ab	92 b
2	MI14W0190	53 ab	0.7 a	1.8 a	108b
2	MI16R0898	54 a	0.6 a	1.0 a	135 ab
2	MI16W0133	51 abc	0.6 a	1.0 a	154 a
2	MI16W0528	49 cd	0.6 a	1.2 a	161 a
2	Whitetail*	50 d	0.6 a	1.2 a	117 b
3	Beck 705	49 b	0.6 a	1.3 ab	136 ab
3	Beck 722	51 ab	0.6 a	3.1 a	83 c
3	Beck 724	53 a	0.8 a	1.7 ab	90 bc
3	Beck 727	50 ab	0.7 a	1.4 ab	115 abc
3	Beck 732	50 ab	0.7 a	1.1 b	144 a
3	Beck 721*	53 ab	0.8 a	1.8 ab	120 abc
3	Hilliard*	52 ab	1.2 a	2.5 ab	79 c
4	GA10127-18E26	51 a	0.7 a	1.3 b	126 a
4	GA131246LDH-18E35	52 a	0.6 a	0.9 b	149 a
4	GA15VDH-FHB-MAS23-18LE43F	53 a	0.7 a	1.4 b	141 a
4	GA12505B14-18LE23F	54 a	0.7 a	1.4 b	112 an
4	GW 2032 (14E19)*	53 a	1.0 a	2.6 a	68

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 8. Mean (n=4) 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	13VTK59-55	6.2 a	3175 a	2188 a	987 c	1639 a	3827 a	81.1 a
1	DH15SRW65-53	6.1 ab	3058 a	1869 b	1189 ab	1351 b	3220 b	80.5 a
1	16VDH-SRW03-023	6.0 b	2569 b	1532 d	1037 bc	1284 b	2816 c	79.9 a
1	VA17W-75	6.1 ab	2708 b	1648 cd	1061 bc	1308 b	2956 bc	80.5 a
1	Branson*	6.0 b	3046 a	1820 bc	1226 a	1401 b	3220 b	80.3 a
1	Hilliard*	6.0 b	2739 b	1665 cd	1075 abc	1320 b	2984 bc	80.7 a
2	MI14W0190	6.1 ab	3089 ab	1732 b	1357 a	1295 c	3026 b	76.8 ab
2	MI16R0898	6.2 a	3382 a	2107 a	1276 a	1493 a	3599 a	80.1 a
2	MI16W0133	6.2 a	3208 ab	1890 ab	1318 a	1330 bc	3220 b	74.9 ab
2	MI16W0528	6.1 b	2998 b	1758 ab	1241 a	1445 ab	3202 b	68.1 b
2	Whitetail*	6.2 ab	3163 ab	1902 ab	1261 a	1438 ab	3340 ab	68.4 b
3	Beck 705	6.2 bc	3259 b	1931 bc	1328 bc	1102 b	3380 b	74.8 a
3	Beck 722	6.3 abc	3490 ab	2129 c	1411 ab	1319 ab	3448 b	80.6 a
3	Beck 724	6.3 ab	3674 a	2504 a	1170 d	1718 a	4222 a	80.6 a
3	Beck 727	6.3 a	3520 ab	2281 ab	1239 cd	1451 ab	3732 b	80.9 a
3	Beck 732	6.2 bc	3581 ab	2102 bc	1479 a	1502 ab	3604 b	73.4 a
3	Beck 721*	6.2 abc	3479 ab	2093 bc	1386 abc	1412 ab	3500 b	80.4 a
3	Hilliard*	6.1 c	3509 ab	2036 bc	1474 ab	1499 ab	3534 b	80.3 a
4	GA10127-18E26	5.9 cd	3092 a	1421 c	1587 a	1183 b	2741 b	68.3 b
4	GA131246LDH-18E35	5.8 d	2511 b	1163 d	1373 ab	1147 b	2552 b	68.2 b
4	GA15VDH-FHB-MAS23-18LE43F	6.1 b	3104 a	2040 a	1090 c	1678 a	3872 a	80.3 a
4	GA12505B14-18LE23F	6.0 bc	3213 a	1661 b	1478 a	1257 b	3097 ab	79.4 ab
4	GW 2032 (14E19)*	6.3 a	3127 a	2117 a	1150 bc	1617 a	3752 a	81.1 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 9. Mean sugar-snap cookie test (AACCI Approved Methods 10-50D (n=4) & 10-52 (n=3)) 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	13VTK59-55	483 a	57 a	9.0 a	83 a	8.9 a	4.0 a
1	DH15SRW65-53	481 a	55 a	9.2 a	85 a	8.9 a	5.3 a
1	16VDH-SRW03-023	485 a	57 a	8.9 a	83 a	8.9 a	4.7 a
1	VA17W-75	472 a	58 a	8.6 a	80 a	8.6 a	3.3 a
1	Branson*	488 a	52 a	9.8 a	91 a	9.0 a	3.3 a
1	Hilliard*	486 a	55 a	9.2 a	86 a	8.8 a	4.0 a
2	MI14W0190	491 a	52 a	9.7 a	90 a	9.1 a	5.7 a
2	MI16R0898	497 a	52 a	10.0 a	93 a	9.2 a	6.0 a
2	MI16W0133	502 a	48 a	10.7 a	99 a	9.2 a	5.7 a
2	MI16W0528	516 a	47 a	11.2 a	104 a	9.4 a	6.0 a
2	Whitetail*	502 a	49 a	10.7 a	99 a	9.2 a	5.7 a
3	Beck 705	514 a	46 a	11.3 a	105 a	9.3 a	6.0 a
3	Beck 722	499 a	50 a	10.3 a	95 a	9.2 a	5.0 a
3	Beck 724	493 a	54 a	9.5 a	88 a	8.9 a	5.0 a
3	Beck 727	512 a	46 a	11.5 a	107 a	9.3 a	5.3 a
3	Beck 732	508 a	46 a	11.3 a	106 a	9.3 a	6.0 a
3	Beck 721*	498 a	51 a	9.9 a	92 a	9.1 a	5.0 a
3	Hilliard*	503 a	52 a	10.2 a	94 a	9.1 a	4.7 a
4	GA10127-18E26	487 a	55 a	9.1 a	85 a	8.9 a	5.0 a
4	GA131246LDH-18E35	491 a	54 a	9.3 a	87 a	9.1 a	5.3 a
4	GA15VDH-FHB-MAS23-18LE43F	491 a	54 a	9.2 a	85 a	9.0 a	5.7 a
4	GA12505B14-18LE23F	481 a	57 a	8.5 a	79 a	8.8 a	4.7 a
4	GW 2032 (14E19)*	470 a	61 a	7.9 a	74 a	8.7 a	3.7 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 10. Mean (n=2) sponge cake baking test parameters^a

Group	Entry	Sponge Cake	
		Volume (mL)	Texture Score
1	13VTK59-55	997 c	27.5 a
1	DH15SRW65-53	1104 bc	31.5 a
1	16VDH-SRW03-023	1300 a	38.5 a
1	VA17W-75	1252 ab	37.0 a
1	Branson*	1341 a	40.0 a
1	Hilliard*	1302 a	39.5 a
2	MI14W0190	1248 a	36.5 a
2	MI16R0898	1273 a	37.5 a
2	MI16W0133	1294 a	40.0 a
2	MI16W0528	1302 a	40.0 a
2	Whitetail*	1285 a	37.5 a
3	Beck 705	1313 a	40.5 a
3	Beck 722	1286 a	38.0 a
3	Beck 724	1249 a	34.5 a
3	Beck 727	1364 a	42.5 a
3	Beck 732	1327 a	38.5 a
3	Beck 721*	1258 a	38.5 a
3	Hilliard*	1250 a	33.5 a
4	GA10127-18E26	1280 a	39.5 a
4	GA131246LDH-18E35	1211 a	36.5 a
4	GA15VDH-FHB-MAS23-18LE43F	1270 a	39.0 a
4	GA12505B14-18LE23F	1240 a	38.5 a
4	GW 2032 (14E19)*	1227 a	34.0 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Table 11. Mean flour quality scores for making cookies (n=9) and sponge cakes (n=2), and product quality scores^a

Group	Entry	Cookies		Sponge Cake	
		Flour Score	Product Score	Flour Score	Product Score
1	13VTK59-55	6.9 a	6.4 a	6.5 a	4.0 a
1	DH15SRW65-53	7.4 a	7.0 a	6.5 a	4.5 a
1	16VDH-SRW03-023	6.6 a	6.4 a	7.0 a	6.0 a
1	VA17W-75	6.4 a	5.2 a	5.5 a	4.5 a
1	Branson*	7.5 a	6.6 a	7.0 a	8.5 a
1	Hilliard*	6.6 a	6.2 a	6.0 a	7.0 a
2	MI14W0190	7.6 a	7.0 a	6.5 a	6.0 a
2	MI16R0898	7.4 a	7.4 a	7.5 a	6.5 a
2	MI16W0133	7.0 a	7.8 a	7.5 a	6.5 a
2	MI16W0528	7.3 a	7.8 a	8.0 a	9.0 a
2	Whitetail*	7.1 a	7.8 a	7.0 a	5.5 a
3	Beck 705	6.9 ab	8.4 a	8.0 a	9.0 a
3	Beck 722	7.7 a	7.4 ab	7.0 ab	8.5 ab
3	Beck 724	6.1 b	6.8 b	5.5 b	6.5 ab
3	Beck 727	7.3 a	8.2 a	7.0 ab	8.0 ab
3	Beck 732	6.9 ab	7.6 ab	8.0 a	8.0 ab
3	Beck 721*	7.3 a	7.4 ab	6.5 ab	6.5 b
3	Hilliard*	7.4 ab	7.6 ab	6.5 ab	7.0 ab
4	GA10127-18E26	6.1 a	6.6 a	7.0 a	7.5 a
4	GA131246LDH-18E35	6.3 a	7.2 a	7.5 a	4.5 a
4	GA15VDH-FHB-MAS23-18LE43F	6.4 a	7.2 a	8.0 a	7.5 a
4	GA12505B14-18LE23F	6.2 a	6.0 a	6.5 a	6.5 a
4	GW 2032 (14E19)*	6.1 a	5.8a	6.0 a	7.5 a

*Check varieties.

^aMeans with different letters within the same group are significantly different at $P<0.05$.

Cooperator Data for Each Quality Test Parameter

Table 12. Water SRC (%) of 2021 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Mondelez	Kellogg	Star of West	SWQL	WWQL	Mean	STDEV
1	13VTK59-55	53.8	56.6	53.0	51.1	55.2	55.0	53.3	54.0	1.8
1	DH15SRW65-53	52.8	54.0	51.0	49.7	51.9	52.4	51.6	51.9	1.4
1	16VDH-SRW03-023	52.8	54.5	53.1	50.7	54.2	54.9	54.3	53.5	1.4
1	VA17W-75	59.6	55.3	55.2	54.4	56.3	55.9	55.6	56.0	1.7
1	Branson*	54.1	50.8	47.5	48.0	49.9	50.6	48.7	50.0	2.2
1	Hilliard*	57.2	54.7	52.9	52.4	53.6	54.1	53.3	54.0	1.6
2	MI14W0190	50.2	50.3	49.1	48.3	50.7	50.5	51.6	50.1	1.1
2	MI16R0898	50.0	53.3	51.2	49.7	54.2	53.7	52.6	52.1	1.8
2	MI16W0133	52.4	50.3	48.7	47.6	50.7	51.6	51.8	50.4	1.7
2	MI16W0528	48.1	50.0	48.5	46.6	50.4	50.4	49.5	49.1	1.4
2	Whitetail*	48.2	50.5	47.9	46.7	49.6	51.1	49.6	49.1	1.5
3	Beck 705	48.7	51.1	46.8	45.9	48.5	49.5	47.4	48.3	1.8
3	Beck 722	50.9	50.0	47.7	47.8	46.9	51.2	51.3	49.4	1.9
3	Beck 724	53.3	56.2	55.7	53.8	57.0	57.0	57.4	55.8	1.6
3	Beck 727	47.0	52.6	49.4	47.6	50.9	50.5	49.1	49.6	1.9
3	Beck 732	51.1	57.2	52.7	57.8	53.5	54.4	54.4	54.4	2.4
3	Beck 721*	51.9	52.6	51.7	49.7	49.4	53.7	52.1	51.6	1.5
3	Hilliard*	51.6	52.4	50.7	56.3	52.1	52.4	51.4	52.4	1.8
4	GA10127-18E26	51.9	54.3	56.2	50.6	54.5	54.7	53.0	53.6	1.9
4	GA131246LDH-18E35	53.2	54.4	53.2	50.9	55.0	54.3	53.4	53.5	1.3
4	GA15VDH-FHB-MAS23-18LE43F	53.0	53.6	54.5	50.7	54.8	55.1	51.4	53.3	1.7
4	GA12505B14-18LE23F	55.9	55.3	53.6	51.7	50.8	55.2	54.1	53.8	1.9
4	GW 2032 (14E19)*	55.2	55.9	52.5	51.0	54.0	55.2	52.6	53.8	1.8

*Check varieties.

Table 13. Sodium Carbonate SRC (%) of 2021 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Mondelez	Kellogg	Star of West	SWQL	WWQL	Mean	STDEV
1	13VTK59-55	73.1	73.3	76.0	70.4	73.7	74.8	69.6	73.0	2.3
1	DH15SRW65-53	68.5	69.0	71.6	66.8	69.5	70.3	65.3	68.7	2.1
1	16VDH-SRW03-023	71.9	72.3	76.9	71.0	72.8	73.9	69.9	72.7	2.2
1	VA17W-75	84.0	70.6	83.8	75.3	79.5	78.3	75.0	78.1	4.9
1	Branson*	75.3	70.6	74.3	67.1	69.2	71.0	66.1	70.5	3.4
1	Hilliard*	81.1	76.5	80.5	73.3	76.1	75.5	72.6	76.5	3.3
2	MI14W0190	64.5	64.6	70.8	62.1	64.9	66.8	64.0	65.4	2.8
2	MI16R0898	70.5	70.3	73.7	68.0	71.1	72.8	67.2	70.5	2.3
2	MI16W0133	72.1	70.4	76.2	68.2	72.1	73.4	67.2	71.4	3.1
2	MI16W0528	67.6	67.2	70.4	64.7	67.7	68.6	64.6	67.2	2.1
2	Whitetail*	68.4	68.1	69.7	65.6	69.5	71.0	66.3	68.4	1.9
3	Beck 705	66.2	65.6	70.0	62.8	64.8	66.8	61.7	65.4	2.7
3	Beck 722	64.7	65.9	69.0	63.6	66.9	67.9	63.1	65.9	2.2
3	Beck 724	77.8	75.4	80.1	73.6	75.3	77.4	74.0	76.2	2.3
3	Beck 727	68.7	69.0	71.0	67.8	68.8	70.1	66.3	68.8	1.5
3	Beck 732	70.5	70.6	72.0	71.5	70.8	71.8	68.0	70.7	1.4
3	Beck 721*	65.2	69.5	73.0	71.6	69.8	72.0	65.9	69.6	3.0
3	Hilliard*	72.2	72.4	75.4	74.1	72.8	73.7	70.3	73.0	1.6
4	GA10127-18E26	70.2	71.6	84.0	70.7	74.4	74.2	67.9	73.3	5.2
4	GA131246LDH-18E35	64.9	67.2	74.7	64.1	70.0	69.4	64.5	67.8	3.8
4	GA15VDH-FHB-MAS23-18LE43F	70.2	68.8	80.5	66.7	71.8	72.3	67.3	71.1	4.7
4	GA12505B14-18LE23F	71.4	72.1	78.1	67.4	73.1	72.7	69.1	72.0	3.4
4	GW 2032 (14E19)*	69.5	72.2	79.4	68.5	74.2	73.7	69.2	72.4	3.8

*Check varieties.

Table 14. Sucrose SRC (%) of 2021 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Mondelez	Kellogg	Star of West	SWQL	WWQL	Mean	STDEV
1	13VTK59-55	92.1	94.6	100.1	88.9	95.0	90.2	90.3	93.0	3.9
1	DH15SRW65-53	92.5	92.9	99.6	87.3	95.5	89.4	87.7	92.1	4.4
1	16VDH-SRW03-023	93.5	113.0	100.4	88.0	96.0	92.4	90.9	96.3	8.3
1	VA17W-75	113.0	93.1	130.6	104.0	116.6	109.9	107.6	110.7	11.6
1	Branson*	102.0	100.8	115.1	95.0	103.9	97.9	92.0	100.9	7.5
1	Hilliard*	104.4	107.3	117.6	101.7	112.4	102.3	100.9	106.7	6.3
2	MI14W0190	86.5	85.3	87.1	82.1	85.1	82.6	84.2	84.7	1.9
2	MI16R0898	89.3	88.7	89.9	86.4	90.8	85.7	86.1	88.1	2.0
2	MI16W0133	93.9	89.6	99.4	86.7	92.2	86.4	85.6	90.5	5.0
2	MI16W0528	81.1	82.1	93.9	79.8	81.9	79.3	79.2	82.5	5.2
2	Whitetail*	85.9	87.8	92.9	86.3	89.0	84.1	85.8	87.4	2.9
3	Beck 705	83.9	81.4	92.0	80.3	83.6	80.0	79.9	83.0	4.3
3	Beck 722	85.2	88.4	102.4	84.5	90.4	86.1	85.5	88.9	6.3
3	Beck 724	91.6	100.8	113.9	94.7	101.4	95.6	97.1	99.3	7.3
3	Beck 727	85.6	89.6	105.3	82.6	91.6	86.0	85.2	89.4	7.6
3	Beck 732	85.7	87.0	95.8	82.8	87.2	83.5	84.5	86.7	4.4
3	Beck 721*	88.7	87.6	100.7	83.1	89.8	84.9	87.0	88.8	5.7
3	Hilliard*	93.9	95.6	113.2	95.6	99.4	92.8	93.0	97.6	7.2
4	GA10127-18E26	98.6	97.5	116.0	93.5	100.1	92.8	95.4	99.1	7.9
4	GA131246LDH-18E35	95.6	86.6	111.3	89.7	94.0	88.3	90.8	93.7	8.3
4	GA15VDH-FHB-MAS23-18LE43F	96.1	91.3	110.6	88.4	93.3	89.5	89.7	94.1	7.7
4	GA12505B14-18LE23F	97.0	94.3	111.0	92.0	98.8	92.0	95.3	97.2	6.6
4	GW 2032 (14E19)*	96.7	96.2	109.2	92.8	97.5	91.5	93.5	96.8	5.9

*Check varieties.

Table 15. Lactic acid SRC (%) of 2021 WQC entries by cooperators

Group	Entry	Ardent	Mennel	Mondelez	Kellogg	Star of West	SWQL	WWQL	Mean	STDEV
1	13VTK59-55	120.9	125.0	117.5	128.1	121.6	110.5	111.4	119.3	6.6
1	DH15SRW65-53	118.9	121.1	105.4	125.5	115.9	108.8	108.3	114.9	7.5
1	16VDH-SRW03-023	108.7	117.5	93.9	121.1	110.9	107.1	104.8	109.1	8.9
1	VA17W-75	151.8	119.3	139.1	157.2	153.5	143.3	145.0	144.2	12.7
1	Branson*	145.8	149.6	125.2	160.0	142.4	130.6	139.1	141.8	11.7
1	Hilliard*	140.6	143.2	128.6	156.3	139.5	132.2	132.0	138.9	9.3
2	MI14W0190	109.4	115.6	101.9	124.3	115.7	104.2	104.7	110.8	8.1
2	MI16R0898	107.3	111.8	103.7	121.4	115.9	102.3	105.5	109.7	7.0
2	MI16W0133	98.4	106.9	92.9	108.4	102.9	97.0	97.1	100.5	5.7
2	MI16W0528	109.8	116.5	110.3	122.6	119.5	104.2	104.8	112.5	7.1
2	Whitetail*	104.3	116.7	104.3	121.7	113.3	104.7	104.4	109.9	7.3
3	Beck 705	100.0	105.0	94.9	114.1	102.8	97.9	98.0	101.8	6.4
3	Beck 722	110.3	116.2	107.9	125.9	113.4	104.1	108.1	112.3	7.2
3	Beck 724	137.6	144.7	136.1	152.2	141.7	125.5	130.1	138.3	9.0
3	Beck 727	116.9	128.5	121.1	137.4	130.1	115.8	112.5	123.2	9.0
3	Beck 732	103.4	113.2	106.2	107.8	113.0	99.9	98.2	106.0	5.9
3	Beck 721*	88.3	107.7	92.8	98.1	103.8	97.9	99.7	98.3	6.5
3	Hilliard*	108.3	130.5	106.9	115.3	119.3	118.6	116.9	116.5	7.8
4	GA10127-18E26	105.6	112.1	99.2	115.3	109.7	103.6	102.8	106.9	5.7
4	GA131246LDH-18E35	98.5	99.5	98.4	104.7	102.3	92.6	88.8	97.8	5.5
4	GA15VDH-FHB-MAS23-18LE43F	92.5	98.1	84.9	104.3	96.8	89.9	89.7	93.7	6.5
4	GA12505B14-18LE23F	90.2	98.9	84.5	103.5	90.9	88.9	90.3	92.5	6.5
4	GW 2032 (14E19)*	113.2	118.8	101.1	122.5	111.5	101.3	105.0	110.5	8.4

*Check varieties.

Table 16. Sugar-snap cookie (10-50) diameter (mm) of 2021 WQC entries by cooperators

Group	Entry	ADM	Ardent	Mennel	Star of West	Mean	STDEV
1	13VTK59-55	493	495	485	459	483	16.4
1	DH15SRW65-53	495	494	479	456	481	18.0
1	16VDH-SRW03-023	495	495	492	459	485	17.5
1	VA17W-75	482	488	473	446	472	18.4
1	Branson*	499	500	494	461	488	18.6
1	Hilliard*	490	499	492	463	486	15.9
2	MI14W0190	501	500	494	468	491	15.7
2	MI16R0898	509	514	507	461	497	24.5
2	MI16W0133	515	506	503	484	502	12.9
2	MI16W0528	534	518	523	489	516	19.3
2	Whitetail*	517	513	504	476	502	18.6
3	Beck 705	535	514	521	486	514	20.7
3	Beck 722	513	508	499	478	499	15.5
3	Beck 724	508	505	494	464	493	20.0
3	Beck 727	528	518	515	489	512	16.4
3	Beck 732	524	514	517	478	508	20.4
3	Beck 721*	515	509	497	473	498	18.7
3	Hilliard*	523	511	500	480	503	18.2
4	GA10127-18E26	494	501	490	465	487	15.5
4	GA131246LDH-18E35	498	498	492	476	491	10.5
4	GA15VDH-FHB-MAS23-18LE43F	508	496	491	469	491	16.3
4	GA12505B14-18LE23F	491	489	489	457	481	16.4
4	GW 2032 (14E19)*	486	481	467	448	470	17.0

*Check varieties.

Table 17. Sugar-snap cookie (10-52) diameter (cm) of 2021 WQC entries by cooperators

Group	Entry	Limagrain	SWQL	WWQL	Mean	STDEV
1	13VTK59-55	8.6	9.2	9.0	8.9	0.29
1	DH15SRW65-53	8.5	9.1	9.1	8.9	0.33
1	16VDH-SRW03-023	8.6	9.1	9.1	9.0	0.30
1	VA17W-75	8.4	8.8	8.7	8.6	0.23
1	Branson*	8.7	9.2	9.1	9.0	0.27
1	Hilliard*	8.5	9.1	8.9	8.9	0.31
2	MI14W0190	8.7	9.4	9.2	9.1	0.36
2	MI16R0898	8.8	9.5	9.4	9.2	0.37
2	MI16W0133	8.8	9.5	9.3	9.2	0.34
2	MI16W0528	8.9	9.7	9.7	9.4	0.44
2	Whitetail*	8.7	9.5	9.3	9.2	0.40
3	Beck 705	9.0	9.6	9.4	9.3	0.35
3	Beck 722	8.8	9.5	9.2	9.1	0.36
3	Beck 724	8.5	9.2	9.1	8.9	0.38
3	Beck 727	8.9	9.5	9.6	9.3	0.40
3	Beck 732	8.9	9.7	9.3	9.3	0.38
3	Beck 721*	8.6	9.3	9.3	9.1	0.41
3	Hilliard*	8.7	9.4	9.3	9.2	0.37
4	GA10127-18E26	8.5	9.2	9.1	9.0	0.39
4	GA131246LDH-18E35	8.5	9.4	9.3	9.1	0.49
4	GA15VDH-FHB-MAS23-18LE43F	8.5	9.4	9.2	9.1	0.48
4	GA12505B14-18LE23F	8.4	9.0	9.0	8.8	0.32
4	GW 2032 (14E19)*	8.4	8.9	8.9	8.7	0.29

*Check varieties.

Table 18. Sponge cake volume (mL) of 2021 WQC entries by cooperators

Group	Entry	WMC	WWQL	Mean	STDEV
1	13VTK59-55	1116	878	997	168
1	DH15SRW65-53	1156	1051	1104	74
1	16VDH-SRW03-023	1293	1306	1300	9
1	VA17W-75	1226	1278	1252	37
1	Branson*	1333	1349	1341	11
1	Hilliard*	1276	1327	1302	36
2	MI14W0190	1258	1237	1248	15
2	MI16R0898	1279	1266	1273	9
2	MI16W0133	1279	1308	1294	21
2	MI16W0528	1256	1348	1302	65
2	Whitetail*	1302	1268	1285	24
3	Beck 705	1292	1334	1313	30
3	Beck 722	1236	1336	1286	71
3	Beck 724	1169	1328	1249	112
3	Beck 727	1359	1368	1364	6
3	Beck 732	1302	1352	1327	35
3	Beck 721*	1234	1281	1258	33
3	Hilliard*	1192	1308	1250	82
4	GA10127-18E26	1245	1315	1280	49
4	GA131246LDH-18E35	1200	1221	1211	15
4	GA15VDH-FHB-MAS23-18LE43F	1209	1331	1270	86
4	GA12505B14-18LE23F	1201	1278	1240	54
4	GW 2032 (14E19)*	1140	1314	1227	123

*Check varieties.

Table 19. Cookie quality scores of 2021 WQC entries by cooperators

Group	Entry	ADM	Ardent	Limagrain	Mennel	Star of West	WWQL	Mean	STDEV
1	13VTK59-55	8	8	7	7	5	4	6.5	1.6
1	DH15SRW65-53	8	8	8	8	6	5	7.2	1.3
1	16VDH-SRW03-023	7	7	6	8	5	5	6.3	1.2
1	VA17W-75	7	7	6	5	6	1	5.3	2.3
1	Branson*	8	7	8	6	7	5	6.8	1.2
1	Hilliard*	8	8	7	7	6	2	6.3	2.3
2	MI14W0190	8	6	8	8	6	7	7.2	1.0
2	MI16R0898	8	7	6	6	7	9	7.2	1.2
2	MI16W0133	8	7	6	8	8	8	7.5	0.8
2	MI16W0528	7	7	6	7	9	9	7.5	1.2
2	Whitetail*	8	8	6	8	7	8	7.5	0.8
3	Beck 705	7	9	6	8	9	9	8.0	1.3
3	Beck 722	8	9	8	8	6	6	7.5	1.2
3	Beck 724	8	8	5	7	6	5	6.5	1.4
3	Beck 727	8	9	8	7	8	9	8.2	0.8
3	Beck 732	7	8	5	7	8	8	7.2	1.2
3	Beck 721*	8	8	6	7	7	7	7.2	0.8
3	Hilliard*	8	9	7	7	7	7	7.5	0.8
4	GA10127-18E26	7	9	4	7	5	5	6.2	1.8
4	GA131246LDH-18E35	7	9	4	6	7	7	6.7	1.6
4	GA15VDH-FHB-MAS23-18LE43F	7	9	4	7	6	7	6.7	1.6
4	GA12505B14-18LE23F	7	8	4	7	5	3	5.7	2.0
4	GW 2032 (14E19)*	8	8	5	7	4	2	5.7	2.4

*Check varieties.

Table 20. Sponge cake quality scores of 2021 WQC entries by cooperators

Group	Entry	WMC	WWQL	Mean	STDEV
1	13VTK59-55	3	1	2.0	1.4
1	DH15SRW65-53	5	1	3.0	2.8
1	16VDH-SRW03-023	7	5	6.0	1.4
1	VA17W-75	6	4	5.0	1.4
1	Branson*	7	9	8.0	1.4
1	Hilliard*	7	8	7.5	0.7
2	MI14W0190	6	4	5.0	1.4
2	MI16R0898	6	5	5.5	0.7
2	MI16W0133	8	5	6.5	2.1
2	MI16W0528	7	9	8.0	1.4
2	Whitetail*	7	3	5.0	2.8
3	Beck 705	6	9	7.5	2.1
3	Beck 722	5.5	9	7.3	2.5
3	Beck 724	5	8	6.5	2.1
3	Beck 727	8	8	8.0	0.0
3	Beck 732	6	8	7.0	1.4
3	Beck 721*	6	6	6.0	0.0
3	Hilliard*	4	7	5.5	2.1
4	GA10127-18E26	5	9	7.0	2.8
4	GA131246LDH-18E35	4	2	3.0	1.4
4	GA15VDH-FHB-MAS23-18LE43F	4	8	6.0	2.8
4	GA12505B14-18LE23F	4	7	5.5	2.1
4	GW 2032 (14E19)*	3	9	6.0	4.2

*Check varieties.

Table 21. Wheat grain and flour quality characteristics of the 2021 crop Soft Wheat Quality Council entries between 2009 and 2020 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	13VTK59-55	3-9	61.8	10.1	29.4	67.7	52.8	8.3	57.0	72.8	93.8	104.9	18.5
1	DH15SRW65-53	1-3	61.6	10.3	22.0	68.4	53.2	8.4	54.6	67.3	89.6	102.3	19.2
1	16VDH-SRW03-023	1-4	59.1	10.1	18.0	68.3	56.8	7.9	56.9	71.6	97.1	102.1	18.8
1	VA17W-75	3-11	61.4	10.4	31.8	66.8	53.6	8.2	58.6	77.7	105.9	118.5	17.7
1	Branson*	75-311	59.8	10.6	6.0	69.2	61.6	8.3	52.3	66.9	91.2	108.6	18.8
1	Hilliard*	8-124	59.8	10.5	15.1	66.9	59.6	8.1	55.0	73.3	100.6	118.8	18.4
2	MI14W0190	8-14	60.8	10.8	25.1	68.4	54.8	8.7	51.2	65.1	86.5	95.3	19.1
2	MI16R0898	2-7	59.4	9.6	12.1	68.1	60.9	7.1	54.5	67.7	86.6	100.8	19.9
2	MI16W0133	2-5	57.0	9.5	9.8	70.1	63.3	7.2	52.5	68.1	86.1	98.3	19.3
2	MI16W0528	2-5	57.7	9.6	9.3	69.9	63.6	7.1	51.8	66.1	87.3	104.9	20.1
2	Whitetail*	2-7	57.7	9.5	4.5	70.2	64.5	7.2	51.9	68.1	89.9	97.7	19.7
3	Beck 705	0											
3	Beck 722	0											
3	Beck 724	0											
3	Beck 727	1	60.6	10.1	16.3	69.6	64.4	8.1	52.1	68.2	90.0	102.2	19.2
3	Beck 732	0											
3	Beck 721*	1-2	58.3	9.1	27.0	69.2	59.5	7.9	54.3	71.3	90.6	85.6	19.6
3	Hilliard*	8-124	59.8	10.5	15.1	66.9	59.6	8.1	55.0	73.3	100.6	118.8	18.4
4	GA10127-18E26	0-1	61.9	9.6	25.6	69.2	57.1	7.7		76.1		111.0	18.6
4	GA131246LDH-18E35	0-1	60.9	10.4	31.6	69.0	51.8	8.7		72.8		106.9	18.7
4	GA15VDH-FHB-MAS23-18LE43F	0-1	61.6	10.7	32.6	67.0	50.9	8.5		74.5		104.1	18.2
4	GA12505B14-18LE23F	0											
4	GW 2032 (14E19)*	0-3	60.8	10.2	24.3	69.1	55.2	8.3		73.0		113.0	18.0

*Check varieties.

Cooperator Data

ADM Milling Quality Evaluations

Table 22. Sugar-snap cookie baking test parameters by ADM Milling

Group	Entry	Cookie (10-50D)			
		Width (mm)	Thickness (mm)	W/T Ratio	Spread Factor
1	13VTK59-55	49.3	6.1	8.1	78.0
1	DH15SRW65-53	49.5	5.9	8.4	81.0
1	16VDH-SRW03-023	49.5	6.1	8.1	78.0
1	VA17W-75	48.2	6.5	7.4	72.0
1	Branson*	49.9	5.5	9.1	88.0
1	Hilliard*	49.0	6.0	8.2	79.0
2	MI14W0190	50.1	5.8	8.6	84.0
2	MI16R0898	50.9	5.5	9.2	90.0
2	MI16W0133	51.5	5.4	9.5	92.0
2	MI16W0528	53.4	5.0	10.7	103.0
2	Whitetail*	51.7	5.2	9.9	96.0
3	Beck 705	53.5	4.7	11.4	110.0
3	Beck 722	51.3	5.5	9.3	90.0
3	Beck 724	50.8	5.6	9.1	88.0
3	Beck 727	52.8	4.5	11.7	114.0
3	Beck 732	52.4	4.5	11.6	113.0
3	Beck 721*	51.5	5.4	9.5	92.0
3	Hilliard*	52.3	5.5	9.5	92.0
4	GA10127-18E26	49.4	6.0	8.2	80.0
4	GA131246LDH-18E35	49.8	5.9	8.4	82.0
4	GA15VDH-FHB-MAS23-18LE43F	50.8	6.0	8.5	82.0
4	GA12505B14-18LE23F	49.1	6.0	8.2	79.0
4	GW 2032 (14E19)*	48.6	6.2	7.8	76.0

*Check varieties.

Table 23. 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				Additional Comments	
Group	Entry	Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	13VTK59-55	Average protein & ash		Primary Analysis	8	Cookie	Good spread Slight checking	Slightly dry dough	8	Equal to Hilliard Check
1	DH15SRW65-53	Highest Protein & ash		Primary Analysis	8	Cookie	Nice spread slight checking		8	Good spread Equal to Hilliard Check
1	16VDH-SRW03-023	Lowest Protein		Primary Analysis	7	Cookie	Good spread Slight checking	Dry dough	7	Lower protein average spread
1	VA17W-75	Average protein & ash		Primary Analysis	8	Cookie	Lower spread Slight checking	Dry dough	7	Lowest spread of group SI poorer than Checks
1	Branson (check)	Lowest ash Average Protein		Primary Analysis	8	Cookie	Nice spread	Dry dough Checking	8	Largest spread in group
1	Hilliard (check)	Lowest ash Average Protein		Primary Analysis	8	Cookie	Good dough nice spread	No checking	8	Average spread
2	MI14W0190	Highest Protein		Primary Analysis	9	Cookie	Nice spread Good dough	excessive checking	8	Average spread
2	MI16R0898	Lower Protein Average ash		Primary Analysis	8	Cookie	Nice spread Good dough	excessive checking	8	Lower protein good spread
2	MI16W0133	Lower Protein Average ash		Primary Analysis	8	Cookie	Nice spread Good dough	excessive checking	8	Lower protein good spread
2	MI16W0528	Lowest Protein		Primary Analysis	7	Cookie	Biggest spread factor	Lowest protein	7	Low protein excessive checking
2	Whitetail (check)	Average protein		Primary Analysis	8	Cookie	Good dough nice spread		8	Slight checking Average protein
3	Beck 705	Low protein		Primary Analysis	7	Cookie	Good dough	Big spread factor	7	Slight checking Low protein
3	Beck 722	Average Protein		Primary Analysis	8	Cookie	Good dough slight checking		8	Equal to both checks
3	Beck 724	Average Protein		Primary Analysis	8	Cookie	Slight checking	Dry dough	8	Equal to Beck 721 check
3	Beck 727	Average Protein Lower ash		Primary Analysis	8	Cookie	Slight checking good dough	Biggest spread of group	8	Bigger spread factor than checks
3	Beck 732	Lowest Protein		Primary Analysis	7	Cookie	Slight checking good dough	Big spread	7	Low protein but bigger spread than checks
3	Beck 721 (check)	Average protein and ash		Primary Analysis	8	Cookie	Slight checking	Dry dough	8	Nice spread factor Average protein
3	Hilliard (check)	Average protein and ash		Primary Analysis	8	Cookie	Slight checking	Dry dough	8	Nice spread factor Average protein
4	GA10127-18E26	Low protein average ash		Primary Analysis	7	Cookie	Slight checking	Good dough	7	Low protein Average spread
4	GA131246LDH-18E35	Low protein average ash		Primary Analysis	7	Cookie	Slight checking	Good dough	7	Low protein Average spread
4	GA15VDH-FHB-MAS23-18LE43F	Low protein average ash		Primary Analysis	7	Cookie	Slight checking	Good dough	7	Low protein Average spread
4	GA12505B14-18LE23F	Lower Protein average ash		Primary Analysis	7	Cookie	Checking	Dry dough	7	Lower protein Average spread
4	GW 2032 (14E19) (check)	Average protein Highest ash		Primary Analysis	8	Cookie	Good dough slight checking		8	Lowest spread factor but highest protein

Ardent Mills Quality Evaluations

Table 24. 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	13VTK59-55	53.8	73.1	92.1	120.9	494.7	38.0	13.0	109.2
1	DH15SRW65-53	52.8	68.5	92.5	118.9	493.7	38.6	12.8	107.3
1	16VDH-SRW03-023	52.8	71.9	93.5	108.7	494.9	40.5	12.2	102.6
1	VA17W-75	59.6	84.0	113.0	151.8	487.7	41.1	11.9	99.5
1	Branson*	54.1	75.3	102.0	145.8	499.8	37.0	13.5	113.3
1	Hilliard*	57.2	81.1	104.4	140.6	498.5	38.1	13.1	109.7
2	MI14W0190	50.2	64.5	86.5	109.4	500.2	39.3	12.7	106.9
2	MI16R0898	50.0	70.5	89.3	107.3	513.7	37.4	13.7	115.2
2	MI16W0133	52.4	72.1	93.9	98.4	506.3	34.5	14.7	123.1
2	MI16W0528	48.1	67.6	81.1	109.8	518.4	35.6	14.6	122.1
2	Whitetail*	48.2	68.4	85.9	104.3	513.2	35.9	14.3	119.9
3	Beck 705	48.7	66.2	83.9	100.0	513.6	36.1	14.2	119.4
3	Beck 722	50.9	64.7	85.2	110.3	507.8	36.2	14.0	117.8
3	Beck 724	53.3	77.8	91.6	137.6	505.1	38.7	13.1	109.6
3	Beck 727	47.0	68.7	85.6	116.9	517.8	34.8	14.9	124.8
3	Beck 732	51.1	70.5	85.7	103.4	514.2	36.1	14.2	119.4
3	Beck 721*	51.9	65.2	88.7	88.3	509.1	39.3	13.0	108.8
3	Hilliard*	51.6	72.2	93.9	108.3	511.4	36.1	14.2	119.0
4	GA10127-18E26	51.9	70.2	98.6	105.6	500.6	42.1	11.9	99.7
4	GA131246LDH-18E35	53.2	64.9	95.6	98.5	497.8	41.8	11.9	99.9
4	GA15VDH-FHB-MAS23-18LE43F	53.0	70.2	96.1	92.5	495.5	41.6	11.9	99.1
4	GA12505B14-18LE23F	55.9	71.4	97.0	90.2	488.5	47.8	10.2	85.8
4	GW 2032 (14E19)*	55.2	69.5	96.7	113.2	481.5	48.6	9.9	83.1

*Check varieties.

Table 25. Evaluation comments on flour quality and baked product performance by Ardent Mills

Group	Entry	Analytical Flour Qualities				End Product Performance			
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent			
		Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score
1	13VTK59-55	Good MAP, Good SRC		SRC, MAP	8	Cookie	Similar spread factor to check		8
1	DH15SRW65-53	Good MAP, Good SRC		SRC, MAP	8	Cookie	Similar spread factor to check		8
1	16VDH-SRW03-023	Good MAP, Good SRC		SRC, MAP	8	Cookie	Acceptable spread factor	uneven spread on cookie, bubbling on top	7
1	VA17W-75	Good MAP, Good SRC, High LA		SRC, MAP	9	Cookie	Good appearance	lower spread factor	7
1	Branson (check)	High LA		SRC, MAP	8	Cookie		uneven browning	7
1	Hilliard (check)	High LA		SRC, MAP	8	Cookie			8
2	MI14W0190	Good MAP, Good SRC		SRC, MAP	8	Cookie	Acceptable color	lower spread factor, slight bubbling on top of the sample	6
2	MI16R0898	Good MAP, Good SRC		SRC, MAP	8	Cookie	Similar spread factor to check	bubbling on cookie surface	7
2	MI16W0133	Good MAP	Low LA	SRC, MAP	7	Cookie	Similar spread factor to check	bubbling on cookie surface	7
2	MI16W0528	Good MAP, Good SRC		SRC, MAP	8	Cookie	Similar spread factor to check	slight bubbling on cookie surface	7
2	Whitetail (check)			SRC, MAP	8	Cookie			8
3	Beck 705	Good MAP	slightly low water	SRC, MAP	7	Cookie	Similar spread factor to Hilliard check		9
3	Beck 722	Good MAP, Good SRC		SRC, MAP	8	Cookie	Similar spread factor to Hilliard check		9
3	Beck 724	Good MAP, High LA	high sodium carb	SRC, MAP	8	Cookie	Similar spread factor to Beck check		8
3	Beck 727	Good MAP	slightly low water	SRC, MAP	7	Cookie	Higher Spread factor than checks		9
3	Beck 732	Good SRC	slightly low protein	SRC, MAP	7	Cookie	Similar spread factor to Beck check		8
3	Beck 721 (check)		Low LA	SRC, MAP	7	Cookie			8
3	Hilliard (check)			SRC, MAP	8	Cookie			9
4	GA10127-18E26		Low protein, slightly low water, slightly low LA	SRC, MAP	6	Cookie	Higher Spread factor than check		9
4	GA131246LDH-18E35		Low protein, low LA	SRC, MAP	7	Cookie	Higher Spread factor than check		9
4	GA15VDH-FHB-MAS23-18LE43F		Low protein, low LA	SRC, MAP	7	Cookie	Higher Spread factor than check		9
4	GA12505B14-18LE23F	Good MAP	Low LA	SRC, MAP	7	Cookie	Similar spread factor to check		8
4	GW 2032 (14E19) (check)			SRC, MAP	8	Cookie			8

Kellogg Quality Evaluations

Table 26. Solvent retention capacity and alveograph parameters by Kelloggs

Group	Entry	Solvent Retention Capacity (%)				Alveograph					Damage Starch (%)
		Water	Sodium	Sucros	Lactic	P	L	P/L	le	W	
1	13VTK59-55	51.1	70.4	88.9	128.1	56.0	55.0	1.0	41.8	85.0	5.0
1	DH15SRW65-53	49.7	66.8	87.3	125.5	37.0	89.0	0.4	40.1	55.0	3.7
1	16VDH-SRW03-023	50.7	71.0	88.0	121.1	53.0	40.0	1.3	36.7	78.0	4.6
1	VA17W-75	54.4	75.3	104.0	157.2	75.0	67.0	1.1	49.7	123.0	4.7
1	Branson*	48.0	67.1	95.0	160.0	35.0	91.0	0.4	50.7	57.0	3.7
1	Hilliard*	52.4	73.3	101.7	156.3	47.0	70.0	0.7	46.4	74.0	4.2
2	MI14W0190	48.3	62.1	82.1	124.3	30.0	77.0	0.4	45.4	47.0	4.2
2	MI16R0898	49.7	68.0	86.4	121.4	37.0	57.0	0.7	42.9	56.0	4.5
2	MI16W0133	47.6	68.2	86.7	108.4	30.0	67.0	0.5	36.5	42.0	3.8
2	MI16W0528	46.6	64.7	79.8	122.6	23.0	58.0	0.4	49.9	36.0	3.8
2	Whitetail*	46.7	65.6	86.3	121.7	25.0	87.0	0.3	44.3	38.0	3.9
3	Beck 705	45.9	62.8	80.3	114.1	21.0	94.0	0.2	39.4	30.0	4.1
3	Beck 722	47.8	63.6	84.5	125.9	31.0	70.0	0.4	48.8	50.0	4.0
3	Beck 724	53.8	73.6	94.7	152.2	61.0	63.0	1.0	53.5	102.0	4.2
3	Beck 727	47.6	67.8	82.6	137.4	30.0	61.0	0.5	53.6	50.0	3.6
3	Beck 732	57.8	71.5	82.8	107.8	30.0	55.0	0.6	45.2	45.0	3.7
3	Beck 721*	49.7	71.6	83.1	98.1	37.0	70.0	0.5	37.6	53.0	4.5
3	Hilliard*	56.3	74.1	95.6	115.3	38.0	71.0	0.5	45.8	59.0	3.5
4	GA10127-18E26	50.6	70.7	93.5	115.3	39.0	60.0	0.7	45.3	60.0	4.2
4	GA131246LDH-18E35	50.9	64.1	89.7	104.7	39.0	48.0	0.8	43.7	59.0	4.7
4	GA15VDH-FHB-MAS23-18LE43F	50.7	66.7	88.4	104.3	38.0	43.0	0.9	38.2	56.0	5.0
4	GA12505B14-18LE23F	51.7	67.4	92.0	103.5	48.0	45.0	1.1	41.6	72.0	5.0
4	GW 2032 (14E19)*	51.0	68.5	92.8	122.5	47.0	74.0	0.6	51.3	76.0	5.0

*Check varieties.

Table 27. Farinograph and rapid visco-analyzer parameters by Kelloggs

Group	Entry	Farinograph				Rapid Visco-Analyzer							
		Water Absorption (%)	Development Time (min)	Stability (min)	Degree of Softening g	Peak Time (min)	Peak (cP)	Trough (cP)	Break-down (cP)	Setback (cP)	Final (cP)	Pasting Temp (°C)	Peak/Final Ratio
1	13VTK59-55	54.6	1.1	1.8	124.0	6.1	3509	2388	1121	1832	4220	67.0	0.83
1	DH15SRW65-53	52.6	1.3	2.5	126.0	6.1	3308	2064	1244	1458	3522	68.0	0.94
1	16VDH-SRW03-023	55.2	0.9	1.8	136.0	5.9	2759	1635	1125	1341	2975	67.0	0.93
1	VA17W-75	54.6	1.3	2.5	122.0	6.0	2942	1768	1175	1418	3185	68.0	0.92
1	Branson*	50.2	1.0	2.5	94.0	5.9	3309	1898	1411	1524	3422	69.0	0.97
1	Hilliard*	53.7	1.3	2.3	105.0	6.0	3011	1797	1215	1425	3221	67.0	0.93
2	MI14W0190	51.3	0.9	2.2	107.0	6.0	3331	1852	1479	1423	3275	67.0	1.02
2	MI16R0898	54.4	0.8	1.4	149.0	6.1	3646	2288	1358	1605	3893	66.0	0.94
2	MI16W0133	50.1	0.9	1.5	143.0	6.1	3504	2030	1474	1422	3452	67.0	1.01
2	MI16W0528	47.6	0.7	1.3	167.0	6.0	3129	1831	1299	1532	3362	67.0	0.93
2	Whitetail*	49.0	0.7	1.9	108.0	6.1	3243	1961	1282	1504	3465	67.0	0.94
3	Beck 705	48.4	0.8	1.6	157.0	6.1	3511	2091	1420	1575	3666	68.0	0.96
3	Beck 722	50.4	0.8	4.2	93.0	6.3	3732	2220	1512	1398	3618	67.0	1.03
3	Beck 724	52.3	1.1	2.1	87.0	6.3	3995	2792	1203	1853	4645	67.0	0.86
3	Beck 727	48.6	0.9	1.8	119.0	6.3	3891	2538	1353	1558	4095	67.0	0.95
3	Beck 732	49.0	1.0	1.6	131.0	6.2	3969	2371	1598	1672	4043	68.0	0.98
3	Beck 721*	51.7	1.0	2.5	111.0	6.2	3817	2338	1479	1546	3884	67.0	0.98
3	Hilliard*	51.0	1.1	2.4	104.0	6.0	3767	2178	1589	1626	3805	67.0	0.99
4	GA10127-18E26	49.6	0.8	1.5	141.0	5.9	3304	1541	1420	1575	3666	67.0	0.90
4	GA131246LDH-18E35	50.5	0.7	1.2	150.0	5.7	2682	1251	1512	1398	3618	66.0	0.74
4	GA15VDH-FHB-MAS23-18LE43F	51.3	0.8	1.7	126.0	6.0	3274	2171	1203	1853	4645	66.0	0.70
4	GA12505B14-18LE23F	53.1	0.9	1.6	129.0	5.9	3474	1824	1353	1558	4095	66.0	0.85
4	GW 2032 (14E19)*	51.5	0.9	2.8	75.0	6.2	3336	2302	1598	1672	4043	65.0	0.83

*Check varieties.

Table 28. Flour moisture and protein content of the entries by Kelloggs

Grou	Entry	Moisture (%)	Protein (%)
1	13VTK59-55	14.2	8.7
1	DH15SRW65-53	14.0	9.2
1	16VDH-SRW03-023	14.0	8.3
1	VA17W-75	14.1	8.9
1	Branson*	14.5	8.8
1	Hilliard*	14.1	8.7
2	MI14W0190	13.9	9.0
2	MI16R0898	13.9	7.8
2	MI16W0133	13.9	7.9
2	MI16W0528	13.9	7.4
2	Whitetail*	14.0	8.2
3	Beck 705	14.0	7.7
3	Beck 722	13.9	8.7
3	Beck 724	13.9	8.2
3	Beck 727	14.2	8.2
3	Beck 732	13.9	6.8
3	Beck 721*	14.1	8.2
3	Hilliard*	14.2	8.6
4	GA10127-18E26	13.9	6.7
4	GA131246LDH-18E35	13.8	6.4
4	GA15VDH-FHB-MAS23-18LE43F	13.8	6.6
4	GA12505B14-18LE23F	14.0	7.2
4	GW 2032 (14E19)*	14.1	8.4

*Check varieties.

Table 29. Evaluation comments on analytical flour quality by Kelloggs

		Analytical Flour Qualities		
		Score: 1 Poor - 9 Excellent		
Group	Entry	Likes	Dislikes	Score
1	13VTK59-55 FLOUR	Good protein content, good performance in gluten strength, decrease food breakage	High degree of softening, weaker hard wheat	7
1	DH15SRW65-53 FLOUR	High protein content,	Low elasticity, higher water absorption	8
1	16VDH-SRW03-023 FLOUR	Good protein content	Low lactic acid, weak gluten	6
1	VA17W-75 FLOUR	High lactic acid value and hence great for good cracker strength		7
1	BRANSEN(CHECK) FLOUR	Good protein content and higher lactic acid value		7
1	HILLARD(CHECK) FLOUR	Good protein content and higher lactic acid value, great for waffle		7
2	MI14W0190 FLOUR	High protein content,	low degree of softening, suitable for baking	8
2	MI16W0898 FLOUR	High lactic acid value and hence great for good cracker strength	protein content is OK, high water absorption	5
2	MI16W0133 Flour	Protein content is OK	Low lactic acid value compare to check, suitable for cake, low elasticity	5
2	MI16W0528 Flour	High degree of softening, suitable for Cake	Low protein content, higher water absorption	5
2	Whitetail (Check) Flour	Good protein content,		6
3	Beck 705 Flour		Low protein content, low elasticity suitable for cake	5
3	Beck 722 Flour	High protein content, low degree of softening, great for bread		7
3	Beck 724 Flour	Good protein content, higher lactic acid value, great for cracker strength		6
3	Beck 727 Flour	Good protein content, higher lactic acid value, great for cracker strength, low water absorption		6
3	Beck 732 Flour		Low protein content, low lactic acid value suitable for cake	4
3	Beck 721 (Check) Flour	Good protein content	low lactic acid value, very low extensibility suitable for cake	6
3	Hilliard (Check) Flour	good protein content,	high water absorption	7
4	GA10127-18E26 Flour		Low protein content, higher degree of softening. Suitable for cake	3
4	GA131245LDH-18E35 Flour		Low protein content, low lactic acid value not great for cracker strength	3
4	GA15VDH-FHB-MAS23-18LE43F Flour		Low protein content, low elasticity	3
4	GA12505B14-18LE23F Flour		Low protein content, high degree of softening	4
4	GW 2032(14E19)(Check) Flour	High lactic acid value, good elasticity and hence great for good cracker strength	increased water absorption	6

Limagrain Cereal Seeds Quality Evaluations

Table 30. Cookie baking test parameters by Limagrain Cereal Seeds

Group	Entry	Cookies (10-52)		
		Width (cm)	Thickness (cm)	Top Grain Score
1	13VTK59-55	8.6	0.81	1
1	DH15SRW65-53	8.5	0.78	2
1	16VDH-SRW03-023	8.6	0.75	1
1	VA17W-75	8.4	0.76	1
1	Branson*	8.7	0.71	1
1	Hilliard*	8.5	0.77	1
2	MI14W0190	8.7	0.78	2
2	MI16R0898	8.8	0.68	2
2	MI16W0133	8.8	0.66	2
2	MI16W0528	8.9	0.66	2
2	Whitetail*	8.7	0.70	2
3	Beck 705	9.0	0.72	2
3	Beck 722	8.8	0.73	2
3	Beck 724	8.5	0.74	2
3	Beck 727	8.9	0.63	2
3	Beck 732	8.9	0.69	2
3	Beck 721*	8.6	0.70	2
3	Hilliard*	8.7	0.68	2
4	GA10127-18E26	8.5	0.72	2
4	GA131246LDH-18E35	8.5	0.72	2
4	GA15VDH-FHB-MAS23-18LE43F	8.5	0.82	2
4	GA12505B14-18LE23F	8.4	0.82	2
4	GW 2032 (14E19)*	8.4	0.78	1

*Check varieties.

Table 31. Evaluation comments on analytical flour quality and baked product performance by Limagrain Cereal Seeds

Group	Entry	End Product Performance			
		Product	Likes	Dislikes	Score
1	13VTK59-55	cookie 10-52.02			7
1	DH15SRW65-53	cookie 10-52.02			8
1	16VDH-SRW03-023	cookie 10-52.02			6
1	VA17W-75	cookie 10-52.02			6
1	Branson (check)	cookie 10-52.02			8
1	Hilliard (check)	cookie 10-52.02			7
2	MI14W0190	cookie 10-52.02			8
2	MI16R0898	cookie 10-52.02			6
2	MI16W0133	cookie 10-52.02			6
2	MI16W0528	cookie 10-52.02			6
2	Whitetail (check)	cookie 10-52.02			6
3	Beck 705	cookie 10-52.02			6
3	Beck 722	cookie 10-52.02			8
3	Beck 724	cookie 10-52.02			5
3	Beck 727	cookie 10-52.02			8
3	Beck 732	cookie 10-52.02			5
3	Beck 721 (check)	cookie 10-52.02			6
3	Hilliard (check)	cookie 10-52.02			7
4	GA10127-18E26	cookie 10-52.02			4
4	GA131246LDH-18E35	cookie 10-52.02			4
4	GA15VDH-FHB-MAS23-18LE43F	cookie 10-52.02			4
4	GA12505B14-18LE23F	cookie 10-52.02			4
4	GW 2032 (14E19) (check)	cookie 10-52.02			5

Mennel Milling Quality Evaluations

Table 32. Solvent retention capacity and farinograph test parameters by Mennel Milling

Group	Entry	Solvent Retention Capacity (%)				Farinograph			
		Water	Sodium Carb	Sucrose	Lactic Acid	Water Absorb (%)	Develop Time (min)	Stability (min)	Degree of Softening
1	13VTK59-55	56.6	73.3	94.6	125.0	58.6	1.1	0.6	122
1	DH15SRW65-53	54.0	69.0	92.9	121.1	53.7	0.6	2.3	99
1	16VDH-SRW03-023	54.5	72.3	113.0	117.5	60.1	0.5	1.0	128
1	VA17W-75	55.3	70.6	93.1	119.3	57.9	1.2	2.4	81
1	Branson*	50.8	70.6	100.8	149.6	54.6	1.1	2.4	86
1	Hilliard*	54.7	76.5	107.3	143.2	56.6	0.6	2.0	78
2	MI14W0190	50.3	64.6	85.3	115.6	54.1	0.6	1.5	108
2	MI16R0898	53.3	70.3	88.7	111.8	53.5	0.4	0.6	121
2	MI16W0133	50.3	70.4	89.6	106.9	52.1	0.3	0.4	164
2	MI16W0528	50.0	67.2	82.1	116.5	49.6	0.5	1.0	154
2	Whitetail*	50.5	68.1	87.8	116.7	50.6	0.5	0.6	126
3	Beck 705	51.1	65.6	81.4	105.0	49.9	0.4	1.1	115
3	Beck 722	50.0	65.9	88.4	116.2	52.3	0.4	2.0	73
3	Beck 724	56.2	75.4	100.8	144.7	53.1	0.5	1.4	92
3	Beck 727	52.6	69.0	89.6	128.5	51.9	0.6	1.0	110
3	Beck 732	57.2	70.6	87.0	113.2	51.8	0.5	0.5	156
3	Beck 721*	52.6	69.5	87.6	107.7	54.2	0.6	1.2	129
3	Hilliard*	52.4	72.4	95.6	130.5	53.1	1.2	2.6	53
4	GA10127-18E26	54.3	71.6	97.5	112.1	52.1	0.6	1.2	111
4	GA131246LDH-18E35	54.4	67.2	86.6	99.5	52.8	0.4	0.5	148
4	GA15VDH-FHB-MAS23-18LE43F	53.6	68.8	91.3	98.1	54.1	0.5	1.0	156
4	GA12505B14-18LE23F	55.3	72.1	94.3	98.9	54.8	0.5	1.2	95
4	GW 2032 (14E19)*	55.9	72.2	96.2	118.8	53.8	1.0	2.4	60

*Check varieties.

Table 33. Sugar-snap cookie baking test (10-50D) and biscuit test parameters by Mennel Milling

Group	Entry	Cookies (10-50D)				Biscuit		
		Width (mm)	Thickness (mm)	W/T Ratio	Spread Factor	Width (mm)	Height (mm)	Weight (g)
1	13VTK59-55	484.5	62.9	7.7	76.1	251	169	120.0
1	DH15SRW65-53	479.0	57.6	8.3	82.2	248	195	125.7
1	16VDH-SRW03-023	491.5	60.2	8.2	80.6	245	170	117.7
1	VA17W-75	472.5	59.4	8.0	78.6	241	181	118.4
1	Branson*	494.0	55.0	9.0	88.7	242	173	117.4
1	Hilliard*	492.0	59.8	8.2	81.2	244	177	115.6
2	MI14W0190	494.0	53.9	9.2	89.5	248	176	112.5
2	MI16R0898	506.5	55.2	9.2	89.6	250	155	111.6
2	MI16W0133	502.5	52.4	9.6	93.6	253	158	111.5
2	MI16W0528	523.0	51.2	10.2	99.8	253	171	117.1
2	Whitetail*	504.0	51.6	9.8	95.4	250	163	108.8
3	Beck 705	521.0	50.7	10.3	100.3	247	191	127.4
3	Beck 722	498.5	53.8	9.3	90.4	244	164	123.4
3	Beck 724	494.0	59.3	8.3	81.3	245	169	125.4
3	Beck 727	515.0	50.6	10.2	99.2	248	172	126.2
3	Beck 732	516.5	50.3	10.3	100.2	249	166	120.2
3	Beck 721*	496.5	55.6	8.9	87.1	246	166	121.2
3	Hilliard*	499.5	55.6	9.0	87.7	253	163	121.3
4	GA10127-18E26	490.0	55.9	8.8	85.6	247	159	117.6
4	GA131246LDH-18E35	492.0	57.0	8.6	84.3	245	160	119.2
4	GA15VDH-FHB-MAS23-18LE43F	490.5	57.4	8.5	83.4	248	160	119.4
4	GA12505B14-18LE23F	489.0	59.7	8.2	79.9	242	160	113.4
4	GW 2032 (14E19)*	466.5	63.2	7.4	72.1	243	171	119.6

*Check varieties.

Table 34. 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	13VTK59-55	6.3	2999	2154	845	1554	3708	87.3	0.81
1	DH15SRW65-53	6.2	2928	1861	1067	1313	3174	86.9	0.92
1	16VDH-SRW03-023	6.1	2555	1600	956	1295	2895	85.2	0.88
1	VA17W-75	6.2	2617	1688	929	1276	2964	85.9	0.88
1	Branson*	6.1	2962	1867	1095	1379	3246	85.6	0.91
1	Hilliard*	6.1	2586	1653	933	1261	2914	86.8	0.89
2	MI14W0190	6.2	3046	1791	1256	1291	3082	86.3	0.99
2	MI16R0898	6.3	3292	2144	1148	1471	3615	85.6	0.93
2	MI16W0133	6.4	3124	1958	1167	1318	3276	87.2	0.95
2	MI16W0528	6.1	3150	1914	1236	1476	3390	69.1	0.93
2	Whitetail*	6.2	3538	2245	1294	1521	3766	69.0	0.94
3	Beck 705	6.3	3154	1956	1198	1418	3373	86.8	0.94
3	Beck 722	6.1	3666	2236	1430	1300	3536	86.0	1.04
3	Beck 724	6.4	3582	2564	1018	1671	4235	86.4	0.85
3	Beck 727	6.4	3381	2321	1059	1431	3752	87.2	0.90
3	Beck 732	6.2	3482	2098	1384	1487	3585	78.3	0.97
3	Beck 721*	6.3	3392	2144	1248	1411	3537	86.4	0.96
3	Hilliard*	6.2	3477	2097	1380	1502	3599	86.4	0.97
4	GA10127-18E26	5.9	3135	1487	1650	1095	2581	69.5	1.21
4	GA131246LDH-18E35	5.8	2553	1212	1341	1141	2353	69.4	1.08
4	GA15VDH-FHB- MAS23-18LE43F	6.2	3219	2149	1071	1673	3821	86.0	0.84
4	GA12505B14- 18LE23F	6.1	3111	1676	1435	1188	2864	86.0	1.09
4	GW 2032 (14E19)*	6.4	3140	2188	952	1609	3798	87.6	0.83

*Check varieties.

Table 35. Evaluation comments on flour quality and baked product performance by Mennel Milling

		Analytical Flour Qualities				End Product Performance				
Group	Entry	Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent				Additional Comments
		Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	
1	13VTK59-55	High LA%	High water% and sucrose%	SRC	6	Cookies	Light crust color	Low SF	7	Biscuits 7 average height, good color and mass
1	DH15SRW65-53	Average LA%, average sucrose%	High water%	SRC	7	Cookies	Average SF, light crust color		8	Biscuits 8 good height, color and mass
1	16VDH-SRW03-023	Average LA%	High water% and sucrose%	SRC	6	Cookies	Average SF, light crust color		8	Biscuits 7 average height, good color
1	VA17W-75	Average LA%, average sucrose%	High water%	SRC	7	Cookies		Low SF, pale yellow crust color	5	Biscuits 7 dark color, good height
1	Branson (check)	High LA%, low water%	High sucrose%	SRC	8	Cookies	Average SF	Dark crust color, cracks on crust	6	Biscuits 7 average height, good color
1	Hilliard (check)	High LA%	High water% and sucrose%	SRC	6	Cookies	Average SF	Dark crust color	7	Biscuits 7 good height, dark color
2	MI14W0190	Low water% and sucrose%	Low LA%	SRC	8	Cookies	Average SF, Light crust color		8	Biscuits 8 good height, color and mass
2	MI16R0898	Average water% and sucrose%	Low LA%	SRC	7	Cookies	Average SF	Dark crust color, more cracks on ends	6	Biscuits 5 low height and dark color
2	MI16W0133	Low water% and average sucrose%	Low LA%	SRC	7	Cookies	High SF, Light crust color		8	Biscuits 5 low height and dark color
2	MI16W0528	Low water% and sucrose%, average LA%		SRC	8	Cookies	High SF	Dark crust color	7	Biscuits 7 average height, good color
2	Whitetail (check)	Average LA%, Low water%, average sucrose%		SRC	8	Cookies	High SF, Light crust color		8	Biscuits 7 low height, good color
3	Beck 705	Average water%, low sucrose%	Low LA%	SRC	7	Cookies	High SF, Light crust color		8	Biscuits 7 good height, dark color
3	Beck 722	Average LA%, Low water%, average sucrose%		SRC	8	Cookies	High SF, Light crust color		8	Biscuits 6 low height, light color
3	Beck 724	High LA%	High water% and sucrose%	SRC	6	Cookies	Average SF, Light crust color		7	Biscuits 6 average height, dark color
3	Beck 727	High LA%, Average water%, average sucrose%		SRC	8	Cookies	High SF	Dark crust color, more cracks	7	Biscuits 7 average height, light color
3	Beck 732	Average sucrose%	Low LA%, high water%	SRC	6	Cookies	High SF	Dark crust color, more cracks	7	Biscuits 7 average height, light color
3	Beck 721 (check)	Average water%, average sucrose%	Low LA%	SRC	7	Cookies	Average SF	Dark crust color	7	Biscuits 7 average height, light color
3	Hilliard (check)	High LA%, average water%	High sucrose%	SRC	8	Cookies	Average SF, Light crust color	Cracks on ends	7	Biscuits 6 low height, dark color
4	GA10127-18E26		Low LA%, High sucrose% and water%	SRC	6	Cookies	Average SF	Dark crust color	7	Biscuits 6 light color, gritty texture, low height
4	GA131246LDH-18E35	Low sucrose%	Low LA%, High water%	SRC	6	Cookies	Average SF	Dark crust color, more cracks	6	Biscuits 7 light color, low height
4	GA15VDH-FHB-MAS23-18LE43F	Average water% and sucrose%	Low LA%	SRC	7	Cookies	Average SF, Light crust color	slight cracks on edges	7	Biscuits 5 dark color, low height
4	GA12505B14-18LE23F		Low LA%, high water% and sucrose%	SRC	6	Cookies	Light crust color	Low SF	7	Biscuits 7 light color, low height
4	GW 2032 (14E19) (check)	Average LA%	High water% and sucrose%	SRC	6	Cookies	Light crust color	Low SF	7	Biscuits 6 dark color, average height

Mondelez Quality Evaluations

Table 36. Solvent retention capacity parameters by Mondelez

Group	Entry	Solvent Retention Capacity (%)			
		Water	Sodium Carbonate	Sucrose	Lactic Acid
1	13VTK59-55	53.0	76.0	100.1	117.5
1	DH15SRW65-53	51.0	71.6	99.6	105.4
1	16VDH-SRW03-023	53.1	76.9	100.4	93.9
1	VA17W-75	55.2	83.8	130.6	139.1
1	Branson*	47.5	74.3	115.1	125.2
1	Hilliard*	52.9	80.5	117.6	128.6
2	MI14W0190	49.1	70.8	87.1	101.9
2	MI16R0898	51.2	73.7	89.9	103.7
2	MI16W0133	48.7	76.2	99.4	92.9
2	MI16W0528	48.5	70.4	93.9	110.3
2	Whitetail*	47.9	69.7	92.9	104.3
3	Beck 705	46.8	70.0	92.0	94.9
3	Beck 722	47.7	69.0	102.4	107.9
3	Beck 724	55.7	80.1	113.9	136.1
3	Beck 727	49.4	71.0	105.3	121.1
3	Beck 732	52.7	72.0	95.8	106.2
3	Beck 721*	51.7	73.0	100.7	92.8
3	Hilliard*	50.7	75.4	113.2	106.9
4	GA10127-18E26	56.2	84.0	116.0	99.2
4	GA131246LDH-18E35	53.2	74.7	111.3	98.4
4	GA15VDH-FHB-MAS23-18LE43F	54.5	80.5	110.6	84.9
4	GA12505B14-18LE23F	53.6	78.1	111.0	84.5
4	GW 2032 (14E19)*	52.5	79.4	109.2	101.1

*Check varieties.

Table 37. Evaluation comments on flour quality by Mondelez

Group	Entry	Analytical Flour Qualities		
		Score: 1 Poor - 9 Excellent		
		Likes	Dislikes	Score
1	13VTK59-55	Good water absorption		8
1	DH15SRW65-53	Very good carbonate and water absorption.		8
1	16VDH-SRW03-023	Good water absorption	Low lactic acid absorption in comparison to the checks	7
1	VA17W-75		Medium high water and high sodium carbonate absorption	7
1	Branson (check)			
1	Hilliard (check)			
2	MI14W0190	Low water and sodium carbonate absorption		8
2	MI16R0898		Medium high water and sodium carbonate absorption	8
2	MI16W0133		Medium high sodium carbonate absorption and lower lactic absorption	7
2	MI16W0528	Low water and sodium carbonate absorption		8
2	Whitetail (check)			
3	Beck 705	Low water and sodium carbonate absorption		8
3	Beck 722	Low water and sodium carbonate absorption		8
3	Beck 724		Medium high water and high sodium carbonate absorption	7
3	Beck 727	Low water and sodium carbonate absorption		8
3	Beck 732	Low water and sodium carbonate absorption		8
3	Beck 721 (check)			
3	Hilliard (check)			
4	GA10127-18E26		Medium high water and high sodium carbonate absorption	7
4	GA131246LDH-18E35	Low water and sodium carbonate absorption		8
4	GA15VDH-FHB-MAS23-18LE43F		High sodium carbonate absorption	7
4	GA12505B14-18LE23F		Medium high sodium carbonate absorption	8
4	GW 2032 (14E19) (check)			

Siemer Milling Quality Evaluations

Table 38. Alveograph test parameters by Siemer Milling

Group	Entry	Alveograph			
		P	L	P/L	W
		mm	mm	Ratio	joules
1	13VTK59-55	56.7	74.9	0.76	144.6
1	DH15SRW65-53	34.8	127.9	0.27	122.0
1	16VDH-SRW03-023	55.6	65.8	0.85	129.0
1	VA17W-75	67.1	84.5	0.79	205.2
1	Branson*	35.1	149.1	0.24	162.8
1	Hilliard*	53.4	91.3	0.59	163.9
2	MI14W0190	25.4	161.5	0.16	111.9
2	MI16R0898	35.6	91.3	0.39	109.2
2	MI16W0133	25.3	107.4	0.24	82.4
2	MI16W0528	23.1	76.4	0.30	75.2
2	Whitetail*	23.7	136.2	0.17	91.2
3	Beck 705	20.1	130.0	0.15	75.0
3	Beck 722	30.3	129.0	0.24	120.4
3	Beck 724	63.0	69.5	0.91	173.2
3	Beck 727	28.5	97.4	0.29	106.1
3	Beck 732	34.4	67.3	0.51	100.0
3	Beck 721*	31.7	107.4	0.30	96.4
3	Hilliard*	39.1	109.3	0.36	144.8
4	GA10127-18E26	45.7	73.3	0.62	123.1
4	GA131246LDH-18E35	42.6	70.3	0.61	112.5
4	GA15VDH-FHB-MAS23-18LE43F	44.4	58.0	0.77	95.9
4	GA12505B14-18LE23F	56.9	67.3	0.85	126.3
4	GW 2032 (14E19)*	64.5	71.0	0.91	175.7

*Check varieties.

Table 39. Evaluation comments on alveograph dough test by Siemer Milling

Group	Entry	Dislikes	Score	Additional Comments Mitigating Physical/Chemical Properties
1	13VTK59-55	Strong flour	5	
1	DH15SRW65-53		8	
1	16VDH-SRW03-023	Strong Flour	5	
1	VA17W-75	Tall Peaks High W Value	3	Dough slightly stiff
1	Branson (check)	Long extensibility	6	
1	Hilliard (check)	Strong Flour	5	
2	MI14W0190	Low P/L Long length	5	Dough sticky
2	MI16R0898		9	
2	MI16W0133		7	Dough very soft
2	MI16W0528	Lower peak	6	
2	Whitetail (check)	Lower P/L	5	
3	Beck 705	Low Peak and Low P/L	3	
3	Beck 722		7	Dough soft and sticky
3	Beck 724	Tall Peaks High W Value	3	Dough stiff
3	Beck 727		8	
3	Beck 732	Shorter length	7	
3	Beck 721 (check)		9	
3	Hilliard (check)		8	
4	GA10127-18E26	Stronger flour	6	
4	GA131246LDH-18E35	Stronger flour	6	
4	GA15VDH-FHB-MAS23-18LE43F	Stronger flour	6	
4	GA12505B14-18LE23F	Tall Peaks	4	
4	GW 2032 (14E19) (check)	Tall Peaks High W Value	3	

Star of the West Milling Evaluations

Table 40. 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	13VTK59-55	55.2	73.7	95.0	121.6	0.72	459.0	65.0	7.06	68.5	383	633
1	DH15SRW65-53	51.9	69.5	95.5	115.9	0.70	456.0	63.0	7.25	69.9	430	545
1	16VDH-SRW03-023	54.2	72.8	96.0	110.9	0.66	459.0	65.0	7.06	69.3	321	327
1	VA17W-75	56.3	79.5	116.6	153.5	0.78	446.0	67.0	7.25	71.2	332	415
1	Branson*	49.9	69.2	103.9	142.4	0.82	460.5	61.0	7.55	74.1	299	517
1	Hilliard*	53.6	76.1	112.4	139.5	0.74	462.5	62.0	7.46	72.4	315	394
2	MI14W0190	50.7	64.9	85.1	115.7	0.77	467.5	57.0	8.20	80.5	319	574
2	MI16R0898	54.2	71.1	90.8	115.9	0.72	461.0	58.5	7.88	77.4	319	802
2	MI16W0133	50.7	72.1	92.2	102.9	0.63	484.0	53.0	9.13	88.5	327	704
2	MI16W0528	50.4	67.7	81.9	119.5	0.80	488.5	52.0	9.39	90.6	290	521
2	Whitetail*	49.6	69.5	89.0	113.3	0.72	475.5	55.0	8.65	84.9	323	540
3	Beck 705	48.5	64.8	83.6	102.8	0.69	485.5	51.5	9.43	92.0	327	794
3	Beck 722	46.9	66.9	90.4	113.4	0.72	477.5	56.5	8.46	82.1	322	751
3	Beck 724	57.0	75.3	101.4	141.7	0.80	464.0	62.0	7.48	72.6	374	572
3	Beck 727	50.9	68.8	91.6	130.1	0.81	489.0	52.5	9.31	90.4	349	815
3	Beck 732	53.5	70.8	87.2	113.0	0.72	478.0	52.0	9.19	89.7	316	748
3	Beck 721*	49.4	69.8	89.8	103.8	0.65	472.5	57.0	8.29	80.9	318	722
3	Hilliard*	52.1	72.8	99.4	119.3	0.69	480.0	60.0	8.08	77.9	316	756
4	GA10127-18E26	54.5	74.4	100.1	109.7	0.63	465.0	61.0	7.62	74.4	328	448
4	GA131246LDH-18E35	55.0	70.0	94.0	102.3	0.62	475.5	58.0	8.20	80.0	293	958
4	GA15VDH-FHB- MAS23-18LE43F	54.8	71.8	93.3	96.8	0.59	468.5	58.0	8.00	77.1	358	682
4	GA12505B14-	50.8	73.1	98.8	90.9	0.53	456.5	62.0	7.36	71.0	333	517
4	GW 2032 (14E19)*	54.0	74.2	97.5	111.5	0.65	448.0	69.0	6.49	63.0	437	617

*Check varieties.

Table 41. Rapid Visco-Analyzer parameters by Star of the West Milling

Group	Entry	Peak Time (min)	Peak (cP)	Trough (cP)	Break-down (cP)	Setback (cP)	Final (cP)	Pasting Temp (°C)	Peak/Final Ratio
1	13VTK59-55	6.1	3001	2002	999	1599	3601	83.9	0.8
1	DH15SRW65-53	6.0	2859	1664	1195	1300	2964	82.4	1.0
1	16VDH-SRW03-023	5.9	2409	1360	1049	1247	2607	83.1	0.9
1	VA17W-75	6.0	2556	1485	1071	1245	2730	83.1	0.9
1	Branson*	5.9	2862	1650	1212	1351	3001	83.1	1.0
1	Hilliard*	5.9	2573	1516	1057	1263	2779	83.8	0.9
2	MI14W0190	6.0	2872	1538	1334	1215	2753	68.7	1.0
2	MI16R0898	6.1	3169	1904	1265	1437	3341	83.9	0.9
2	MI16W0133	6.2	3012	1716	1296	1277	2993	67.8	1.0
2	MI16W0528	6.0	2781	1571	1210	1377	2948	67.0	0.9
2	Whitetail*	6.1	2808	1588	1220	1355	2943	68.7	1.0
3	Beck 705	6.1	3099	1761	1338	1406	3167	67.0	1.0
3	Beck 722	6.2	3067	1873	1394	1297	3170	83.0	1.0
3	Beck 724	6.2	3455	2252	1203	1704	3956	84.0	0.9
3	Beck 727	6.2	3320	2033	1287	1441	3474	83.0	1.0
3	Beck 732	6.1	3307	1841	1466	1439	3280	70.3	1.0
3	Beck 721*	6.1	3228	1864	1364	1357	3221	83.9	1.0
3	Hilliard*	6.1	3251	1850	1401	1411	3261	83.2	1.0
4	GA10127-18E26	5.7	2866	1261	1605	1017	2278	67.8	1.3
4	GA131246LDH-18E35	5.7	2301	1011	1310	999	2010	67.8	1.1
4	GA15VDH-FHB- MAS23-18LE43F	6.0	2874	1836	1038	1592	3428	83.9	0.8
4	GA12505B14-18LE23F	5.9	3015	1477	1538	1136	2613	81.5	1.2
4	GW 2032 (14E19)*	6.1	2906	1898	1008	1608	3506	84.8	0.8

*Check varieties.

Table 42. Evaluation comments on flour quality and baked product performance by Star of the West Milling

		Analytical Flour Qualities			End Product Performance				Additional Comments
		Score: 1 Poor - 9 Excellent			Score: 1 Poor - 9 Excellent				
Group	Entry	Likes	Dislikes	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties
1	I3VTK59-55	good lactic acid	high sodium carbonate SRC	7	Sugar snap cookies		tight cookies	5	
1	DH15SRW65-53	fairly good SRC profile for the group		7	Sugar snap cookies			6	
1	I6VDH-SRW03-023		Lowest lactic acid of group	6	Sugar snap cookies		tight cookies	5	
1	VA17W-75	High lactic acid	High sodium carbonate SRC and sucrose	6	Sugar snap cookies			6	Flour is more yellow than others in this set.
1	Branson (check)	Low water SRC and High lactic acid		9	Sugar snap cookies	Best cookies of the group		7	
1	Hilliard (check)		high sodium carbonate SRC	7	Sugar snap cookies			6	
2	MI14W0190	Low absorption for water and sodium carbonate. Good overall SRC profile		9	Sugar snap cookies			6	
2	MI16R0898		High water and sodium carbonate absorption	7	Sugar snap cookies	Fairly tight cookies, but with a good top pattern.		7	
2	MI16W0133		Highest sodium carbonate and lowest lactic acid of the group	7	Sugar snap cookies	Good cookies with a fairly good top pattern		8	
2	MI16W0528	good SRC profile		8	Sugar snap cookies	Best cookies of the group. Wide cookies with good top pattern		9	Made good cookies, SRC indicates that it would make good crackers as well.
2	Whitetail (check)	Very good SRC profile		8	Sugar snap cookies			7	
3	Beck 705	Very good SRC profile		9	Sugar snap cookies	Best cookies of the group. Wide cookies with good top pattern		9	
3	Beck 722	Very good SRC profile		9	Sugar snap cookies			6	
3	Beck 724		High sodium carbonate SRC and sucrose	6	Sugar snap cookies		Fairly tight cookies	6	
3	Beck 727	Low water SRC and High lactic acid	High sodium carbonate SRC	7	Sugar snap cookies	Good cookies with a fairly good top pattern		8	Made good cookies, SRC indicates that it would make good crackers as well.
3	Beck 732		fairly low protein	7	Sugar snap cookies	Good cookies with a fairly good top pattern		8	
3	Beck 721 (check)	good SRC profile		8	Sugar snap cookies			7	
3	Hilliard (check)		High sodium carbonate SRC	7	Sugar snap cookies			7	
4	GA10127-18E26		High sodium carbonate SRC and sucrose	6	Sugar snap cookies			5	All cookies in set are fairly tight.
4	GA131246LDH-18E35		Lower than usual protein, High water absorption	5	Sugar snap cookies			7	
4	GA15VDH-FHB-MAS23-18LE43F		Lower than usual protein	5	Sugar snap cookies			6	
4	GA12505B14-18LE23F	low water SRC	Low lactic acid	7	Sugar snap cookies			5	
4	GW 2032 (14E19) (check)		High water and sodium carbonate absorption	6	Sugar snap cookies		tight cookies	4	

Wheat Marketing Center Quality Evaluations

Table 43. Sponge cake baking test parameters by Wheat Marketing Center

Group	Entry	Sponge Cake					Ranking
		External	Crumb Grain	Texture Score	Volume (ml)	Total Score	
1	13VTK59-55	12	19	9	1116	40	6
1	DH15SRW65-53	13	18	15	1156	46	5
1	16VDH-SRW03-023	14	21	21	1293	56	2
1	VA17W-75	14	18	21	1226	53	4
1	Branson*	14	21	21	1333	56	1
1	Hilliard*	14	21	21	1276	56	3
2	MI14W0190	14	20	18	1258	52	5
2	MI16R0898	14	21	18	1279	53	4
2	MI16W0133	14	21	24	1279	59	1
2	MI16W0528	14	20	21	1256	55	3
2	Whitetail*	14	20	21	1302	55	2
3	Beck 705	14	21	21	1292	56	2
3	Beck 722	14	20	18	1236	52	5
3	Beck 724	13	19	15	1169	47	6
3	Beck 727	14	21	27	1359	62	1
3	Beck 732	14	20	21	1302	55	3
3	Beck 721*	14	20	21	1234	55	4
3	Hilliard*	13	20	12	1192	45	7
4	GA10127-18E26	14	20	21	1245	55	1
4	GA131246LDH-18E35	13	20	21	1200	54	4
4	GA15VDH-FHB-MAS23-18LE43F	13	21	21	1209	55	2
4	GA12505B14-18LE23F	14	19	21	1201	54	3
4	GW 2032 (14E19)*	12	19	12	1140	43	5

*Check varieties.

Table 44. Evaluation comments on flour quality and sponge cake baking test performance by Wheat Marketing Center

Group	Entry	Analytical Flour Qualities				End Product Performance				Additional Comments	
		Score: 1 Poor - 9 Excellent				Score: 1 Poor - 9 Excellent					
		Likes	Dislikes	Basis	Score	Product	Likes	Dislikes	Score	Mitigating Physical/Chemical Properties	
1	13VTK59-55	Similar protein to checks		Primary Analysis	6	Japanese Sponge Cake		Poor exterior and interior, Very hard texture, Low volume	3		
1	DH15SRW65-53		Slightly higher protein and ash than checks	Primary Analysis	5	Japanese Sponge Cake		Poor interior, Hard texture, Low volume	5		
1	16VDH-SRW03-023	Slightly lower protein than checks		Primary Analysis	7	Japanese Sponge Cake	Good cake similar to checks		7		
1	VA17W-75	Similar protein to checks		Primary Analysis	6	Japanese Sponge Cake		Poor interior	6		
1	Branson (check)			Primary Analysis	6	Japanese Sponge Cake			7		
1	Hilliard (check)			Primary Analysis	6	Japanese Sponge Cake			7		
2	MI14W0190		Higher protein than check	Primary Analysis	5	Japanese Sponge Cake		Slightly hard texture	6		
2	MI16R0898	Slightly lower protein than check		Primary Analysis	7	Japanese Sponge Cake		Slightly hard texture	6		
2	MI16W0133	Slightly lower protein than check		Primary Analysis	7	Japanese Sponge Cake	Very soft texture		8		
2	MI16W0528	Slightly lower protein than check		Primary Analysis	7	Japanese Sponge Cake	Good cake similar to check		7		
2	Whitetail (check)			Primary Analysis	6	Japanese Sponge Cake			7		
3	Beck 705	Lower protein than checks		Primary Analysis	7	Japanese Sponge Cake	Large volume, similar cake to Beck721 check		6		
3	Beck 722	Similar protein to checks		Primary Analysis	6	Japanese Sponge Cake		Slightly hard texture	5.5		
3	Beck 724	Similar protein to checks		Primary Analysis	6	Japanese Sponge Cake		Hard texture	5		
3	Beck 727	Similar protein to checks		Primary Analysis	6	Japanese Sponge Cake	Very soft texture, Large volume		8		
3	Beck 732	Lower protein than checks		Primary Analysis	8	Japanese Sponge Cake	Large volume, similar cake to Beck721 check		6		
3	Beck 721 (check)			Primary Analysis	6	Japanese Sponge Cake			6		
3	Hilliard (check)			Primary Analysis	6	Japanese Sponge Cake		Very hard texture	4	This check is not good!	
4	GA10127-18E26	Lower protein than check		Primary Analysis	8	Japanese Sponge Cake	Better than check		5		
4	GA131246LDH-18E35	Lower protein than check		Primary Analysis	8	Japanese Sponge Cake	Better than check		4		
4	GA15VDH-FHB-MAS23-18LE43F	Lower protein and ash than check		Primary Analysis	9	Japanese Sponge Cake	Better than check		4		
4	GA12505B14-18LE23F	Lower protein than check		Primary Analysis	7	Japanese Sponge Cake	Better than check		4		
4	GW 2032 (14E19) (check)			Primary Analysis	6	Japanese Sponge Cake		Poor exterior, Very hard texture, Small volume	3	This check is not good!	

USDA-ARS Western Wheat Quality Laboratory Quality Evaluations

Table 45. Solvent retention capacity and mixograph test parameters by USDA-ARS Western Wheat Quality Laboratory

Group	Entry	Solvent Retention Capacity (%)				Mixograph					
		Water	Sodium Carb	Sucrose	Lactic Acid	Water Abs. (%)	Type (min)	Mid-point Time	Mid-Point Height	Mid-point Work	Mid-point Width+2 min
1	13VTK59-55	53.3	69.6	90.3	111.4	56.0	5M	2.0	43.9	80.3	14.5
1	DH15SRW65-53	51.6	65.3	87.7	108.3	56.0	2M	2.4	44.0	97.3	11.5
1	16VDH-SRW03-023	54.3	69.9	90.9	104.8	55.0	3M	2.1	43.0	83.5	13.1
1	VA17W-75	55.6	75.0	107.6	145.0	57.5	2M	2.3	49.7	102.7	23.7
1	Branson*	48.7	66.1	92.0	139.1	56.5	5M	3.8	44.0	153.5	11.9
1	Hilliard*	53.3	72.6	100.9	132.0	55.5	3M	2.5	44.3	102.2	15.8
2	MI14W0190	51.6	64.0	84.2	104.7	55.5	3M	2.8	45.4	105.4	14.6
2	MI16R0898	52.6	67.2	86.1	105.5	54.5	3M	2.8	42.2	108.8	12.4
2	MI16W0133	51.8	67.2	85.6	97.1	52.5	4M	3.9	38.7	144.1	5.6
2	MI16W0528	49.5	64.6	79.2	104.8	51.0	4L	4.0	38.1	137.5	14.6
2	Whitetail*	49.6	66.3	85.8	104.4	53.0	4M	2.5	44.5	100.8	12.9
3	Beck 705	47.4	61.7	79.9	98.0	51.5	4M	2.8	43.4	105.9	12.4
3	Beck 722	51.3	63.1	85.5	108.1	51.5	3M	2.7	45.5	103.6	19.4
3	Beck 724	57.4	74.0	97.1	130.1	55.0	6M	3.7	45.7	153.2	15.8
3	Beck 727	49.1	66.3	85.2	112.5	54.5	5M	3.4	41.8	130.1	12.6
3	Beck 732	54.4	68.0	84.5	98.2	54.5	5M	5.6	39.6	211.0	10.1
3	Beck 721*	52.1	65.9	87.0	99.7	54.5	3M	1.7	45.8	67.5	15.1
3	Hilliard*	51.4	70.3	93.0	116.9	55.5	6M	2.4	46.6	100.7	18.7
4	GA10127-18E26	53.0	67.9	95.4	102.8	54.0	4M	3.4	43.0	135.4	12.9
4	GA131246LDH-18E35	53.4	64.5	90.8	88.8	54.5	6M	2.7	40.0	100.6	11.1
4	GA15VDH-FHB-MAS23-18LE43F	51.4	67.3	89.7	89.7	54.5	5M	3.3	40.4	125.3	11.2
4	GA12505B14-18LE23F	54.1	69.1	95.3	90.3	56.0	3M	2.4	44.2	91.4	14.6
4	GW 2032 (14E19)*	52.6	69.2	93.5	105.0	57.0	5M	3.6	44.7	145.5	15.7

*Check varieties.

Table 46. 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	13VTK59-55	9.0	8	878	15
1	DH15SRW65-53	9.1	8	1051	17
1	16VDH-SRW03-023	9.1	8	1306	21
1	VA17W-75	8.7	6	1278	21
1	Branson*	9.1	7	1349	24
1	Hilliard*	8.9	6	1327	23
2	MI14W0190	9.2	8	1237	21
2	MI16R0898	9.4	9	1266	22
2	MI16W0133	9.3	8	1308	21
2	MI16W0528	9.7	9	1348	25
2	Whitetail*	9.3	8	1268	20
3	Beck 705	9.4	8	1334	25
3	Beck 722	9.2	7	1336	24
3	Beck 724	9.1	8	1328	22
3	Beck 727	9.6	7	1368	23
3	Beck 732	9.3	8	1352	22
3	Beck 721*	9.3	7	1281	22
3	Hilliard*	9.3	7	1308	22
4	GA10127-18E26	9.1	7	1315	24
4	GA131246LDH-18E35	9.3	7	1221	19
4	GA15VDH-FHB-MAS23-18LE43F	9.2	8	1331	23
4	GA12505B14-18LE23F	9.0	7	1278	23
4	GW 2032 (14E19)*	8.9	6	1314	25

*Check varieties.

Table 47. Evaluation comments on flour quality and baked product performance by USDA-ARS Western Wheat Quality Laboratory

Group	Entry	Dislikes	Score	End Product Performance			
				Score: 1 Poor - 9 Excellent			
				Product	Likes	Dislikes	Score
1	13VTK59-55		7	SN Cookie			4
1	DH15SRW65-53		8	SN Cookie			5
1	16VDH-SRW03-023		7	SN Cookie			5
1	VA17W-75		5	SN Cookie		Very poor spread	1
1	Branson (check)		8	SN Cookie			5
1	Hilliard (check)		6	SN Cookie		Poor spread	2
2	MI14W0190		8	SN Cookie			7
2	MI16R0898		8	SN Cookie	Nice spread		9
2	MI16W0133		8	SN Cookie			8
2	MI16W0528		9	SN Cookie	Nice spread		9
2	Whitetail (check)		8	SN Cookie			8
3	Beck 705		9	SN Cookie	Nice spread		9
3	Beck 722		8	SN Cookie			6
3	Beck 724		5	SN Cookie			5
3	Beck 727		8	SN Cookie	Nice spread		9
3	Beck 732		8	SN Cookie			8
3	Beck 721 (check)		7	SN Cookie			7
3	Hilliard (check)		7	SN Cookie			7
4	GA10127-18E26		6	SN Cookie			5
4	GA131246LDH-18E35		7	SN Cookie			7
4	GA15VDH-FHB-MAS23-18LE43F		7	SN Cookie			7
4	GA12505B14-18LE23F		6	SN Cookie		Poor spread	3
4	GW 2032 (14E19) (check)	High ash	6	SN Cookie		Poor spread	2

Table 48. Evaluation comments on flour quality and baked product performance by USDA-ARS Western Wheat Quality Laboratory-Continued.

Group	Entry	End Product Performance			
		Score: 1 Poor - 9 Excellent			
		Product	Likes		Score
1	13VTK59-55	Sponge Cake	Very poor volume, rough crumb		1
1	DH15SRW65-53	Sponge Cake	Very poor volume		1
1	16VDH-SRW03-023	Sponge Cake			5
1	VA17W-75	Sponge Cake			4
1	Branson (check)	Sponge Cake	Great volume and crumb grain		9
1	Hilliard (check)	Sponge Cake			8
2	MI14W0190	Sponge Cake			4
2	MI16R0898	Sponge Cake			5
2	MI16W0133	Sponge Cake			5
2	MI16W0528	Sponge Cake	Great volume and crumb grain		9
2	Whitetail (check)	Sponge Cake	Poor crumb grain		3
3	Beck 705	Sponge Cake	Great volume and crumb grain		9
3	Beck 722	Sponge Cake	Great volume and crumb grain		9
3	Beck 724	Sponge Cake			8
3	Beck 727	Sponge Cake			8
3	Beck 732	Sponge Cake			8
3	Beck 721 (check)	Sponge Cake			6
3	Hilliard (check)	Sponge Cake			7
4	GA10127-18E26	Sponge Cake			9
4	GA131246LDH-18E35	Sponge Cake	Poor crumb grain		2
4	GA15VDH-FHB-MAS23-18LE43F	Sponge Cake			8
4	GA12505B14-18LE23F	Sponge Cake			7
4	GW 2032 (14E19) (check)	Sponge Cake			9

USDA-ARS Soft Wheat Quality Laboratory Soft Wheat Quality Evaluations

Table 49. 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	13VTK59-55	55.0	74.8	90.2	110.5	18.4	3
1	DH15SRW65-53	52.4	70.3	89.4	108.8	18.3	6
1	16VDH-SRW03-023	54.9	73.9	92.4	107.1	18.2	5
1	VA17W-75	55.9	78.3	109.9	143.3	17.6	3
1	Branson*	50.6	71.0	97.9	130.6	18.3	2
1	Hilliard*	54.1	75.5	102.3	132.2	18.3	5
2	MI14W0190	50.5	66.8	82.6	104.2	18.7	7
2	MI16R0898	53.7	72.8	85.7	102.3	18.9	7
2	MI16W0133	51.6	73.4	86.4	97.0	18.9	7
2	MI16W0528	50.4	68.6	79.3	104.2	19.5	7
2	Whitetail*	51.1	71.0	84.1	104.7	19.0	7
3	Beck 705	49.5	66.8	80.0	97.9	19.3	8
3	Beck 722	51.2	67.9	86.1	104.1	18.9	6
3	Beck 724	57.0	77.4	95.6	125.5	18.4	5
3	Beck 727	50.5	70.1	86.0	115.8	19.0	7
3	Beck 732	54.4	71.8	83.5	99.9	19.4	8
3	Beck 721*	53.7	72.0	84.9	97.9	18.7	6
3	Hilliard*	52.4	73.7	92.8	118.6	18.8	5
4	GA10127-18E26	54.7	74.2	92.8	103.6	18.5	6
4	GA131246LDH-18E35	54.3	69.4	88.3	92.6	18.8	7
4	GA15VDH-FHB-MAS23-18LE43F	55.1	72.3	89.5	89.9	18.8	7
4	GA12505B14-18LE23F	55.2	72.7	92.0	88.9	17.9	5
4	GW 2032 (14E19)*	55.2	73.7	91.5	101.3	17.7	4

*Check varieties.

Table 50. Rapid Visco-Analyzer parameters by USDA-ARS Soft Wheat Quality Laboratory

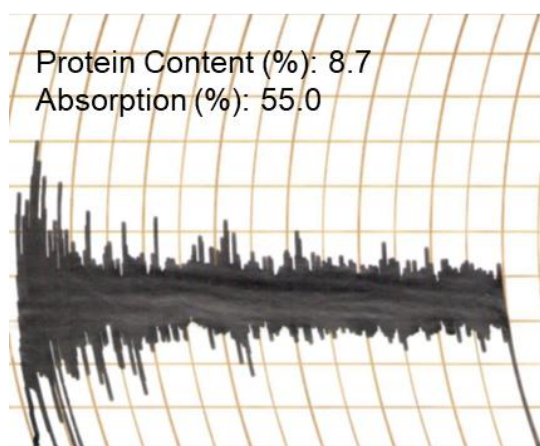
Group	Entry	Peak Time (min)	Peak (cP)	Trough (cP)	Break- down (cP)	Setback (cP)	Final (cP)	Pasting Temperature (°C)
1	13VTK59-55	6.2	3191	2208	983	1572	3780	86.0
1	DH15SRW65-53	6.1	3135	1885	1250	1333	3218	84.8
1	16VDH-SRW03-023	6.0	2552	1534	1019	1253	2786	84.4
1	VA17W-75	6.1	2717	1649	1068	1294	2943	84.8
1	Branson*	6.1	3049	1863	1187	1348	3211	83.5
1	Hilliard*	6.0	2787	1692	1095	1329	3021	85.2
2	MI14W0190	6.2	3106	1746	1360	1249	2995	85.2
2	MI16R0898	6.3	3422	2090	1332	1457	3547	84.7
2	MI16W0133	6.2	3191	1855	1336	1302	3157	77.5
2	MI16W0528	6.1	2933	1715	1219	1393	3107	69.4
2	Whitetail*	6.2	3063	1814	1249	1372	3186	69.0
3	Beck 705	6.2	3271	1914	1357	1399	3313	77.5
3	Beck 722	6.4	3495	2188	1307	1281	3469	86.4
3	Beck 724	6.3	3663	2408	1255	1642	4050	85.1
3	Beck 727	6.4	3489	2232	1257	1374	3606	86.3
3	Beck 732	6.2	3566	2098	1468	1410	3508	77.0
3	Beck 721*	6.2	3478	2024	1454	1335	3359	84.4
3	Hilliard*	6.2	3542	2017	1526	1455	3471	84.7
4	GA10127-18E26	5.9	3064	1393	1672	1046	2439	69.0
4	GA131246LDH-18E35	5.9	2507	1177	1330	1051	2228	69.4
4	GA15VDH-FHB-MAS23- 18LE43F	6.1	3048	2002	1046	1594	3595	85.5
4	GA12505B14-18LE23F	6.1	3251	1667	1585	1147	2814	83.9
4	GW 2032 (14E19)*	6.4	3124	2081	1043	1580	3661	86.9

*Check varieties.

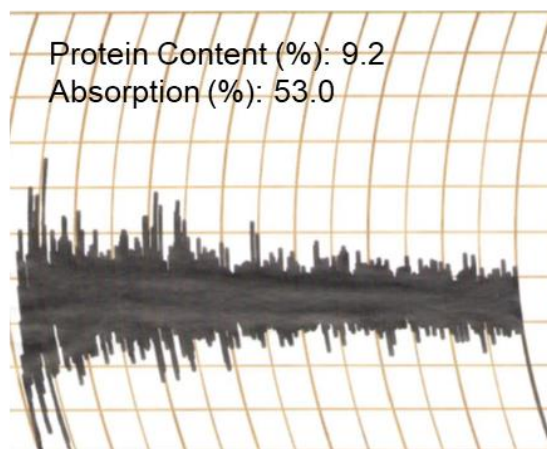
Table 51. Mixograph parameters by USDA-ARS Soft Wheat Quality Laboratory

Group	Entry	Mixing Absorption (%)	Peak Time (min)	Peak Value (%)	Peak Width (%)	Width @7min (%)
1	13VTK59-55	55.0	1.0	44.3	21.5	7.7
1	DH15SRW65-53	53.0	1.2	45.0	17.1	9.0
1	16VDH-SRW03-023	54.0	1.0	44.4	11.3	7.4
1	VA17W-75	53.5	1.0	48.6	21.3	3.4
1	Branson*	52.5	1.2	42.1	16.1	8.1
1	Hilliard*	54.0	1.3	48.3	24.6	7.4
2	MI14W0190	53.0	1.3	47.6	16.7	8.6
2	MI16R0898	53.5	1.0	39.7	21.1	6.3
2	MI16W0133	51.8	0.8	42.0	20.1	7.7
2	MI16W0528	51.2	1.0	39.5	19.6	8.8
2	Whitetail*	51.5	1.0	42.0	20.8	6.2
3	Beck 705	51.0	1.3	46.0	24.4	8.4
3	Beck 722	51.5	1.2	42.9	18.6	9.4
3	Beck 724	54.5	1.0	47.0	30.0	6.5
3	Beck 727	52.0	1.0	40.9	16.7	9.5
3	Beck 732	53.0	1.1	40.2	26.0	9.9
3	Beck 721*	52.0	1.0	44.7	20.1	7.5
3	Hilliard*	53.2	1.2	41.7	13.9	6.6
4	GA10127-18E26	53.0	0.8	43.1	24.3	5.7
4	GA131246LDH-18E35	52.5	1.0	37.1	17.3	7.3
4	GA15VDH-FHB-MAS23- 18LE43F	53.0	1.0	47.5	29.3	5.7
4	GA12505B14-18LE23F	53.5	1.0	49.5	29.1	7.9
4	GW 2032 (14E19)*	54.0	1.2	46.5	29.0	8.3

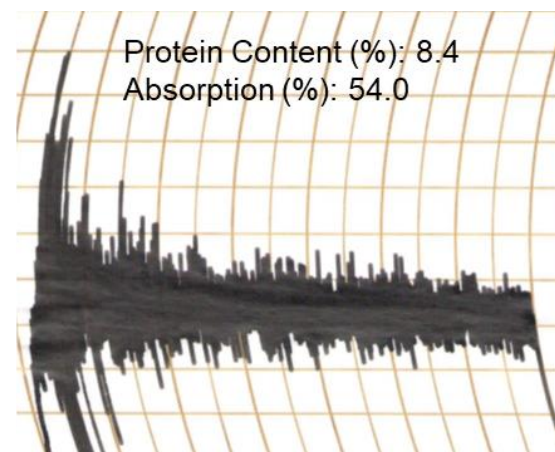
*Check varieties.



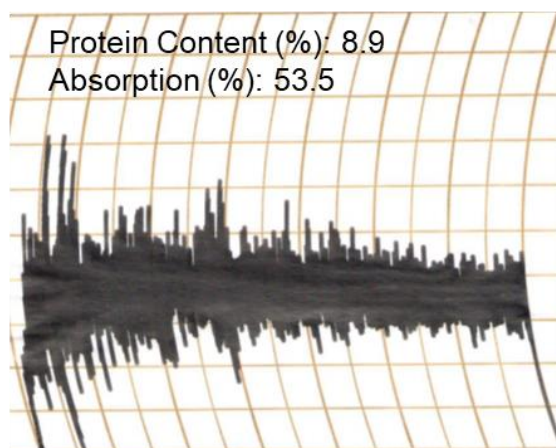
13VTK59-55



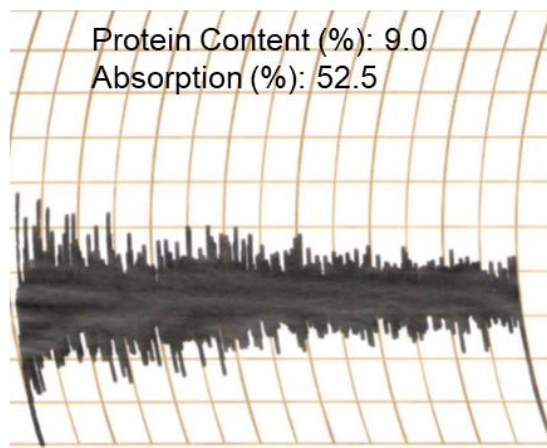
DH15SRW65-53



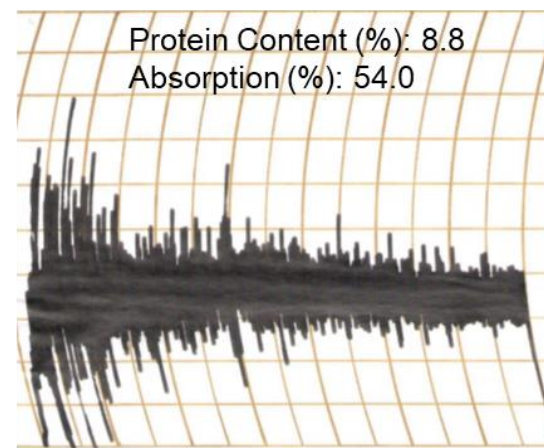
16VDH-SRW03-023



VA17W-75



Branson*



Hilliard*

Figure 1. Mixograms of the WQC 2021 crop entries from Virginia Polytechnic Institute and State University performed by USDA-ARS Soft Wheat Quality Laboratory. *Check varieties.

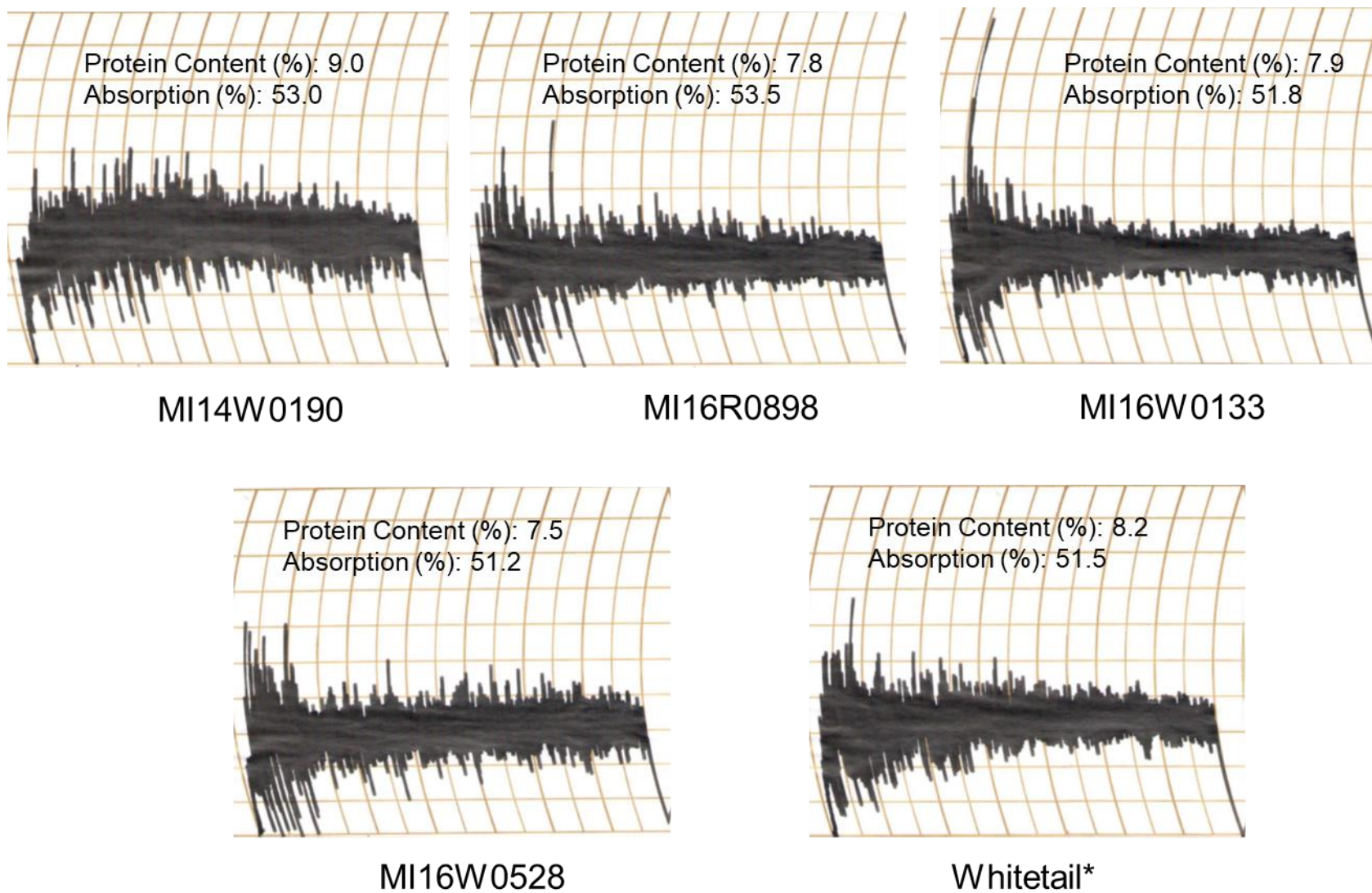
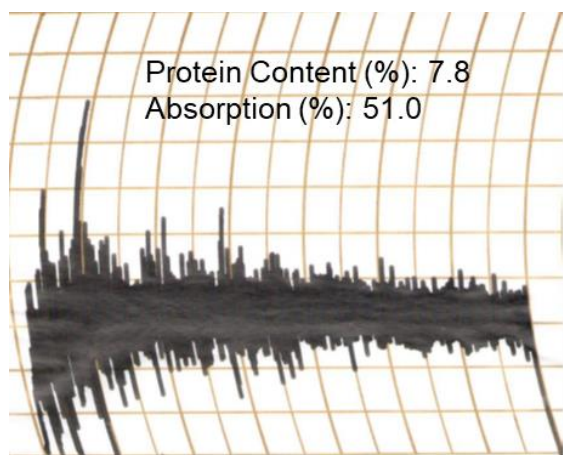
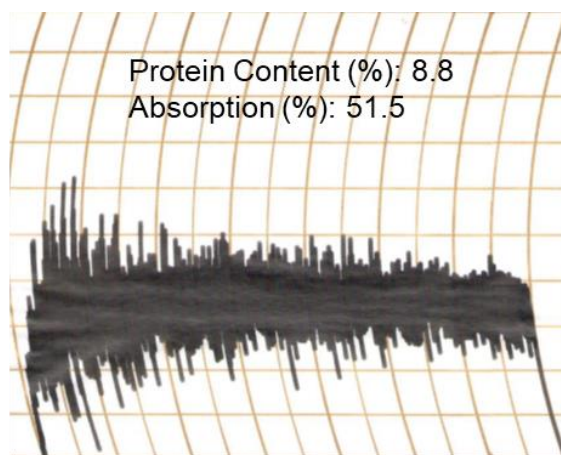


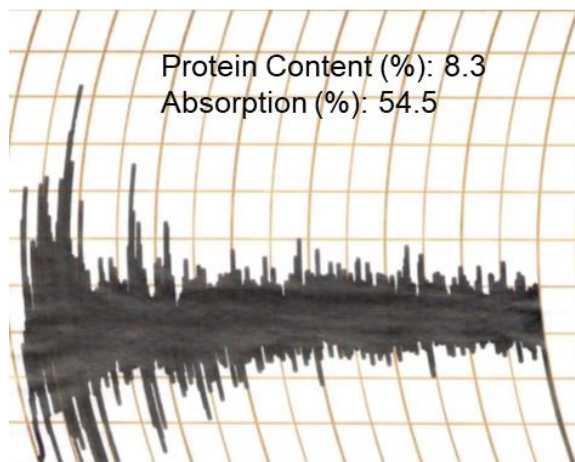
Figure 2. Mixograms of the WQC 2021 crop entries from Michigan State University performed by USDA-ARS Soft Wheat Quality Laboratory. *Check varieties.



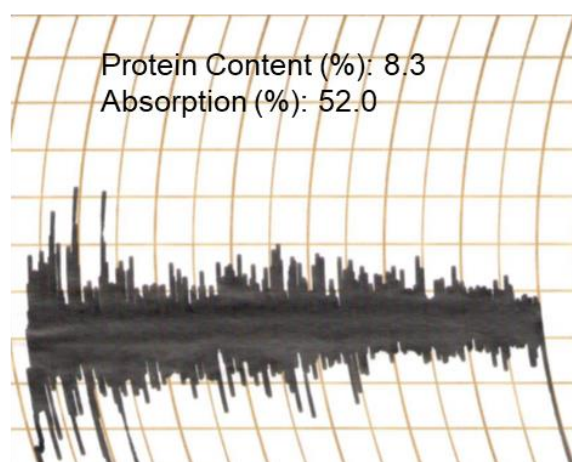
Beck 705



Beck 722

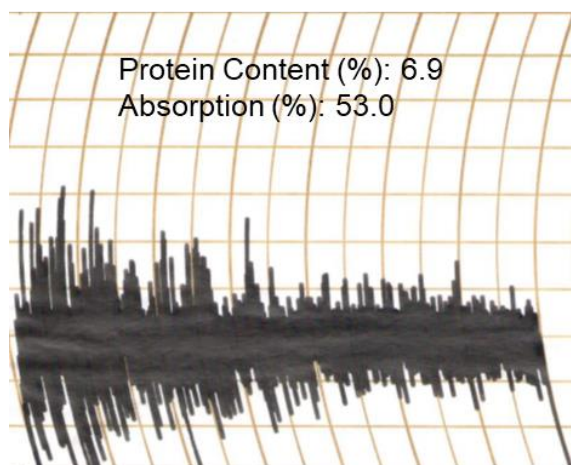


Beck 724

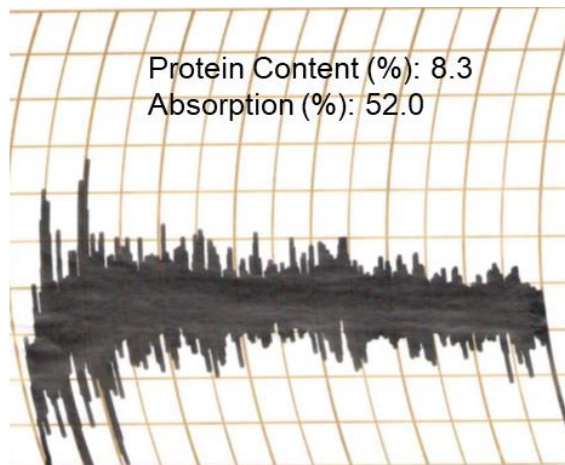


Beck 727

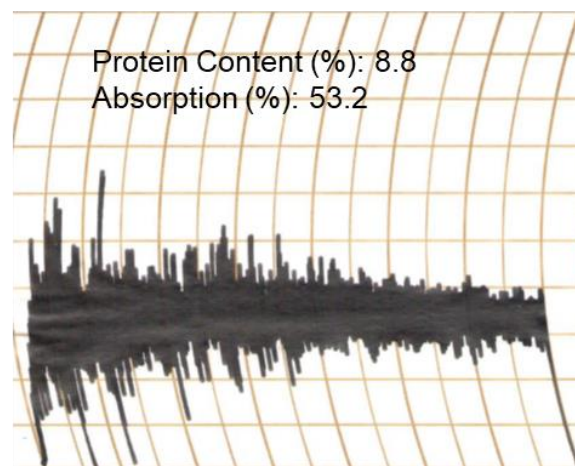
Figure 3. Mixograms of the WQC 2021 crop entries from Beck's Hybrids performed by USDA-ARS Soft Wheat Quality Laboratory.
*Check varieties.



Beck 732

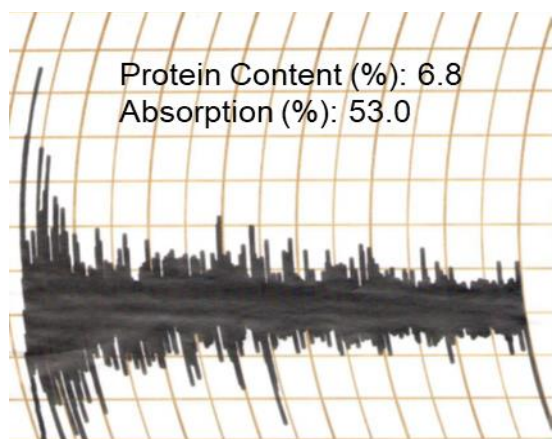


Beck 721*

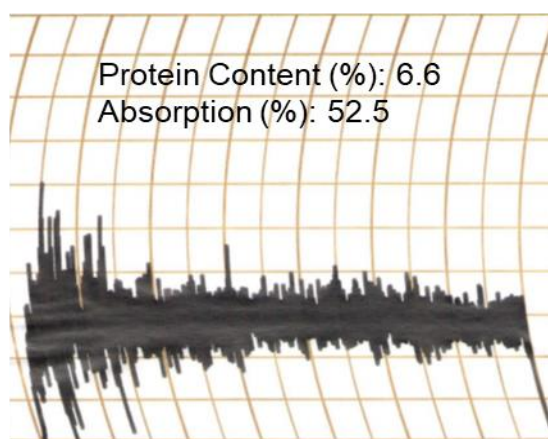


Hilliard*

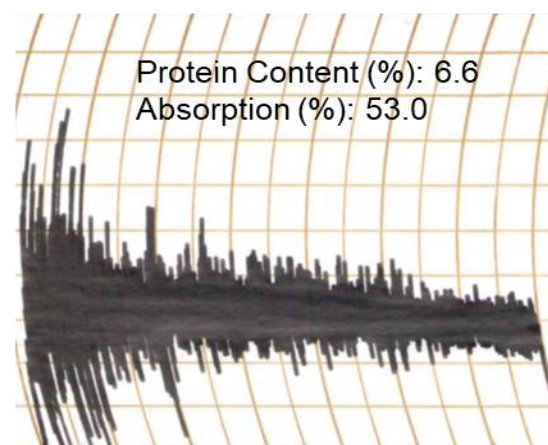
Figure 3-continued. Mixograms of the WQC 2021 crop entries from Beck's Hybrids performed by USDA-ARS Soft Wheat Quality Laboratory. *Check variety.



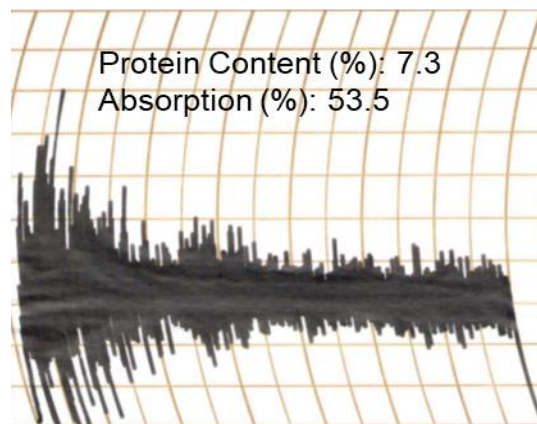
GA10127-18E26



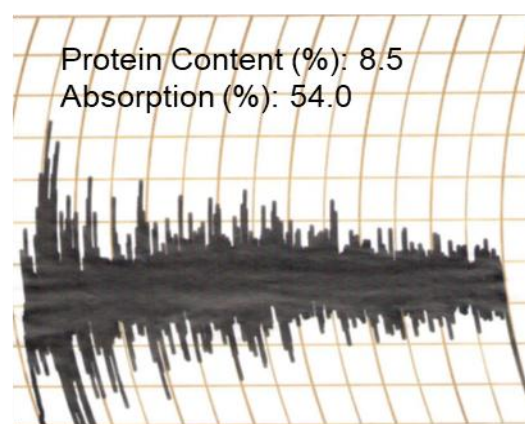
GA131246LDH-18E35



GA15VDH-FHB-
MAS23-18LE43F



GA12505B14-18LE23F



GW 2032 (14E19)*

Figure 4. Mixograms of the WQC 2021 crop entries from University of Georgia performed by USDA-ARS Soft Wheat Quality Laboratory. *Check variety.

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

Whole Kernel Moisture, Air-oven Method, AACC Method 44-15.02

What grain is coarsely ground to minimize moisture loss and dried in a convention oven set at 140°C for 90 min. The moisture content is express as the percent loss of weight during drying.

Whole Wheat Protein

Whole wheat protein is determined by Nitrogen combustion analysis using the Elementar Nitrogen Analyzer. Units are recorded in % protein converted from nitrogen x 5.7 and expressed on a 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 pair 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 range 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 hot aluminum plate in an air oven set at 140°C for 15 min. The moisture content is express as the percent loss of weight during drying.

Flour Protein

Protein determined by near infra-red (NIR), using a Unity NIR instrument calibrated by a nitrogen combustion analysis on the Leco Nitrogen Analyzer. Units are recorded in percent protein converted from nitrogen 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 the 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.

Rapid Visco-Analyzer (RVA) Method

Viscosity units are in centipoise units, peak time in minutes, pasting temperature in degrees centigrade. The hot pasting viscosity/time analysis of starch and flour was accomplished using a Rapid Visco-Analyzer (RVA), Model RVA-4 (Foss North America, Inc., Eden Prairie, MN). The "standard 1" heating profile of that instrument's software (Thermocline for Windows, version 2.0, Newport Scientific Pty. Ltd., Warriewood, NSW, Australia) was employed to produce pasting curves based on 3.5 g (14% moisture basis) flour and 25 ml deionized water. Maximum heating temperature was 95°C and minimum cooled temperature was 50 °C. Peak pasting viscosity, peak time, minimum (trough) viscosity during cooling, breakdown viscosity (difference between peak and minimum viscosities), final viscosity at the conclusion of cooling, and setback (difference between final and minimum viscosities) were determined for each sample.

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

Diameter of Two-cookie 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.