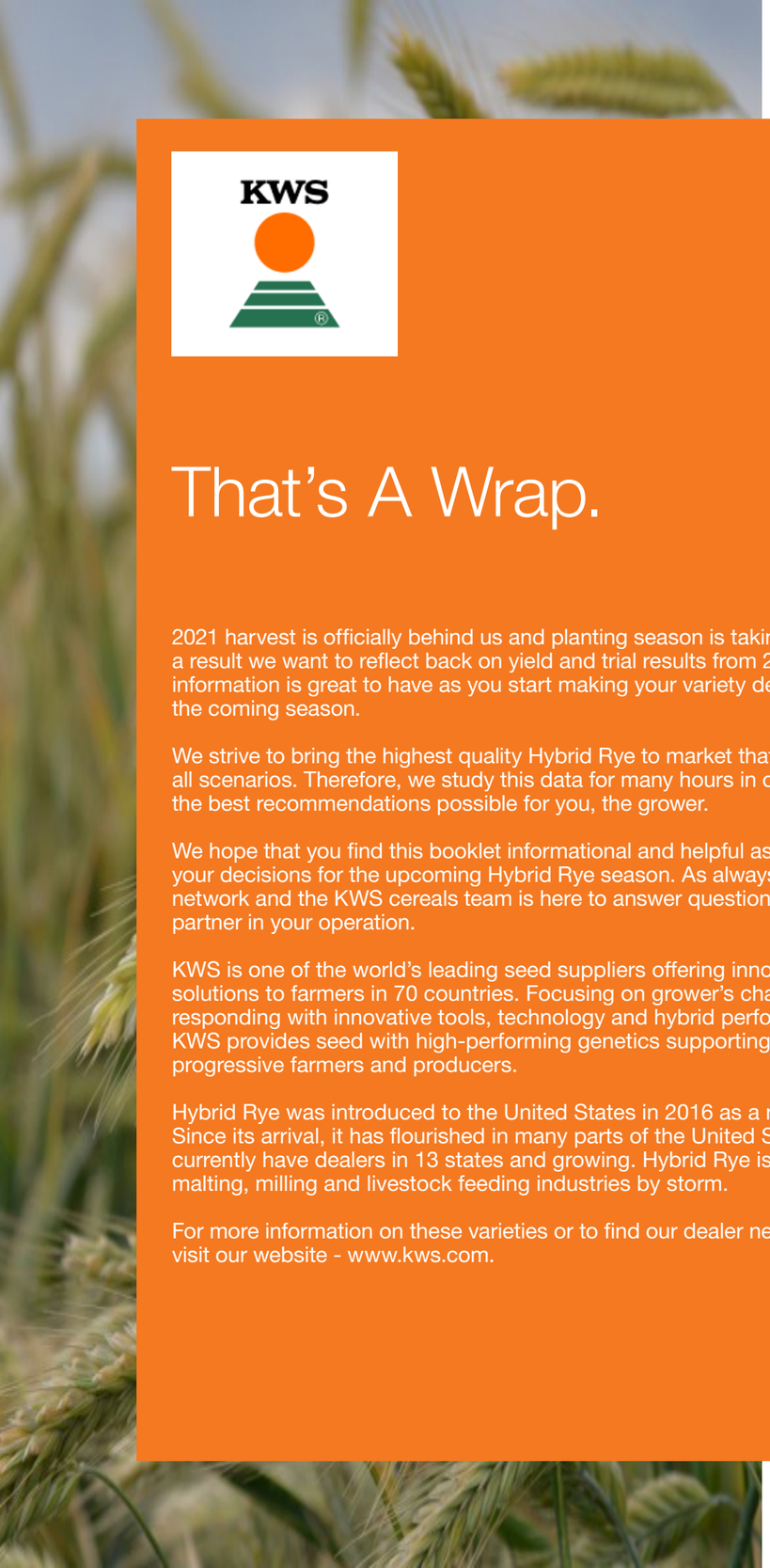
HYBRID RYE

2021 YIELD RESULTS

KWS Progas claims top spot in forage trials!

Hybrid Rye represents a viable new forage option across the US.

First look at a new hybrid grain variety!



That’s A Wrap.

2021 harvest is officially behind us and planting season is taking off. As a result we want to reflect back on yield and trial results from 2021. This information is great to have as you start making your variety decisions for the coming season.

We strive to bring the highest quality Hybrid Rye to market that performs in all scenarios. Therefore, we study this data for many hours in order to make the best recommendations possible for you, the grower.

We hope that you find this booklet informational and helpful as you make your decisions for the upcoming Hybrid Rye season. As always, our dealer network and the KWS cereals team is here to answer questions and be a partner in your operation.

KWS is one of the world’s leading seed suppliers offering innovative solutions to farmers in 70 countries. Focusing on grower’s challenges and responding with innovative tools, technology and hybrid performance, KWS provides seed with high-performing genetics supporting today’s progressive farmers and producers.

Hybrid Rye was introduced to the United States in 2016 as a new crop. Since its arrival, it has flourished in many parts of the United States. We currently have dealers in 13 states and growing. Hybrid Rye is taking the malting, milling and livestock feeding industries by storm.

For more information on these varieties or to find our dealer nearest you, visit our website - www.kws.com.

KWS Progas Overview

KWS Progas is our top performer for forage biomass, offering elite quality and nutrient digestibility. As an added bonus it is earlier maturing than other winter forages making it ideal for double cropping scenarios! This forage variety is a top choice for dairy producers and a favorite for inclusion in lactation diets.

Winner of 3 out 5 Forage Trials!

KWS Propower Overview

KWS Propower is the top choice for cutting at milk stage, producing higher biomass and maintaining quality. KWS Propower is often a bit later maturing, reaching boot stage a few days later than KWS Progas. This forage variety is a top favorite for inclusion in feedlot, dry cow and heifer diets!

Variety Summary

KWS Receptor Overview

KWS Receptor is an exciting new grain variety launching in 2022!

NEW

KWS Bono Overview

As always KWS Bono offers a solid performance across all variety trials. This is our oldest variety, but still a strong performer in our portfolio due to its outstanding performance in sandier and more drought prone soils. With drier conditions across large portions of the US this year, KWS Bono excelled in locations like Minnesota and South Dakota.

KWS Serafino Overview

KWS Serafino is our most broadly adapted variety across all soil types and environments. It is no surprise that this variety consistently placed in the top end of all yield trials across the US. KWS Serafino is our top recommendation for first year Hybrid Rye growers!

KWS Tayo Overview

KWS Tayo tops yield trials again in 2021! This variety excels in high yield environments with uniform, medium type soils with better water holding capacity. While KWS Tayo may require a bit more management, this variety packs a punch when it hits the combine.

Forage Results

Our forage varieties, KWS Progas, KWS Propower, and KWS Problend are known for their unique combination of tonnage and quality. If you are looking for the ultimate forage solution then look no further than KWS Hybrid Rye!

KWS Problend is a new forage option in our line up for 2021. However, it's important to note, this is not a new variety! KWS Problend is a mix of our already available forage varieties KWS Progas and KWS Propower. This blend was created to take advantage of the key attributes that both KWS Progas and KWS Propower bring to the table, while simultaneously offering a longer harvest window and maintaining forage quality!

Trials Featured:
Colorado, New York, Pennsylvania, South Dakota, Virginia

**all yields adjusted to a 35% DM yield*

COLORADO

2021 Forage Trial - Akron, CO

Variety	Forage Type	Early Cut Silage Yield (Tons/Acre)	Late Cut Silage Yield (Tons/Acre)
KWS Progas	Hybrid Rye	5.33	8.11
KWS Bono	Hybrid Rye	5.31	7.52
KWS Propower	Hybrid Rye	4.86	7.27
KWS Serafino	Hybrid Rye	5.23	7.11
Gainer154	Triticale	3.91	6.93
KWS Tayo	Hybrid Rye	4.65	6.86
Thor	Triticale	4.43	6.60
Flex 719	Triticale	3.97	6.57
Pika	Triticale	3.90	6.14
NE 441T	Triticale	3.65	5.72
UKR 04	Triticale	2.87	5.72
Presto	Triticale	3.66	5.68
Langin	Wheat	2.82	5.02

Trial Highlights -

Location: Great Plains Research Station at Akron, CO
This location is non-irrigated, dry land.

Harvest Date - Early cut was harvested on May 27, 2021. Late cut was harvested on June 11, 2021.

Trial Highlights -

Location: Cornell University - New York

Harvest Date - Flag Leaf on May 19, 2021 and Milk Stage on June 15, 2021.

NEW YORK

2021 Forage Rye Trial

Variety	Forage Type	Flag Leaf Cut Timing Silage Yield (Tons/Acre)	Milk Stage Cut Timing Silage Yield (Tons/Acre)
KWS Problend	Hybrid Rye	4.91	11.44
KWS Progas	Hybrid Rye	5.39	11.19
KWS Propower	Hybrid Rye	4.97	10.46
Hazlet	Rye	4.54	9.19
Danko	Rye	4.59	9.03

PENNSYLVANIA

2021 Forage Rye Trial

Variety	Forage Type	Silage Yield (Tons/Acre)
KWS Progas	Hybrid Rye	11.03
KWS Problend	Hybrid Rye	10.20
KWS Propower	Hybrid Rye	9.06
Hazlet	Rye	8.91
Wheeler	Rye	8.83
Aroostook	Rye	7.11

Trial Highlights -

Location: Penn State University - Trials are conducted at Russell E. Larson Agricultural Research Center at Rock Springs and/or the Southeast Research and Extension Center at Landisville.

Planted: September 25, 2020
Harvest Date: early May 2021

SOUTH DAKOTA

Trial Highlights -

Location: Beresford, SD - SDSU Southeast Research Farm

Harvest: Milk Stage/Soft Dough

SW Research Farm - 2021 SDSU

Variety	Forage Type	Silage Yield (Tons/Acre)
KWS Progas	Hybrid Rye	9.81
Hazlet	Rye	9.10
Rymin	Rye	8.93
KWS Propower	Hybrid Rye	8.81
KWS Problend	Hybrid Rye	8.75
Nitrous	Triticale	7.87
Willow Creek	Winter Wheat	6.00

Trial Highlights -

Location: Northern Piedmont Center, Orange, Virginia

Pre-plant fertilizer of 30N-80P-60K was applied on Oct. 13, 2020 and plots were planted on Oct. 15, 2020. Harvested at boot stage in late April.

Nitrogen (UAN) was applied at a rate of 40 lb of N per acre on February 17, 2021 and at a rate of 80 lb of N per acre on March 15, 2021.

Compared to 2020, silage yield over all entries was 2.9 tons per acre less.

VIRGINIA

Forage Variety Trial - Virginia Cooperative Extension

Variety	Forage Type	Silage Yield (Tons/Acre)
KWS Propower	Hybrid Rye	8.57
KWS Progas	Hybrid Rye	7.65
Gainer 154	Triticale	7.41
Gunner	Triticale	7.00
Flex 719	Triticale	6.66
Surge	Triticale	6.56
Thor	Triticale	6.47
Liberty 5658	Wheat	6.30

Hybrid Rye Facts:

- Hybrid Rye develops a very large roots system that helps to improve the nutrient and water uptake and reduce the input requirement by 20% at same yield level as other winter cereals.
- Hybrid Rye has very strong winter hardiness, standability and disease tolerance.
- Feeding studies on hogs/cattle have shown Hybrid Rye can easily replace some corn in the ration without a decrease in productivity.
- Hybrid Rye makes high quality straw.
- Good utilization of manure applied both in autumn and spring.

Grain Results

When it comes to Hybrid Rye grain, our varieties KWS Bono, KWS Serafino and KWS Tayo have your back in all situations. This year you will also notice a new variety in several trials - KWS Receptor. Get excited! This variety will be available in limited quantities for the 2022 planting season - so remember to book your seed early!

Trial Highlights:
Colorado, Iowa, Idaho, Kentucky, Maryland, Minnesota, Nebraska, South Dakota, Wisconsin

2021 was an extremely diverse weather year creating extreme drought to excessive water across the growing regions of the US. KWS Hybrid Rye seems to deal with the extremes quite well, especially drought conditions.

As you look at the data you will see the drought tolerance of Hybrid Rye in trials that received little rainfall, 60 Bu / A where common rye and winter wheat were yielding as low as 20 Bu / A. Conversely, where there was average rainfall you see Hybrid Rye exceeding yields of 140 Bu / A. Both of these scenarios also proved out in growers field. Hybrid Rye mitigated risk and proved profitable.

COLORADO

2021 Grain Trial
Akron, CO

Variety	Grain Type	Bushel/ Acre
KWS Bono	Hybrid Rye	107.7
KWS Serafino	Hybrid Rye	96.8
KWS Tayo	Hybrid Rye	92.6
Presto	Triticale	83.9
NT 15406	Triticale	78.9
Gainer 154	Triticale	73.8
Langin	Winter Wheat	73.6
Thor	Triticale	72.4
Flex 719	Triticale	60.4
Pika	Triticale	48.8

Trial Highlights -

Location: Great Plains Research Station at Akron, CO

This location is non-irrigated, dry land.
Harvest Date: June 20, 2021

IOWA

2021 Practical Farmers Trials - ISU Farms

Variety	Grain Type	Kanawha Bushel/ Acre	Nashua Bushel/ Acre	Boone Bushel/ Acre	Greenfield Bushel/ Acre	Average Bushel/Acre
KWS Bono	Hybrid Rye	74.0	111.0	82.0	90.0	89.3
KWS Serafino	Hybrid Rye	73.0	117.0	79.0	88.0	89.3
Danko	Rye	51.0	86.0	63.0	73.0	68.3
Hazlet	Rye	62.0	79.0	59.0	60.0	65.0
Spooner	Rye	44.0	56.0	51.0	49.0	50.0
Dylan	Rye	41.0	58.0	42.0	49.0	47.5
Gardner	Rye	40.0	68.0	40.0	41.0	47.3
Elbon	Rye	33.0	60.0	32.0	45.0	42.5

Trial Highlights -

The above trials were conducted by the Practical Farmers of Iowa group.
Kanawha location was at the ISU Northern Research Farm. It was planted on Oct. 7, 2020 and harvested on July 19, 2021. 28 lb N/ac and 148 lb P/ac were applied on November 3, 2020 and on April 6, 2021 an additional 36 lb N/ac and 192 lb Gypsum/ac applied.

The Nashua site was located on the ISU Northeast Research Farm and was planted on October 9, 2021 and harvested on July 13, 2021. 60 lb P/ac and 267 lb K/ac on Oct. 21, 2020 and 30 lb N/ac on March 3, 2021. This site saw below 20-year average rainfall this year.

ISU Ag Engineering and Agronomy Farm was the home for the Boone, IA location. Planted on October 7, 2020 and harvested on July 22, 2021. 30 lb N/ac, 100 lb P/ac, and 25 lb S/ac applied on April 3, 2021.

Lastly, the Greenfield, IA location was the Southwest Research Farm, which was planted on October 7, 2020 and harvested on July 28, 2021. It had 14 lb N/ac on April 7, 2021 and 37 lb N/ac, 175 lb P/ac and 164 lb K/ac on April 15, 2021.

IDAHO

Trial Highlights -

Location: Aberdeen, ID
Irrigated

2021 University of Idaho- Grain Trial

Variety	Bushel/ Acre
KWS Bono	141.0
KWS Receptor	137.0
KWS Serafino	135.0
KWS Tayo	126.0

KENTUCKY

2021 University of Kentucky - Grain Trial

Variety	Grain Type	Bushel/ Acre
KWS Serafino	Hybrid Rye	92.9
KWS Bono	Hybrid Rye	85.4
KWS Receptor	Hybrid Rye	83.5
Aventino	Rye	47.0
Guardian	Rye	45.3
Spooner	Rye	44.3
Aroostook	Rye	42.2

Trial Highlights -

Location: Lexington, KY - Fayette Co.
Plant date: October 23, 2020
Harvest Date: June 29, 2021

Conventional tillage
Substantial lodging issues noted in non-hybrid varieties of rye.

Trial Highlights -

Location: Maryland

This site had severe storms in June and July with 50 mph winds and in two instances had over 2 inches of rain in less than 30 minutes.

MARYLAND

2021 University of Maryland - Grain Trial

Variety	Bushel/ Acre
KWS Tayo	125.0
KWS Bono	120.0
KWS Serafino	119.0

MINNESOTA

2021 University of MN Grain Trial

Variety	Grain Type	Becker, MN Bushel/ Acre	Crookston, MN Bushel/ Acre	Lamberton, MN Bushel/ Acre	LeCenter, MN Bushel/ Acre	Roseau, MN Bushel/ Acre	Average Bushel/ Acre
KWS Receptor	Hybrid Rye	95.1	94.3	108.3	114.2	139.1	110.2
KWS Tayo	Hybrid Rye	93.7	81.9	102.6	120.2	143.6	108.4
KWS Bono	Hybrid Rye	114.1	84.6	100.3	117.9	123.6	108.1
KWS Serafino	Hybrid Rye	101.4	77.8	97.1	119.0	140.3	107.1
Danko	Rye	75.1	51.3	85.2	101.3	89.9	80.6
Dylan	Rye	67.4	69.1	74.9	82.8	96.1	78.1
Hazlet	Rye	71.3	56.7	80.5	89.9	91.3	77.9
Musketeer	Rye	68.5	58.3	72.1	86.1	89.8	75.0
Remington	Rye	64.5	58.6	66.4	86.5	86.4	72.5
Rymin	Rye	64.3	54.7	69.1	82.0	87.8	71.6
Gardner	Rye	52.0	49.0	64.3	80.5	66.2	62.4
Spooner	Rye	58.6	40.1	63.0	79.3	65.1	61.2
Elbon	Rye	39.6	33.1	48.7	64.1	54.8	48.1

Trial Highlights -

The above chart is ordered by average rank from the 5 locations.
Becker, Crookston and Lamberton were dryer locations.
LeCenter and Roseau received more moisture.
Additionally, Hybrid Rye yield potential in Minnesota was reduced when encountering an unusually cold, late spring. This yield reduction is a result of a shorter period of vegetative growth and the inability of the crop to take up sufficient nitrogen to maximize grain yield as it was applied too late for the crop to take advantage of it.

NEBRASKA

2021 University of NE Grain Trial

Variety	Grain Type	Lincoln, NE Bushel/ Acre	Sidney, NE Bushel/ Acre	Average Bushel/ Acre
KWS Receptor	Hybrid Rye	144.1	114.4	129.3
KWS Tayo	Hybrid Rye	142.8	110.8	126.8
KWS Serafino	Hybrid Rye	136.7	111.6	124.2
KWS Bono	Hybrid Rye	133.5	111.0	122.3
Hazlet	Rye	99.0	76.8	87.9

Trial Highlights -

Location: Lincoln, NE & Sidney, NE

Lincoln - Very good year with a cool, wet spring, excellent soil fertility, little stress and continued well-timed rains even with high temperatures during grain filing.

Sidney - Very dry at planting and continued drought conditions throughout most of the year. Wheat within the trial was not harvested due to poor stands.

SOUTH DAKOTA

2021 South Dakota State University Trial - Southeast Research Farm

Variety	Artesian	Kimball	Beresford -1	Tyndall	Beresford -2	Lennox	Average
	Bushel/ Acre	Bushel/ Acre	Bushel/ Acre	Bushel/ Acre	Bushel/Acre	Bushel/Acre	Bushel/Acre
KWS Tayo	80.8	51.6	58.3	55.7	53.8	50.0	58.4
KWS Bono	84.0	72.3	50.2	52.2	48.5	42.2	58.2
KWS Receptor	81.8	58.6	47.2	50.6	51.7	38.8	54.8
KWS Brasetto	78.9	52.5	46.8	55.8	43.1	50.1	54.5
KWS Serafino	82.3	57.1	45.0	50.7	44.7	42.6	53.7
Hazlet	66.0	36.4	43.7	38.5	42.9	35.1	43.8
Rymin	52.0	42.1	36.7	35.0	38.9	34.8	39.9
Dylan	54.3	33.3	40.4	30.0	36.5	31.5	37.7
Elbon	40.7	31.6	35.3	24.7	37.8	31.0	33.5
Overland Hard Red Winter Wheat	13.0	25.0	40.1	29.0	32.3	24.9	27.4

Trial Highlights -

The above graph is ordered by average rank from the 6 locations.

The Artesian site had substantial wildlife damage to Overland. Artesian also had drought in the fall during stand establishment and in June during seed filling.

It is important to note that the Tyndall site did not recieve any fertilizer.

The Lennox trial had rows plugged on the drill across the trial, so each variety was the same, but seed distribution was not optimum across the area.

Kimball had heavy lodging presence at the site and has the more alkali soil.

Overall the yields were lower this year due to overall drought conditions.

The period of August 2020 thru July 2021 had 10 months with below avg. precipitation for a shortfall of 10.21 inches. June 2021 avg. high temperature 88.4 degrees F; low temperature 59.4 degrees F. 68 year average high and low temperatures for June are 82 and 58; respectfully.

Southeast Farm Precipitation August 2020 thru July 2021

Month	Precipitation (inches)	69-year average (inches)	Departure from avg. (inches)
August 2020	1.23	3.04	(1.81)
September	0.35	2.81	(2.46)
October	0.70	1.92	(1.22)
November	0.91	1.13	(0.22)
December	0.26	0.66	(0.40)
January 2021	1.01	0.46	0.55
February	0.30	0.78	(0.48)
March	2.33	1.46	0.87
April	2.45	2.53	(0.08)
May	2.07	3.53	(1.51)
June	0.71	4.14	3.48)
July	3.02	3.08	(0.06
Total	15.34	25.55	(10.21)

Trial Highlights -

Location: Arlington, WI
Plant date: September 25, 2020
Harvest Date: July 21, 2021

Hybrid Rye planted at 800,000 seeds/ acre.
Common rye planted at 1,000,000 seeds/ acre

Nitrogen 30 lbs on September 29, 2020
55 lbs at spring green up

WISCONSIN

2021 University of Wisconsin - Grain Trial

Variety	Grain Type	Bushel/ Acre
KWS Serafino	Hybrid Rye	120.9
KWS Tayo	Hybrid Rye	118.6
KWS Bono	Hybrid Rye	115.1
KWS Receptor	Hybrid Rye	110.5
P25R74	WWheat	106.7
Spooner	Rye	73.5
Spooner	Rye	44.3

All About Hybrid Rye

This 2021 crop year highlighted the strengths of KWS Hybrid Rye:

- Very high yield potential
- Very strong winter hardiness and standability
- Lower crop inputs needed
  - Less fertilizer due to better nutrient efficiency
  - Less or no herbicide due to strong competition to weeds (allelophaty)
  - Less or no fungicide due to very strong disease tolerance
- Improved drought tolerance (25% less water use than wheat or barley)
- Crop rotation benefits, increasing yields in subsequent corn & soybeans
- Very low ergot - PollenPlus® technology

Want to learn more about Hybrid Rye?

Contact the KWS team or visit our website at: www.kws.com

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