

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

APPLICATION FOR RELEASE OF (check one):

X Cultivar

1. Crop: Wheat

2. Experimental no. or name: GA151313-LDH-192-20E48 (GA20E48)

3. **Pedigree and history:** GA20E48 is from the cross of 'AGS 2024'/'PIO26R41'/'JT141' made in 2015. 'AGS 2024' is a UGA cultivar released and licensed to AgSouth Genetics company in 2014. AGS 2024 is a very high yielding cultivar, well adapted to the Southeast region (SE). It was used in the cross for its high yield, adaptation to SE, and resistance to many diseases including rusts. 'PIO26R41' is also a very adapted cultivar to the SE region developed by Pioneer company. It was used in the cross for its high yield and resistance to diseases. 'JT141' is "Jamestown 141" released by VA Tech in 2007. It is a very well adapted cultivar to the SE region with very good resistance to Fusarium head blight (FHB) disease having *Fhb1B_JT* gene. So, it was used particularly for the FHB resistance. The F1 plants were grown in the greenhouse in 2016 and harvested seeds were sent to Limagrain company (LCS) to produce DH lines. DH seeds received in 2017 were then planted in Griffin in 2018 for selection and seed increase. Selections were made based on agronomic appearance, reactions to pests and homogeneity. Selected head rows in 2018 were entered in the Preliminary Elite Yield Trials (PYT) evaluations at two locations (Plains and Griffin, GA) in 2019. One of the selected rows was the initial seed of GA20E48. Subsequently, GA20E48 was evaluated in Elite Yield Trials (EYT) in 2020 in GA and MS and in the SUNGRAINS preliminary yield trials (SUNPre). From 2021-2024, GA20E48 was evaluated in the official variety trial (OVT) of the Georgia's Small Grain Performance Trials (GSSGPT) conducted by the Statewide testing program. Simultaneously, GA20E48 was also tested in the UGA small grains breeding program GA State Trials (GST) conducted in five locations across GA and MS. In 2021, it was also evaluated at 6 locations (AR, FL, GA, LA, NC, and VA) in a regional nursery (SUNWHEAT) and in 2022, it was evaluated in the Uniform Southern Wheat (USW) Nursery at 18 locations in the southeast region (SE). In 2023 and 2024, seed of GA20E48 was distributed to the SE region states to be included in their Official Variety State Trials (OVTs). This includes MS, AL, NC, SC, LA, VA, and TX.

In 2020, a small block (100 sq. ft.) of GA20E48 was planted in Plains, GA from remnant seed of a head row from double haploid evaluation nursery. In 2021, a small strip (500 sq. ft.) was planted in Plains, GA and rogued thoroughly for aberrant types due to seed mixture. In 2022, three large increase strips of GA20E48 were planted at Plains, GA. The middle strip was rogued thoroughly for aberrant types to create breeder seed. The Georgia Seed Development Commission has increased the breeder seed of GA20E48 at Plains on about 5 acres in 2023 and in 2024 for seed purification.

4. **Description of plant material:** In general, GA20E48 is exceptionally high grain yielding wheat line (Tables 1 to 3; 5 to 17; 17 to 18; 21 to 23) with a medium-late maturity and good to average test weight (Tables 1-3; 7; 14; 15; 21 to 24). It is a line with awned spikes and medium short height plants (Tables 1-3; 7; 14; 15 and 22). Its maturity is similar to Blanton (Table 14) and Jamestown (Table 15); 6 to 7 days later than Go Wheat 2032 (Table 1) and AGS 3015 (Table 3 and 7); 2 to 6 days earlier than PIO26R45 (Table 14), PIO26R41 (Table

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

15) and all checks except AGS4043 (Table 22). GA20E48 is relatively short similar to Jamestown and PIO 26R41 (Table 15) and AGS 4043 (Table 22). However, it is shorter than most checks (Tables 1; 3; 7; 14; 15; 22; and 23) including AGS 3040, Blanton and Hilliard by 4 to 5 inches (Tables 14 and 15). In the regional SUNGRAINS trials (Table 2 and 3), GA20E48 performed very well in general. It was 2nd among 110 entries in the entire SE region and was top (1st) in the region -FL excluded- in the SUNWHEAT nursery grown in 8 locations in the SE (Table 3). Similarly, in the regional USW trials harvested from 15 locations, GA20E48 was top (1st) yielder among the 38 elite entries and ranked 4th for its test weight (Table 15). GA20E48 is also resistant to medium resistant to lodging (Tables 1; 2; 3; 14; 15 and 22). Additionally, GA20E48 has an excellent pest's resistance package including resistance to races of leaf and stripe rusts (Tables 1; 2; 4; 16; and 21) and powdery mildew (Table 4 and 16). The resistance of GA20E48 to the three rusts races is due to the 4 genes package (*Yr17/Lr37/Sr38, Lr18*; Table 21). It also has a good resistance to Hessian fly in GA and across the SE region (Tables 7; 19; and 21) and Texas (Table 19) due to the gene resistance *H13* (Table 21). Similarly, GA20E48 has two major known QTLs (*Fhb_1B_JT* and *Fhb_1A_Ne*) for FHB, providing it with good levels of resistance compared to very susceptible grown cultivars (Tables 1; 2; 4; 16 and 21). GA20E48 is also resistant to powdery mildew, medium resistant to bacteria, and Septoria blotch (Tables 4 and 16). It has the major QTL (*Sbm1*) for wheat soil-borne virus that protects against the virus. GA20E48 has very good milling and baking quality as a soft red winter wheat, including flour extraction/yield, kernel softness, and cookie diameter (Table 20). The industry standards on milling and baking quality are flour yield (650 or above) and softness (50 or above).

5. **Need for and potential users of plant material:** The wheat growers in GA and the SE region are looking for new wheat cultivars with high yield and good genetic resistances package against prevalent pests in a range of maturity from early to medium-late. Hence, there is an urgent and continual need for developing improved cultivars with pests' resistance, medium maturing varieties that have a high yield potential. The University of Georgia wheat breeding program is historically well recognized as a major developer and provider of high yielding cultivars with good diseases, insects, bacteria, and viruses' resistance package not only for GA but also for the entire SE region. Therefore, given the GA20E48 genetic makeup, is one of the wheat lines that will address wheat growers' needs to improve their wheat production and income. This line is an exceptionally high yielder and has an excellent package comprising of major genes to protect it against major pests in the region. Its milling and baking attributes make GA20E48 a good addition to the wheat industry. Therefore, several private companies are interested in the University of Georgia's breeding lines to market as varieties within Georgia and the SE region. MIXON SEED SERVICE (previously AgSouth Genetics) and JoMAr have already expressed their interest in licensing this line if released (See their emails attached at the end of this application). Other companies such as Erwin-Keith, Inc./ Progeny Ag, and Northern Star Integrated Services may also be interested in licensing this line.
6. **Justification for release:** In GA, GA20E48 was a very high yielding, medium late maturing and awned line. It is a medium short line with good test weight and quality. Based the data from regional SUNGRAINS nurseries in 2020 and 2021 (Tables 2, 3 and 4); the 2022 USW regional nursery (Tables 15 and 16) and the 2023 and 204 OVTs in LA, AL, and NC (Tables 17; 23 and 24); TX and SC (Table 18 and 23); GA20E48 showed very good performance as

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

medium-late line with good test weight in the SE region. Overall, GA20E48 performed better than checks (Tables 1 to 3; 5 to 17; 17 to 18). In GA, it was among the top lines that dominated the entries tested in the EYT (Table 1), SRWW Georgia State trials, SVT (Tables 5 to 7 and 21), and the GA statewide GSSGPT trials (Tables 8 to 14 and 22). Regionally, GA20E48 was ranked 5th/145 entries and 2nd/110 entries for grain yield in the SUNGRAINS regional trials SUNPre and SUNWHEAT trials grown in 4 and 8 locations across the SE region, respectively (Tables 2 and 3). In the USW trials harvested from **15 locations** in GA and the SE region (Table 14 and 15), it performed EXCEPTIONALLY well. It ranked the **top (1st) and 4th** among the 38 entries for grain yield and test weight, respectively. Most importantly, GA20E48 is one the few UGA developed lines that combines high yield in the entire SE region including GA and has good pests' resistance package due to many desirable genes pyramided in GA20E48 (Table 25). This line has good milling and baking quality while maintaining very good agronomic performance and diseases/insects/viruses' resistance packages.

Additional data -received so far- from testing of GA20E48 in this 2023-2024 cycle, confirmed the good performance of this line to GA and Se region (Tables 21-24). In GA SRWW GST, GA20E48 performed very well and exceeded most checks grain yield at Griffin and Plains with good test weigh and excellent resistance to ruts and hessian fly (Table 21). Similarly, in the GSSGPT (Table 22), GA20E48 was early, medium tall and a grain yield superior to checks with good test weigh and lodging resistance. In the SE regional OVTs, GA20E48 performed well overall (Tables 23 and 24). Its grain yield was always superior or equivalent to checks. This shows that GA20E48 is widely adapted not only to GA but to the SE region in general.

In summary, GA20E48 is an excellent wheat line potential for release due to:

- A. GA20E48 is a very high yielding compared to checks in GA and the SE region (Tables 1 to 3; 5 to 17; 17 to 18; 21 to 24). Its wide adaptation to the region which is expressed in its high yield better than checks and other lines in regional uniform south wheat (USW) and official variety (OVTs) trials in the SE region (Tables 15 to 18 and 21 to 24).
- B. In the Uniform regional USW trials from **15 locations** in GA and the SE region (Table 14 and 15), GA20E48 ranked the **top (1st) and 4th** among the 38 entries for **grain yield and test weight**, respectively. It ranked 5th/145 and 2nd/110 entries for grain yield in the SUNGRAINS regional trials SPL and SUNWHEAT trials, respectively (Tables 2 and 3).
- C. GA20E48 has many known good genes (Table 21) including *Fhb_1B_JT* and *Fhb_1A_Ne*, *Yr17/Lr37/Sr38*, *Lr18*, *Sbm1*... that protect it against major pests including scab, rusts, soil-born mosaic virus, powdery mildew... (Tables 2, 4 and 16). It also has known genes that give it very good levels of resistance to pests including *H13* for Hessian fly (Tables 7 and 19). GA20E48 is medium resistance to FHB (Tables 1, 2, 4 and 13) due to the two genes *Fhb_1B_JT* and *Fhb_1A_Ne* (Tables 1, 2, 4, and 16). This resistances package allows it wide adaptation to GA and the US SE region. In addition, GA20E48 is a very good addition to the milling and baking industry given it has good quality attributes including flour extraction/yield, and cookie diameter.

Given the high performance of GA20E48 in GA and the SE region, representatives from different licensing companies have been following this line for many years and are interested

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

in it. JoMar and MIXON SEED SERVICE (previously AgSouth Genetics), have expressed their strong interests (this and last year) in licensing this line if released (see attached emails at the end of this application). Similarly, other companies who licensed many UGA released wheat cultivars Erwin-Keith, Inc./Progeny Ag are also considering potentially licensing GA20E48.

7. Participating scientists: Mohamed Mergoum, Jerry Johnson; David Buntin, and James Buck.
8. Location(s) at which plant material was developed: Griffin and Plains, GA
9. Recommended form of intellectual property protection and royalty: Plant Variety Protection Certificate and assess royalty on each 50 lb unit of seed.

Cultivar and associate cultivar applications only provide the following information:

10. Method of propagation: Seed
11. Amount of breeder seed stocks available (if applicable): 10 bushels
12. Amount of foundation seed stocks available if applicable: about 100 bushels
13. Amount of cutting or bud material available for vegetatively propagated material for nursery distribution (if applicable):
14. Describe any unusual difficulty anticipated in the production of any class of seed stocks: None
15. Suggest up to three names for the cultivar: Allow the licensee to determine the name.
16. Name approved by plant cultivar and germplasm release committee:

APPLICATION FOR RELEASE

GA151313-LDH-192 -20E48

Application for the release of _____

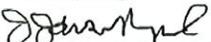
After the application has been reviewed and approved by the Committee and requested changes have been made, please send the entire application through DocuSign, including this signature page. There are directions for establishing your own DocuSign account; the College OIT help desk will be able to help you if you run into issues establishing your account, or if you have other questions.

At the Add Recipients step, please be sure to click on the signing order check box, so that it goes for signature in the correct order. Use Needs to Sign for everyone below:

Release recommended by:

A.  Signed by: 08/08/2024 | 2:16 PM PDT
 Originating Scientist _____ Date _____

B.  DocuSigned by: 08/08/2024 | 5:24 PM EDT
 Chair, GAES PCGRC _____ Date _____
 This will be Wayne Parrott, wparrott@uga.edu

C.  DocuSigned by: 08/09/2024 | 3:53 PM EDT
 Department Head _____ Date _____
 This will be either

- Jodi Johnson-Maynard, jmaynard@uga.edu, or
- Leo Lombardini, lombardini@uga.edu, or
- Harald Scherm, scherm@uga.edu

D.  DocuSigned by: 08/13/2024 | 9:04 PM EDT
 For Griffin and Tifton, Assistant Dean _____ Date _____
 This will be either

- Michael Toews, mtoews@uga.edu, for Tifton, or
- Jeff Dean, jeffdean@uga.edu, for Griffin

E.  DocuSigned by: 08/13/2024 | 1:13 PM EDT
 Associate Dean for Research _____ Date _____

- This will be Dr. Harsha Thippareddi, agresch@uga.edu

- And the last step will also be Dr. Harsha Thippareddi, agresch@uga.edu

Approved:

F.  DocuSigned by: 08/13/2024 | 1:13 PM EDT
 Dean and Director _____ Date _____

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 1. Average grain yield, test weight, plant height, days to heading, lodging, and reactions to Barley yellow dwarf virus (BYDV) and Fusarium head blight (FHB) of GA GA20E48 and commonly grown SRWW cultivars included in GA Elite yield trials (EYT) at Plains, Calhoun and Griffin, GA, and locations at MS in 2020.

Entry	Source	Grain Yield	Test weight	Plant Height	Days to heading	Plant lodging ¹	BYD virus ¹	FHB reaction ¹
		bu/ac	lb/bu	Inch	day	%	%	0-9 ¹
GA20E48	Line GA	88	57	31	91	0	5	1
Go Wheat 2032	Check GA	86	59	33	84	20	10	2
AGS 2024	Check GA	87	57	34	89	30	10	2
Blanton	Check GA	78	57	33	86	35	0	3
Highest rating ²		-	-	-	-	70	40	1.6
LSD 0.05		6	1.1	1	2	10	6	1.4
Number of environments		4	4	3	4	2	1	2

¹Plant lodging and Barley yellow dwarf virus (BYDV) were evaluated in %, while Fusarium head blight (FHB) was evaluated based on a 0-9 scale where 0 = resistant and 9 = very susceptible.

²Indicate the highest trait score of the trial.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 2. Average grain yield, test weight, days to heading, plant height and lodging, and reactions to Fusarium head blight (FHB) (Severity (Sev.) and Fusarium Damaged Kernels (FDK)), leaf and stripe rusts for GA20E48 and commonly grown SRWW cultivars included in SUNGRAINS Preliminary Early (SPE) trials grown in GA, LA, NC, SC in 2020.

Entry	Source	Grain Yield	Test weight	Days to heading	Plant Height	Plant lodging	FHB Sev. ¹	FHB FDK ¹	Leaf rust	Stripe rust
		bu/ac	lb/bu	day	Inch	0-9 ²	0-9 ²	%	0-9 ²	0-9 ²
GA20E48	Line GA	93.9	57.3	89	31.3	0.7	2.2	15	0.0	0.4
Savoy	Check GA	64.3	56.5	82	34.1	3.4	3.2	30	0.0	1.5
AGS 3030	Check GA	85.3	52.8	82	34.0	0.7	2.5	35	0.0	0.1
AGS 2055	Check GA	92.6	56.8	91	36.5	0.7	2.9	50	0.0	0.8
Hillard	Check VA	86.7	59.0	89	35.7	0.3	0.0		2.0	0.0
Highest rating ³		-	-	-	-	7.0	5.6	87	6.5	7.3
LSD 0.05		6.5	1.1	2.1	2.1	1.1	1.1	8.7	1.0	1.2
Number of environments		4	4	4	4	3	2	1	1	2

¹Sev.= Severity, FDK: Fusarium damaged kernel

²Lodging, Fusarium head blight (FHB) severity, leaf and stripe rusts diseases evaluations were based on a 0-9 scale where 0 = resistant and 9 = very susceptible.

³Indicate the highest score of the trait in the trial.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 3. Average of grain yield, test weight, days to heading, plant height and lodging of GA20E48 and commonly grown SRWW cultivars included in regional Multi-State SUNGRAINS wheat advanced yield trials (SUNWHEAT) in 2021.

Entry	Source	Grain Yield	Test weight	Days to heading	Plant Height	Plant lodging
		bu/ac	lb/bu	Day	Inch	0-9 ¹
GA20E48	Line GA	71.3	57.7	99	30.7	1.5
PIO 26R41	Check PIO	65.5	57.7	104	33.9	1.3
AGS 3015	Check GA	65.0	58.6	92	35.4	1.8
SS8641	Check GA	59.8	56.9	97	35.0	1.8
Hilliard	Check VA	64.3	57.0	102	35.7	1.0
Disease highest rating ²	-	-	-	-	-	8.1
LSD 0.05	-	4.7	1.5	2.2	3.2	1.1
Number of environments	-	8	4	6	3	2

¹Lodging, reactions to diseases were evaluated on 0-9 scale where 0 = resistant and 9 = very susceptible.

²Indicate the highest score of the most susceptible genotype in the trial.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 4. Reactions to diseases; Powdery (Powd.) mildew, *Septoria nodorum* Blotch (SNB) glumes and leaves, leaf and stripe rusts, Fusarium head blight (FHB) (Severity (Sev.), Fusarium damaged kernels (FDK) and Deoxynivalenol (DON)), and Bacterial (Bact.) streak of GA20E48 and commonly grown SRWW cultivars included in regional Multi-State SUNGRAINS wheat advanced yield trials SUNWHEAT in 2021.

Entry	Source	Powd. mildew	Septoria Leaves	Septoria Glumes	Leaf rust	Stripe rust	FHB Sev.	FHB FDK	FHB DON	Bact. Streak
		0-9 ¹	% ²	ppm ²	0-9 ¹					
GA20E48	Line GA	0.0	4.3	2.0	0.0	0.9	1.0	48	13.2	3.1
PIO 26R41	Check PIO	0.0	4.5	2.0	1.5	0.2	0.9	40	10.5	2.5
AGS3015	Check GA	4.0	5.3	2.3	0.0	4.7	2.9	38	9.1	3.2
SS8641	Check GA	0.0	3.3	1.0	0.0	2.5	3.2	33	8.0	1.8
Hilliard	Check VA	0.0	4.5	1.3	0.0	0.3	1.0	38	10.6	2.3
Disease highest rating ³		7.1	8.3	7.7	7.8	8.0	5.5	88	35.5	6.5
LSD 0.05		1.7	2.1	2.3	1.1	1.2	1.1	12.1	11.1	2.1
Number of environments		1	1	1	2	3	5	3	3	2

¹Reactions to Powdery (Powd.) mildew, *Septoria nodorum* blotch (SNB), leaf and stripe rusts, and Fusarium head blight (FHB) severity were evaluated on 0-9 scale where 0 = resistant and 9 = very susceptible.

²FHB Deoxynivalenol (DON) toxin level measured in part per million (ppm) and Fusarium damaged kernels in %.

³Indicate the highest trait score of the most susceptible genotype in the trial.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 5. Overall and location Grain yield (GY) average of GA20E48 and commonly grown SRWW cultivars included in the SRWW in the SRWW Georgia's State Trials (GST) grown in five locations (4 in Georgia (GA) and one in Mississippi (MS)) in 2021.

Entry	Source	GA			MS	Overall Average
		Plains	Griffin	Calhoun		
		-----bu/ac-----				
GA20E48	Line GA	105.3	94.5	97.5	91.7	97.2
AGS 2024	Check GA	89.7	88.2	98.2	81.4	89.4
Go Wheat 2032	Check GA	102.6	87.0	105.0	76.7	92.8
Blanton	Check GA	95.5	92.8	87.7	77.4	88.4
AGS 3015	Check GA	90.7	83.9	99.2	63.9	84.4
SS 8641	Check GA	95.9	79.4	89.8	71.8	84.2
LSD 0.05	-	6.2	5.7	7.7	6.2	-
Number of environments	-	1	1	1	1	5

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 6. Overall and location Grain yield (GY) average of GA20E48 and commonly grown SRWW cultivars included in the SRWW in the SRWW Georgia's State Trials (GST) grown in five locations (4 in Georgia (GA) and one in Mississippi (MS)) in 2022.

Entry	Source	GA				MS	Overall Average
		Plains	Griffin	Calhoun	Rome		
		----- bu/ac -----					
GA151313-LDH-192-20E48	Line GA	97.8	99.6	74.8	125	66.7	85
Go Wheat 2032	Check GA	79.6	53.7	88.8	114	63.1	71
AGS 3040	Check GA	98.1	45.0	75.7	121	53.8	68
Blanton	Check GA	84.8	45.1	59.9	121	41.9	58
AGS 3015	Check GA	89.9	54.4	72.7	-	54.0	68
LSD 0.05	-	6.8	5.3	6.6	6.7	5.2	5.5
Number of environments	-	1	1	1	1	1	5

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 7. Overall and location Grain yield (GY) average, test weigh (TW), Plant height (PH), heading date (HD), and Hessian fly (HF) of GA20E48 and commonly grown SRWW cultivars included in the SRWW in the SRWW Georgia's State Trials (GST) grown over three locations in Georgia (GA) in 2023.

Entry	Source	GA			Overall	TW	PH	HD	HF
		Plains	Griffin	Calhoun	Average				
		-----bu/ac-----			lb/bu	Inch.	day	%	
GA20E48	Line GA	83.2	89.0	77.8	83.3	58.9	33.0	91.0	15
AGS 3015	Check GA	70.6	71.2	62.2	68.0	57.7	37.0	85.0	35
Blanton	Check GA	68.3	69.5	57.3	65.0	57.8	36.0	87.0	15
AGS 4043	Check GA	86.7	97.7	72.5	85.6	57.3	36.0	90.0	10
LSD 0.05	-	3.1	6.4	3.6	-	1.2	2.0	2.0	11
Number of environments	-	1	1	1	3	3	3	3	1

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 8. Average grain yield per location, North, South and Statewide in GA of GA20E48 and commonly grown SRWW cultivars included in the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2021.

Entry	Source	Plains ¹		Griffin	Midville	Tifton	Rome	North ²	South ²	Statewide
		No Fung.	Fung.							
----- bu/ac -----										
GA20E48	UGA Line	69.3	73.6	109.8	69.2	69.4	131.5	120.7	70.4	87.1
AGS 3040	Check GA	72.8	74.0	84.0	58.3	59.7	128.2	106.1	66.2	79.5
Blanton	Check GA	69.4	77.2	94.6	60.4	64.6	125.3	110.0	67.9	81.9
Go Wheat 2032	Check GA	61.3	78.4	108.3	68.1	68.8	127.9	118.1	69.2	85.5
SH 5550	Check GA	62.9	69.8	-	59.2	66.5	-	-	64.6	64.6
26R45	Check PIO	79.1	75.2	98.7	56.8	59.4	75.8	87.3	67.6	74.2
LSD 0.10	-	5.4	4.9	11.9	5.4	3.5	12.0	12.0	4.6	7.1
No. of Environments	-	1	1	1	1	1	1	2	4	6

¹In Plains, No Fung.= Without fungicide and Fung.= with Fungicide

²North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 9. Average grain yield per location, North, South and Statewide in GA of GA20E48 and commonly grown SRWW cultivars included in official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2022.

Entry	Source	Plains ¹		Griffin	Midville	Tifton	Rome	North ¹	South ¹	Statewide
		No Fung.	Fung.							
----- bu/ac -----										
GA20E48	UGA Line	92.1	91.5	69.3	91.1	68.9	124.9	97.1	85.9	89.6
AGS 2024	Check GA	90.4	90.5	48.1	81.5	73.3	115.0	81.6	83.9	83.1
Blanton	Check GA	76.6	80.0	40.5	74.7	69.6	120.9	80.7	75.2	77.1
Go Wheat 2032	Check GA	76.0	81.1	48.4	76.0	62.2	114.1	81.3	73.8	76.3
SH 5550	Check GA	87.7	93.6	-	91.9	75.6	-	-	87.2	87.2
26R45	Check PIO	84.3	91.6	73.2	98.1	60.1	94.1	83.7	83.5	83.6
LSD 0.10	-	5.6	6.2	12.9	5.9	5.1	14.4	13.7	5.5	8.4
No. of Environments	-	1	1	1	1	1	1	2	4	6

¹In Plains, No Fung.= Without fungicide and Fung.= with Fungicide

²North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 10. Average grain yield per location, North, South and Statewide across GA of GA20E48 and commonly grown SRWW cultivars included in the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2023.

Entry	Source	Plains ¹		Griffi	Midvill	Tifton	Rome	North ²	South ²	Statewide
		No Fung.	Fung.							
----- bu/ac -----										
GA20E48	UGA	53.7	74.2	92.2	107.0	79.8	99.6	95.9	78.7	84.4
AGS 3040	Check GA	47.9	71.5	82.1	94.1	34.3	87.7	84.9	62.0	69.6
Blanton	Check GA	51.8	66.4	86.3	101.8	75.1	88.6	87.5	73.8	78.3
Go Wheat 2032	Check GA	54.7	54.6	85.6	85.6	63.1	84.8	85.2	64.5	71.4
SH 5550	Check GA	44.5	50.2	-	70.7	23.0	-	-	47.1	47.1
26R45	Check GA	48.5	56.8	81.3	72.2	41.5	79.4	80.4	54.8	63.3
LSD 0.10	-	9.7	8.8	11.3	9.7	7.5	13.7	12.5	8.4	10.1
No. of Environments	-	1	1	1	1	1	1	2	4	6

¹In Plains, No Fung.= Without fungicide and Fung.= with Fungicide

²North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 11. Grain yield average in North, South and Statewide in two years (2021 and 2022) across Georgia of GA20E48 and commonly grown SRWW cultivars included the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2021 and 2022.

Entry	Source	North ¹		South ¹		2021-2022 Statewide		
		2021	2022	2021	2022	North	South	Overall
----- bu/acre -----								
GA20E48	Line GA	120.7	97.1	70.4	85.9	108.9	78.1	93.5
AGS 2024	Check GA	116.2	81.6	71.5	83.9	98.9	77.7	88.3
Blanton	Check GA	110.0	80.7	67.9	75.2	95.3	71.6	83.4
Go Wheat 2032	Check GA	118.1	81.3	69.2	73.8	99.7	71.5	85.6
SH 5550	Check GA	-	-	64.6	87.2	-	75.9	-
26R45	Check GA	87.3	83.7	67.6	83.5	85.5	75.6	80.5
LSD 0.10	-	12.0	13.7	4.6	5.5	-	-	-
Number of environments	-	2	2	4	4	4	8	12

¹North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 12. Grain yield average in North, South and Statewide in two years (2022 and 2023) across Georgia of GA20E48 and commonly grown SRWW cultivars included the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2022 and 2023.

Entry	Source	North ¹		South ¹		2022-2023 Statewide		
		2022	2023	2022	2023	North	South	Overall
----- bu/acre -----								
GA20E48	Line GA	97.1	95.9	85.9	78.7	96.5	82.3	89.4
AGS 2024	Check GA	81.6	88.5	83.9	75.0	85.0	79.5	82.3
Blanton	Check GA	80.7	87.5	75.2	73.8	84.1	74.5	79.3
Go Wheat 2032	Check GA	81.3	85.2	73.8	64.5	83.2	69.2	76.2
SH 5550	Check GA	-	-	87.2	47.1	-	67.2	
26R45	Check GA	83.7	80.4	83.5	54.8	82.0	69.1	75.6
LSD 0.10	-	13.7	12.5	5.5	8.4	-	-	-
Number of environments	-	2	2	4	4	4	8	12

¹North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
 GA151313-LDH-192 -20E48

Table 13. Grain yield average in North, South and Statewide in two years (2021 and 2023) across Georgia of GA20E48 and commonly grown SRWW cultivars in the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia in 2021 and 2023.

Entry	Source	North ¹		South ¹		2021 & 2023 Statewide		Overall
		2021	2023	2021	2023	North	South	
----- bu/acre -----								
GA20E48	Line GA	120.7	95.9	70.4	78.7	108.3	74.5	91.4
AGS 2024	Check GA	116.2	88.5	71.5	75.0	102.3	73.2	87.8
AGS 3040	Check GA	106.1	84.9	66.2	62.0	95.5	64.1	79.8
Blanton	Check GA	110.0	87.5	67.9	73.8	98.7	70.8	84.8
Go Wheat 2032	Check GA	118.1	85.2	69.2	64.5	101.7	66.8	84.2
SH 5550	Check GA	-	-	64.6	47.1	-	55.9	-
26R45	Check GA	87.3	80.4	67.6	54.8	83.8	61.2	72.5
LSD 0.10	-	13.7	12.5	5.5	8.4	-	-	-
Number of environments	-	2	2	4	4	4	8	12

¹North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 14. Grain yield average in North, South and Statewide across three years; days to heading (DH), test weight (TW), plant height (PH) and lodging (Lodg.) of GA20E48 and commonly grown SRWW cultivars included in the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown over six locations in Georgia from 2021 to 2023.

Entry	Source	3 years average			DH	2022-2023 Statewide		
		North ¹	South ¹	Statewide		TW	PH	Lodg.
GA20E48	Line GA	104.6	78.3	91.4	99	55.4	30.8	15.2
AGS 2024	Check GA	95.4	76.8	86.1	100	55.8	34.4	20.4
AGS 3040	Check GA	94.6	73.1	83.8	97	54.3	37.2	15.5
Blanton	Check GA	92.7	72.3	82.5	99	55.9	34.9	19.5
Go Wheat 2032	Check GA	94.9	69.2	82.0	97	55.5	34.2	4.1
SH 5550	Check GA	-	66.3	-	-	55.1	34.4	0.7
26R45	Check GA	83.8	68.6	76.2	104	52.9	35.9	19.5
LSD 0.10	-	-	-	-	-	1.2	2.1	12.6
Number of environments	-	6	12	18	4	4	4	2

¹North = Rome and Griffin; South = Plains (2 tests), Midville, and Tifton.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 15. Overall grain yield (GY) across locations, South and Coastal regions of the US Southeast (SE) region; test weight, days to heading, plant height and lodging of the GA20E48 and commonly grown SRWW cultivars included in the regional Uniform Southern Wheat (USW) nursery planted in 15 locations in GA and states in the SE region in 2021 season.

Entry	Source	GY Overall	GY South ¹	GY Costal ¹	Test weight	Days to heading	Plant height	Plant lodging
		bu/ac	bu/ac	bu/ac	lb/bu	day	inch	0-9 ²
GA20E48	UGA Line	87.6	85.5	89.3	61.0	108	30	0.0
AGS 2000	Check GA	68.9	68.8	73.5	57.5	105	35	1.4
Jamestown	Check VA	72.0	71.8	77.1	59.1	106	31	0.9
Hilliard	Check VA	85.7	82.0	84.4	61.6	112	36	0.0
PIO 26R41	Check PIO	82.0	77.3	80.1	60.3	114	32	0.5
LSD 0.10		6.8	7.2	5.4	2.0	2.6	2.3	1.4
Number of environments ¹		15	5	4	12	9	7	1

¹Costal locations from LA, FL, SC, and NC and South locations from TX, LA, GA, FL, and SC. Remaining locations in North (GA, AR, KY, IL, and MO)

² Lodging scores using a 0-9 scale where 0 = resistant and 9 = very susceptible.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 16. Reactions to pests (leaf and stripe rusts, bacteria, powdery mildew, septoria (Leaves and Glumes), and Fusarium head blight (FHB) disease (severity, Fusarium damaged kernels (FDK) and Deoxynivalenol (DON)) of GA20E48 and commonly grown SRWW cultivars included in the Uniform Southern Wheat (USW) nursery planted in GA and other locations across the US Southeast region in 2022.

Entry	Source	Leaf	Stripe	Wheat	Powdery	Septoria		FHB		
		rust	rust	Bacteria	Mildew	Leaves	Glumes	Severity	FDK	DON
		0-9 ¹	%	ppm ²						
GA20E48	UGA Line	0.3	0.0	2.6	0.8	6.5	1.0	3.4	8	0.4
AGS 2000	Check GA	0.0	2.5	3.5	5.1	5.0	0.8	4.1	5	2.2
Jamestown	Check VA	2.7	0.0	5.8	3.6	6.3	2.0	2.0	8	0.3
Hilliard	Check VA	1.2	0.0	3.7	1.2	5.3	2.3	1.9	7	1.1
Pioneer Brand 26R41	Check PIO	4.0	0.0	3.1	1.2	4.5	2.3	1.8	13	1.7
Disease highest rating ³	-	3.7	6.9	5.1	3.5	6.5	6.5	4.3	44	11.7
LSD 0.10		1.1	1.2	1.5	1.1	1.3	1.3	1.5	12	7.1
Number of environments		2	2	1	2	1	2	5	2	2

¹Leaf and stripe rusts, bacteria, powdery mildew, Septoria, and FHB severity scored on a 0-9 scale where 0 = resistant and 9 = very susceptible.

²Fusarium Damaged Kernel (FDK) was measured in % and FHB Deoxynivalenol (DON) toxin was measured as part per million (ppm).

³Indicate the highest disease score of the most susceptible genotype in the trial.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 17. Average of grain yield (GY) and test weight (TW) GA20E48 and commonly grown SRWW cultivars included in the Official State Variety Trials (OVTs) across states in the SE region including Louisiana (LA, 2 locations), Alabama (AL, 5 locations), and North Carolina (NC, 5 locations) in 2022-2023 crop season.

Entry	States												
	LA			AL					NC ¹				
	GY ¹ WIN	GY ¹ CL	TW	GY ¹ HL	GY ¹ FH	GY ¹ MJ	GY ¹ LS	GY ¹ PV	NC ¹ GV	NC ¹ LR	NC ¹ RB	NC ¹ UN	NC ¹ State
	----- bu/ac -----		lb/bu	----- bu/ac -----					----- bu/ac -----				
GA20E48	67.0	98.7	57.9	76	48	32	60	37	104.2	93.6	94.3	91.9	91.9
AGS 3015 (Check) ²	55.3	89.1	58.2	62	61	25	53	29	98.8 ²	68.6	83.9	88.0	84.8
AGS 3022 (Check) ²	58.5	100.2	58.1	71	66	27	60	42	107.9 ²	86.0	92.9	109.5	93.8
USG3640 (Check) ²	-	-	-	63	53	27	54	29	95.3 ²	75.4	81.2	83.2	83.3
26R94 (Check) ²	41.8	76.9	56.5	66	56	17	36	31	93.0 ²	58.8	85.1	105.8	86.9
LSD 0.10	12.8	5.7	-	9	8	8	14	31	7.9	7.3	7.8	10.8	-
Number of environments	1	1	2	1	1	1	1	1	1	1	1	1	6

¹LA locations: Winnsboro (WIN) and Crowley (CL); AL Locations: Headland (HL) and Fiarhope (FH) in South AL; Marion Junction (MJ), Tallassee (TS), and Prattville (PV) in the Center AL; North Carolina (NC) locations: Granville (GV), Lenoir (LR), Robeson (RB) and Union (UN).

²Checks vary by state: For LA and AL, Checks are indicated in the Table (AGS 3015, AGS 3022, USG3640 an 26R94 while in North Carolina (NC), checks are P26R41, Hilliard, USG3354 and USG3574

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 18. Average grain yield, test weight (TW), plant height (PH), heading date (HD), and Hessian fly (HF) reaction of GA20E48 and commonly grown SRWW cultivars included in the Official State Variety Trials (OVTs) across two locations in Texas (TX Hill co. and McGregor) in 2022-2023 crop season.

Entry	TX							SC		
	2 Loc. ¹	HC	MG	TW	PH	HD	HF	Entry	GY	TW
	----- bu/ac -----			lb/bu	Inch	Day	0-9 ²		bu/ac	lb/bu
GA20E48	70.3	65.0	75.6	62.1	24.7	97.3	0.33	GA20E48	102.6	59.1
AGS 3022	69.0	66.4	71.6	61.5	26.5	90.7	0.67	AGS2024	83.7	58.9
Go Wheat 2032	64.8	62.4	67.3	61.3	29.7	80.7	0.33	AGS3015	79.2	59.8
AGS 2055	62.8	55.2	70.4	61.6	29	102.3	5.00	AGS3040	67.5	57.5
Go Wheat 6000	59.8	54.4	65.2	60.2	26	95.7	4.33	AGS4023	75.6	60.5
USG 3783	46.7	46.6	46.8	58.5	25.3	103.7	3.00	AGS4043	78.3	59.0
USG 3463	23.1	18.9	27.2	0?	25.3	103.7	8.00	Blanton	81.2	59.3
LSD 0.10	5.0	6.8	7.4	>10	1.8	3.7	1.55	Hilliard	77.4	59.7
Number of environments		1	1	1	1	1	1	-	2	2

¹Locations are Hill Co (HC) and McGregor (MG).

²Hessian fly severity under field conditions in the USW was scored on a 0-9 scale where 0 = resistant and 9 = very susceptible.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 19. Reactions of GA20E48 and commonly grown SRWW cultivars to Hessian fly under field conditions in the Uniform South Wheat nursery (USW) and in GA (Griffin (GR) and Plains (PL) and artificial insect infestation grown under greenhouse (Biotypes B, O, and L) during the 2021-2023 period.

Entry	Source	USW	Greenhouse ²			Entry	Source	2021-2022		2022-2023	
		Filed	B	O	L			GR ¹ GA	PL ¹ GA	GR ¹ GA	PL ¹ GA
		0-9 ¹	%	%	%			%	%	%	%
GA20E48	Line GA	3.5	100	100	100	GA 20E48	Line GA	0	0	0.0	15.0
AGS 2000 (Sucs.)	Check GA	5.5	0.0	0.0	0.0	AGS 2024 (S)	Check GA	40	10	0.0	50.0
Jamestown	Check VA	5.5	100	0.0	0.0	AGS 3015	Check GA	5	5	0.0	35.0
Hilliard	Check VA	2.0	100	0.0	0.0	AGS 3040	Check GA	0	30	5.0	10.0
PIO26R41	Check PIO	5.0	100	100	100	Blanton	Check GA	0	5	5.0	15.0
Number of environments		2	1	1	1	# of Env.	-	1	1	1	1

¹Hessian fly severity under field conditions in the USW was scored on a 0-9 scale where 0 = resistant and 9 = very susceptible. At Plains and Griffin, GA = % of infested tillers by the fly (total of 20 tillers/entry) were evaluated.

²Under greenhouse conditions, Hessian fly was scored as % of resistant plants to biotypes B, O and L.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 20. Average test weight, flour yield, softness equivalent, kernel and flour protein and cookie diameter of GA20E48 and commonly grown SRWW cultivars grown in the Uniform South Wheat (USW) nurseries grown in 2 locations in GA and SC in 2021-22 crop season.

Entry	Source	Test weight	Flour yield ¹	Softness equivalence ¹	Kernel protein ²	Flour protein ²	Cookie diameter ¹
		Lb/bu	g kg ⁻¹	%	g kg ⁻¹	g kg ⁻¹	cm
GA20E48	Line GA	57.0	673	65.3	100	74	18.9
AGS 2000	Check GA	57.2	717	62.3	95	75	19.7
Jamestown	Check VA	58.5	669	60.6	99	75	18.7
Hilliard	Check VA	56.5	678	65.0	87	69	19.4
Pioneer Brand 26R41	Check PIO	57.3	690	63.1	93	74	19.6
Standard dev. 0.05	-	1.2	15	3.3	7	6	0.5
Number of environments	-	2	2	2	2	2	2

¹Evaluations done by the USDA-ARS wheat quality lab., Wooster, OH. The industry standards for milling and baking quality are flour yield (650 or above) and softness (50 or above)

²Kernel and flour protein (g kg⁻¹) at 12 and 14% grain and flour moisture, respectively.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 21. Average grain yield and test weight, reactions to yellow rust, Fusarium head blight (FHB) and Hessian fly (HF) of GA20E48 and commonly grown SRWW cultivars grown in the SRWW Georgia's State Trials (GST) at Griffin and Plains in GA in 2023-24 crop season.

Entry		GY Griffin	TW Griffin	GY Plains	TW Plains	Yellow Rust	FHB ¹	HF Plains
		bu/ac	lb/bu	bu/ac	Lb/bu	0-9	0-9	%
GA20E48	Line GA	103.4	54.9	99.5	59.9	0	2	10
AGS4043	Check GA	96.2	58.0	79.4	58.7	3	1	5
AGS2024	Check GA	91.8	49.0	83.5	58.2	2	7	10
Blanton	Check GA	95.3	57.5	96.4	59.0	4	-	-
Hilliard	Check VT	96.9	55.3	88.5	56.0	2	-	-
Standard dev. 0.05	-	6.1	4.7	6.7	4.6	1	1	9
Number of environments	-	1	1	1	1	1	1	1

¹FHB=Fusarium Head Bligh disease.

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 22. Average grain yield, test weight, days to heading, plant height and lodging of GA20E48 and commonly grown SRWW cultivars grown in the official Georgia's Statewide Small Grain Performance Trials (GSSGPT) grown in 6 locations in GA in 2023-24 crop season.

Entry	Source	Grain Yield	Test Weight	Days to Heading	Plant Height	Lodging
		lb/bu	g kg ⁻¹	day	inch	%
GA20E48	Line GA	101.2	54.9	90	32.6	28.3
AGS 4043	Check GA	90.4	55.5	91	32.9	25.6
AGS 2024	Check GA	92.7	55.7	93	35.9	32.0
AGS 4023	Check VA	87.1	56.7	96	36.5	31.1
AGS 3026	Check VA	81.6	53.1	96	36.9	28.3
Go Wheat 6000	Check	93.7	55.3	92	37.5	26.6
Standard dev. 0.05	-	7.2	2.5	1.3	1.1	5.7
Number of environments	-	6	6	6	6	6

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 23. Average grain yield (GY) and test weight (TW) GA20E48 and commonly grown SRWW cultivars included in the Official State Variety Trials (OVTs) across states in the SE region including Mississippi (MS) and Alabama in 2023-2024 crop season.

Entry	States									
	MS			AL				TX		
	GY North	GY Beaumont (South)	GY Delta	GY Central	GY North	GY South	GY State	GY	TW	Height
----- bu/ac -----			bu/ac	bu/ac	bu/ac	bu/ac	Bu/ac	lb/bu	Inch	
GA20E48	62.5	81.9	73.5	61	65	87	75	69.5	58.9	30.5
AGS4043 ¹	-	-	-	63	57	71	65	-	-	-
AGS2055	63.4	82.9	74.6	70	58	71	66	49.3	55.9	35.2
Jamestown	-	-	-	53	54	69	62	-	-	-
AGS3022	-	-	-	54	-	83	-	72.1	58.8	32.2
GoWheat6000	56.0	78.6	73.7	61	61	66	63	66.3	57.3	34.5
DeltaGrow1800	58.0	77.7	75.2	-	-	-	-	-	-	-
No. environments	4	1	2	3	2	3	8	2	2	2

¹Checks vary by state and by region within states

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Table 24. Average grain yield (GY) GA20E48 and commonly grown SRWW cultivars included in the Official State Variety Trials (OVTs) across states in the SE region including Louisiana (LA) and North Carolina (NC) in 2023-2024 crop season.

Entry	States							
	LA				NC			
	LA South GY ¹ bu/ac	LA South TW ¹ lb/bu	LA North GY ² bu/ac	LA north TW ² lb/ac	GY State	GY Beaufort	GY Perquimans	GY Person
GA20E48	83.7	54.4	72.1	57.3	91.2	123.9	108.3	81.9
AGS 2055	81.5	55.9	68.2	56.2	-	-	-	-
PIONEER 26R94	77.1	56.7	57.6	57.5	-	-	-	-
AGS 4023	75.7	56.8	69.2	58.3	90.0	109.7	103.8	82.9
AGS 4043	63.4	55.5	63.5	56.0	91.6	126.2	110.9	87.0
AGS 3022	81.5	57.0	75.3	57.5	-	-	-	-
AGS2024	-	-	-	-	88.0	112.0	112.0	82.1
LSD (0.05)	9.3	1.8	9.6	1.4	-	7.1	7.5	6.7
No. environments	3	3	2	2	7	1	1	1

¹Data from three locations: Baton Rouge, Crowley and Jeanerette LA

²Data from two locations: Alexandria and Winnsboro.

APPLICATION FOR RELEASE
 GA151313-LDH-192 -20E48

Table 25. GA GA20E48: General genetic information.

Entry	Pedigree	Markers
GA20E48	AGS 2024/PIO26R41//JT141	<i>Rht-B1a,Rht-D1b, Ppd-D1a_insens,vrn-A1,vrn-A1,vrn-A1,vrn-B1_short,vrn-D3b,vrn-A1,vrn-A1,vrn-B1,vrn-B1,vrn-B1,vrn-D1,ND,Fhb_1B_JT,Fhb_1A_Ne,Yr17/Lr37/Sr38,Lr18,n-1RS:1BL,n-1RS:1AL,H13,'Sbm1,n-Bx7OE,Ax2*2+12,soft,RR_rr_RR,</i>

APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48

Licensing companies interested in the UGA wheat 20th series lines

1- AGS

- 2024

From: Blake Shepard <blake@mixonseed.com>
Sent: Monday, June 10, 2024 3:18 PM
To: Mohamed Mergoum <mmergoum@uga.edu>; Jimmy Clements <jimmy@mixonseed.com>
Cc: Robert Etheridge <robert@mixonseed.com>
Subject: RE: Interest in UGA wheat lines

[EXTERNAL SENDER - PROCEED CAUTIOUSLY]

Mohamed,

Thanks for reaching out.

All the lines look good visually both in Plains and Union County NC.

Of these lines, 20E48 would hold the most interest for AGSouth Genetics.

- 2023

From: Jimmy Clements <jimmy@mixonseed.com>
Sent: Tuesday, June 20, 2023 9:20 AM
To: Mohamed Mergoum <mmergoum@uga.edu>
Cc: Blake Shepard <blake@mixonseed.com>; Robert Etheridge <robert@mixonseed.com>; Roger Boerma <roger.boerma@gfdc.com>; Jerry W Johnson <jjohnso@uga.edu>
Subject: Re: 2023 wheat potential releases.

[EXTERNAL SENDER - PROCEED CAUTIOUSLY]

DocuSign Envelope ID: BAC8C7AA-DC90-476F-A1FA-ECC9C74558BE

**APPLICATION FOR RELEASE
GA151313-LDH-192 -20E48**

Mohamed

AGS has interest in the line
20E48 and plans to bid on that line

Jimmy Clements
AGSouth genetics

Sent from my iPhone

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GA151313-LDH-192 -20E48

2- JoMAr Company

- 2024:

From: Bryan Gerard <bryan@jomarseeds.com>
Sent: Monday, June 10, 2024 1:08 PM
To: Brent W. Marable <marable@uga.edu>; Blake Fleeman (blake.fleeman@gsdc.com) <blake.fleeman@gsdc.com>; Mohamed Mergoum <mmergoum@uga.edu>
Subject: E48

[EXTERNAL SENDER - PROCEED CAUTIOUSLY]

Good day all,

We are going to make an aggressive bid for the E48. Any chance since it would have been released last year that the process could start earlier?

Bryan Gerard
President/ JoMar Seeds/ 765-655-3145

YOUR WHEAT SOURCE

- 2023

From: Bryan Gerard <bryan@jomarseeds.com>
Sent: Monday, June 26, 2023 10:25 AM
To: Mohamed Mergoum <mmergoum@uga.edu>
Subject: RE: 2023 UGA wheat potential releases

[EXTERNAL SENDER - PROCEED CAUTIOUSLY]

48 and 36 seem to be the ones we would have most interest in but still waiting on more data from this year

Bryan Gerard
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