

Summary

- Differences in hybrid response to water stress were detected in late (≥ 116 day), medium (110-115 day) and early (≤ 109 day) relative maturity groups.
- Monitoring root zone soil water status coupled with timely irrigation improved grain yield across maturity groups by 45 bu/acre compared to rainfed-free drain, and wet stress conditions, reinforcing that, in most years, irrigation and effective drainage are critical for achieving top yields in North Carolina.
- Hybrids that exhibit high yield and yield resilience have the characteristics most favorable for maximizing return per acre and profitability.

Introduction

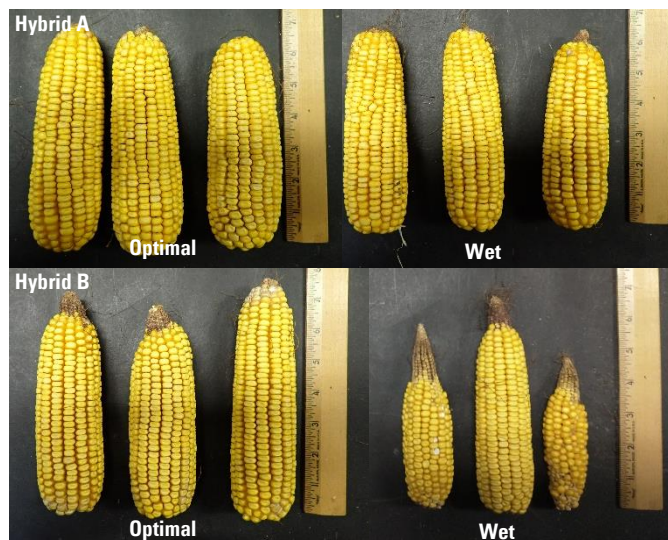
The goals of these performance trials were to:

- Evaluate elite, commercially available corn hybrids to water stress conditions during critical (V6+) development stages.
- Provide an objective guide for extension agents, producers, and advisors in selecting hybrids appropriate for their field situations.

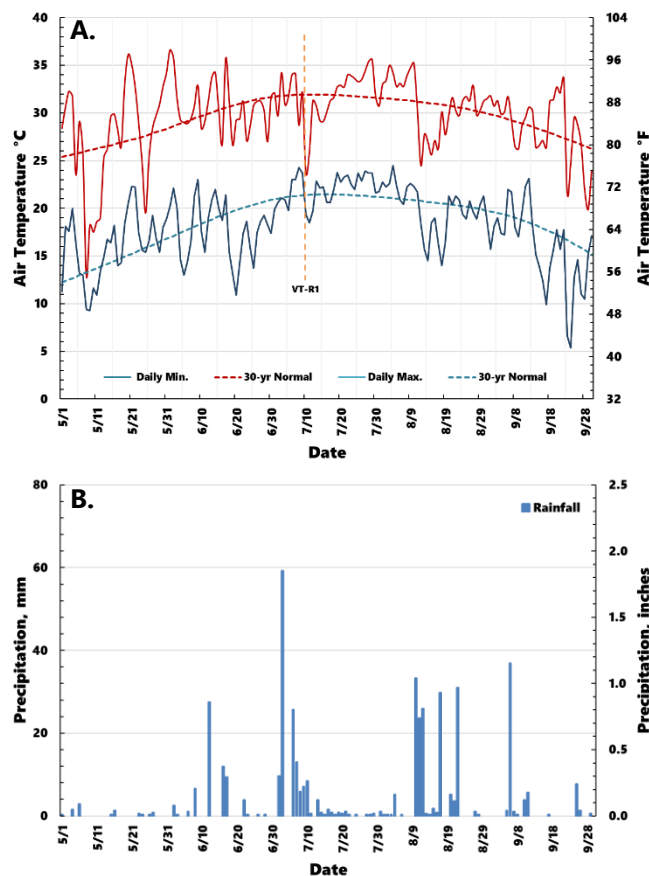
The trials, conducted at the Total Ag Water Management (TAWM) Site located at the Tidewater Research Station in Plymouth, NC, artificially impose water stress during the growing season under a uniform soil type and observed natural precipitation. Twenty hybrid entries from seven agribusiness partners were trialed in 2022. The hybrids were randomized and replicated four times in a two-level experimental design on a Portsmouth fine sandy loam soil. The target planting density was 34,000 plants/acre on 30-inch row spacing. The trials were planted on May 6 and harvested September 27. Yield data were analyzed as a mixed-effects model in SAS 9.4 Proc Glimmix. Mean separation was performed via least significant difference (LSD, $\alpha = 0.05$); the two top yielding ranges were selected.

Hybrids were evaluated under three soil-water treatment regimes. The soil-water regimes were defined as:

- **Rainfed-Free Drain:** intended to create drier than normal conditions typical of well-drained sites in NC. Drain tile spacing is 37.5' which is highly intensive for a Portsmouth fine sandy loam soil and intended to provide a much higher drainage intensity than needed for efficient crop production on this soil type. Soil water matric potential was governed entirely by natural rainfall and tile drains discharging at full capacity throughout the growing season.
- **Optimal:** intended to create ideal conditions representative of economically efficient water management systems. The tile spacing was set to 37.5' to prevent saturated soil conditions. Soil water matric potential was continuously monitored 8" and 20" deep in the root zone. Subsurface drip irrigation was utilized to apply water during dryer than normal periods.
- **Wet:** This treatment was intended to create wet stress conditions. Tile drainage spacing was 37.5' and was controlled to both reduce and/or stop drainage to artificially impose wet stress. This was coupled with subsurface drip irrigation to further impose wet stress. The drainage outlet was not allowed to free flow unless the groundwater was between 0' and 1.0' below the surface. Irrigation water was continually pumped into the drainage system if the water table fell below 1.0' along with daily subsurface drip irrigation to enhance wet stress conditions. This treatment would represent river bottoms, tidal controlled drainage areas, and small depressional areas. It would be typical of poorly drained and very poorly drained fields with little surface or subsurface drainage capacity.

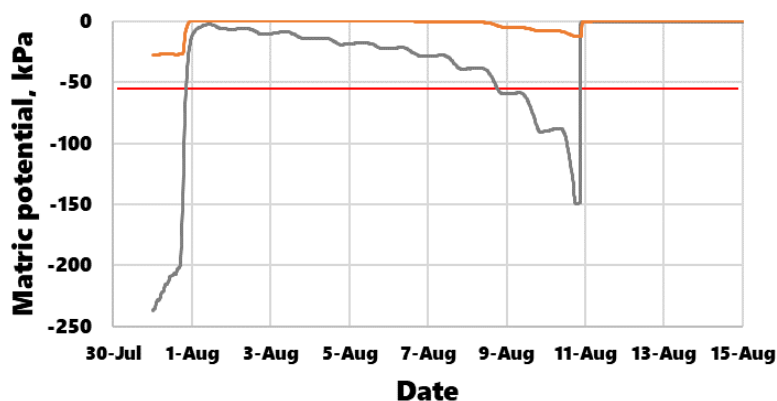


Yield resilience is the ability of a corn hybrid to maintain yield under less than ideal growing conditions. Which hybrid would you select for a wet field?

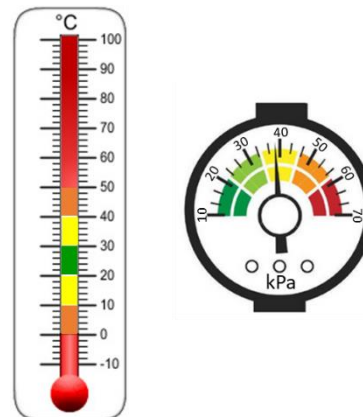


Weather information from May 1 to September 30, 2022, for Tidewater Research Station, Plymouth, NC. Panel A.: Daily maximum and minimum temperatures, and 30-yr Normals. Orange dotted line is VT-R1 occurrence. Panel B.: Daily precipitation.

Interpretive Guide and Indicators



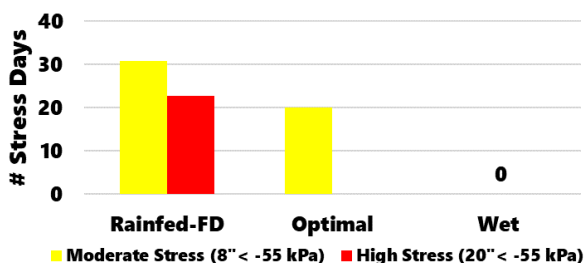
— Teros 21 Matric Potential 8" — Teros 21 Matric Potential 20"



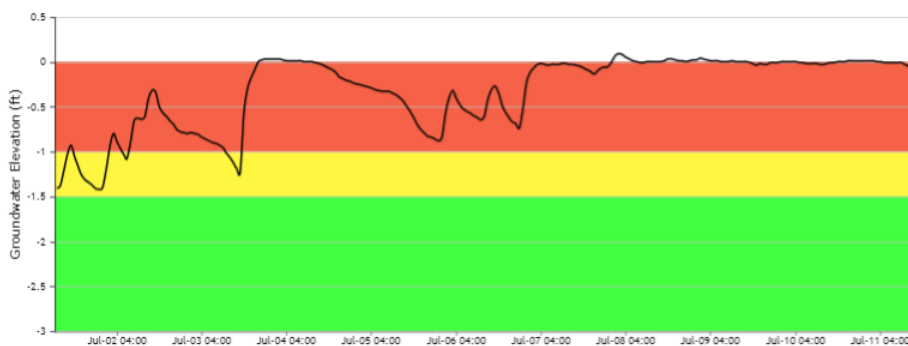
Above, thermometer measuring heat content with fill color indicating human comfort ranges. Right: dial gauge measuring water potential in kilopascals (kPa) with fill color indicating plant comfort ranges. Green=optimal Red= danger zone.

Dry stress levels in corn were determined by monitoring matric potential in real time 8" and 20" deep in the root zone at critical growth stages. Matric potential is a measure of the energy needed by plants to extract water in a porous medium like soil. Lower matric potential (more negative) causes plants to work harder to provide the water necessary for nutrient uptake, thermoregulation, and carbon assimilation. The red horizontal line in the chart above marks -55 kPa, the threshold for "moderate" stress 8" deep and high stress 20" deep in the root zone in a Portsmouth fine sandy loam soil.

Corn dry stress 2022 from V6 through black layer, top 20" of root zone

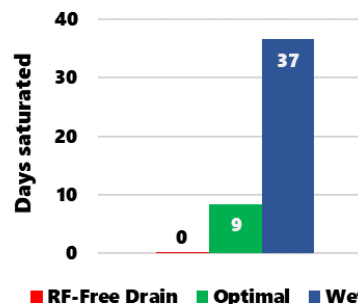


Dry stress July 1, 2022, RF Free Drain block



Ground water table depth trace showing depth of the water table beneath corn in the WET treatment. Zones are color coded according to the depth and relative crop stress level: Red=highest crop stress, <12" deep; Yellow=medium crop stress, 12-18" deep; and Green=no crop stress, >18" deep. Line above the ground surface on July 8-9 is ponded water.

Corn wet stress 2022 from V6 through black layer, top 12" of root zone

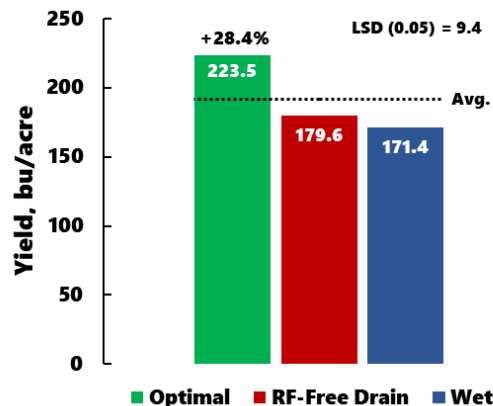


Key Performance Statistics for RM ≥ 116 Day Hybrids, Tidewater Research Station 2022

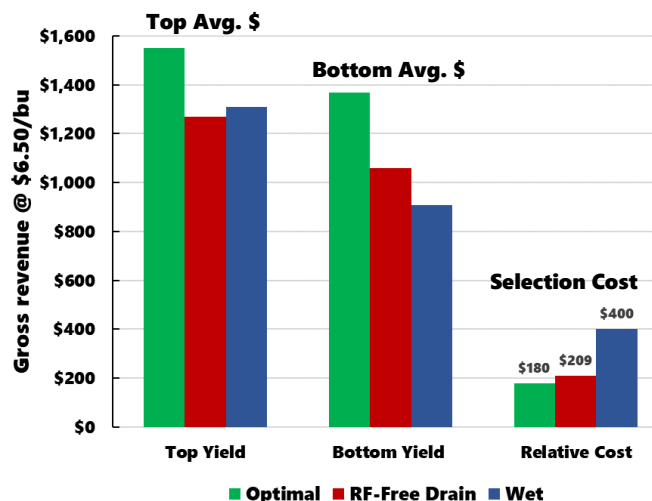
2022 Late Maturity Corn Hybrid Resilience Trial Information

Soil-Water Regime	Company	Entry	RM, Days	n	Mean* Yield, bu/acre	CV	
Optimal	Bayer	68-95SSX	118	4	238.3	1.1	
	Pioneer	P1870YHR	118	4	225.6	2.2	
	Dyna-Gro	D58VC65	118	4	224.8	3.2	
	AgriGold	A646-12VT2P	116	4	222.4	7.8	
	Pioneer	P1622VYHR	116	4	222.2	2.2	
	Bayer	68-69VT2P	118	4	220.7	3.5	
	Syngenta	NK1677-3110	116	4	210.6	4.1	
	<i>Mean</i>					223.5	
	<i>LSD, 0.05</i>					13.7	
	RF-Free Drain	Bayer	68-95SSX	118	4	195.1	6.0
Bayer		68-69VT2P	118	4	192.8	8.7	
Pioneer		P1870YHR	118	4	187.1	5.1	
AgriGold		A646-12VT2P	116	4	184.6	8.4	
Pioneer		P1622VYHR	116	4	170.6	7.7	
Syngenta		NK1677-3110	116	4	164.3	10.4	
Dyna-Gro		D58VC65	118	4	163.0	3.7	
<i>Mean</i>					179.6		
<i>LSD, 0.05</i>					19.1		
Wet		Bayer	68-95SSX	118	4	201.4	7.1
	Dyna-Gro	D58VC65	118	4	179.7	10.1	
	Syngenta	NK1677-3110	116	4	176.6	8.3	
	Pioneer	P1622VYHR	116	4	171.8	9.3	
	Pioneer	P1870YHR	118	4	166.4	6.5	
	AgriGold	A646-12VT2P	116	4	163.9	5.4	
	Bayer	68-69VT2P	118	4	139.8	6.4	
	<i>Mean</i>					171.4	
	<i>LSD, 0.05</i>					17.8	
	Overall	Bayer	68-95SSX	118	12	211.6	10.5
Pioneer		P1870YHR	118	12	193.1	13.9	
AgriGold		A646-12VT2P	116	12	190.3	14.9	
Dyna-Gro		D58VC65	118	12	189.1	15.4	
Pioneer		P1622VYHR	116	12	188.2	14.6	
Bayer		68-69VT2P	118	12	184.4	19.9	
Syngenta		NK1677-3110	116	12	183.8	13.1	
<i>Mean</i>					191.5		
<i>LSD, 0.05</i>					9.4		

*Means with the same color band are not different at the LSD α=0.05 test level.



Optimal root zone moisture achieved by real-time soil water monitoring and timely irrigation returned 49.5 bu/acre (+28.4%) more grain across late maturity (≥116 day) hybrids averaged over RF-Free Drain and Wet treatments. LSD=Least significant difference, 9.4 bu/acre.

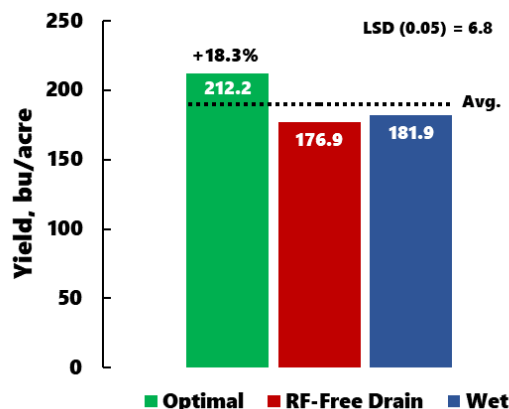


Gross revenue and relative cost comparison of late maturity (≥116 day) hybrid selection under three soil water treatment exposures, based on the 2022 Tidewater trials. Top Yield is the gross revenue generated by the highest average yielding hybrid in each management category; Bottom Yield is the gross revenue generated by the lowest average yielding hybrid. Relative cost is Top Yield – Bottom Yield for each category representing the cost of hybrid selection in different environments.

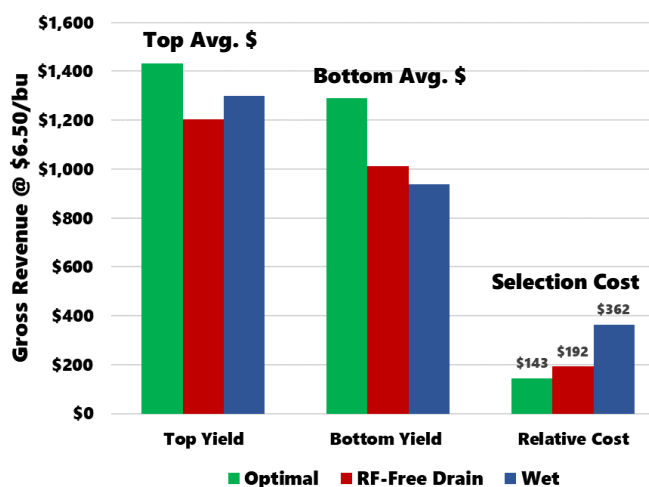
Key Performance Statistics for RM 110-115 Day Hybrids, Tidewater Research Station 2022 con't.

2022 Medium Maturity Corn Hybrid Resilience Trial Information

Soil-Water Regime	Company	Entry	RM, Days	n	Yield [†] , bu/acre	CV	
Optimal	Pioneer	P1222YHR	112	4	220.4	4.7	
	Local Seed	1513C	115	4	220.0	1.9	
	Pioneer	P1289YHR	112	4	219.4	3.5	
	AgriGold	A645-16VT2P	115	4	218.6	3.8	
	Local Seed	1307C	113	4	208.6	1.8	
	AgVenture	AV7913AM	113	4	207.2	4.8	
	Syngenta	NK1082-5222A	110	4	205.1	2.2	
	Bayer	62-70VT2P	112	4	198.4	2.6	
	<i>Average</i>					212.2	
	<i>LSD, 0.05</i>					10.6	
RF-Free Drain	Pioneer	P1289YHR	112	4	185.2	5.1	
	AgriGold	A645-16VT2P	115	4	183.9	1.5	
	Syngenta	NK1082-5222A	110	4	183.3	6.2	
	AgVenture	AV7913AM	113	4	177.6	3.6	
	Pioneer	P1222YHR	112	4	176.5	4.0	
	Local Seed	1513C	115	4	167.7	2.6	
	Local Seed	1307C	113	4	164.0	1.0	
	Bayer	62-70VT2P	112	4	155.7	2.3	
	<i>Average</i>					176.9	
	<i>LSD, 0.05</i>					9.0	
Wet	Local Seed	1307C	113	4	200.0	4.3	
	Pioneer	P1289YHR	112	4	197.4	4.9	
	Local Seed	1513C	115	4	196.0	6.0	
	AgVenture	AV7913AM	113	4	182.3	8.9	
	Pioneer	P1222YHR	112	4	181.2	5.3	
	Bayer	62-70VT2P	112	4	179.5	8.0	
	Syngenta	NK1082-5222A	110	4	174.3	5.6	
	AgriGold	A645-16VT2P	115	4	144.3	6.9	
	<i>Average</i>					181.9	
	<i>LSD, 0.05</i>					15.0	
Overall	Pioneer	P1289YHR	112	12	200.7	8.4	
	Local Seed	1513C	115	12	194.5	12.0	
	Pioneer	P1222YHR	112	12	192.7	11.5	
	Local Seed	1307C	113	12	190.8	10.9	
	AgVenture	AV7913AM	113	12	189.0	9.1	
	Syngenta	NK1082-5222A	110	12	187.6	8.4	
	AgriGold	A645-16VT2P	115	12	182.2	17.8	
	Bayer	62-70VT2P	112	12	177.9	11.2	
	<i>Average</i>					189.4	
	<i>LSD, 0.05</i>					6.6	



Providing optimal root zone water at critical growth stages (V6+) returned 32.8 bu/acre (+18.3%) more grain across medium maturity (110-115 day) hybrids averaged over RF-Free Drain and Wet treatments. LSD=Least significant difference, 6.8 bu/acre.



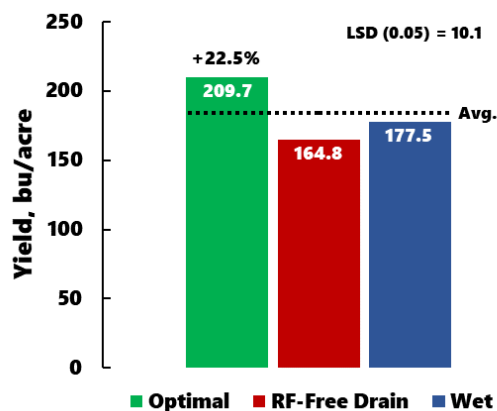
Gross revenue and relative cost comparison of medium maturity (110-115 day) hybrid selection under three soil water treatment exposures, based on the 2022 Tidewater trials. Top Yield is the gross revenue generated by the highest average yielding hybrid in each management category; Bottom Yield is the gross revenue generated by the lowest average yielding hybrid. Relative cost is Top Yield – Bottom Yield for each category representing the cost of hybrid selection in different environments.

[†]Means with the same color band are not different at the LSD $\alpha=0.05$ test level.

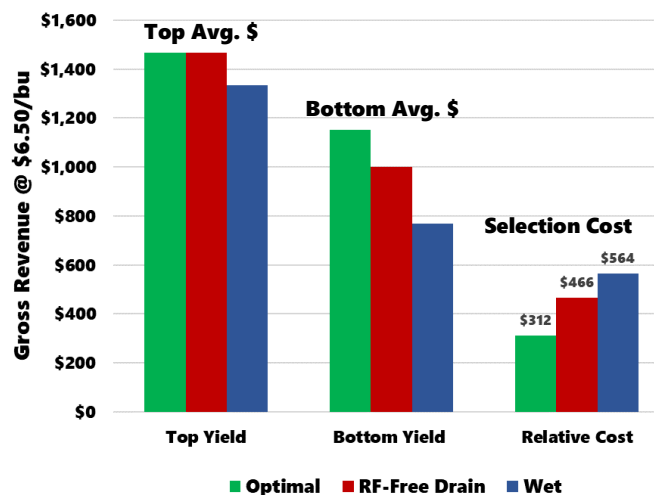
Key Performance Statistics for ≤109 Day Hybrids, Tidewater Research Station 2022 con't.

2022 Early Maturity Corn Hybrid Resilience Trial Information						
Soil-Water Regime	Company	Entry	RM, Days	n	Mean* Yield, bu/acre	CV
Optimal	Pioneer	P0953YHR	109	4	225.5	2.7
	AgVenture	AV2606AM	106	4	219.9	3.5
	Bayer	59-82VT2P	109	4	213.4	2.8
	Pioneer	P0935YHR	109	4	212.1	1.3
	AgVenture	AV5508AM	108	4	177.4	2.3
						Average
					LSD, 0.05	8.5
RF-Free Drain	Pioneer	P0953YHR	109	4	180.8	6.0
	Bayer	59-82VT2P	109	4	170.4	4.9
	AgVenture	AV2606AM	106	4	164.6	9.5
	AgVenture	AV5508AM	108	4	154.2	5.4
	Pioneer	P0935YHR	109	4	153.8	1.4
						Average
					LSD, 0.05	16.7
Wet	Pioneer	P0953YHR	109	4	205.1	6.2
	AgVenture	AV2606AM	106	4	192.8	2.3
	Bayer	59-82VT2P	109	4	189.1	5.6
	Pioneer	P0935YHR	109	4	182.41	4.8
	AgVenture	AV5508AM	108	4	118.3	10.6
						Average
					LSD, 0.05	11.2
Overall	Pioneer	P0953YHR	109	12	203.8	10.4
	AgVenture	AV2606AM	106	12	192.4	13.2
	Bayer	59-82VT2P	109	12	191.0	10.4
	Pioneer	P0935YHR	109	12	182.8	13.9
	AgVenture	AV5508AM	108	12	150.0	17.8
						Average
					LSD, 0.05	6.8

*Means with the same color band are not different at the LSD α=0.05 test level.



Early maturity (≤109 day) hybrids returned 38.5 bu/acre (+22.5%) more grain under optimal root zone water management compared to RF-Free Drain and Wet treatments. LSD=Least significant difference, 10.1 bu/acre.



Gross revenue and relative cost comparison of early maturity (≤109 day) hybrid selection under three soil water treatment exposures, based on the 2022 Tidewater trials. Top Yield is the gross revenue generated by the highest average yielding hybrid in each management category; Bottom Yield is the gross revenue generated by the lowest average yielding hybrid. Relative cost is Top Yield – Bottom Yield for each category representing the cost of hybrid selection in different environments.

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Revision Notes

Rev.31Jan2023: The mean values for WET and OVERALL yield categories in the medium season table on page 4 of this document were originally misreported as 187.2 bu/acre and 191.1 bu/acre. The correct values are 181.9 bu/acre and 189.4 bu/acre. The bar labels in the adjacent yield plot copied these errors and have been corrected. The difference in return is +18.3%, not 19.2% as originally reported. We apologize for any confusion this may have caused.

