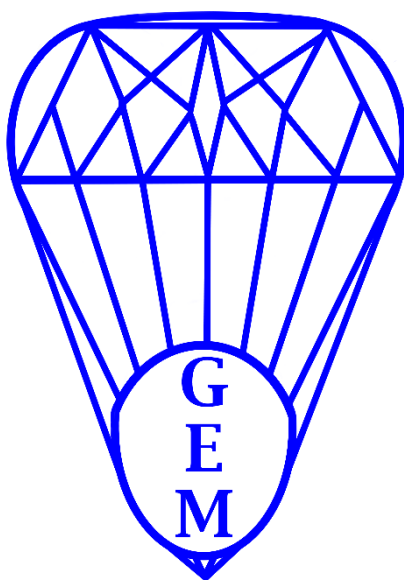


United States Department of Agriculture

Agricultural Research Service



Germplasm Enhancement of Maize

2021 GEM Cooperator Handout

December 16th 2021

The information in this report is shared cooperatively.

The data are not published, but are presented with the understanding that they will not be used in publications without specific consent of the public cooperator.

GEM Mission:

The mission of the GEM (Germplasm Enhancement of Maize) Project is to effectively increase the diversity of U.S. maize germplasm utilized by producers, global end-users and consumers. The mission will be achieved through a collaborative effort between USDA-ARS, and both public and private research scientists by utilizing exotic, public, and proprietary maize germplasm. The resulting germplasm and associated knowledge, derived via the identification and incorporation of favorable alleles for prioritized traits from exotic sources, is utilized in private and public breeding programs and ultimately contributes to increased genetic diversity of maize grown by producers and improved product performance. In addition, the GEM Project provides opportunities for training plant scientists in the enhancement and utilization of unadapted germplasm. This contributes to the global sustainability of agricultural production, economic stability, and the nutrition and well-being of society.

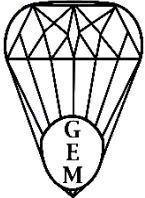
2021 GEM Cooperator Meeting Booklet

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GEM WEBSITE

<https://www.ars.usda.gov/midwest-area/ames/plant-introduction-research/home/germplasm-enhancement-of-maize/>

 Germplasm Enhancement of Maize	Cooperator Meeting: DATE: Thursday, December 16, 2021 HOURL: 9:00 am CST Zoom: https://www.zoomgov.com/j/1619807412?pwd=a3dsdkV1VThuQTUxbHpZWtdidnN5UT09
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Meeting called by: W. Trevisan, Chair		Note taker:
Agenda Topics		
Minutes of December 17, 2020	D. Peters	9:00 – 9:05
New Releases & Project Updates	M. Krakowsky, A. Vanous	9:05 – 9:30
Male Sterility Allele Screening Update	M. Krakowsky, A. Vanous	9:30 – 9:40
Germplasm Distribution Update	A. Vanous	9:40 – 9:45
GEM Website Update	A. Vanous	9:45 – 9:55
Germplasm Sampling Expansion	D. Peters	10:00 – 10:15
GEM Top 10 Project Results	J. Edwards	10:15 – 10:40
Adjourn		~10:40

GEM Cooperator Virtual Meeting - December 17, 2020

Zoom Host – David Peters, GEM Coordinator, Ames

Walter Trevisan, TSG Chairman

1. Walter Trevisan called the meeting to order at 9:00 am CST. Minutes for the December 11, 2019, meeting were presented for approval. Walter Trevisan moved to accept the minutes. Wenwei Xu seconded the motion. Cooperators voted to accept the minutes as presented.

2. New Releases & Project Updates

- Raleigh

Raleigh is releasing 2 new lines for 2021 (GEMS-0320 and GEMS-0321). Both lines are derived from CIMMYT La Posta Sequia germplasm and are 50% tropical. Data for lines was reviewed in presentation and is available in Cooperator books.

Raleigh thanked Cooperators for helping to secure additional funding for Raleigh Project. Matt briefly covered where the money will be invested in the project and how this will strengthen the GEM mission. Despite additional funding, pandemic restrictions necessitated reduced nursery effort and impact to yield trial program. Winter nursery has expanded to sites in McAllen, Texas and Puerto Vallarta, Mexico. Previous winter nursery in Florida was not longer possible under the pandemic travel restrictions. Summary of materials in yield testing program was presented and can be viewed in the annual report. Allelic diversity effort is winding down and only a limited number of crosses remain to be made. Breeding cross observation activities were scaled back to 150 entries in summer of 2020.

- Ames

Ames is not releasing any lines for 2021. Damage to Ames nursery and yield trials along with loss of Cooperator yield trials associated with derecho in August resulted in limited and questionable data to make coding decisions. Best lines from 2020 testing will be retested in 2021.

Dr. Adam Vanous was welcomed to the Ames staff in 2020 as a Cat 3 Support Scientist. Summary of breeding program was presented and can be reviewed in Cooperator book distributed as printable file to Cooperators. Isolated crossing program was outlined and thanks to Cooperator in-kind support noted. Pandemic restrictions limited breeding cross observation and hand pollinated segregating nursery size. Student labor during summer of 2020 was very limited. Disease and insect resistance testing program with Cooperators was well supported in 2020 and remains strong. Summary was presented and can be reviewed in annual report. Yield trial program was maintained at normal level but derecho damage resulted in loss of 100 reps. Entire Keystone and Carroll sites were lost, along with over 70% of home location.

3. CIMMYT Update – Terry Molnar

Update on the maize breeding effort in CIMMYT was presented. Multiple achievements were highlighted including release of germplasm with MCMV and MLN tolerant germplasm for use in Africa. Several “B pool” (NSS) lines are being released including 4 for Tar Spot resistance (tropical germplasm sources from Mexico and Guatemala) and 5 for drought tolerance (subtropical germplasm sources from Argentina and Mexico). Released line CML576 is the best

source for Tar Spot resistance. All lines released by CIMMYT require agreement to SMTA before use.

Efforts to develop lines from land race materials using genomic selection have proven not workable. Terry commented that you are looking for unknown alleles and not known alleles. This changes the entire situation.

4. Male Sterility Allele Screening Update – Matt Krakowsky

Matt presented status of screening GEM released lines for presence of Ga-1 allele that would allow crossing to popcorn. Available data from a graduate student thesis conducted at Raleigh. Plan to screen GEM lines in 2021 noted.

5. Allelic Diversity Update – Dave Peters

Update provided on the land races and number of lines projected for release in 2021, 2022, and 2023. Line release timelines dependent on labor availability and pandemic restrictions in 2021 and 2022 growing seasons.

6. Germplasm Donation Update/Germplasm Sampling – Dave Peters

- Bayer Donation

Brief presentation given on germplasm donation from Bayer Crop Science. Summary of land races involved, and country of origin was presented. Plans for germplasm evaluation and utilization briefly reviewed.

- Novasem Germplasm Donation

Brief presentation on breeding crosses made by Mexican Cooperator Novasem. Crosses of GEM lines to company elite lines derived from Tuspeno and ETO germplasm were made in Puerto Vallarta. Material will be provided back to GEM for use in breeding program in early 2021.

7. GEM Website Update – Dave Peters

Status of GEM website was reviewed. Hosting site for new website was noted and organizational plan for new website was briefly reviewed. Objective of having basic functions restored by mid-2021 was noted.

8. GEM Top 10 Project Results – Jode Edwards & David Peters

Review of Top 10 project was done before data summary was presented. Jode Edwards presented the most recent updates on the data and how the GEM lines combined with current elite germplasm from Corteva, Bayer, Dow, AgReliant, and Syngenta. The new Top Lines project protocols were then reviewed to update all Cooperators on the new system to evaluate 30 GEM lines across elite lines from 6 Cooperators every year will work.

9. Recognition of Candy Gardner Service to GEM

Special thanks given to recognize Dr. Candy Gardner's contributions to the GEM Project over her 21+ years with ARS. Participating Cooperators were given a chance to thank Candy. Multiple individuals took the opportunity to wish her well as she retires from ARS.

10. Meeting Adjourned – 11:00 am CST

Annual Reports

2021 Annual Report of the GEM Project, Ames, IA and Raleigh, NC

PERSONNEL:

Ames: **USDA-ARS-PIRU**

Midwest Dr. Adam Vanous
GEM Support Scientist (Vacant)
Dr. Mack Shen, IT Specialist
GEM Technician (Vacant)
GEM Technician (Vacant)

Dr. David Peters, Research Leader

Raleigh: **USDA-ARS-PSRU**

Dr. Matt Krakowsky, Southeast GEM Coordinator
Dr. Peter Balint-Kurti, Research Geneticist
Dr. Jim Holland, Maize Research Geneticist
Mark McLaughlin, GEM Technician

Dr. David Marshall, Research Leader

Raleigh: **North Carolina State University**

Dr. Major Goodman, William Neal
Reynolds Distinguished Professor

GEM - Ames Highlights

Germplasm releases and development:

- Three hundred and twenty-five (325) GEM line releases are now available to GEM Cooperators. A total of 342 lines have been released, including 17 from our university collaborators.
- The Ames program will be releasing four new GEM lines for the 2022 planting year. Yield data for the 2022 releases can be found in ‘GEM Releases’ section of this handout (p.13).
- GEMS-0322: KO679Y, a tropical inbred from South Africa, and GEMS-0030, derived from a tropical hybrid from Brazil, are represented.
- GEMS-0323: Derived from a three-way cross of GEMS-0147, GEMS-0219, and GEMS-0227. These three GEM lines are composed of a tropical hybrid from Thailand, a mixed (Creole) Cuban population and a Florida Synthetic, and a tropical inbred from Thailand, respectively.
- GEMS-0324: Ki14, a tropical inbred from Thailand, and GEMS-0227, derived from a tropical inbred from Thailand, are represented.
- GEMN-0325: MP494, a Mississippi inbred, and GEMN-0130, derived from a tropical hybrid from Brazil, are represented.
- Summary Tables of test cross data are presented in the section of this book labeled ‘Released Lines.’

Table 1. 2020 GEM-Ames Germplasm Releases

GEM Code	Pedigree	Race	Country	Type	Het. Group
GEMS-0322	KO679Y/GEMS-0030//794-015-001-001-B	Trop Inbred / Trop Hybrid	South Africa / Brazil	38% Exotic	SS
GEMS-0323	GEMS-0219//GEMS-0147/GEMS-0227-SIB-B-122-001-B	Mixed (Creole) / Trop Inbred / Trop Hybrid	Cuba / Thailand / Brazil	28% Exotic	SS
GEMS-0324	GEMS-0227/Ki14//41-002-001-001-B	Trop Inbred / Trop Hybrid	Thailand / Brazil	31% Exotic	SS
GEMS-0325	PHN46//GEMN-0130/MP494///41-002-001-001-B	MS Inbred / Trop Hybrid	USA / Brazil	19% Exotic	NSS

Breeding Nursery and Isolated Crossing:

- Nine new breeding cross populations were sent to six Cooperators for in-kind support.
- Twenty-seven families of S1 ears were advanced to S2 in Ames. These S2s will be topcrossed in isolated blocks in 2022.
- Twenty S1 bulked families were advanced to S2 in Ames. These S2s will be advanced to S3 in 2022.
- Five families of S1 ears were advanced to S2 by Cooperators. The S2 ears will be topcrossed in 2022 within each Cooperator's program and moved to first year testing in 2023.
- Pandemic related work, travel, and labor availability restrictions necessitated the cancelation of shade structure crossing and reduction of nursery size. Lack of labor availability resulted in limited collection of plant and ear height data. Collection of ear characteristics were not possible.
- Winter nursery (returned Spring 2021) returns from Puerto Vallarta, Jalisco, Mexico were adequate. Breeding cross development to make new 25% tropical populations was successful with ample seed quantities returned. Hand pollination nurseries supporting line advancement, breeding cross development, and line increase have been sent to Puerto Vallarta and Hawaii for return Spring 2022.

Nursery and isolation row summary:

- 6,761 nursery rows were pollinated
 - 3,887 selection rows
 - 2,396 various types of increase rows
 - 308 crossing block rows
 - 200 development crossing rows
- 936 observation rows
- 2,200 isolation rows were contract grown with GroAlliance
- 200 isolation rows were contributed by Farmers Business Network
- 100 isolation rows were contributed by Master's Choice / Maximum Production Genetics
- 2,312 isolation rows were contributed by Peterson Corn Genetics
- Not included in the count are the numerous nursery rows grown by Cooperators for in-kind support to generate breeding crosses, S1 families, etc.

Genomic Prediction Project:

- A collaborative project with Bayer Crop Science was initiated to explore use of genomic prediction in GEM breeding program. Bayer has committed to run 100 high-density parental samples and 2,500 low-density genotyping samples, annually.
- Ames program sent 33 parental lines for high-density genotyping and 2,082 S2 samples for low-density genotyping.

Breeding Cross Observation:

- One hundred breeding crosses were observed and evaluated for breeding potential in Ames, Iowa, Capron, Illinois (Longping NA), and Ft. Branch, Indiana (AgReliant Genetics, LLC). Results for this multi-site observation set are presented in Table 18 of the 'Breeding Cross Observation' section of this book.
- An additional 219 breeding crosses were evaluated for breeding potential in Ames, Iowa. Results for this set can also be found in the 'Breeding Cross Observation' section. Data from this set is presented in Table 19.

Host Plant Resistance:

- Pathology and entomology research collaborators from the U.S. private and public sectors screened GEM releases for Northern Leaf Blight (NLB), Southern Leaf Blight (SLB), Gray Leaf Spot (GLS), Goss's Bacterial Wilt (GW), Fusarium ear rot (FUSERS), Aspergillus (aflatoxin and other mycotoxins), Tar Spot, Eyespot, and Armyworm feeding. Disease evaluation trials are summarized in Table 2.
- International collaborators evaluated GEM releases for Late Wilt, Maize Stunt, Tar Spot, agronomic traits, and ear rots.
- 2021 disease data can be requested by emailing nuo.shed@usda.gov.

Appreciation is extended for all in-kind support and extensive efforts by private and public GEM Cooperators:

- Corteva provided Fusarium ear rot data and head smut data (Jonathan Flora) from their Woodland, California site. Northern leaf blight disease data (Rick Blum) was provided from their central Iowa site.
- Bayer Crop Science provided Goss's Bacterial Wilt screening data from Nebraska. Trials were also conducted for Tar Spot in northern Illinois; however, infection levels were too low to provide meaningful data collection.
- University of Florida provided Armyworm feeding data.
- Professional Seed Research (Jim Dodd) provided data for Eyespot; however, infections from Tar Spot did not allow for Eyespot data collection.
- USDA-ARS-PSRU in Raleigh, NC planned trials for GLS (Peter Balint-Kurti), SLB (Peter Balint-Kurti), and Fusarium ear rot (Jim Holland).
- USDA-ARS-CHPRRU, Mississippi State University, MS (Paul Williams and Gary Windham) provided evaluation data for aflatoxin content in grain.
- Wyffels Hybrids (Chris Eichhorn) screened GEM lines for Goss's Bacterial Wilt screening. Disease development was minimal, leading to a tighter spread in the rating scale.

Table 2. 2020 Disease Observation Summary - Domestic

Cooperator	Location	Disease	Plots
Bayer	Nebraska	Goss's Bacterial Wilt	500
	Illinois	Tar Spot	300
Corteva	Iowa	Northern Leaf Blight	500
	California	Fusarium Ear Rot	500
	California	Head Smut	500
PSR	Illinois	Eyespot	100
USDA-ARS	North Carolina	Gray Leaf Spot	360
	North Carolina	Southern Leaf Blight	360
	North Carolina	Fusarium Ear Rot/Fumonisin	50
	Mississippi	Aflatoxin	45
Wyffels	Illinois	Goss's Bacterial Wilt	150

Ames 2020 Yield Trials:

- Cooperator in-kind trial support contributions are detailed in Tables 3 and 4.
- Approximately 17,570 plots (2,625 entries) were managed or coordinated through Ames in 2021.
- Of the core development program, 3,096 plots were devoted to 2nd year trials and 8,640 were in 1st year trials.
- Yield trials were planted in late April or early May. All sites suffered from dry conditions post planting. The Williams and Ames sites were damaged from wind events; however, data from these sites were still useful.
- Stand count data was collected in collaboration with Iowa Crop Improvement Association using their drone data collection system. The drone system provided accurate stand counts at a much lower cost than traditional student labor methods.
- The five standard checks in this year's trials included:
MBS3628/MBS9530 MBS3520/MBS8731
Pioneer P0987 Pioneer P1151 Pioneer P1498.

Table 3. Ames and Cooperator Yield Trial Resource Summary

Trial Type	# Entries	# Plots GEM-Ames	# Plots Private Coops	Total Plots
1st Year Trials	1,440	8,640	0	8,640
2nd Year Trials	516	3,096	2,064	5,160
Released Line Trials	108	648	540	1,188
Collaborator Trials	561	2,582	0	2,582
Totals	2,625	14,966	2,604	17,570

Quality Traits (including grain mold/mycotoxin):

- Aflatoxin accumulation screening focused on GEM-Ames lines released since 2016. Aflatoxin levels for GEMS-0032 were low (26 ng/g) as documented in previous years. Four GEM-Ames lines (GEMS-0050, GEMN-0096, GEMS-0280, and GEMS303) and two GEM-Raleigh lines (GEMS-0293 and GEMS-0310) showed aflatoxin accumulation levels below 300 ng/g, as compared to PHN46/PHW79 with 794 ng/g and T173/Va35 with 469 ng/g.

New GEM Cooperators in 2021:

One new public U.S. Cooperator joined the GEM Project in 2021; Central State University, Wilberforce, Ohio was accepted in September 2021 (Mark Campbell).

Table 4. Private In-Kind Support - Summer 2021

Collaborator	Breeding & Nursery Support	Breeding Cross Obs	Made Top Crosses	Yield Trials	Disease & Insect Screening	GEM Top Lines Project
Ag Reliant Genetics, LLC		X		X		X
Bayer Crop Science	X		X	X	X	X
Becks Superior Hybrids				X		X
Corteva			X	X	X	X
CRD			X	X		
DKD Genetics	X			X		
Force Genetics	X					
GEM-Raleigh		X		X		
KMR				X		
Longping NA	X	X		X		
Masters Choice	X			X		
MDS				X		
Peterson Genetics			X			
Professional Seed Research					X	
Renk Seed Company	X					
Syngenta			X	X		X
Terrell Seed Research	X	X				
Trimble Genetics					X	
University of Florida					X	
USDA-ARS (Balint-Kurti)					X	
USDA-ARS (Holland)					X	
USDA-ARS (Williams)					X	
Wyffels Hybrids				X	X	X

Ames, Iowa GEM Project 2021 Field Day: The Ames field day plan was canceled due to pandemic related restrictions.

Germplasm Donation:

- Bayer Crop Science initiated a germplasm project in 2016 to adapt several land races to the central Corn-Belt. Representative accessions (1 to 5 per land race) were selected and crossed to a current elite 105-day SS and 105-day NSS inbred line. Crosses were made within each land race and lines selected for flowering in central Iowa. Lines were recombined and selected through the 2019 growing season for adaptation to central Iowa.
- Single ears representing 50%, 63%, and 75% land race origin were selected on ear type phenotype and genotypically evaluated to insure identity and land race content. A total of 1,990 ears representing 31 land races were donated to GEM with unrestricted release for line development and genetic research. Twenty-one of these land races had not been used in the GEM project breeding program. The remaining 10 land races involved accessions not previously used in GEM.

- Races selected for first round increase were suggested by W. Trevisan and W. Salhuana.
- Table 5 lists the landraces and the percentages of the tropical donor for the lines increased in summer 2021.

Table 5. Germplasm Donation Increase Summary		
RACE	% Tropical	Country(s)
AMAGACENO	62.5, 75	Colombia
ANCASHINO	50, 62.5, 75	Peru
CAMELIA	75	Chile
CHANDELLE	50, 62.5	Cuba, Domitian Republic
COSTENO	50, 62.5	Colombia
MONTANA	50, 62.5	Colombia
MOROCHO	50, 62.5, 75	Peru
PUYA	50, 62.5	Colombia
SABANERO	50, 62.5, 75	Colombia
TEPECINTLE	50, 62.5, 75	Guatemala, Mexico
VANDENO	50, 62.5, 75	Domitian Republic

GEM Top Lines Project:

- The purpose of the project is to annually test 30 lines released by the Ames and Raleigh programs on an array of current elite seed industry testers to calculate GCA and SCA estimates. The information would be useful for assessing potential value of the lines for recycling in different breeding programs and other purposes and inform on best heterotic combinations. Selected lines will be tested for two years by the following GEM Cooperators: AgReliant Genetics, Bayer Crop Science, Becks Hybrids, Corteva, Syngenta, and Wyffels.
- Thirty lines were selected for the trial based on yield trial performance across testers. Six lines (3 SS, 3 NSS) were selected based on best performance in the Top 48 trial that concluded in 2017. Remaining lines were selected on phenotypic evaluation and yield trial performance and were released since 2015.
- Lines were distributed to six private sector TSG members for inclusion in 2020 summer crossing nurseries and isolated crossing. The lines were crossed to current two elite testers from each program; however, due to the derecho, 2020 crossing nurseries and isolated crossing were lost, resulting in a one year delay.
- Yield trials planted in 2021 were a subset of the full trial set and trials will be rerun in 2022. The target goal of 8 to 10 locations with 1 replication per location including sites inside and outside of the Corn-Belt. Data generated will be returned to the Ames GEM Coordinator for full analysis. The combined data will be available to all GEM Cooperators through the GEM website.
- Yield trials using these 30 GEM lines and testers will be conducted for 2 years. After completion of the cycle, a new set of 30 GEM lines will be identified and be part of the next Top Lines testing round (2024/2025 growing seasons).

Ga1 Screening

- Fifty-four GEM releases from Ames were tested for the presence of Ga1-s

Table 6. Ames releases testing positive for Ga1-s

Line	Seed Set Ears	Pollinations	Background	
GEMS-0201	3	3	BR105	Suwan
GEMN-0225 (Check)	7	8	BR105	Suwan
GEMS-0248	2	8	AR16042	Cristalino Colorado
GEMS-0264	3	6	BR105	Suwan
GEMS-0268	5	10	NS1	Suwan
GEMN-0286	1	1	MDI022	Cuban Yellow
GEMS-0307	4	9	CML373	
GEMS-0308	7	10	CML373	

Ames GEM Program 2022 Goals:

The Ames GEM Program has identified several areas for changes planned for 2021 and beyond.

Nursery:

- Efforts to generate new breeding cross populations of 50% and 25% exotic content will be included as an annual focus of the program. The breeding cross observation system will be focused to evaluate 120 - 200 25% and 100 – 150 50% exotic populations each year at three sites.
- Continue to increase and phenotypically evaluate germplasm donated by Bayer. Develop strategy for use of this resource in consultation with experience germplasm introgression breeders.

Isolated Crossing:

- Expand and stabilize isolated crossing capacity through external contract and available in-kind support capacity.

Disease Evaluations:

- International disease evaluation capacity will be expanded for diseases not yet in the US (and for endemic diseases with unique pathogen races) within our Cooperator network, and Cooperators will be sought that can contribute to this capacity. Specific diseases of interest include Gray Leaf Spot in South Africa, Maize Stunt Virus in Brazil, and Tar Spot in Mexico.

Personnel:

- Fill vacant positions within the program.

GEM Website:

- Continue to look for solutions to update the GEM website for appearance and user interface.

2021 Annual Report of the GEM Project

GEM-Raleigh Highlights

Germplasm releases:

- There will be no new releases from the Raleigh project for 2022. We are transitioning to new testers in Raleigh, and this, combined with the restricted nurseries for the past few years, has led to a decline in the number of entries in the 2nd year yield trials. None of the entries in the 2021 second year trials met the criteria for release.

GEM-Raleigh Budget Increase:

- I would like to again thank the GEM Cooperators, the GEM TSG, and particularly the GEM members who have made great efforts each spring to travel to the Capitol to talk to congressional staff members about the valuable work performed by the GEM project. Your efforts culminated in a significant budget increase for the project in FY20 and forward, which was especially needed for the Raleigh location. Our budget increased by over 200% from FY19 to FY20 and we have been using the new funds to replace antiquated equipment, upgrade to new systems, and eventually we hope to add support personnel. Our recent acquisitions include:
 - Two additional small batch seed treaters, which have been particularly useful for preparing seed for shipment to winter nursery, given the short turn-around.
 - Two new vehicles to replace aging (and mechanically suspect) project vehicles (received May 2021)
 - A new research plot combine that should arrive in April 2022.

We have also funded agreements with NCSU to support our research and new graduate students on the project, and we have greatly expanded our winter nursery operations. We are currently in the market for a new truck and trailer to haul the planter/tractor combination and the combine. We also need to construct a machine shed to store our equipment at the Clayton, NC location.

Germplasm development:

- Due to the COVID-19 pandemic and the lack of available summer help our nursery was reduced again for the 2021 growing season, though it was larger than the 2020 nursery. Approximately 1200 GEM nursery plots were grown in Clayton, NC, while isolation plots were planted in collaboration with Peterson Genetics (230 plots across four testers) and under contract with GroAlliance (360 plots with MBS3640GT).
- No winter nursery was planted in Homestead, FL again this year due to travel restrictions, but 900 nursery plots were sent to winter nursery with Moreno-Retis in Puerto Vallarta, Mexico. These nursery plots include some GEM germplasm for advancement from S_0 to S_1 , and while this is less than optimal for selection it does provide us with an opportunity to advance germplasm that was not planted this past summer. Most of the germplasm sent to Mexico was for breeding cross development or for making testcrosses for yield trials. We are looking into other possibilities for winter nursery as well, but the timing of our season in North Carolina and the maturities of the germplasm we are working with restricts our options. We tried winter nursery in south Texas for three consecutive years without much success, largely due to unfavorable weather. The timing of the south Texas nursery was also difficult as it is planted too early for us to turn around seed from the current year's nursery.

- Development of about 70 new breeding crosses was attempted in during the summer of 2021, and most were successfully produced.

Table 7. 2021 Breeding crosses produced in Raleigh	
Stiff Stalk breeding crosses	non-Stiff Stalk breeding crosses
BR106/S42//GEMS-0050	Ucayali 12/N40x//GEMN-0048
BR106/S42//GEMS-0281	Valle 343/N40x//GEMN-0048
CML341/S42//GEMS-0281	Venezuela 981/N40x///GEMN-0048
CML343/GEMS-0032//S40x///GEMS-0281	Barbados GP2/LH82//GEMN-0048
CML343/PHHB9//GEMS-0281	GEMN-0048//Tropical Hybrid 19x03/N40
GEMS-0050//CML343/S42	GEMN-0048//CML449/GEMN-0272
CML343/S42//GEMS-0281	LH216/Tropical Hybrid 19x03//GEMN-0048
CML494/GEMS-0032//S40x///GEMS-0281	Lima 13/LH82//GEMN-0048
DKB830/S51//GEMS-0050	PHK56/Tropical Hybrid 19x03//GEMN-0048
DKB830/S51//GEMS-0281	PM-801/LH82//GEMN-0048
DKB844/S51//GEMS-0050	POPULATION 32 (IST) C2/LH185//GEMN-0048
DKB844/S51//GEMS-0281	SCRO GP3/LH82//GEMN-0048
GEMS-0050/GEMS-0243	DK_WKBC5/CML323
GEMS-0050/GEMS-0245	CML323/PHVB2
GEMS-0320/GEMS-0050	CML323/PHND1
GEMS-0050/GEMS-0321	GEMN-0272/CML323
GEMS-0281/GEMS-0050	GEMN-0287/CML323
GEMS-0281/GEMS-0245	GEMN-0272/GEMN-0048
GEMS-0281/GEMS-0320	GEMN-0287/PHVB2
GEMS-0321/GEMS-0281	GEMN-0310/GEMN-0048
La Posta Sequia C7 F71-1-1-1-2-B*4/S40a//GEMS-0281	CML449/PHVB2
La Posta Sequia C7 F71-1-1-1-2-B*4/S40b//GEMS-0281	CML449/PHND1
NC320/NC368//GEMS-0050	CML449/DK_WKBC5
NC320/NC368//GEMS-0281	
POP21 (IST) C2/PHP38//GEMS-0281	
DK_FBLL/CML287	
DK_FBLL/CML380	
LH228/CML380	
LH233/CML287	
LH233/CML380	
ZS1202/CML380	
CML343/FBLL	
CML343/LH228	
CML343/LH233	
CML343/ZS1202	
LH233/CML78	
GEMS-0226/GEMS-0320	
BR106:PHG39-012-002-#/LH236	
GEMS-0281/GEMS-0298	
GEMS-0293/LH233	

Testcrossing and Isolated Crossing Blocks

- The project at Raleigh has long relied on using F₁ testers for ICBs at Clayton, NC due to the poor performance of Corn-Belt adapted inbreds in North Carolina. As of late 2020 we started contracting ICBs using MBS testers, but this process has gotten off to a rocky start. Our attempts in fall/winter 2020 (south Texas) and summer 2021 (central Illinois) were both largely unsuccessful to weather issues, particularly too much rain early in the growing season.
- We sent two ICBs to Mexico this fall, including 400 female rows with MBS3520 and 900 female rows with MBS6717, but we will probably not receive these back in time for planting next spring due to delays in getting the seed shipped followed by delays in getting the packages through customs.
- The later maturity of the GEM-Raleigh materials makes it difficult to find ICBs in the US, so we are looking at other off-season options.
- In the summer of 2021, we made crosses of several MBS lines (MBS2887, MBS3520, MBS3640GT, MBS3708, MBS6717 and MBS9508) to GEM releases in Clayton, NC to evaluate their potential as pollen parents and these were largely successful in producing sufficient hand-pollinated seed. We did not attempt crosses with two of the more promising non-SSS lines for our maturity and geography, MBS8731 and MBS8814, as these have already proven to be poor pollen producers under our conditions.

Germplasm Evaluations:

- Overall, about 4500 yield plots were coordinated from Raleigh, with slightly more than half of those planted at five locations in NC and the rest planted by five cooperators (Corteva, Bayer, University of Tennessee, AgReliant and GEM-Ames) at thirteen locations throughout the Southeast and Midwest; Trials were completely lost at two cooperator locations.
- Corteva planted almost 1500 plots across six locations of crosses from two families, GEMS-0227/42T1 and GEMS-0227/42T2, and Bayer planted about 625 plots across six locations of crosses from GEMN-0048/GEMN-0135. In both cases the populations were advanced in-house and crossed to a proprietary tester, and the best performing lines will be returned to Raleigh for further testing.
- Forty experimental entries were planted at eighteen locations in second-year trials (experiments 21NCG01, 21NCG02 and 21NCG03).
- Thirty-eight entries were evaluated in an additional second-year trial (21NCG04) at nine locations for possible inclusion in release trials in 2022. This set of lines come from 2020 first-year trials that ended up having insufficient replications which led to inconclusive data.
- Evaluations of GEM releases from Raleigh and Ames were included in experiments 21NCG01 and 21NCG02 to identify lines with the best potential for use in GEM x GEM crosses; entries included GEM releases that have performed well in previous trials as well as newer entries that had not yet been evaluated in head-to-head experiments. Summary tables are presented in the Yield Trials section of this booklet.

Table 8. GEM-Raleigh Yield Trials (2021)				
Trial	Experimental Pedigree(s)	# of Locations	Tester	# of Experimental Entries
21NCG01	Various (2 nd year, pre-release)	18	LH132.PHG39	16
21NCG02	Various (2 nd year, pre-release)	18	LH283.LH287	17
21NCG03	GEMS-0050/CL-G1501:S17b-B-020 and GEMS-0220/GEMS-0027	18	MBS8731, LH283.LH287	7
21NCG04	Various (2 nd year, re-test)	9	MBS8731, LH132.PHG39, LH283.LH287	38
21NCG05	ex-PVPs	11	LH132.PHG39, LH283.LH287	32
21NCG06	GEM releases	12	LH235	11
21NCG07	Advanced families from GEMS-0255, GEMS-0274 and GEMS-0293	5	LH283.LH287	40
21NCG08	S2 families from GEMS-0256/GEMS-0243, CML373/PHP38, and KO679Y/89291/LH195	7	LH283.LH287	35
21NCG09	Unreleased CIMMYT Germplasm, NC320, Tx736, Tx740, NEI9004	1	PHHB9.LH236, LH283.LH287	20
21NCG10	CIMMYT inbreds and unreleased CIMMYT Germplasm	1	PHHB9.LH236, LH283.LH287	40

Host Plant Resistance:

- GEM releases were evaluated for aflatoxin accumulation and Fall armyworm damage by USDA-ARS researchers at Starkville, MS in 2021 and the results are presented later in this booklet. For aflatoxin accumulation the only lines showing consistent promise are GEMS-0027 and GEMS-0032, which have been studied by the researchers in Starkville for some time, and GEMS-0273, a derivative of GEMS-0032. For Fall armyworm GEMN-0135 showed some promise as a new source of resistance.
- Fusarium evaluations of GEM-Raleigh lines were not conducted in 2021.
- Gray Leaf Spot (two locations) and Northern Leaf Blight (one location) evaluations were conducted for GEM lines in North Carolina. Results are presented later in the booklet. The two releases from 2021, GEMS-0320 and GEMS-0321, show promise for both diseases.

Breeding Cross Observations:

- Breeding crosses and exotic/semi-exotic populations were planted in three different blocks at Clayton, NC during 2021. The blocks were planted based on seed availability; the first block (C7b) was planted with seed on hand during the early spring, the second block (C7a) was planted with seed that arrived from winter nursery (Mexico) and the third block (C8a) was planted with new breeding crosses received from Novasem. Results can be found in the “**Breeding Cross Observation**” section.
- The C7b block contained several exotic and semi-exotic populations that were donated to the PI Station by Funks Seeds and Cargill, as well as some CIMMYT populations. A few of these populations may be used in developing new breeding crosses. Most of the breeding crosses in this block were 25% exotic, and the most promising will be included in the nursery next year (labelled RAL22).

- The C7a block contains mostly 50% exotic breeding crosses with some 25% exotic crosses. Many of the 50% exotic crosses will need a second cross before they can be worked in North Carolina, but the most promising crosses will be included in the nursery next year or the following year (labelled RAL22 or RAL23). We were able to run our combine through these plots (two reps, one location) to collect yield and moisture data.
- The C8a block contains S1s of crosses received from Novasem (Mexico). Novasem crossed their proprietary germplasm numerous GEM releases, and these crosses were selfed in winter nursery in 2020/2021. The seed arrived late in the spring but we were able to plant one rep and the most promising will be included in the nursery next year or the following year (labelled RAL22 or RAL23).

Allelic Diversity:

- There were a small number of summer nursery rows dedicated to the development of BC₁s of Polulo-CHZM 01 030 for the Allelic Diversity project. Chutucuno chico (CHI 360) F₁s will be attempted again in summer 2022, as the accession was far earlier than the recurrent parents (PHB47 and PHZ51).

Corn Gametophyte Factors:

- As we discussed at our meetings in December 2020 and September 2021, the “dent-sterile” allele (Ga1-s) is important to popcorn and other specialty corn producers to maintain genetic purity of their product in farmer’s fields when planted in close proximity to field corn. As concerns have been raised about the presence of the Ga1-m allele in field corn (this allele can allow field corn pollen to pollinate “dent-sterile” germplasm and overcome the pollen blocking mechanism), we have been screening GEM releases for the presence of the Ga1-m allele. Results are present in the “**Genetic Sterility Allele**” section.

Thanks again to our yield trial Cooperators, Corteva, Bayer, AgReliant, the University of Tennessee (Dennis West) and GEM Ames, and to Corteva and Bayer for nursery support as well. Also, USDA-ARS Raleigh, Starkville and Tifton as well as Texas A+M University (Seth Murray) have provided us with valuable host plant resistance data for several years, And thanks to the GEM TSG for their support and guidance, and hopefully we will all be able to meet in person in Chicago in 2022!

GEM Releases

GEMS-0322: KO679Y/GEMS-0030//794-015-001-001-B

Year	# Reps	Exp	Tester	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight
2021	9	2164203	MBS5562	215.6	12.6	17.2	2.0	12.0	57.4
% Check Mean				96.7	99.8	96.7	58.8	315.8	101.7
2021	10	2164207	MBS8731	213.9	12.3	17.6	8.0	7.0	55.6
% Check Mean				96.9	97.1	99.5	117.6	109.4	97.7

- KO679Y is a tropical inbred from South Africa
- GEMS-0030 has an exotic parent from Brazil



GEMS-0323: GEMS-0219//GEMS-0147/GEMS-0227-SIB-B-122-001-B

Year	# Reps	Exp	Tester	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight
2021	9	2164204	MBS8488	213.0	13.1	16.5	4.0	12.0	58.0
% Check Mean				90.5	99.0	87.6	95.2	176.5	101.5
2021	10	2164207	MBS8731	224.8	12.7	17.9	7.0	5.0	55.3
% Check Mean				101.8	100.3	101.1	102.9	78.1	97.2

- GEMS-0147 has an exotic parent from Thailand
- GEMS-0219 has exotic parents from Cuba and USA
- GEMS-0227 has an exotic parent from Thailand



GEMS-0324: GEMS-0227/Ki14//41-002-001-001-B

Year	# Reps	Exp	Tester	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight
2021	9	2164203	MBS8488	207.5	12.3	17.0	1.0	1.0	58.6
% Check Mean				93.0	97.4	95.8	29.4	263.2	103.9
2021	10	2164206	MBS8731	238.8	13.6	17.6	5.0	6.0	55.7
% Check Mean				106.2	105.6	100.3	96.2	176.5	97.3

- Ki14 is a tropical inbred from Thailand
- GEMS-0227 has an exotic parent from Thailand



GEMS-0325: PHN46//GEMN-0130/MP494///41-002-001-001-B

Year	# Reps	Exp	Tester	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight
2021	10	2164201	MBS3520	226.2	13.1	17.4	12.0	5.0	56.4
% Check Mean				100.3	100.8	99.8	187.5	119.0	98.1
2021	9	2164202	MBS3495	203.8	11.9	17.2	15.0	7.0	57.2
% Check Mean				91.7	93.0	98.5	241.9	81.4	100.1

- Ki14 is a tropical inbred from Thailand
- GEMS-0227 has an exotic parent from Thailand



Table 9. Racial Background of GEM Releases

Race	Ames Releases	NC Releases	Other Releases	Total Releases
Alazan	1	0	0	1
Argentino	6	0	0	6
Argentino/Tropical Inbred	5	0	0	5
Camelia	7	0	1	8
Canilla	0	0	0	0
Cateto	0	11	0	11
Cateto Sulino	4	0	0	4
Composite (Suwan)	10	1	0	11
Composite (Tuxpeño)	1	0	0	1
Corn Belt Dent	1	0	0	1
Criollo	1	1	0	2
Criollo/Argentino (CUBA164)	15	1	2	18
Criollo/Tuson (CUBA173)	1	0	0	1
Cristalino Colorado	16	0	2	18
Cuban yellow	7	3	0	10
Dent. Blanco Rugoso	3	0	3	6
Dentado Blanco	5	0	0	5
Dente Amarelo	8	3	1	12
Dente Branco	5	0	0	5
Early Caribbean	1	0	0	1
Florida Synthetic // Dente Amarelo / Tropical Hybrid	1	0	0	1
Florida Synthetic / Mississippi Inbred	1	0	0	1
Hybrid Blanco	0	0	0	0
Tropical Hybrid	26	75	4	105
Mixed	13	3	4	20
GEM Derived	12	5	0	16
Multiple Borer Composite	1	0	0	1
Semidentado Riograndense	2	0	0	2
Southern Dent	1	0	0	1
St. Croix	1	1	1	3
Suwan	14	2	0	16
Tropical Inbred / Mississippi Inbred / Florida Synthetic	1	0	0	1
Tropical Line	10	7	0	17
Tusón	10	2	1	13
Tusón/Canilla	1	0	0	1
Tuxpeño	3	9	0	12
Tuxpeño/Olotillo	2	0	0	2
Totals	196	124	19	339

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
1	Piura 144/B94///B94)	GEMS-0001	Alazan	Peru	Ames	2001
2	FS8A(S):S09-043-002	GEMS-0002	Florida Synthetic	USA	Ohio St.	2003
3	BR52051(SE32):S17-B-023-001-B-B	GEMS-0003	Dente Amarelo	Brazil	NC	2003
4	DK212T:S11-B-013-002-B-B	GEMS-0004	Tropical Hybrid	Thailand	NC	2003
5	DK212T:S11-B-015-001-B-B	GEMS-0005	Tropical Hybrid	Thailand	NC	2003
6	DK212T:S11-B-017-001-B-B	GEMS-0006	Tropical Hybrid	Thailand	NC	2003
7	DK212T:S11-B-018-001-B-B	GEMS-0007	Tropical Hybrid	Thailand	NC	2003
8	DK212T:S11-B-038-001-B-B	GEMS-0008	Tropical Hybrid	Thailand	NC	2003
9	DK212T:S11-B-040-001-B-B	GEMS-0009	Tropical Hybrid	Thailand	NC	2003
10	DK212T:S11-B-041-002-B-B	GEMS-0010	Tropical Hybrid	Thailand	NC	2003
11	DK212T:S11-B-045-002-B-B	GEMS-0011	Tropical Hybrid	Thailand	NC	2003
12	DK888:S11-B-003-001-B-B	GEMS-0012	Tropical Hybrid	Thailand	NC	2003
13	DK888:S11-B-004-004-B-B	GEMS-0013	Tropical Hybrid	Thailand	NC	2003
14	DK888:S11-B-010-001-B-B	GEMS-0014	Tropical Hybrid	Thailand	NC	2003
15	DK888:S11-B-014-001-B-B	GEMS-0015	Tropical Hybrid	Thailand	NC	2003
16	DK888:S11-B-015-003-B-B	GEMS-0016	Tropical Hybrid	Thailand	NC	2003
17	DK888:S11-B-025-001-B-B	GEMS-0017	Tropical Hybrid	Thailand	NC	2003
18	DK888:S11-B-026-002-B-B	GEMS-0018	Tropical Hybrid	Thailand	NC	2003
19	DK888:S11-B-029-001-B-B	GEMS-0019	Tropical Hybrid	Thailand	NC	2003
20	DK888:S11-B-033-001-B-B	GEMS-0020	Tropical Hybrid	Thailand	NC	2003
21	DK888:S11-B-035-002-B-B	GEMS-0021	Tropical Hybrid	Thailand	NC	2003
22	DK888:S11-B-035-003-B-B	GEMS-0022	Tropical Hybrid	Thailand	NC	2003
23	DK888:S11-B-039-002-B-B	GEMS-0023	Tropical Hybrid	Thailand	NC	2003
24	DKB830:S11-B-045-001-B-B	GEMS-0024	Tropical Hybrid	Mexico	NC	2003
25	DKXL370:S11-B-001-002-B-B	GEMS-0025	Tropical Hybrid	Brazil	NC	2003
26	DKXL370:S11-B-025-001-B-B	GEMS-0027	Tropical Hybrid	Brazil	NC	2003
27	DKXL370:S11-B-025-002-B-B	GEMS-0028	Tropical Hybrid	Brazil	NC	2003
28	DKXL370:S11-B-028-001-B-B	GEMS-0029	Tropical Hybrid	Brazil	NC	2003
29	DKXL380:S11-B-004-003-B-B	GEMS-0030	Tropical Hybrid	Brazil	NC	2003
30	DKXL380:S11-B-028-001-B-B	GEMS-0031	Tropical Hybrid	Brazil	NC	2003
31	DKXL380:S11-B-029-001-B-B	GEMS-0032	Tropical Hybrid	Brazil	NC	2003
32	BR51403(PE001):N16-B-044-B	GEMN-0033	Cateto	Brazil	NC	2003
33	BR51403(PE001):N16-B-172-B	GEMN-0035	Cateto	Brazil	NC	2003
34	BR51403(PE001):N16-B-176-B	GEMN-0036	Cateto	Brazil	NC	2003
35	BR51403(PE001):N16-B-181-B	GEMN-0037	Cateto	Brazil	NC	2003
36	BR51403(PE001):N16-B-239-B	GEMN-0039	Cateto	Brazil	NC	2003
37	BR51403(PE001):N16-B-431-B	GEMN-0040	Cateto	Brazil	NC	2003
38	BR51403(PE001):N16-B-521-B	GEMN-0041	Cateto	Brazil	NC	2003
39	BR51403(PE001):N16-B-705-B	GEMN-0042	Cateto	Brazil	NC	2003
40	BR51403(PE001):N16-B-857-B	GEMN-0043	Cateto	Brazil	NC	2003
41	CH05015:N12-20-1-B-B	GEMN-0044	Camelia	Chile	Ames	2003
42	CH05015:N12-140-1-B-B	GEMN-0045	Camelia	Chile	Ames	2003
43	CH05015:N15-8-1-B-B	GEMN-0046	Camelia	Chile	Ames	2003
44	UR13085:N0215-014-001	GEMN-0047	Cateto Sulino	Uruguay	Ames	2003
45	DKXL370:N11a20-31-1-B-B	GEMN-0048	Tropical Hybrid	Brazil	Ames	2003

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
46	DKB844:S1601-512-1-B	GEMS-0049	Tropical Hybrid	Mexico	Ames	2003
47	DKB844:S1601-517-1-B	GEMS-0050	Tropical Hybrid	Mexico	Ames	2003
48	CUBA164:S2008a-83-1-B	GEMS-0051	Mixed (Creole)	Cuba	Ames	2003
49	CUBA164:S2008a-326-1-B	GEMS-0052	Mixed (Creole)	Cuba	Ames	2003
50	CUBA164:S15-192-2-B	GEMS-0053	Mixed (Creole)	Cuba	Ames	2003
51	AR16035:S02-450-1-B	GEMS-0054	Cristalino Colorado	Argentina	Ames	2003
52	AR16035:S02-443-1-B-B	GEMS-0055	Cristalino Colorado	Argentina	Ames	2003
53	FS8B(T):N1809-946-1-B	GEMN-0056	Florida Synthetic	USA	Ames	2003
54	AR01150:N04-545-1-B	GEMN-0057	Dent. Blanco Rugoso	Argentina	Ames	2003
55	AR01150:N04-696-1-B	GEMN-0058	Dent. Blanco Rugoso	Argentina	Ames	2003
56	SCRO1:N1310-398-1-B	GEMN-0059	St. Croix	St. Croix	Ames	2003
57	CHIS775:N1912-519-1-B-B	GEMN-0060	Tuxpeño	Mexico	Ames	2003
58	AR16026:S17-10-1-B-B	GEMS-0061	Cristalino Colorado	Argentina	Ames	2003
59	AR16026:S17-16-1-B-B	GEMS-0062	Cristalino Colorado	Argentina	Ames	2003
60	CUBA164:S1511b-325-001	GEMS-0063	Mixed (Creole)	Cuba	Ames	2003
61	CUBA164:S1511b-249-1-B-B	GEMS-0064	Mixed (Creole)	Cuba	Ames	2003
62	CUBA117:S1520-41-1-B-B	GEMS-0065	Argentino	Cuba	Ames	2003
63	CUBA117:S1520-52-1-B-B	GEMS-0066	Argentino	Cuba	Ames	2003
64	GUAT209:S13 x (H99ae x OH43ae)-4-4-2-1	GEMS-0067	Tusón	Guatemala	Truman St	2007
65	AR16026:S1704-153-001	GEMS-0068	Cristalino Colorado	Argentina	Ames	2003
66	AR16035:S19-161-001	GEMS-0069	Cristalino Colorado	Argentina	Ames	2003
67	CH05015:N12-183-001	GEMN-0070	Camelia	Chile	Ames	2003
68	CH05015:N15-003-001	GEMN-0071	Camelia	Chile	Ames	2003
69	CHIS775:S1911b-439-001	GEMS-0072	Tuxpeño	Mexico	Ames	2003
70	CUBA117:S15-372-001	GEMS-0073	Argentino	Cuba	Ames	2003
71	CUBA164:S1517-163-001	GEMS-0074	Mixed (Creole)	Cuba	Ames	2003
72	CUBA164:S1517-241-002	GEMS-0075	Mixed (Creole)	Cuba	Ames	2003
73	DKB844:N11b-118-001	GEMN-0076	Tropical Hybrid	Mexico	Ames	2003
74	DKXL370:N11a20-604-001	GEMN-0077	Tropical Hybrid	Brazil	Ames	2003
75	FS8A(S):S09-362-001	GEMS-0078	Florida Synthetic	USA	Ames	2003
76	FS8B(S):S0316-802-001	GEMS-0079	Florida Synthetic	USA	Ames	2003
77	FS8B(S):S0316-814-001	GEMS-0080	Florida Synthetic	USA	Ames	2003
78	FS8B(T):N1802-382-001	GEMN-0081	Florida Synthetic	USA	Ames	2003
79	FS8B(T):N1802-525-001	GEMN-0082	Florida Synthetic	USA	Ames	2003
80	GUAT209:N1925-081-001	GEMN-0083	Tusón	Guatemala	Ames	2003
81	PASCO14:S0105-198-001	GEMS-0084	Cuban yellow	Peru	Ames	2003
82	UR01089:S0525-519-001	GEMS-0085	Cateto Sulino	Uruguay	Ames	2003
83	UR10001:S1813-257-001	GEMS-0086	Dente Branco	Uruguay	Ames	2003
84	AR03056:N09-024-001	GEMN-0087	Dentado Blanco	Argentina	Ames	2004
85	AR03056:N09-182-001	GEMN-0088	Dentado Blanco	Argentina	Ames	2004
86	AR03056:N09-191-001	GEMN-0089	Dentado Blanco	Argentina	Ames	2004
87	AR03056:N09-250-001	GEMN-0090	Dentado Blanco	Argentina	Ames	2004
88	CHIS740:S1411a-783-002	GEMS-0091	Tuxpeño/Olotillo	Mexico	Ames	2004
89	CUBA164:S2012-444-001	GEMS-0092	Mixed (Creole)	Cuba	Ames	2004
90	CUBA164:S2012-966-001	GEMS-0093	Mixed (Creole)	Cuba	Ames	2004

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
91	DKXL370:N11a20-199-002	GEMN-0094	Tropical Hybrid	Brazil	Ames	2004
92	DKXL370:N11a20-234-002	GEMN-0095	Tropical Hybrid	Brazil	Ames	2004
93	DKXL370:N11a20-322-001	GEMN-0096	Tropical Hybrid	Brazil	Ames	2004
94	FS8B(T):N11a-087-001	GEMN-0097	Florida Synthetic	USA	Ames	2004
95	FS8B(T):N11a-110-001	GEMN-0098	Florida Synthetic	USA	Ames	2004
96	FS8B(T):N11a-322-001	GEMN-0099	Florida Synthetic	USA	Ames	2004
97	UR11003:S0302-937-001	GEMS-0100	Dente Branco	Uruguay	Ames	2004
98	DK212T:S11b-007-B-B	GEMS-0101	Tropical Hybrid	Thailand	NC	2004
99	DK888:S11b-001-B	GEMS-0102	Tropical Hybrid	Thailand	NC	2004
100	DK888:N11(95)-B-027-010-B-B	GEMN-0103	Tropical Hybrid	Thailand	NC	2004
101	DK888:N11(95)-B-027-012-B-B	GEMN-0104	Tropical Hybrid	Thailand	NC	2004
102	DK888:N11(95)-B-027-015-B-B	GEMN-0105	Tropical Hybrid	Thailand	NC	2004
103	DK888:N11(95)-B-022-007-B-B	GEMN-0106	Tropical Hybrid	Thailand	NC	2004
104	DK888:N11(95)-B-022-012-B-B	GEMN-0107	Tropical Hybrid	Thailand	NC	2004
105	DK888:N11(95)-B-027-001-B-B	GEMN-0108	Tropical Hybrid	Thailand	NC	2004
106	DKXL380:N11-B-015-003-B-B	GEMN-0109	Tropical Hybrid	Brazil	NC	2004
107	BARBGP2:N08a18-332-001	GEMN-0110	Tusón	Barbados	Ames	2005
108	CH05015:N1204-057-001	GEMN-0111	Camelia	Chile	Ames	2005
109	CH05015:N1502-086-001	GEMN-0112	Camelia	Chile	Ames	2005
110	CHIS775:S1911b-120-001	GEMS-0113	Tuxpeño	Mexico	Ames	2005
111	DK212T:N11a12-191-001	GEMN-0114	Tropical Hybrid	Thailand	Ames	2005
112	DKB844:S1601-073-001	GEMS-0115	Tropical Hybrid	Mexico	Ames	2005
113	DKB844:S1601-003-002	GEMS-0116	Tropical Hybrid	Mexico	Ames	2005
114	DREP150:N2011d-624-001	GEMN-0117	Mixed	Dom. Republic	Ames	2005
115	UR11003:S0302-1011-001	GEMS-0118	Dente Branco	Uruguay	Ames	2005
116	CHS775:N19-042-001-B	GEMN-0119	Tuxpeño	Mexico	NC	2005
117	CHS775:N19-042-003-B	GEMN-0120	Tuxpeño	Mexico	NC	2005
118	CHS775:N19-027-010-B	GEMN-0121	Tuxpeño	Mexico	NC	2005
119	CHS775:N19-093-002-B	GEMN-0122	Tuxpeño	Mexico	NC	2005
120	CHS775:N19-030-011-B	GEMN-0123	Tuxpeño	Mexico	NC	2005
121	DK212T:N11-B-003-001-B	GEMN-0124	Tropical Hybrid	Thailand	NC	2005
122	DK888:S11-B-029-001-B	GEMS-0125	Tropical Hybrid	Thailand	NC	2005
123	DK888:S11-B-029-006-B	GEMS-0126	Tropical Hybrid	Thailand	NC	2005
124	DK888:N11(95)-B-017-001-B	GEMN-0127	Tropical Hybrid	Thailand	NC	2005
125	DKXL370:N11-B-005-002-B	GEMN-0128	Tropical Hybrid	Brazil	NC	2005
126	DKXL370:N11-B-005-006-B	GEMN-0129	Tropical Hybrid	Brazil	NC	2005
127	DKXL370:N11-B-005-010-B	GEMN-0130	Tropical Hybrid	Brazil	NC	2005
128	DKXL370:N11-B-005-011-B	GEMN-0131	Tropical Hybrid	Brazil	NC	2005
129	DKXL370:N11-B-005-021-B	GEMN-0132	Tropical Hybrid	Brazil	NC	2005
130	DKXL370:N11-B-029-002-B	GEMN-0133	Tropical Hybrid	Brazil	NC	2005
131	DKXL380:N11-B-010-017-B	GEMN-0134	Tropical Hybrid	Brazil	NC	2005
132	DKXL380:N11-B-007-025-B	GEMN-0135	Tropical Hybrid	Brazil	NC	2005
133	DKXL380:N11-B-007-028-B	GEMN-0136	Tropical Hybrid	Brazil	NC	2005
134	SCR Gp3:N14-028-003-003-B	GEMN-0137	Tusón	St. Croix	NC	2005
135	AR17056:N2035-421-001	GEMN-0138	Cristalino Colorado	Argentina	Ames	2006

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
136	AR17056:N2035-473-001	GEMN-0139	Cristalino Colorado	Argentina	Ames	2006
137	BR51675:N0620-033-001	GEMN-0140	Dente Amarelo	Brazil	Ames	2006
138	BR51675:N0620-053-001	GEMN-0141	Dente Amarelo	Brazil	Ames	2006
139	BR52060:S0210-143-001	GEMS-0142	Dente Amarelo	Brazil	Ames	2006
140	BR52060:S0210-147-001	GEMS-0143	Dente Amarelo	Brazil	Ames	2006
141	MDI022:N2120-284-001	GEMN-0144	Cuban yellow	Peru	Ames	2006
142	MDI022:N2120-333-001	GEMN-0145	Cuban yellow	Peru	Ames	2006
143	NEI9004:S2818-003-001	GEMS-0146	Tropical Inbred	Thailand	Ames	2006
144	NEI9004:S2818-025-001	GEMS-0147	Tropical Inbred	Thailand	Ames	2006
145	NEI9004:S2818-376-001	GEMS-0148	Tropical Inbred	Thailand	Ames	2006
146	UR05017:S0415-180-002	GEMS-0149	Semidentado Riograndense	Uruguay	Ames	2006
147	UR05017:S0415-187-001	GEMS-0150	Semidentado Riograndense	Uruguay	Ames	2006
148	CHIS775:N19-042-001-003-B-B-B-B	GEMN-0151	Tuxpeño	Mexico	NC	2006
149	DK212T:N11-B-016-005-B-B-B	GEMN-0152	Hybrid Tropical	Thailand	NC	2006
150	DKXL380:N11-B-007-027-B-B-B-B	GEMN-0153	Hybrid Tropical	Brazil	NC	2006
151	AR13026:N08b15-016	GEMN-0154	Cristalino Colorado	Argentina	Ames	2007
152	AR13026:N08b15-086	GEMN-0155	Cristalino Colorado	Argentina	Ames	2007
153	BR51721:N2012-098-002	GEMN-0156	Dente Amarelo	Brazil	Ames	2007
154	BR51721:N2012-164-002	GEMN-0157	Dente Amarelo	Brazil	Ames	2007
155	BR51721:N2012-397-001	GEMN-0158	Dente Amarelo	Brazil	Ames	2007
156	CASH:N1410-018-001	GEMN-0159	Corn Belt Dent	USA	Ames	2007
157	CUBA117:S1542-037-002	GEMS-0160	Argentino	Cuba	Ames	2007
158	CUBA117:S1542-057-001	GEMS-0161	Argentino	Cuba	Ames	2007
159	CUBA117:S1542-057-002	GEMS-0162	Argentino	Cuba	Ames	2007
160	CUBA164:S2012-456-001	GEMS-0163	Mixed (Creole)	Cuba	Ames	2007
161	DK212T:N11-B-003-022-B-B-B	GEMN-0164	Tropical Hybrid	Thailand	NC	2007
162	DK888:N11(95)-B-022-012-026-B-B	GEMN-0165	Tropical Hybrid	Thailand	NC	2007
163	DK888:N11(95)-B-027-001-008-B-B	GEMN-0166	Tropical Hybrid	Thailand	NC	2007
164	DK888:N11(95)-B-027-001-018-B-B	GEMN-0167	Tropical Hybrid	Thailand	NC	2007
165	DK888:N11(95)-B-027-001-019-B	GEMN-0168	Tropical Hybrid	Thailand	NC	2007
166	DK888:N11(95)-B-027-001-027-B	GEMN-0169	Tropical Hybrid	Thailand	NC	2007
167	DK888:N11(95)-B-027-001-030-B	GEMN-0170	Tropical Hybrid	Thailand	NC	2007
168	DK888:N11(95)-B-027-001-037-B	GEMN-0171	Tropical Hybrid	Thailand	NC	2007
169	DK888:N11(95)-B-027-001-040-B	GEMN-0172	Tropical Hybrid	Thailand	NC	2007
170	DK888:N11(95)-B-027-012-009-B	GEMN-0173	Tropical Hybrid	Thailand	NC	2007
171	AR17056:N2025-574-001	GEMN-0174	Cristalino Colorado	Argentina	Ames	2008
172	BVIR155:S2012-029-001	GEMS-0175	Tusón	British Virgin Is.	Ames	2008
173	CUBA164:S2008c-289-001	GEMS-0176	Mixed (Creole)	Cuba	Ames	2008
174	DK888:N11a08a-395-001	GEMN-0177	Tropical Hybrid	Thailand	Ames	2008
175	DK888:N11a08a-440-001	GEMN-0178	Tropical Hybrid	Thailand	Ames	2008
176	FS8B(T):N11a08c-030-002	GEMN-0179	Mixed	USA	Ames	2008
177	GUAT209:S1308a-047-001	GEMS-0180	Tusón	Guatemala	Ames	2008
178	GUAT209:S1308a-068-001	GEMS-0181	Tusón	Guatemala	Ames	2008
179	GUAT209:S1308a-084-001	GEMS-0182	Tusón	Guatemala	Ames	2008
180	GUAT209:S1308a-104-001	GEMS-0183	Tusón	Guatemala	Ames	2008

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
181	GUAT209:S1308a-120-001	GEMS-0184	Tusón	Guatemala	Ames	2008
182	CUBA164:S2012-966-001-B wx	GEMS-0185	Mixed (Creole)	Cuba	Ames	2008
183	DKXL370:N11a20-036-002-B wx	GEMN-0186	Tropical Hybrid	Brazil	Ames	2008
184	ANTIG03:N1218-056-001	GEMN-0187	Criollo	Antigua	Ames	2009
185	DKXL212:S0912-012-001	GEMS-0188	Tropical Hybrid	Brazil	Ames	2009
186	DKXL212:S0912-117-001	GEMS-0189	Tropical Hybrid	Brazil	Ames	2009
187	PASCO14:N0424-078-001	GEMN-0190	Cuban yellow	Peru	Ames	2009
188	SCROGP3:N2017-003-001	GEMN-0191	Tusón	St. Croix	Ames	2009
189	SCROGP3:N2017-172-001	GEMN-0192	Tusón	St. Croix	Ames	2009
190	UR11002:N0308b-086-001	GEMN-0193	Dente Branco	Uruguay	Ames	2009
191	DK888:N11(95)-B-027-001-011-B	GEMN-0194	Tropical Hybrid	Thailand	NC	2009
192	DK888:N11(95)-B-027-001-015-B	GEMN-0195	Tropical Hybrid	Thailand	NC	2009
193	DK888:N11(95)-B-003-001-001-B	GEMN-0196	Tropical Hybrid	Thailand	NC	2009
194	DK888:N11(95)-002-021-008-B-B	GEMN-0197	Tropical Hybrid	Thailand	NC	2009
195	DK212T:N11-040-001-007	GEMN-0198	Tropical Hybrid	Thailand	NC	2009
196	AR16021:S0908a-039-001	GEMS-0199	Cristalino Colorado	Argentina	Ames	2010
197	BR105:S1612-008-001	GEMS-0200	Composite (Suwan)	Brazil	Ames	2010
198	BR105:S1612-057-001	GEMS-0201	Composite (Suwan)	Brazil	Ames	2010
199	BR105:S1640-128-001	GEMS-0202	Composite (Suwan)	Brazil	Ames	2010
200	CUBA164:S2008dF44-012-001	GEMS-0203	Mixed (Creole)	Cuba	Ames	2010
201	FS8A(T):N1804-006-001	GEMN-0204	Florida Synthetic	USA	Ames	2010
202	GUAD05:N3215-197-001	GEMN-0205	Early Caribbean	Guadalupe	Ames	2010
203	AR16035:S02-615-001-B wx	GEMS-0206	Cristalino Colorado	Argentina	Ames	2010
204	BR51403(PE001):N16-B-044-004-001-001C-001	GEMN-0207	Cateto	Brazil	NC	2010
205	BR51403(PE001):N16-B-044-004-001-002G-003	GEMN-0208	Cateto	Brazil	NC	2010
206	BR51721(RN07):N20-B-017-002	GEMN-0209	Dente Amarelo	Brazil	NC	2010
207	CL-G1607(CML420):N11-008-001-007	GEMN-0210	CML Tropical Inbred	Mexico	NC	2010
208	DK888:N11-B-027-012-B-007	GEMN-0212	Tropical Hybrid	Thailand	NC	2010
209	DKXL380:N11-B-007-010-B-002	GEMN-0213	Tropical Hybrid	Brazil	NC	2010
210	MDI022:N21-B-002-003	GEMN-0214	Cuban yellow	Peru	NC	2010
211	NS1:S08-006-001-002	GEMS-0215	Tropical Inbred	Thailand	NC	2010
212	PASCO14:N11b-B-001-002	GEMN-0216	Cuban Yellow	Peru	NC	2010
213	DK888:N11-B-027-001-B-001	GEMN-0217	Tropical Hybrid	Thailand	NC	2010
214	(CUBA164:S2012-459-001-B/GEMS-0002)-B-B-011	GEMS-0218	Mixed (Creole)/Florida Synthetic	Cuba/USA	Ames	2011
215	(CUBA164:S2012-459-001-B/GEMS-0002)-B-B-031	GEMS-0219	Mixed (Creole)/Florida Synthetic	Cuba/USA	Ames	2011
216	(GEMS-0113/GEMS-0091)-B-058-001	GEMS-0220	Tuxpeño/Olotillo	Mexico	Ames	2011
217	BR105:N1641-159-001	GEMN-0221	Composite (Suwan)	Brazil	Ames	2011
218	MBRC10:S1741-B-057	GEMS-0222	Multiple Borer Composite	Mexico	Ames	2011
219	CUBA164:S2012-444-001-B wx	GEMS-0223	Mixed (Creole)	Cuba	Ames	2011
220	BG070404:D27S42-B-014	GEMS-0224	Unclassified	Venezuela	Ames	2012
221	BR105:N16a16b-B-074	GEMN-0225	Composite (Suwan)	Brazil	Ames	2012
222	BR106:S(LH132)(PHG39)-B-053	GEMS-0226	Composite (Tuxpeño)	Brazil	Ames	2012
223	NEI9004:S2809-B-022	GEMS-0227	Tropical Inbred	Thailand	Ames	2012
224	NEI9004:S2809-B-025	GEMS-0228	Tropical Inbred	Thailand	Ames	2012
225	SANM126:N12(LH123)-B-033	GEMN-0229	Cuban yellow	Peru	Ames	2012

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
226	CML413:N18-001-036-002	GEMN-0230	CML Tropical Inbred	Mexico	NC	2012
227	CUBA164:D27-B-017-001	GEMN-0231	Mixed (Creole)	Cuba	NC	2012
228	SCR_Gp3:N14-028-003-B-002	GEMN-0232	Tusón	St. Croix	NC	2012
229	CML329:N18-001-020-001	GEMN-0233	CML Tropical Inbred	Mexico	NC	2012
230	AR17026:S1648-B-030	GEMS-0234	Cristalino Colorado	Argentina	Ames	2013
231	CUBA173:S0446-B-030	GEMS-0235	Criollo/Tusón	Cuba	Ames	2013
232	DK212T:N11a10-B-110	GEMN-0236	Tropical Hybrid	Thailand	Ames	2013
233	DKXL370:S08c17c-B-008	GEMS-0237	Tropical Hybrid	Brazil	Ames	2013
234	NEI9004:N0803-B-027	GEMN-0238	Tropical Inbred	Thailand	Ames	2013
235	NEI9004:N0803-B-053	GEMN-0239	Tropical Inbred	Thailand	Ames	2013
236	UR13085:S(N28)(CUBA117:S1520-156-1-B-B)-B-023	GEMS-0240	Cateto Sulino	Uruguay	Ames	2013
237	UR13085:S(N28)(CUBA117:S1520-156-1-B-B)-B-058	GEMS-0241	Cateto Sulino	Uruguay	Ames	2013
238	SE32(BR52051):N11c-015-004-B	GEMN-0242	Dente Amarelo	Brazil	NC	2013
239	CML287:S15-024-003-B	GEMS-0243	CML Tropical Inbred	Mexico	NC	2013
240	CML287:S15-027-001-B	GEMS-0244	CML Tropical Inbred	Mexico	NC	2013
241	DK888:S11b-037-018-008-B	GEMS-0245	Tropical Hybrid	Thailand	NC	2013
242	AR01150:N0402-B-026	GEMN-0246	Dentado Blanco Rugoso	Argentina	Ames	2014
243	AR03056:N0902-064-001-B-B	GEMN-0247	Dentado Blanco	Argentina	Ames	2014
244	AR16042:S2028-B-012-B-B	GEMS-0248	Cristalino Colorado	Argentina	Ames	2014
245	BR105:N1643-B-020-B-B	GEMN-0249	Composite (Suwan)	Brazil	Ames	2014
246	CL-G1703:S17c43-B-023-B-B	GEMS-0250	Tropical Line	CIMMYT	Ames	2014
247	CL-G1703:S17c43-B-026-B-B	GEMS-0251	Tropical Line	CIMMYT	Ames	2014
248	DKB844:N11b18-241-001-B-B	GEMN-0252	Tropical Hybrid	Mexico	Ames	2014
249	DK212T:S0640-034-002	GEMS-0253	Tropical Hybrid	Thailand	NC	2015
250	FS8B(T):N11a-225-002	GEMN-0254	Florida Synthetic	USA	NC	2015
251	FS8B(S):S03-133-002	GEMS-0255	Florida Synthetic	USA	NC	2015
252	NS1:S0834-006-002	GEMS-0256	Suwan	Thailand	NC	2015
253	CHIS462:N08d-013-001	GEMN-0257	Tuxpeño	Mexico	NC	2015
254	DKB830:S19-009-004	GEMS-0258	Tropical Hybrid	Mexico	NC	2015
255	SCR01:N11c-015-002	GEMN-0259	St. Croix	St. Croix	NC	2015
256	(GEMN-0140/GEMN-0097)-B-B-026-B-B	GEMN-0260	Dente Amarelo/Florida Syn	Brazil/USA	Ames	2015
257	(GEMN-0140/GEMN-0097)-B-B-027-B-B	GEMN-0261	Dente Amarelo/Florida Syn	Brazil/USA	Ames	2015
258	(GEMS-0147/GEMS-0180)-B-104-001-B-B	GEMS-0262	Trop Inbred/Tusón	Thailand/Quatemala	Ames	2015
259	BR105:S1626(GEMS-0175)-B-049-B-B	GEMS-0263	Composite Suwan/Tusón	Brazil/BVIR	Ames	2015
260	BR105:S1643-078-001-B-B	GEMS-0264	Composite Suwan	Brazil	Ames	2015
261	DKXL212:S0950-B-083-B-B	GEMS-0265	Tropical Hybrid	Brazil	Ames	2015
262	NEI9008:N0826(GEMN-0155)-B-074-B-B	GEMN-0266	Suwan/Cristalino Colorado	Thailand/Argentina	Ames	2015
263	NEI9008:N0826(GEMN-0155)-B-095-B-B	GEMN-0267	Suwan/Cristalino Colorado	Thailand/Argentina	Ames	2015
264	NS1:S0852-B-021-B-B	GEMS-0268	Suwan	Thailand	Ames	2015
265	NS1:S0852-B-054-B-B	GEMS-0269	Suwan	Thailand	Ames	2015
266	ANTIG01:N16-050-002	GEMN-0270	Criollo	Antigua	NC	2016
267	BR105:N16-043-001	GEMN-0271	Composite (Suwan)	Brazil	NC	2016
268	(GEMN-0043xGEMN-0097)-B-001	GEMN-0272	Cateto/Florida Syn	Brazil/USA	NC	2016
269	(GEMS-0032xGEMS-0050)-B-007	GEMS-0273	Trop Hybrid/Trop Hybrid	Brazil/Mexico	NC	2016
270	(GEMS-0032xGEMS-0113)-B-004	GEMS-0274	Trop Hybrid/Tuxpeño	Brazil/Mexico	NC	2016

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
271	((KO679Y/GEMS-0115)/GEMS-0162)-008-001	GEMS-0275	Tropical Hybrid	S. Africa/Mexico	Ames	2016
272	(53SS4/GEMS-0026)-SIB-B-003	GEMS-0276	Tropical Hybrid	Brazil	Ames	2016
273	(53SS4/GEMS-0031)-SIB-B-039	GEMS-0277	Tropical Hybrid	Brazil	Ames	2016
274	(GEMS-0115/S49w)-B-B-036	GEMS-0278	Tropical Hybrid	Mexico	Ames	2016
275	(GEMS-0176/S49w)-B-B-028	GEMS-0279	Mixed (Creole)	Cuba	Ames	2016
276	BR52051:S172641-B-018	GEMS-0280	Dente Amarelo	Brazil	Ames	2016
277	BR52051:S172641-B-054	GEMS-0281	Dente Amarelo	Brazil	Ames	2016
278	CHIS740:S(PHW17)(87916W)-126-001	GEMS-0282	Tuxpeno/Olotillo	Chile	Ames	2016
279	UR11002:S1409-068-001	GEMS-0283	Dente Branco	Uruguay	Ames	2016
280	AR17056:S1217-B-025	GEMS-0284	Cristalino Colorado	Argentina	Ames	2016
281	(GEMN-0117/DKXL212:N11a-139-001-001-B-B-B-B-B)-B-B-019	GEMN-0285	Tusón/Canilla	Dom. Republic	Ames	2016
282	MDI022:N(PHG35)(GEMN-0097)-072-001	GEMN-0286	Cuban yellow	Peru	Ames	2016
283	(GEMN-0108xGEMN-0178)-B-004	GEMN-0287	Trop Hybrid/Trop Hybrid	Brazil/Thailand	NC	2016
284	(GEMS-0147/GEMS-0115)-B-002-001-001-B	GEMS-0288	Trop Inbred/Trop Inbred	Thailand/Mexico	Ames	2017
285	(GEMS-0147/GEMS-0180)-B-033-001-001-B	GEMS-0289	Trop Inbred/Tusón	Thailand/Guatemala	Ames	2017
286	BR52051:S172641-B-050-001-B	GEMS-0290	Dente Amarelo	Brazil	Ames	2017
287	Ki21:S(DJ7)(GEMS-0115)-B-051-002-B	GEMS-0291	Tropical Inbred x GEM	Thailand	Ames	2017
288	(GEMN-0097/GEMN-0136)-B-008	GEMN-0292	Mixed/Tropical Hybrid	USA/Brazil	NC	2017
289	CML341:S42-B-124	GEMS-0293	Tuxpeño	Mexico	NC	2017
290	DKB844:S16-005-022-012	GEMS-0294	Tropical Hybrid	Mexico	NC	2017
291	DKB830:S51-031-003	GEMS-0295	Tropical Hybrid	Mexico	NC	2017
292	(GEMS-0113/GEMS-0162)-B-B-054-001	GEMS-0296	Tuxpeño/Argentino	Mexico/Cuba	Ames	2018
293	(GEMS-0115/GEMS-0222)-B-B-033-001	GEMS-0297	Trop Hybrid/Mult Borer Composite	Mexico	Ames	2018
294	(GEMS-0219/GEMS-0227)-B-015-001	GEMS-0298	Mixed (Creole)/Trop Inbred	Cuba/Thailand	Ames	2018
295	(H8431/((GEMS-0115/Mp717)/TZAR101))-SIB-B-005-001	GEMS-0299	Trop Hybrid/Trop Inbred	Mexico/Nigeria	Ames	2018
296	NS1:S(GEMS-0149)41-051-001-001	GEMS-0300	Suwan	Thailand	Ames	2018
297	NS1:S(GEMS-0149)41-066-001-001	GEMS-0301	Suwan	Thailand	Ames	2018
298	ATL100:N(LH82)(GEMN-0097)-041-001	GEMN-0302	Tropical Hybrid/Florida Syn	Brazil/USA	Ames	2018
299	(GEMS-0162/GEMS-0227)-040-002-001	GEMS-0303	Argentino/Trop Inbred	Cuba/Thailand	Ames	2019
300	(GEMS-0162/GEMS-0227)-046-001-001	GEMS-0304	Argentino/Trop Inbred	Cuba/Thailand	Ames	2019
301	(GEMS-0227/PHP38)-018-001-001	GEMS-0305	Tropical Inbred	Thailand	Ames	2019
302	((LH195/KO679Y)/GEMS-0227)-010-001-002	GEMS-0306	Tropical Inbred	South Africa/Thailand	Ames	2019
303	((PHB47/CML373)/GEMS-0162)-SIB-053-002	GEMS-0307	Tropical Inbred/Argentino	Mexico/Cuba	Ames	2019
304	((PHB47/CML373)/GEMS-0162)-SIB-086-001	GEMS-0308	Tropical Inbred/Argentino	Mexico/Cuba	Ames	2019
305	ATL100:N(LH82)(GEMN-0097)-090-001	GEMN-0309	Tropical Hybrid	Brazil	Ames	2019
306	(GEMN-0104/GEMN-0097)-070-003	GEMN-0310	Trop Hybrid/Florida Syn	Thailand/USA	NC	2019
307	BR106:S42-063-002	GEMS-0311	Tuxpeño	Brazil	NC	2019
308	PASCO14:S11a-128-003	GEMS-0312	Cuban yellow	Peru	NC	2019
309	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	GEMS-0313	Argentino / Tropical Inbred	Cuba/Thailand	Ames	2020
310	((GEMS-0227/Ki14)/12)-080-001-002	GEMS-0314	Tropical Inbred	Thailand	Ames	2020
311	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	GEMS-0315	Trop Inb/MS Inb/Florida Syn	Thailand	Ames	2020
312	((KO679Y/GEMS-0030)/12)-090-001-001	GEMS-0316	Trop Inbred /Trop Hybrid	South Africa/Brazil	Ames	2020
313	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	GEMN-0317	Florida Syn/Dente Amarelo /Trop Hyb	Brazil	Ames	2020
314	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	GEMN-0318	Florida Syn/Mississippi Inbred	USA	Ames	2020
315	Ki14:N4212-185-001-002	GEMN-0319	Tropical Inbred	Thailand	Ames	2020

Table 10. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site	Year
316	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-031	GEMS-0320	Tropical Inbred	Mexico	NC	2021
317	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-018	GEMS-0321	Tropical Inbred	Mexico	NC	2021
318	((KO679Y/GEMS-0030)/794)-015-001	GEMS-0322	Trop Inbred/Trop Hybrid	South Africa/Brazil	Ames	2022
319	(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-122-001	GEMS-0323	Mixed (Creole)/Trop Inb/Trop Hybrid	Cuba/Thailand/Brazil	Ames	2022
320	(GEMS-0227/Ki14)/41-002-001	GEMS-0324	Trop Inbred/Trop Hybrid	Thailand/Brazil	Ames	2022
321	(PHN46/(GEMN-0130/MP494))/41-002-001	GEMN-0325	MS Inbred/Trop Hybrid	USA/Brazil	Ames	2022
1	DKXL212:N11a-139-001-001	DE EXP	Tropical Hybrid	Brazil	UDEL	2003
2	DE3 (DKXL212:N11a-191)	DE3	Tropical Hybrid	Brazil	UDEL	2002
3	DE4 (DKXL212:N11a-365)	DE4	Tropical Hybrid	Brazil	UDEL	2002
4	DE6 (DKXL212:N11a-234)	DE6	Tropical Hybrid	Brazil	UDEL	2005
5	NY212 (FS8B(T):N1802-212)	NY212	Mixed	USA	Cornell U	2009
6	NY215 (FS8B(T):N1802-215)	NY215	Mixed	USA	Cornell U	2009
7	NY266 (AR01150:N0406-266)	NY266	Dent. Blanco Rugoso	Argentina	Cornell U	2009
8	Tx204 (AR01150:N0406)	Tx204	Dent. Blanco Rugoso	Argentina	Texas A&M	2004
9	Tx205 (AR01150:N0406)	Tx205	Dent. Blanco Rugoso	Argentina	Texas A&M	2004
10	W605S (AR17026:N1019)	W605S	Cristalino Colorado	Argentina	U of Wisc.	2004
11	W606S (SCRO1:N1310)	W606S	St. Croix	St. Croix	U of Wisc.	2009
12	W607S (BR52051:N04)	W607S	Dente Amarelo	Brazil	U of Wisc.	2009
13	W608S (CH05015:N15)	W608S	Camelia	Chile	U of Wisc.	2009
14	W609S (FS8B(T):N11a)	W609S	Mixed	USA	U of Wisc.	2009
15	W610S (CUBA164:S2012)	W610S	Mixed (Creole)	Cuba	U of Wisc.	2009
16	W615S (GEM Quality Syn. GQS C0)	W615S	Criollo/Argentino	Cuba	U of Wisc.	2013
17	W616S (AR16026:S1719)	W616S	Cristalino Colorado	Argentina	U of Wisc.	2013

Bolded codes are Crop Science Registered

Genetic Sterility Allele

Table 11. Sixty-five GEM releases were tested for the presence of the Ga1-m allele at Clayton, NC in 2021. GEM lines were used as males in crosses with a Ga1-s W22 stock provided by Jerry Kermickle via Jim Holland. Two NC lines that are known to carry Ga1-s, along with three ex-PVPS, were also included in the test.

GEMS-0002	GEMS-0115	GEMS-0215	GEMN-0270
GEMS-0003	GEMN-0124	GEMS-0219	GEMN-0271
GEMS-0027	GEMN-0135	GEMS-0220	GEMN-0272
GEMS-0032	GEMN-0137	GEMS-0226	GEMS-0273
GEMN-0048	GEMS-0142	GEMS-0227	GEMS-0280
GEMS-0049	GEMN-0144	GEMN-0230	GEMS-0281
GEMS-0050	GEMS-0147	GEMN-0232	GEMS-0282
GEMS-0061	GEMN-0157	GEMS-0235	GEMN-0287
GEMS-0066	GEMN-0177	GEMS-0237	GEMS-0293
GEMS-0072	GEMN-0178	GEMN-0238	GEMS-0294
GEMS-0093	GEMN-0187	GEMS-0243	GEMS-0295
GEMN-0096	GEMN-0192	GEMS-0245	GEMS-0311
GEMN-0097	GEMS-0200	GEMS-0255	GEMS-0312
GEMN-0098	GEMN-0205	GEMN-0257	GEMS-0320
GEMN-0104	GEMN-0207	GEMS-0258	GEMS-0321
GEMS-0113	GEMN-0209	GEMN-0259	
			PHMK0
NC302	NC354	LH213	LH283

Table 12. The results from 2021 were compared with results from Zachary Jones' dissertation. The tester used by Jones may have resulted in some false positives, as it appears that one of the lines used to create the tester (NC400) is segregating for Ga1-m or ga1. As expected, the two NC lines produced full seed set when used as males, while there was no seed set when the ex-PVPs were used as males.

<u>GEM line</u>	<u>2021 Raleigh</u>	<u>Z. Jones Dissertation</u>	<u>Background</u>
GEMS-0003	5 of 8 with seed set	4/5 with seed set	Brazil 52051/Dente Amarelo
GEMS-0093	12 of 12 with seed set	Not tested	Cuba164/Creole
GEMN-0137	2 of 9 with seed set	3/5 with seed set	St. Croix Gp3/Tusón
GEMN-0205	0 of 12 with seed set	1/5 with seed set	Guad05/Early Caribbean
GEMN-0209	0 of 11 with seed set	2/5 with seed set	Brazil 51721/Dente Amarelo
GEMN-0225	15 of 17 with seed set	3/5 with seed set	BR105/Suwan
GEMN-0230	5 of 7 with seed set	4/5 with seed set	CML413/Tropical inbred
GEMN-0232	10 of 10 with seed set	1/5 with seed set	St. Croix Gp3/Tusón
GEMN-0259	0 of 9 with seed set	2/5 with seed set	St. Croix 01/St. Croix
GEMN-0271	5 of 9 with seed set	0/5 with seed set	BR105/Suwan
GEMS-0281	0 of 12 with seed set	1/5 with seed set	Brazil 52051/Dente Amarelo

Table 13. Tropical inbreds were also tested in 2021, with results listed below:

Line	Observation
CML78	10 of 10 with seed set
CML287	0 of 10 with seed set
CML312	6 of 13 with seed set
CML321	6 of 10 with seed set
CML323	0 of 11 with seed set
CML343	0 of 10 with seed set
CML380	0 of 7 with seed set
CML449	0 of 10 with seed set
CML451	1 of 10 with seed set
CML494	0 of 4 with seed set
La Posta Sequia C7 F71-1-1-1-2-B*4	0 of 8 with seed set
La Posta Seq C7 F64-1-1-1-1-B*4	0 of 12 with seed set
La Posta Seq C7 F64-1-1-1-2-B*4	0 of 10 with seed set
89291	0 of 10 with seed set
89343	1 of 10 with seed set
N3-2-3-3	0 of 10 with seed set
KO679Y	0 of 12 with seed set
D940Y	0 of 8 with seed set

CMLs 78, 312 and 321 all set seed when used as males. CML321 appears to have the Ga1-s allele based on previous crosses that were attempted in winter nursery in 2019, while the other two lines likely contain Ga1-m. We did not have clear results for all crosses attempted, with some ears sowing a few scattered kernels; we did not count these as positive results. This may be the result of contamination from pollen from the tassels on the female plants, and in the future all female plants will be detasseled prior to pollen shed. The results for CML380, 89343 and D940Y are suspect as those lines did not appear to produce much pollen, and it would be best to reproduce this study in a winter nursery.

Table 14. GEM-Ames lines screened for Ga1-s

Line	Seed Set Ears	Pollinations
B73	0	10
Mo17	0	12
GEMS-0050	0	11
GEMN-0097	0	8
GEMS-0115	0	7
GEMN-0158	0	3
GEMN-0178	0	8
GEMS-0201	3	3
GEMN-0225	7	8
GEMS-0227	0	9
GEMS-0248	2	8
GEMS-0251	0	12
GEMS-0264	3	6
GEMN-0267	0	10
GEMS-0268	5	10
GEMS-0269	0	12
GEMS-0280	0	7
GEMS-0275	0	8
GEMS-0276	0	10
GEMS-0277	0	10
GEMS-0278	0	9
GEMS-0279	0	10
GEMS-0280	0	9
GEMS-0281	0	9
GEMS-0282	0	10
GEMS-0283	0	10
GEMS-0284	0	7
GEMN-0285	0	9
GEMN-0286	1	1
GEMS-0288	0	7
GEMS-0289	0	9
GEMS-0290	0	13
GEMS-0291	0	6
GEMS-0296	0	8
GEMS-0297	0	12
GEMS-0298	0	8
GEMS-0299	0	12
GEMS-0300	0	12
GEMS-0301	0	8
GEMS-0302	0	9
GEMS-0303	0	9
GEMS-0304	0	9
GEMS-0305	0	7

Table 14. GEM-Ames lines screened for Ga1-s

Line	Seed Set Ears	Pollinations
GEMS-0306	0	9
GEMS-0307	4	9
GEMS-0308	7	10
GEMN-0309	0	9
GEMS-0313	0	12
GEMS-0314	0	11
GEMS-0315	0	10
GEMS-0316	0	10
GEMN-0317	0	11
GEMN-0318	0	9
GEMN-0319	0	7

Breeding Cross Observation

Table 15. Breeding Cross Observations - GEM Raleigh

Pedigree	Yield* (bu/ac)	Moisture* (%)	Test Weight*	Root Lodging (%)	Stalk Lodging (%)	Ear Height (cm)	Plant Height (cm)	Anthesis (GDD)	Silking (GDD)	Notes ^{&}
PHP38/Chiapas 462//LH236	119	16.9	63.0	0.0	4.0	158	313	1478	1491	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
PHP38/Durango 32//LH236	103	16.2	62.0	0.0	0.0	144	291	1450	1459	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
PHP38/Durango 32//PHHB9	87	15.2	62.0	0.0	0.0	159	295	1422	1423	Ear height variable, possibly workable with sufficient plants
PHP38/Guanajuato 69//LH236	118	16.7	62.0	0.0	0.0	149	312	1435	1440	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
San Luis Potosi 146/PHP38//LH236	103	16.8	61.5	0.0	0.0	143	308	1300	1314	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
Jalisco167B/PHP38//LH236	99	16.4	61.5	0.0	0.0	140	294	1474	1458	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
Jalisco 167B/LH236	107	16.3	60.5	0.0	0.0	170	334	1434	1490	Needs 2nd cross
BR017728 (BAI III)/PHHB9	121	15.6	62.5	0.0	0.0	172	326	1464	1471	Needs 2nd cross
BR028029 (CMS 06)/LH236	106	16.7	61.0	0.5	0.5	172	319	1484	1497	Needs 2nd cross
BR028029 (CMS 06)/PHHB9	106	16.4	62.0	0.5	0.0	174	324	1438	1448	Needs 2nd cross
BR044083 (C.JAIBA III)/LH236	105	16.1	62.0	0.0	0.0	176	319	1457	1477	Needs 2nd cross
BR044083 (C.JAIBA III)/PHHB9	100	16.0	63.0	0.0	0.5	181	328	1403	1403	Needs 2nd cross
BR050024 (C. MANAUS)/LH236	102	16.7	61.0	0.0	0.0	164	311	1445	1464	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
BR050024 (C. MANAUS)/PHHB9	96	15.9	62.5	0.0	0.5	171	322	1430	1443	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
BR051675 (PE 27)/LH236	113	16.6	61.5	0.5	1.0	196	348	1464	1490	Needs 2nd cross
BR051675 (PE 27)/PHHB9	113	16.2	61.0	0.5	0.0	193	344	1435	1460	Needs 2nd cross
BR051721 (RN 07)/LH236	114	16.5	62.0	0.0	0.5	180	338	1451	1483	Needs 2nd cross
BR051721 (RN 07)/PHHB9	107	16.1	61.5	0.0	0.5	176	322	1434	1464	Needs 2nd cross
BR051764 (SE 03)/LH236	96	17.2	60.5	0.0	1.5	182	327	1497	1504	Needs 2nd cross
BR051764 (SE 03)/PHHB9	100	15.7	62.5	0.0	0.5	184	327	1451	1451	Needs 2nd cross
BRA 052019 (SE 28)/LH236	97	17.0	63.5	0.0	2.0	173	330	1484	1517	Needs 2nd cross
BRA 052019 (SE 28)/PHHB9	106	16.5	63.0	0.0	0.0	192	340	1484	1483	Needs 2nd cross
Veracruz 147/LH236	115	16.9	61.0	0.0	0.5	178	331	1490	1513	Needs 2nd cross
Veracruz 147/PHHB9	111	16.4	62.0	0.0	0.0	180	328	1490	1517	Needs 2nd cross
EV-8444/LH236	115	17.0	62.0	0.0	0.0	153	294	1417	1433	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
EV-8444/PHHB9	101	16.0	62.5	0.0	0.0	166	315	1429	1441	Needs 2nd cross
La Posta Sequia C6 GTS)%B/LH236	113	17.4	60.5	0.0	0.0	155	299	1470	1470	Probably needs 2nd cross
La Posta Sequia C6 GTS)%B/PHHB9	116	16.2	62.0	0.0	0.0	168	314	1464	1445	Probably needs 2nd cross
Pool 26 C31 GTS)%B/LH236	122	17.1	62.0	0.0	0.0	157	317	1464	1464	Ear height variable, possibly workable with sufficient plants
Pool 26 C31 GTS)%B/PHHB9	125	16.0	62.5	0.0	0.0	169	320	1451	1445	Probably needs 2nd cross
Pool 26 Seq C3 GTS)%B/LH236	107	17.1	61.5	0.0	0.0	144	298	1422	1445	Workable
Pool 26 Seq C3 GTS)%B/PHHB9	126	16.3	63.0	0.0	0.0	162	302	1401	1394	Ear height variable, possibly workable with sufficient plants
Pool26GT#1)%B/LH236	111	17.9	60.5	0.0	0.0	151	310	1464	1496	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
Pool26GT#1)%B/PHHB9	111	16.7	63.0	0.0	0.0	169	322	1445	1457	Probably needs 2nd cross
Pool26GT#2)%B/LH236	103	17.0	61.0	0.0	0.5	166	327	1457	1496	Needs 2nd cross
Pool26GT#2)%B/PHHB9	102	16.4	62.5	0.0	0.0	178	322	1451	1445	Needs 2nd cross
Pool26GT#3)%B/LH236	109	16.7	62.0	0.0	0.5	159	317	1464	1504	Probably needs 2nd cross
Pool26GT#3)%B/PHHB9	114	16.2	62.5	0.0	0.0	174	313	1445	1440	Needs 2nd cross

Pedigree	Yield* (bu/ac)	Moisture* (%)	Test Weight*	Root Lodging (%)	Stalk Lodging (%)	Ear Height (cm)	Plant Height (cm)	Anthesis (GDD)	Silking (GDD)	Notes ^{&}
Pool26GT#4)%B/LH236	106	17.3	62.0	0.0	2.5	158	304	1439	1445	Ear height variable, possibly workable with sufficient plants
Pool26GT#4)%B/PHHB9	121	16.1	62.0	0.0	0.5	173	315	1445	1445	Probably needs 2nd cross
Pool34GT#1)%B/LH236	119	16.4	61.5	0.0	0.0	143	292	1378	1391	Workable
Pool34GT#1)%B/PHHB9	109	15.9	62.5	0.0	0.5	154	292	1371	1364	Ear height variable, probably workable with sufficient plants
Pool34GT#2)%B/LH236	96	16.5	60.5	0.0	0.0	144	281	1384	1384	Workable
Pool34GT#2)%B/PHHB9	109	16.3	62.0	0.0	0.5	151	288	1389	1399	Ear height variable, probably workable with sufficient plants
Pool34GT#3)%B/LH236	114	16.1	62.0	0.0	0.0	136	286	1384	1404	Workable
Pool34GT#3)%B/PHHB9	104	16.4	63.5	0.0	0.0	155	293	1406	1396	Probably needs 2nd cross
Population 44 (IST) C2/LH236	120	17.0	61.0	0.0	0.0	151	293	1433	1433	Ear height variable, probably workable with sufficient plants
SA-4/LH236	105	17.0	62.5	0.0	0.0	149	289	1406	1429	Possibly workable
SA-4/PHHB9	103	16.4	63.0	0.0	0.0	158	292	1412	1417	Probably needs 2nd cross
SA-6/LH236	104	17.0	62.0	0.0	0.0	154	299	1464	1484	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
SA-6/PHHB9	110	16.1	62.0	0.0	0.0	162	306	1464	1483	Probably needs 2nd cross
Tuxpeno Sequia C8 GTS)%B/LH236	114	16.6	60.5	0.0	0.0	150	297	1470	1490	Ear height variable, possibly workable with sufficient plants, second rep is lower than first
Tuxpeno Sequia C8 GTS)%B/PHHB9	101	16.2	61.5	0.0	0.5	165	304	1451	1440	Ear height variable, possibly workable with sufficient plants
CL-FAWW11/PHHB9	115	17.3	64.0	0.0	0.0	173	325	1476	1451	Needs 2nd cross
CML343//LH236/DK_84QAB1	107	17.2	60.5	0.0	0.0	143	298	1490	1510	Ear height variable, possibly workable with sufficient plants; RAL22
CML343//LH242/DK_84QAB1	127	15.8	60.0	0.0	0.0	154	297	1497	1517	Ear height variable, possibly workable with sufficient plants
CML343//PHHB9/DK_84QAB1	116	16.7	61.0	0.0	0.0	154	306	1470	1471	Ear height variable, possibly workable with sufficient plants
CML343//PHHB9/LH236	112	15.6	61.0	0.0	0.0	142	288	1484	1504	Ear height variable, possibly workable with sufficient plants; Poor stand; RAL22
CML343//PHHB9/LH242	119	15.8	60.5	0.0	0.0	153	300	1470	1497	Probably needs 2nd cross
D940Y//LH236/DK_84QAB1	116	15.4	61.5	0.0	0.0	150	293	1434	1464	Long shanks, ear height variable, probably workable with sufficient plants; RAL22
D940Y//LH242/DK_84QAB1	102	16.3	61.5	0.0	0.0	154	288	1490	1537	Ear height variable, probably workable with sufficient plants
D940Y//PHHB9/DK_84QAB1	86	16.0	62.5	0.0	0.0	159	289	1470	1490	Ear height variable, possibly workable with sufficient plants
D940Y//PHHB9/LH236	91	16.1	62.0	0.0	0.0	150	294	1445	1484	Long shanks, ear height variable, probably workable with sufficient plants; RAL22
D940Y//PHHB9/LH242	82	16.1	61.5	0.0	0.0	153	299	1484	1517	Probably needs 2nd cross; Poor stand
La Posta Sequia C7 F71-1-1-1-2-B*3//LH236/DK_84QAB1	126	16.3	60.5	0.0	0.0	158	306	1427	1451	Probably needs 2nd cross
La Posta Sequia C7 F71-1-1-1-2-B*3//LH242/DK_84QAB1	107	16.3	60.5	0.0	0.0	162	303	1433	1452	Probably needs 2nd cross; Poor stand
La Posta Sequia C7 F71-1-1-1-2-B*3//PHHB9/DK_84QAB1	133	16.1	60.5	0.0	0.0	158	301	1427	1439	Probably needs 2nd cross
La Posta Sequia C7 F71-1-1-1-2-B*3//PHHB9/LH236	125	16.1	60.5	0.0	0.0	153	304	1434	1451	Probably needs 2nd cross
La Posta Sequia C7 F71-1-1-1-2-B*3//PHHB9/LH242	132	15.5	60.5	0.0	0.5	158	303	1433	1458	Probably needs 2nd cross
KS23(S)C5//LH236/DK_84QAB1	99	17.3	61.5	0.0	0.0	164	312	1445	1445	Ear height variable, possibly workable with sufficient plants
KS23(S)C5//LH242/DK_84QAB1	87	16.3	61.5	0.0	2.0	172	308	1423	1435	Probably needs 2nd cross
KS23(S)C5//PHHB9/DK_84QAB1	93	16.8	62.0	0.0	2.0	165	322	1422	1465	Probably needs 2nd cross
KS23(S)C5//PHHB9/LH236	98	16.7	62.0	0.0	0.0	166	319	1464	1470	Probably needs 2nd cross
KS23(S)C5//PHHB9/LH242	103	16.3	62.0	0.0	0.0	168	316	1445	1451	Probably needs 2nd cross
KS23(S)C5/LH236	104	17.5	61.5	0.0	0.0	157	306	1457	1497	Probably needs 2nd cross

Pedigree	Yield* (bu/ac)	Moisture* (%)	Test Weight*	Root Lodging (%)	Stalk Lodging (%)	Ear Height (cm)	Plant Height (cm)	Anthesis (GDD)	Silking (GDD)	Notes ^{&}
KS23-4/LH236	119	17.4	61.5	0.0	0.0	166	322	1422	1434	Probably needs 2nd cross
KS23-4/PHHB9	114	16.7	62.5	0.0	0.0	170	314	1452	1428	Probably needs 2nd cross
CML274/LH236	131	17.0	60.5	0.0	0.0	152	304	1490	1510	Probably needs 2nd cross
CML274/PHHB9	112	16.0	61.5	0.0	0.0	157	298	1483	1483	Probably needs 2nd cross (ear height and husk cover issues)
CML78/LH236	95	18.0	62.0	0.0	0.0	126	286	1396	1401	Very good
DO620Y/LH236	122	15.8	61.0	0.0	0.0	148	282	1434	1458	Long shanks, possibly workable? May need 2nd cross
DO620Y/PHHB9	100	15.7	62.0	0.0	0.0	158	287	1440	1451	Possibly workable? May need 2nd cross
HI 62/PHHB9	110	17.3	62.5	0.0	0.0	157	301	1445	1445	Possibly workable? May need 2nd cross
HI 63/PHHB9	116	16.5	64.0	0.0	0.0	168	298	1470	1483	Probably needs 2nd cross
KO326Y/LH236	105	15.4	61.0	0.0	0.0	134	267	1391	1391	Good
KO326Y/PHHB9	100	16.3	62.0	0.0	0.0	145	273	1406	1417	Probably workable
KO679Y/LH236	121	17.2	61.5	0.0	0.0	133	271	1412	1418	Very good
KO537Y/PHHB9	123	16.9	62.0	0.0	0.0	147	287	1406	1406	Probably workable
KO537Y/LH283	123	18.0	62.5	0.0	0.0	141	280	1396	1422	Probably workable but plant health a concern
CML36/LH283	124	17.0	64.5	0.0	0.5	173	312	1445	1445	Ear height and plant health issues
HI 53/LH283	100	15.7	63.5	0.0	7.5	165	302	1396	1396	Ear height and plant health issues
L36/LH283	116	15.4	64.0	1.0	0.0	188	326	1446	1440	Ear height and plant health issues
Tx736/LH214	111	16.1	62.0	0.0	0.0	128	274	1301	1315	Good
Tx736/LH283	111	15.8	62.0	0.0	0.0	137	273	1293	1280	OK, plant health issues as compared with LH214 cross
GEMN-0232/LH283	131	16.4	61.5	0.0	0.0	154	283	1364	1314	Ear height issues
Pool 25 C31-001)%B/LH214	98	17.2	64.0	0.0	0.5	157	307	1417	1436	Ear height variable, possibly workable with sufficient plants
Pool 25 C31-001)%B/LH283	109	16.8	64.5	0.0	0.0	171	309	1445	1459	Probably needs 2nd cross
Pool25GT#1)%B/LH214	89	16.1	62.5	0.0	0.5	158	303	1412	1429	Ear height variable, possibly workable with sufficient plants
Pool25GT#1)%B/LH283	99	16.8	63.5	0.0	2.5	164	298	1422	1417	Probably needs 2nd cross
Pool25GT#2)%B/LH214	94	16.2	63.0	0.0	1.0	164	313	1434	1428	Probably needs 2nd cross
Pool25GT#2)%B/LH283	124	16.1	63.5	0.0	1.0	163	298	1412	1405	Probably needs 2nd cross
Pool25GT#3)%B/LH214	111	16.5	64.0	0.0	0.0	147	302	1391	1376	Probably needs 2nd cross
Pool25GT#3)%B/LH283	103	15.5	62.5	0.0	1.0	158	291	1371	1360	Ear height and plant health issues
Pool25GT#3)%B/LH284	104	15.8	63.5	0.0	0.5	145	294	1336	1300	Decent ear height but plant health is a concern
Pool33GT#1)%B/LH214	105	16.0	64.0	0.0	0.0	144	298	1328	1349	Ear height variable, workable with sufficient plants (RAL23)
Pool33GT#2)%B/LH214	96	16.0	64.0	0.0	0.5	139	282	1307	1307	Ear height variable, workable with sufficient plants (RAL23)
Pool33GT#2)%B/LH284	101	15.2	62.5	0.0	1.0	141	278	1259	1266	Decent ear height but plant health is a concern
Pool33GT#3)%B/LH214	99	16.4	63.0	0.0	1.0	141	293	1371	1369	Ear height variable, probably workable with sufficient plants
Pool33GT#3)%B/LH284	81	15.7	61.5	0.5	0.0	139	291	1300	1307	Decent ear height but plant health and husk cover are concerns
Popn32 (IST) C2/LH185//GEMN-0048	103	16.0	61.5	0.0	0.0	145	288	1374	1382	Ear height variable, workable with sufficient plants, second rep is lower than first
SA-5/LH214	91	16.5	63.5	0.0	0.5	148	294	1405	1412	Ear height variable, probably workable with sufficient plants
SA-5/LH283	104	15.8	63.5	0.0	0.5	152	276	1401	1401	Ear height variable, possibly workable with sufficient plants
SA-7/LH214	111	16.4	63.5	0.0	0.5	162	307	1411	1417	Probably needs 2nd cross
SA-7/LH283	101	16.6	64.0	0.0	0.5	159	289	1389	1369	Probably needs 2nd cross
Barbados GP2/H82//LH214	114	16.0	62.0	0.0	1.0	148	303	1357	1386	Ear height variable, probably workable with sufficient plants (RAL23)

Pedigree	Yield* (bu/ac)	Moisture* (%)	Test Weight*	Root Lodging (%)	Stalk Lodging (%)	Ear Height (cm)	Plant Height (cm)	Anthesis (GDD)	Silking (GDD)	Notes ^{&}
Lima 13/LH82//LH214	101	14.6	61.5	0.0	2.0	143	282	1308	1343	Ear height variable, probably workable with sufficient plants (RAL23)
PM-801/LH82//LH214	107	15.2	62.0	0.0	0.5	154	289	1350	1376	Ear height variable, probably workable with sufficient plants (RAL23)
Saint Croix GP3/LH82//LH214	104	15.2	62.5	0.0	0.5	149	282	1464	1477	Ear height variable, probably workable with sufficient plants (RAL23)
LH185/TropHyb40//LH283	92	15.4	61.5	0.0	0.0	148	283	1374	1370	Husk cover and plant height issues
TropHyb40/LH82//LH214	97	15.4	61.5	0.0	0.5	132	275	1286	1300	Good (RAL22)
TropHyb40/LH82//LH284	101	14.9	62.0	0.0	0.5	131	277	1286	1280	Decent ear height but plant health and husk cover are concerns
TropHyb40/LH82//GEMN-0048	102	15.0	59.0	0.0	0.0	134	274	1314	1336	Decent ear height but plant health is a concern
LH213/TropHyb40//GEMN-0048	84	14.9	59.5	0.0	1.0	154	309	1417	1406	Ear height variable, probably workable with sufficient plants
LH216/TropHyb40//GEMN-0048	109	15.7	61.0	0.0	0.0	163	300	1417	1412	Ear height variable, possibly workable with sufficient plants
PHK56/TropHyb40//GEMN-0048	111	14.9	60.5	0.0	4.0	155	301	1381	1380	Ear height variable, possibly workable with sufficient plants
PHK56/TropHyb40//LH214	105	15.5	61.5	0.0	0.5	142	301	1328	1341	Ear height variable, possibly workable with sufficient plants
Mean	108	16.3				157	302			
LSD	22	1.2				14	18			
C.V.	9.8	3.2				4.4	2.9			

* Yield, Moisture and Test Weight collected from two-row plots planted with two replications at one location in 2021

[&] RAL22 and RAL23 indicates breeding cross that we intend to plant in the nursery for advancement in 2022 and 2023, respectively

Table 16. Breeding Cross Observations - GEM Raleigh

Pedigree	Anthesis (GDD)	Silking (GDD)	Ear Height (cm)	Plant Height (cm)	Notes
GS11(R)C1	1545	1656	189	323	Kitale II(R11)C6*/GS17CO; very tall, ear height way up, white flint/semi-flint
GS12(R)C1	1730	N/A	186	323	ETO/BS16//EC573(R12)C6; tall, barren stalks, ear height way up
GS15(R)C4	1268	1286	137	270	Virginia Corn Belt Exotic breeding population; low ear height, decent ears, yellow dent
GS16(R)C1	1529	1553	145	261	RRS in ETO Leaf and Tassel Reduction C6 and ETO (IPTT)C2 synthetics; poor stand, decent ear height, late? white flint
GS17CO	1205	1224	108	229	Tuxpeno P.B. C7/RSSSC; low ear height, early? semiflint/semident
GS18(R)C2	1447	1531	139	273	Pioneer West Indies composite; decent ear height, ok, yellow dent/semident/semiflunt
GS27(R)C2	1553	1584	146	265	FS7B; decent, yellow dent/semident/semiflunt
GS32(R)C1	1473	1489	143	273	FS7B and an Elite Virus Dent Synthetic; decent, yellow dent/semident, collapsing 9-12
GS34(R)C2	1431	1477	144	275	BSCB1(R)C7, BS11(FR)C3, and BS12(HI)C6*/EC573(R12)C4; ear height up a bit, ok, yellow dent
GS51(M)C4	1503	1579	160	321	CBW I with elite Corn Belt SSS lines; tall, ear height up, ok, flint/semiflunt, collapsing 9-12
POPULATION 33 (IST) C2	1429	1518	129	240	Intermediate maturity subtropical yellow flint; some decent ears, some poor, decent ear height, ear height/ph an issue?
POPULATION 34 (IST) C2	1574	1632	151	265	Intermediate to late maturity subtropical white semi-flint; Ear height up, many barren stalks and poor ears
POPULATION 42 (IST) C2	1615	1717	169	289	ETO Illinois; Ear height up, several barren stalks, white flint
POPULATION 44 (IST) C2	1610	1723	171	284	American Early Dent and Tuxpeno; Ear height up, white dent
EV8444-SR	1602	1693	183	288	Selection from Population 44 converted to MSR; Ear height up, slightly better ear production and slightly more flinty than Population 44 (IST) C2
POPULATION 45 (IST) C2	1422	1496	163	276	Intermediate maturity subtropical yellow dent; better ear height than others
Corn Belt-Southern Synthetic	1333	1407	130	251	Nice ears, decent ear height
Indian Chief IR14	1617	1660	146	270	Moderately high, small ears, some lodging, slightly more flint than Jarvis
Jarvis IR14	1524	1567	153	276	Moderately high, small ears, slightly more dent than Jarvis
Cargill North Temp Zone Mexican Dent	1296	1304	118	221	Decent, cross to "late" ex-pvp or Raleigh GEM release not derived from Mexican germplasm?
Cargill North Temperate Zone Caribbean	1249	1279	121	204	Decent but poor germination
Cargill North Temperate Zone Cateto	1185	1210	116	215	Poor stand, low ears
Cargill North Temperate Zone Coroico	1158	1217	120	206	OK
Cargill North Temperate Zone Cuzco	1119	1173	104	205	OK but collapsed early
42T1/GEMS-0226//42A	1425	1467	156	276	Ear height variable but workable, ears ok. RAL22
42T1/GEMS-0227//42B	1319	1327	125	268	Low ear height, good ears, but too early?
42T2/GEMS-0226//42B	1347	1367	131	265	Low ear height, ok ears, good? RAL22
42T2/GEMS-0227//42A	1335	1360	123	249	Low ear height, short, decent ears, too early?
GEMS-0215/LH236	1452	1484	156	283	Ear height good, overall good
GEMS-0215/NC368	1498	1558	165	296	Ear height up, decent, ear height/plant height issues
GEMS-0281/GEMS-0258	1428	1438	154	266	Decent
GEMS-0295/LH236	1456	1452	141	261	Good
GEMS-0295/NC368	1503	1509	161	280	Ear height up, ok
HC33/55T5/LH236	1415	1425	136	265	Decent, good ears, low ear height. RAL22
HC33/55T6/LH236	1395	1427	130	260	Decent, decent ears, low ear height
HC33/Ki30/LH236	1427	1456	134	271	Good, decent ears
HC33/Tuxpeño-BVIR 153/LH236	1441	1466	151	288	Variable ear height, workable but for LH236?
HC33/Tuxpeño-VER 147/LH236	1423	1468	144	268	Decent, ok/decent ears. RAL22
LH195/55T4//GEMS-0147	1545	1537	161	270	Ear height up a bit, smallish ears, irregular kernel rows
LH227/Tuxpeño-BVIR 153/LH236	1439	1490	165	304	High ear height, possibly workable with enough plants but ear height noticeably higher than HC33 cross

Pedigree	Anthesis (GDD)	Silking (GDD)	Ear Height (cm)	Plant Height (cm)	Notes
LH227/Tuxpeño-VER 147//LH236	1449	1489	155	279	High ear height, possibly workable with enough plants but ear height noticeably higher than HC33 cross
PHHB4/55T4//LH236	1459	1477	148	279	Ok, smallish ears, slightly better than LH195/55T4//GEMS-0147
PHHB4/55T4//LH244	1368	1396	143	283	Ear height variable, workable, decent ears. RAL22
PHHB9/Canilla-BVIR 106//LH244	1376	1426	150	290	Variable ear height, workable, good ears, decent. RAL22
PHHB9/Chandelle-BVIR 116//LH244	1396	1418	158	298	Ear height up a bit, need lots for selection
PHHB9/Ki59//LH244	1355	1388	144	274	Good, good ears
PHW52/KS23(S)C5//LH244	1340	1402	145	274	Decent, good ears
LH213//Tuson/Criollo-BVIR 155//LH283	1414	1408	159	279	Ear height variable
LH216/Cubano Amarillo-BVIR 102//LH283	1340	1368	146	260	Good ear height, decent/good ears. RAL22
HK56/Coastal Tropical Flint-BVIR 104//LH263	1354	1393	160	270	Variable ear height, decent ears
HK56/Coastal Tropical Flint-BVIR 104//LH283	1368	1381	143	253	Decent ear height, ear height/plant height issues? decent/good ears. RAL22
PHK56/Cubano Amarillo-BVIR 102//LH263	1348	1374	159	269	Variable ear height, decent ears

& **RAL22** indicates breeding cross that we intend to plant in the nursery for advancement in 2022

Table 17. GEM x Novasem S₁ observations - GEM Raleigh

Pedigree	Anthesis (GDD)	Silking (GDD)	Notes ^{&}
GEMN-0048 / NX20T0025	1694	1694	Ear height variable but workable, decent ears. RAL22
GEMN-0097 / NX20T0066	1510	1510	Ear height variable, need lots of plants but might be feasible, decent ears. RAL22
GEMN-0097 / NX20T0067	1448	1479	Ear height variable but workable, decent ears, Oh43 der. RAL22
GEMN-0098 / NX20T0022	1615	1585	Ear height ok, probably workable, ears not great
GEMN-0104 / NX20T0054	1694	1669	Ear height up a bit, needs another cross
GEMN-0124 / NX20T0055	1539	1585	Decent, workable, ear rot issues? Decent husk cover. RAL22
GEMN-0157 / NX20T0039	1615	1585	Ear height variable, need lots of plants, maybe, so-so ears
GEMN-0177 / NX20T0056	1615	1669	Variable ear height, possibly workable, decent ears
GEMN-0178 / NX20T0070	1615	1643	Needs another cross, smallish ears, good husk cover
GEMN-0178 / NX20T0072	1479	1510	Need large numbers to select from, ear rot concerns, decent husk cover
GEMN-0178 / NX20T0073	1479	1539	Workable, decent ears and ear height, Oh43 der. RAL22
GEMN-0207 / NX20T0041	1669	1669	Probably no: high, smallish ears
GEMN-0238 / NX20T0042	1560	1585	Relatively compact, need high numbers for selection, small ears with irregular kernels, several barren plants
GEMN-0238 / NX20T0043	1585	1615	Ear height variable, probably needs another cross, some decent ears some lousy
GEMN-0247 / NX20T0045	1585	1643	Ear height variable but probably needs another cross
GEMN-0252 / NX20T0029	1615	1643	Needs another cross
GEMN-0254 / NX20T0024	1669	1694	Ear height variable, would require large numbers of plants, smallish ears
GEMN-0257 / NX20T0047	1694	1722	Needs another cross
GEMN-0266 / NX20T0059	1643	1669	Needs another cross
GEMN-0270 / NX20T0053	1615	1669	Needs another cross
GEMN-0272 / NX20T0075	1615	1560	Has enough variability for ear height, ears ok. RAL22
GEMN-0272 / NX20T0077	1585	1585	Potentially workable but ear rot issues and irregular kernel rows.
GEMN-0272 / NX20T0078	1539	1539	Variable, needs large number for selections, Oh43 der, stay green issues in general with Oh43 derivatives
GEMN-0272 / NX20T0079	1510	1539	Ear height ok, needs large numbers or really a second cross, OH43 der.
GEMN-0285 / NX20T0048	1539	1585	Ear height variable, probably needs another cross
GEMN-0286 / NX20T0049	1694	1694	Needs another cross
GEMN-0287 / NX20T0080	1615	1615	Probably needs another cross
GEMN-0287 / NX20T0082	1585	1585	Workable with enough plants
GEMN-0287 / NX20T0084	1479	1510	Workable with enough plants, plant health not as good or just earlier? Oh43 der. RAL22
GEMN-0302 / NX20T0085	1539	1510	Compact and, probably workable, ear height relatively uniform but foliar disease issues and smallish ears
GEMN-0302 / NX20T0087	1510	1479	Very compact, ear height ok, best for foliar disease amongst GEMN-0302 crosses
GEMN-0302 / NX20T0088	1448	1479	Very compact and ear height good but foliar disease issues. Oh43 der.
GEMS-0049 / NX20T0026	1669	1669	Needs another cross
GEMS-0050 / NX20T0060	1585	1615	Workable, decent ears, good ear height, short plants
GEMS-0050 / NX20T0061	1669	1781	Ear height variable, might be workable with enough plants, some barrenness, decent for foliar disease. White B73 der.
GEMS-0093 / NX20T0050	1615	1669	Needs large numbers but workable, ok ears, good size
GEMS-0113 / NX20T0030	1585	1615	Needs another cross
GEMS-0115 / NX20T0062	1585	1585	Probably workable, decent ear height, decent foliar, ok ears (RAL23)
GEMS-0115 / NX20T0063	1669	1643	Ear height way up, needs another cross, some disease issues
GEMS-0142 / NX20T0031	1585	1615	Ear height variable, needs lots to select, husk cover issues
GEMS-0235 / NX20T0051	1643	1669	Needs another cross, husk cover issues
GEMS-0255 / NX20T0019	1669	1669	Ear height variable but probably needs another cross
GEMS-0258 / NX20T0064	1669	1694	Compact, good (RAL23)
GEMS-0258 / NX20T0065	1694	1722	Needs another cross
GEMS-0263 / NX20T0057	1669	1722	Ear height variable, probably needs another cross
GEMS-0275 / NX20T0027	1694	1694	Ear height variable, might be workable
GEMS-0281 / NX20T0032	1585	1615	Ear height variable, workable with numbers (RAL23)

GEMS-0282 / NX20T0033	1694	1694	Needs another cross
Pedigree	Anthesis (GDD)	Silking (GDD)	Notes^{&}
GEMS-0284 / NX20T0034	1615	1615	Could go either way, poor husk cover?
GEMS-0288 / NX20T0020	1615	1615	Workable, decent ear height
GEMS-0289 / NX20T0021	1615	1669	Probably workable with enough plants (RAL23)
GEMS-0294 / NX20T0028	1752	1810	White x white F1, needs another cross
GEMS-0301 / NX20T0058	1585	1615	Probably workable, relatively low ear height, good aspect
GEMS-0307 / NX20T0035	1669	1669	Possibly workable, decent ear height, has husk cover issues
GEMS-0311 / NX20T0037	1694	1752	Needs another cross, husk cover issues
GEMS-0312 / NX20T0038	1722	1810	Needs another cross but could possibly be worked with enough plants

[&] **RAL22 and RAL23 indicates breeding cross that we intend to plant in the nursery for advancement in 2022 and 2023, respectively**

Table 18. 2021 Breeding Cross Observation - GEM Ames, Longping - Capron, IL, AgReliant - Lebanon, IN

Entry	HG	Pedigree	Pollen GDU Ames	Silk GDU Ames	Pollen GDU AgR	Silk GDU AgR	Pollen GDU LP	Silk GDU LP	Plant Height (cm) Ames	Ear Height (cm) Ames	Plant Height (cm) LP	Ear Height (cm) LP	Breeder Score Ames	Breeder Score LP	Overall Rating AgR	CAP Score AgR	Ear Height Rating AgR	Health Rating Maturity AgR	Stand Rating AgR	Root Lodging Rate LP	Notes (AgR)	Notes (Ames)
1	Ck	B73/Mo17	1343	1363	1521	1546	1515	1605	283	105	270	120	4	4	3	2-5	5	3		8		
2	Ck	Pioneer P1151	1384	1372	1571	1581	1616	1616	290	110	265	105	8	7	9	6-7	5-6	7	6	9		
3	Ck	Pioneer 31D58	1384	1384	1473	1499	1581	1616	305	115	275	105	8	6	9	6-7	6	8		9		
4	Ck	MBS2655/MBS9508	1332	1322	1473	1446	1501	1512	300	120	280	110	6	6	5	2-6	5-8	7		9		
5	Ck	MBS3520/MBS8814	1322	1298	1473	1446	1539	1539	290	118	290	125	8	4	2	1	5-6	5		9		
6	SS	42T1/GEMS-0226//42A	1463	1475			1691	1712	310	133	275	125	7	4					1	7	no plants emerged	+, RTL
7	SS	42T1/GEMS-0227//42B	1342	1342	1546	1473	1554	1605	300	120	285	90	7	6	3	2-3	4-5	4	3	9		
8	SS	42T2/GEMS-0226//42B	1363	1363	1446	1473	1592	1629	305	120	285	120	6	5	3	1-5	5-6	7		8		
9	SS	42T2/GEMS-0227//42A	1352	1363	1446	1446	1490	1540	290	115	250	95	5	7	6	3-6	6	4		9		
10	SS	LH195/55T4//GEMS-0227	1452	1452	1546	1473	1616	1629	313	135	285	135	8	5	8	5-7	5	7		9		
11	SS	PHHB4/55T4//PH42B	1463	1463	1521	1499	1605	1643	313	115	275	115	7	5	9	5-7	5	7		8		
12	SS	PHHB4/55T4//WQCD10	1486	1525	1623	1623	1629	1720	310	135	295	145	7	3	4	6-7	3-4	8		5		
13	SS	HC33/55T5//PHHB4	1384	1440	1597	1623	1616	1669	290	125	275	110	7	5	7	5-6	4-5	7	3	7		
14	SS	HC33/55T6//GEMS-0227	1374	1397	1499	1446	1566	1605	310	110	275	110	7	7	7	6	5-7	5		9		
15	SS	HC33/55T6//LH236	1463	1487	1546	1546	1643	1704	300	120	250	95	6	7	9	6	6-7	7		9		
16	SS	HC33/55T6//PHHB4	1406	1406	1499	1499	1616	1664	295	120	275	115	7	6	8	5-6	5-6	7		9		++, Nice
17	SS	LH195/Canilla-BVIR 106//GEMS-0227	1374	1395	1499	1499	1629	1682	325	130	285	95	7	6	8	5-7	6	7		9		
18	SS	PHHB9/Canilla-BVIR 106//GEMS-0227	1374	1406	1473	1446	1578	1619	305	115	290	115	6	7	6	5-8	5-6	5		9		
19	SS	PHHB9/Canilla-BVIR 106/LH244	1417	1463	1499	1571	1664	1729	303	120	285	120	6	4	5	5-6	4-5	5		7		
20	SS	LH195/Canilla-BVIR 106//PH42B	1525	1549	1546	1571	1643	1691	310	120	270	120	8	6	8	6-8	5	8		8		
21	SS	PHHB9/Canilla-BVIR 106//PH42B	1395	1406	1499	1521	1616	1669	305	120	275	120	7	6	6	5-7	5-7	6		8		
22	SS	LH195/Canilla-BVIR 106//PHHB4	1429	1499	1571	1623	1682	1728	293	120	295	120	7	4	9	6-7	5-6	8		5		
23	SS	PHHB9/Canilla-BVIR 106//PHTP9	1384	1452	1473	1473	1581	1629	293	113	255	105	6	6	8	6-8	5	8		5		ED
24	SS	LH195/Canilla-BVIR 106//WQCD10	1429	1487	1546	1109	1669	1736	325	145	290	125	8	4	4	5-6	3-5	7		7		
25	SS	PHHB9/Chandelle-BVIR 116//GEMS-0227	1406	1440	1521	1546	1616	1704	305	115	270	115	6	6	8	6-8	5	7		8	poor husk cover	
26	SS	PHHB9/Chandelle-BVIR 116/LH244	1384	1440	1521	1546	1669	1712	310	115	255	110	6	5	7	6-7	4-5	7		8		Long shank
27	SS	PHHB9/Chandelle-BVIR 116//PH42B	1429	1429	1597	1571	1682	1712	308	120	270	120	7	5	6	6-7	4	7	6	8		+
28	SS	LH204/Chandelle-BVIR 116//PHHB4	1429	1501	1546	1571	1642	1691	320	125	270	105	6	6	9	4-6	5-6	8		7		
29	SS	PHHB9/Chandelle-BVIR 116//PHTP9	1384	1429	1499	1521	1669	1704	303	115	280	140	6	4	6	4-6	4-5	8		7		
30	SS	LH204/Chandelle-BVIR 116//R3212Z	1372	1406	1499	1546	1631	1715	305	120	265	105	4	6	7	6-7	5-6	7		9	short	
31	SS	LH204/Chandelle-BVIR 116//WQCD10	1384	1406	1546	1597	1616	1720	310	140	270	120	6	4	5	5-7	4-5	6		9		
32	SS	PHHB9/Ki20/LH244	1417	1440	1546	1546	1669	1745	308	130	275	120	7	4	7	6-8	5	6		9	poor husk cover	
33	SS	LH227/Ki20//PH42B	1353	1363	1473	1473	1581	1656	305	135	295	130	5	6	8	5-6	5	6		9		
34	SS	PHHB9/Ki20//PH42B	1395	1395	1521	1521	1616	1669	293	115	280	130	6	6	8	6-8	4-5	7		9		
35	SS	LH227/Ki20//PHHB4	1395	1429	1521	1546	1631	1677	325	130	280	110	6	6	5	6-8	4-6	8		9		
36	SS	PHHB9/Ki20//PHTP9	1395	1406	1499	1473	1592	1643	298	130	260	125	6	4	7	6-7	4-6	7	6	8	poor husk cover	
37	SS	LH195/Ki30//GEMS-0227	1395	1395	1499	1521	1616	1691	300	125	260	105	6	7	7	6-7	5-6	5		9		
38	SS	HC33/Ki30//LH236	1463	1487	1546	1597	1656	1704	305	115	255	105	7	7	8	5-7	4-6	7		9		
39	SS	LH195/Ki30//PH42B	1418	1440	1546	1521	1616	1656	295	110	250	85	7	6	7	4-6	5-6	7		9		+
40	SS	HC33/Ki30//PHHB4	1406	1418	1499	1499	1616	1699	300	115	265	105	7	6	7	4-6	5-6	6		8		
41	SS	LH195/Ki30//PHHB4	1417	1476	1546	1571	1643	1744	308	110	260	100	7	6	8	6-7	5	8		9		
42	SS	LH195/Ki30//WQCD10	1440	1452	1521	1546	1605	1704	310	125	285	140	7	4	5	4-6	4	8		8		
43	SS	LH204/Ki45//PH42B	1374	1395	1499	1499	1566	1618	305	120	245	100	6	6	6	3-6	5	6		9	poor husk cover	
44	SS	LH204/Ki45//PHHB4	1384	1395	1521	1521	1618	1643	305	120	285	130	6	5	8	4-6	4-5	7		8		
45	SS	LH204/Ki45//R3212Z	1353	1363	1473	1473	1632	1672	268	110	250	115	5	6	6	4-7	5-6	5		9		
46	SS	LH204/Ki45//WQCD10	1406	1440	1473	1499	1618	1691	288	120	270	120	6	5	5	5-6	4-6	6		9		
47	SS	LH227/Ki59//PH42B	1372	1384	1499	1473	1631	1656	300	120	300	150	6	6	7	5-6	5	6		9		
48	SS	PHHB9/Ki59//PH42B	1417	1429	1546	1499	1592	1631	298	115	255	110	7	6	8	3-8	5	5		7		
49	SS	PHHB9/Ki59//PHTP9	1372	1429	1473	1473	1581	1629	288	113	270	130	6	5	7	6-7	4-5	4		5		+
50	SS	PHHB9/Ki59//R3212Z	1372	1384	1473	1446	1691	1712	285	105	270	115	6	6	8	6-7	5-6	6		9		
51	SS	LH227/Ki59//WQCD10	1406	1429	1446	1446	1643	1691	315	130	270	120	7	5	7	4-6	5	5		9		
52	SS	PHW52/KS23(S)C5//PH42B	1384	1418	1499	1446	1539	1554	293	105	255	115	4	7	8	3-8	5-6	6		9		
53	NSS	LH204/KS23(S)C5//PHHB4	1374	1384	1499	1521	1616	1704	305	125	275	125	7	5	6	5-7	4-6	5		7		
54	NSS	HC33/Tuxpeño-BVIR 153//PH42B	1395	1406	1521	1546	1605	1669	303	115	285	120	6	5	8	5-7	5-6	6		8		
55	NSS	LH227/Tuxpeño-BVIR 153//PH42B	1418	1440	1597	1597	1605	1643	310	123	270	105	5	5	5	4-7	4-5	5	5	6		RTL
56	NSS	LH227/Tuxpeño-BVIR 153//WQCD10	1429	1464	1597	1623	1682	1753	300	125	300	150	7	4	6	5-6	4-5	4	5	6	narrow ear/ long shk	

Table 18. 2021 Breeding Cross Observation - GEM Ames, Longping - Capron, IL, AgReliant - Lebanon, IN

Entry	HG	Pedigree	Pollen GDU Ames	Silk GDU Ames	Pollen GDU AgR	Silk GDU AgR	Pollen GDU LP	Silk GDU LP	Plant Height (cm) Ames	Ear Height (cm) Ames	Plant Height (cm) LP	Ear Height (cm) LP	Breeder Score Ames	Breeder Score LP	Overall Rating AgR	CAP Score AgR	Ear Height Rating AgR	Health Rating Maturity AgR	Stand Rating AgR	Root Lodging Rate LP	Notes (AgR)	Notes (Ames)
57	NSS	HC33/Tuxpeño-VER 147//PH42B	1384	1395	1546	1546	1566	1619	295	125	280	125	6	5	4	3-6	4-5	6	6	6	poor husk cover	RTL
58	NSS	LH227/Tuxpeño-VER 147//PH42B	1372	1395	1546	1546	1566	1629	303	120	290	120	6	6	4	2-6	4-5	5	4	9		
59	NSS	LH227/Tuxpeño-VER 147//PHHB4	1395	1429	1546	1597	1605	1691	300	118	310	130	5	5	5	5-6	5-6	5	3	9		
60	NSS	PHK56/Coastal Tropical Flint-BVIR 104//GEMN-0178	1418	1499	1546	1571	1656	1745	310	140	305	135	6	3	7	4-6	4-5	4		6	shorter statured	
61	NSS	MBWZ/Coastal Tropical Flint-BVIR 104//LH216	1475	1511	1546	1521	1704	1760	295	130	300	145	7	3	4	5-6	3-5	6	5	9		
62	NSS	PHK56/Coastal Tropical Flint-BVIR 104//LH263	1406	1487	1546	1546	1590	1642	303	140	295	140	5	3	3	3-5	3-4	5		6		
63	NSS	PHK56/Coastal Tropical Flint-BVIR 104//LH283	1406	1463	1499	1546	1617	1682	305	145	270	120	7	3	7	5-6	4	6		5		+
64	NSS	MBWZ/Coastal Tropical Flint-BVIR 104//PHBE2	1463	1475	1521	1546	1655	1712	305	125	290	125	7	4	7	6-8	4-5	5		9		
65	NSS	PHK56/Coastal Tropical Flint-BVIR 104//PHBE2	1395	1452	1473	1499	1616	1695	303	140	270	125	6	4	5	4-6	4-6	5		6		
66	NSS	PHJ33/Coastal Tropical Flint-BVIR 104//PHK56	1384	1417	1473	1473	1592	1655	300	130	285	130	6	5	4	3-6	4-6	5		8		
67	NSS	LH216/Cubano Amarillo-BVIR 102//01IBH10	1395	1486	1499	1521	1605	1704	285	120	275	140	6	3	5	4-6	3-6	4		4		
68	NSS	PHK56/Cubano Amarillo-BVIR 102//LH263	1429	1511	1623	1650	1669	1712	315	140	270	130	6	3	3	2-4	3-5	4	2	4	soft, poor stand	
69	NSS	MBWZ/Cubano Amarillo-BVIR 102//LH283	1475	1487	1521	1546	1695	1728	300	130	295	125	7	3	6	5-7	4-5	7		7		
70	NSS	LH216/Cubano Amarillo-BVIR 102//PHBE2	1463	1487	1499	1546	1682	1729	290	130	300	155	7	4	5	6-8	3-5	4		8		
71	NSS	MBWZ/Cubano Amarillo-BVIR 102//PHBE2	1418	1511	1521	1546	1656	1699	295	130	275	125	7	4	7	6-8	4-5	7		5		
72	NSS	PHK56/Cubano Amarillo-BVIR 102//PHBE2	1463	1487	1499	1546	1656	1691	305	130	290	135	6	4	7	6-9	4-5	6		5	segr with flinty k	
73	NSS	LH216/Cubano Amarillo-BVIR 102//PHK56	1384	1452	1473	1473	1618	1704	298	120	310	150	6	5	6	4-7	4-5	6		5		
74	NSS	MBWZ/Cubano Amarillo-BVIR 102//PHK56	1395	1429	1473	1473	1616	1669	290	110	305	130	6	5	6	4-6	4-6	7		8		
75	NSS	PHK56/Cubano Amarillo-BVIR 102//PHR55	1418	1475	1473	1499	1669	1720	295	115	275	120	6	4	7	5-7	4-5	6		5	girthy ears	
76	NSS	PHK56/Early Caribbean-BVIR 139//GEMN-0178	1395	1418	1521	1521	1656	1720	295	115	285	130	6	4	5	3-7	3-5	6		4		
77	NSS	PHK56/Early Caribbean-BVIR 139//LH263	1395	1418	1473	1473	1605	1656	290	110	285	145	5	4	4	2-5	4-5	6		4		
78	NSS	LH216/Early Caribbean-BVIR 139//LH283	1363	1384	1473	1446	1616	1704	290	115	280	130	5	3	5	5-8	3-5	6		3	reddish grain	
79	NSS	MBWZ/Early Caribbean-BVIR 139//LH283	1429	1452	1473	1473	1643	1712	295	120	265	110	6	5	7	6-7	4-5	5		6	reddish grain	
80	NSS	LH216/Early Caribbean-BVIR 139//PHBE2	1395	1440	1473	1446	1605	1682	275	115	270	120	5	4	6	5-8	4-5	5		8		RTL
81	NSS	LH216/Early Caribbean-BVIR 139//PHK56	1343	1395	1473	1473	1581	1643	305	125	280	110	5	4	4	3-6	4-7	5		6		
82	NSS	PHK56/Kei1421//LH263	1440	1452	1546	1521	1631	1643	303	120	275	120	7	4	4	4-6	4	6		8		
83	NSS	MBWZ/Kei1421//LH283	1440	1452	1546	1546	1669	1682	275	120	270	125	7	4	6	3-6	4-5	6		5		+
84	NSS	LH213/Kei1421//PHBE2	1429	1440	1546	1521	1643	1704	285	125	280	125	6	4	8	3-8	5	6		7		++
85	NSS	MBWZ/Kei1421//PHBE2	1463	1475	1571	1571	1643	1669	285	120	295	125	6	5	7	4-7	5	5		9		
86	NSS	PHK56/Kei1421//PHBE2	1417	1452	1571	1546	1592	1656	285	115	275	135	6	5	8	4-7	5	6		9		
87	NSS	LH216/Ki45//GEMN-0097	1374	1406	1499	1499	1581	1616	275	105	300	130	7	4	6	5-7	4-6	4	4	8		
88	NSS	LH216/Ki45//LH283	1385	1406	1597	1571	1605	1616	280	115	270	130	5	3		3-6	5-6	5	2	3	poor stand	
89	NSS	MBWZ/Ki45//PHBE2	1418	1464	1571	1546	1619	1631	280	120	265	120	5	4	5	3-6	5	5	5	7		
90	NSS	PHJ33/Ki45//PHBE2	1406	1440	1546	1597	1616	1669	265	115	265	125	5	4	8	4-6	5-6	5		6		
91	NSS	LH216/Ki45//PHK56	1372	1418	1499	1546	1605	1656	290	120	285	115	6	4	6	2-5	4-5	5		7	long/narrow ears	+
92	NSS	MBWZ/Ki45//PHK56	1372	1395	1499	1473	1616	1691	275	120	285	135	7	5	7	2-6	5	5		7		+
93	NSS	PHJ33/Ki45//PHK56	1352	1395	1446	1446	1566	1629	270	110	265	115	5	5	3	2-4	5-6	5		7		
94	NSS	LH213/Ki59//01IBH10	1353	1395	1473	1473	1593	1656	275	125	255	100	5	5	7	4-5	4-6	6		9		
95	NSS	LH213/Ki59//GEMN-0097	1417	1476	1473	1473	1656	1699	305	120	315	160	6	3	4	3-6	4-5	4		8		
96	NSS	PHK56/Ki59//GEMN-0178	1417	1463	1499	1546	1592	1691	293	125	290	130	7	3	7	5-7	4	6		8	some stay green	
97	NSS	PHK56/Ki59//LH283	1406	1417	1446	1446	1568	1592	280	115	275	120	6	4	7	6	5	4		6		RTL
98	NSS	LH213/Ki59//PHBE2	1429	1440	1499	1499	1643	1664	295	130	290	140	7	4	5	7-4	5-4	4		8		
99	NSS	MBWZ/Tuson/Criollo-BVIR 155//PHK56	1418	1475	1521	1546	1631	1691	305	130	315	150	7	4	5	4	4	6		8		
100	NSS	PHJ33/Tuson/Criollo-BVIR 155//PHK56	1417	1487	1473	1499	1616	1682	310	135	285	120	7	4	4	2-6	3-6	6		8	var ear ht, caps	

GEM-Ames Legend

Planting Date: May 7, 2021

Breeder Score: 1-9, 9 is always the best

Longping Legend

Planting Date: April 26, 2021

Breeder Score: 1-9, 9 is always the best

Root Lodging Rate: 1-9, 9 is always the best

AgReliant Legend

Planting Date: May 14, 2021

CAP Score: Cap score is on a 9 to 1 scale with 9 as very hard (flinty). Due to the heterogeneous nature of the material, a range of caps present

Ear Height Rating: Ear height is on a 9 to 1 scale with 9 as very low eared.

Health Rating Maturity: Health rating conducted at maturity in September. Intactness and stay green increase rating

Stand Rating: Stand Rating is on a 9 to 1 scale with 1 = to no plants. Plots with sufficient stands were not rated

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
1	Check	B73/Mo17	283	118	1321	1363	5	
2	Check	Pioneer P1151	265	98	1274	1264	6	
3	Check	Pioneer 31D58	300	113	1406	1406	8	
4	Check	MBS2655/MBS9508	290	105	1322	1308	7	
5	Check	MBS3520/MBS8814	285	115	1298	1284	8	
6	SS	GEMS-0066/GEMS-0268//GEMS-0072/GEMS-0251	265	105	1394	1395	6	RTL
7	SS	GEMS-0226/GEMS-0264//GEMS-0297/GEMS-0308	293	128	1395	1417	7	
8	SS	PHW52/55T1//LH242	288	120	1429	1429	7	
9	SS	PHW52/55T1//PH42B	293	110	1384	1372	7	
10	SS	LH204/55T1//PH80B	300	125	1418	1440	7	
11	SS	LH204/55T1//PHW52	283	123	1384	1384	6	
12	SS	LH204/55T1//WQCD10	280	103	1342	1328	7	
13	SS	PHW52/55T1//WQCD10	288	103	1322	1332	7	
14	SS	PHG39/55T2//LH227	300	115	1353	1384	8	
15	SS	PHG39/55T2//LH242	293	128	1418	1452	8	
16	SS	PHW52/55T2//LH242	290	125	1406	1440	8	
17	SS	PHW52/55T2//PH42B	300	115	1395	1406	7	
18	SS	PHG39/55T2//PH80B	313	130	1440	1452	9	
19	SS	PHW52/55T2//WQCD10	278	100	1342	1343	6	Variable
20	SS	PHHB4/55T4//LH204	310	135	1428	1440	8	RTL
21	SS	HC33/55T4//LH242	300	140	1463	1475	8	
22	SS	LH227/55T4//LH242	300	125	1452	1452	7	Variable
23	SS	PHHB4/55T4//LH242	325	145	1487	1487	8	
24	SS	PHW52/55T4//LH242	305	130	1463	1476	8	RTL
25	SS	PHW52/55T4//PH42B	305	120	1440	1417	7	
26	SS	LH204/55T4//PH80B	323	140	1463	1475	8	
27	SS	LH227/55T4//PH80B	315	130	1418	1418	7	
28	SS	PHHB4/55T4//PH80B	333	140	1464	1476	8	
29	SS	HC33/55T4//PHW52	305	118	1383	1374	6	
30	SS	LH204/55T4//PHW52	310	120	1372	1363	7	
31	SS	LH227/55T4//PHW52	305	120	1372	1372	7	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
32	SS	HC33/55T4//WQCD10	298	110	1362	1352	7	
33	SS	LH227/55T4//WQCD10	300	120	1362	1352	7	
34	SS	PHW52/55T4//WQCD10	293	110	1363	1363	8	
35	SS	HC33/55T5//LH242	300	123	1474	1487	7	
36	SS	HC33/55T5//PH80B	313	135	1428	1418	8	
37	SS	F298W/BO165W//87916W	280	123	1372	1417	7	Excel grain quality
38	SS	PHN18/BO165W//87916W	295	140	1372	1418	7	
39	SS	PHN18/BO165W//F298W	293	130	1395	1417	7	White
40	SS	PHHB4/BO165W//LH242	300	120	1452	1499	8	
41	SS	PHW52/BO165W//LH242	288	120	1406	1395	7	
42	SS	PHW52/BO165W//LH244	298	115	1372	1372	4	
43	SS	PHHB4/BO165W//PH42B	305	115	1406	1395	5	RTL
44	SS	PHHB4/BO165W//PH80B	313	123	1452	1463	8	
45	SS	F298W/BO165W//PHN18	285	125	1341	1351	7	
46	SS	PHW52/BO165W//WQCD10	285	108	1342	1352	5	
47	SS	PHW52/Cargill North Temp Zone Mexican Dent//LH204	285	108	1265	1284	4	
48	SS	PHHB4/Cargill North Temp Zone Mexican Dent//LH242	290	110	1353	1353	5	
49	SS	LH227/Cargill North Temp Zone Mexican Dent//PH42B	260	95	1255	1256	3	
50	SS	PHHB4/Cargill North Temp Zone Mexican Dent//PH42B	290	100	1322	1343	4	
51	SS	PH42B/Cargill North Temp Zone Mexican Dent//PH80B	305	105	1352	1374	7	
52	SS	PHHB4/Cargill North Temp Zone Mexican Dent//PH80B	303	110	1352	1429	7	
53	SS	F298W/Cargill North Temp Zone Mexican Dent//PHN18	303	128	1321	1308	6	
54	SS	LH227/Cargill North Temp Zone Mexican Dent//PHW52	275	100	1245	1256	4	
55	SS	PH42B/Cargill North Temp Zone Mexican Dent//PHW52	285	108	1308	1298	4	
56	SS	LH227/Cargill North Temp Zone Mexican Dent//WQCD10	273	105	1255	1256	4	Variable
57	SS	PHHB4/Cargill North Temp Zone Mexican Dent//WQCD10	278	95	1308	1308	5	
58	SS	PHW52/Cargill North Temp Zone Mexican Dent//WQCD10	280	105	1288	1298	4	
59	SS	PHHB4/Cargill North Temperate Zone Carribean//LH242	315	130	1406	1406	7	
60	SS	PHHB4/Cargill North Temperate Zone Carribean//PH42B	290	110	1353	1353	6	
61	SS	WQCD10/Cargill North Temperate Zone Carribean//PH42B	303	110	1308	1298	6	
62	SS	PHHB4/Cargill North Temperate Zone Carribean//PH80B	320	135	1395	1418	7	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
63	SS	LH227/Cargill North Temperate Zone Carribean//PHW52	285	105	1311	1308	5	
64	SS	WQCD10/Cargill North Temperate Zone Carribean//PHW52	275	103	1290	1279	5	
65	SS	LH227/Cargill North Temperate Zone Carribean//WQCD10	273	108	1308	1322	5	
66	SS	PHHB4/Cargill North Temperate Zone Carribean//WQCD10	293	110	1332	1332	6	
67	SS	WQCD10/Cargill North Temperate Zone Cateto//PH42B	273	98	1288	1288	4	
68	SS	WQCD10/Cargill North Temperate Zone Cateto//PHW52	275	120	1246	1298	4	
69	SS	WQCD10/Cargill North Temperate Zone Coroico//PH42B	280	100	1322	1332	5	
70	SS	WQCD10/Cargill North Temperate Zone Coroico//PHW52	285	113	1274	1274	4	
71	SS	2FACC/Celaya-GTO84//LH242	308	130	1487	1487	7	
72	SS	PHW52/Celaya-GTO84//LH242	343	135	1501	1501	7	
73	SS	PHW52/Celaya-GTO84//LH244	320	120	1429	1453	7	
74	SS	PHW51/Celaya-GTO84//PH42B	323	120	1395	1440	7	
75	SS	PHW51/Celaya-GTO84//PH80B	330	160	1476	1501	8	
76	SS	2FACC/Celaya-GTO84//WQCD10	305	118	1428	1440	7	
77	SS	WQCD10/CG-Cateto Flint//PH42B	255	85	1256	1256	3	
78	SS	LH227/CG-Cateto Flint//PHW52	270	98	1264	1266	4	
79	SS	WQCD10/CG-Cateto Flint//PHW52	263	105	1246	1266	5	
80	SS	LH227/CG-Cateto Flint//WQCD10	260	103	1237	1274	4	
81	SS	PHW52/CG-Cateto Flint//WQCD10	250	83	1216	1227	4	
82	SS	PHW52/GTO 36//LH242	325	145	1486	1511	7	
83	SS	PHW52/GTO 36//PH42B	320	120	1394	1406	5	
84	SS	2FACC/GTO 36//WQCD10	265	98	1372	1372	6	
85	SS	PHW52/GTO 36//WQCD10	280	100	1352	1342	7	
86	SS	LH227/Ki20//LH242	320	130	1501	1487	7	
87	SS	PHHB4/Ki20//LH242	320	140	1498	1499	8	
88	SS	PHW52/Ki20//LH242	318	135	1486	1513	7	
89	SS	PHHB4/Ki20//PH42B	310	123	1476	1499	6	
90	SS	PHW52/Ki20//PH42B	315	120	1417	1440	7	
91	SS	LH227/Ki20//PH80B	325	125	1464	1487	7	
92	SS	PHHB4/Ki20//PH80B	320	140	1524	1551	8	
93	SS	LH227/Ki20//PHW52	325	138	1429	1441	7	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
94	SS	PHHB4/Ki20//WQCD10	298	100	1418	1440	7	
95	SS	PHW52/Ki20//WQCD10	283	108	1396	1406	5	
96	SS	PHHB4/Ki59//LH242	315	135	1498	1499	8	
97	SS	PHW52/Ki59//LH242	310	120	1428	1440	8	
98	SS	PHHB4/Ki59//PH42B	305	125	1452	1464	7	
99	SS	PHW52/Ki59//PH42B	300	115	1441	1442	7	
100	SS	LH204/Ki59//PH80B	303	130	1475	1487	6	
101	SS	PHHB4/Ki59//PH80B	295	130	1487	1525	8	
102	SS	LH204/Ki59//PHW52	305	120	1385	1385	5	
103	SS	LH227/Ki59//PHW52	293	118	1375	1353	6	
104	SS	PHHB4/Ki59//WQCD10	278	100	1374	1418	6	
105	SS	PHW52/Ki59//WQCD10	295	118	1408	1408	6	
106	SS	PHN18/KO537Y//87916W	283	130	1398	1409	7	Stubby Ear
107	SS	PHN18/KO537Y//F298W	290	135	1406	1441	9	Healthy
108	SS	PHHB4/KO537Y//LH242	285	123	1440	1475	7	
109	SS	PHW52/KO537Y//LH242	275	120	1418	1441	6	
110	SS	PHHB4/KO537Y//PH42B	295	120	1395	1395	6	
111	SS	PHW52/KO537Y//PH42B	290	110	1362	1406	6	
112	SS	WQCD10/KO537Y//PH42B	280	113	1342	1375	7	Excel grain quality
113	SS	PHHB4/KO537Y//PH80B	300	123	1395	1418	8	
114	SS	WQCD10/KO537Y//PHW52	283	100	1322	1343	4	
115	SS	PHHB4/KO537Y//WQCD10	278	100	1342	1343	7	
116	SS	PHW52/KO537Y//WQCD10	273	95	1298	1311	5	
117	SS	PHW52/KS23(S)C5//LH242	315	135	1464	1476	7	
118	SS	PHHB4/KS23(S)C5//PH42B	333	135	1452	1490	7	
119	SS	PHW52/KS23(S)C5//PH42B	318	130	1395	1406	7	
120	SS	PHHB4/KS23(S)C5//PH80B	305	128	1525	1548	8	RTL
121	SS	PHHB4/KS23(S)C5//WQCD10	305	100	1395	1395	6	
122	SS	PHW52/KS23-5//LH242	303	120	1429	1476	7	
123	SS	PHW52/KS23-5//PH42B	288	110	1372	1372	6	
124	SS	PHW52/KS23-5//WQCD10	280	95	1322	1322	5	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
125	SS	PHW52/KS23-6//PH42B	290	110	1383	1363	7	
126	SS	PHW52/KS23-6//WQCD10	273	110	1353	1353	5	
127	NSS	GEMN-0144/GEMN-0249//GEMN-0187/GEMN-0261	293	118	1353	1353	6	
128	NSS	GEMN-0192/GEMN-0309//GEMN-0246/GEMN-0267	278	118	1353	1343	4	RTL
129	NSS	LH176/Cargill North Temperate Zone Carribean//01IBH10	280	98	1318	1328	4	
130	NSS	01IBH10/Cargill North Temperate Zone Carribean//LH283	265	113	1332	1352	6	
131	NSS	LH176/Cargill North Temperate Zone Carribean//LH283	250	90	1298	1279	4	
132	NSS	01IBH10/Cargill North Temperate Zone Carribean//PH24E	255	110	1311	1343	5	
133	NSS	LH283/Cargill North Temperate Zone Carribean//PH24E	245	100	1287	1308	5	
134	NSS	01IBH10/Cargill North Temperate Zone Carribean//PH38B	275	105	1321	1353	5	
135	NSS	LH283/Cargill North Temperate Zone Carribean//PH38B	270	115	1332	1363	5	
136	NSS	LH283/Cargill North Temperate Zone Carribean//PHAW6	263	110	1362	1374	5	
137	NSS	01IBH10/Cargill North Temperate Zone Carribean//PHR55	270	105	1332	1374	5	RTL
138	NSS	LH176/Cargill North Temperate Zone Cateto//01IBH10	255	105	1216	1274	3	STL
139	NSS	LH283/Cargill North Temperate Zone Cateto//01IBH10	258	103	1284	1322	4	
140	NSS	01IBH10/Cargill North Temperate Zone Cateto//LH283	258	103	1321	1322	5	Open husk
141	NSS	01IBH10/Cargill North Temperate Zone Cateto//PH24E	225	100	1264	1298	3	
142	NSS	LH283/Cargill North Temperate Zone Cateto//PH24E	253	100	1274	1298	4	
143	NSS	01IBH10/Cargill North Temperate Zone Cateto//PH38B	263	98	1284	1363	5	Excel grain quality
144	NSS	LH283/Cargill North Temperate Zone Cateto//PH38B	273	100	1385	1395	5	
145	NSS	LH283/Cargill North Temperate Zone Cateto//PHAW6	260	113	1353	1374	5	
146	NSS	01IBH10/Cargill North Temperate Zone Coroico//LH283	255	108	1308	1342	4	
147	NSS	01IBH10/Cargill North Temperate Zone Coroico//PH24E	250	103	1255	1284	4	
148	NSS	01IBH10/Cargill North Temperate Zone Coroico//PH38B	243	105	1287	1352	4	
149	NSS	LH176/Cargill North Temperate Zone Coroico//PH38B	263	110	1298	1319	4	
150	NSS	LH176/Cargill North Temperate Zone Coroico//PHAW6	238	98	1288	1308	4	
151	NSS	LH283/Cargill North Temperate Zone Cuzco//01IBH10	265	110	1256	1308	5	
152	NSS	01IBH10/Cargill North Temperate Zone Cuzco//LH283	280	115	1342	1363	6	
153	NSS	LH176/Cargill North Temperate Zone Cuzco//LH283	260	108	1308	1328	5	
154	NSS	01IBH10/Cargill North Temperate Zone Cuzco//PH24E	240	103	1247	1298	4	RTL
155	NSS	LH176/Cargill North Temperate Zone Cuzco//PH24E	258	103	1237	1266	4	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
156	NSS	LH283/Cargill North Temperate Zone Cuzco//PH24E	250	105	1288	1308	4	
157	NSS	LH283/Cargill North Temperate Zone Cuzco//PH38B	258	110	1308	1308	4	
158	NSS	LH283/Cargill North Temperate Zone Cuzco//PHAW6	255	105	1332	1353	5	
159	NSS	LH176/CG-Cateto Flint//01IBH10	243	100	1227	1298	3	
160	NSS	LH283/CG-Cateto Flint//01IBH10	250	103	1256	1288	4	
161	NSS	LH291/CG-Cateto Flint//LH299	228	83	1168	1178	3	
162	NSS	LH176/CG-Cateto Flint//PH24E	235	95	1216	1256	3	
163	NSS	LH283/CG-Cateto Flint//PH24E	258	118	1256	1274	4	
164	NSS	LH291/CG-Cateto Flint//PH24E	243	103	1206	1247	4	
165	NSS	PHBE2/CG-Cateto Flint//PH24E	243	108	1256	1274	4	
166	NSS	LH283/CG-Cateto Flint//PH38B	270	105	1318	1318	5	
167	NSS	PHBE2/CG-Cateto Flint//PH38B	245	98	1298	1332	4	
168	NSS	PHBE2/CG-Cateto Flint//PHAW6	253	113	1322	1332	5	
169	NSS	HBA1/CML311//01IBH10	300	123	1417	1475	8	
170	NSS	3IIH6/CML311//LH283	303	138	1406	1418	7	
171	NSS	MBWZ/CML311//LH299	283	110	1362	1372	7	Soft cap
172	NSS	3IIH6/CML311//PH24E	298	128	1362	1397	6	RTL
173	NSS	HBA1/CML311//PH24E	310	130	1385	1385	7	
174	NSS	LH168/CML311//PH24E	295	133	1372	1384	7	
175	NSS	3IIH6/CML311//PH38B	305	115	1394	1429	6	RTL
176	NSS	HBA1/CML311//PH38B	308	130	1408	1464	7	
177	NSS	LH168/CML311//PH38B	303	135	1383	1418	7	
178	NSS	MBWZ/CML311//PH38B	300	120	1429	1476	7	RTL
179	NSS	MBWZ/CML311//PHAW6	288	125	1406	1418	6	
180	NSS	LH168/CML311//PHR55	285	125	1353	1395	5	
181	NSS	HBA1/CML323//01IBH10	285	115	1342	1384	5	
182	NSS	MBWZ/CML323//LH168	293	113	1332	1352	6	
183	NSS	MBWZ/CML323//LH299	240	100	1318	1328	4	
184	NSS	3IIH6/CML323//PH24E	263	120	1298	1342	5	
185	NSS	HBA1/CML323//PH24E	285	135	1372	1372	6	
186	NSS	HBA1/CML323//PH38B	300	125	1383	1417	6	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
187	NSS	MBWZ/CML323//PH38B	298	123	1395	1429	6	
188	NSS	3IIH6/CML323//PHAW6	285	125	1384	1384	5	
189	NSS	HBA1/CML323//PHAW6	288	125	1383	1406	7	Smut
190	NSS	HBA1/CML349//01IBH10	318	125	1395	1406	6	
191	NSS	MBWZ/CML349//LH168	303	125	1342	1395	6	
192	NSS	MBWZ/CML349//LH299	280	120	1310	1351	6	
193	NSS	HBA1/CML349//PH24E	298	125	1372	1406	7	
194	NSS	LH168/CML349//PH24E	298	125	1318	1343	6	
195	NSS	LH168/CML349//PH38B	293	123	1332	1372	6	
196	NSS	LH168/CML349//PHND1	280	125	1353	1406	4	Poor appearance
197	NSS	HBA1/CML384//01IBH10	320	140	1498	1511	8	
198	NSS	PHR55/CML384//01IBH10	305	130	1475	1499	7	
199	NSS	PHR55/CML384//LH283	310	130	1501	1513	8	
200	NSS	HBA1/CML384//PH24E	290	130	1463	1487	8	
201	NSS	LH168/CML384//PH24E	288	130	1418	1429	7	
202	NSS	PHR55/CML384//PH24E	283	130	1418	1452	8	
203	NSS	HBA1/CML384//PH38B	305	125	1474	1501	7	
204	NSS	LH168/CML384//PH38B	303	125	1463	1513	7	Long shank
205	NSS	PHR55/CML384//PH38B	313	120	1476	1501	7	
206	NSS	LH168/CML384//PHR55	303	130	1440	1499	8	
207	NSS	MBWZ/Ki45//LH168	305	128	1352	1374	7	
208	NSS	PHJ33/Ki45//LH283	300	130	1406	1406	7	
209	NSS	MBWZ/Ki45//PH38B	280	128	1394	1452	5	
210	NSS	MBWZ/Ki45//PHAW6	263	115	1383	1429	5	
211	NSS	PHJ33/Ki45//PHAW6	270	120	1428	1452	7	
212	NSS	PHK56/Ki59//01IBH10	293	125	1362	1395	6	
213	NSS	PHK56/Ki59//PH38B	298	130	1372	1372	6	RTL
214	NSS	PHK56/Ki59//PHR55	300	123	1372	1384	6	
215	NSS	PHR55/KO301Y//01IBH10	295	130	1372	1418	6	
216	NSS	PHR55/KO301Y//PH38B	290	108	1395	1463	5	
217	NSS	PHR55/KO301Y//PHAW6	283	123	1428	1440	7	

Table 19. 2021 Breeding Cross Observations Set 2 - GEM Ames

Entry	HG	Pedigree	Plant Height (cm)	Ear Height (cm)	Pollen GDU	SILK GDU	Breeder Score	Comments
218	NSS	PHR55/KO326Y//01IBH10	285	115	1372	1395	6	
219	NSS	PHR55/KO326Y//PH38B	280	123	1418	1475	6	

Legend:

Planting Date: May 7, 2021

Breeder Score: 1-9, 9 is always the best

Disease Screening

Table 20. Gray Leaf Spot ratings GEM-Raleigh

Ratings were taken at two locations (Waynesville and Salisbury, NC) about two weeks apart (late July and early August in Salisbury, and late August and early September in Waynesville). Ratings were taken on a 1-9 scale, with 9 being resistant and 1 being almost dead. Three replications per entry. For comparison, LH283.LH287 was 8.6 and Pioneer 3394 and LH132.PHG39 were each 4.9 in a separate experiment run at the same locations. Disease was not as prevalent as in some other years due to weather conditions (hot and dry late in the season at Salisbury and dry early in the season at Waynesville).

GEMN-0104	8.3	GEMS-0072	4.5
GEMN-0108	9.0	GEMS-0215	8.5
GEMN-0213	8.1	GEMS-0253	6.7
GEMN-0242	8.8	GEMS-0255	7.4
GEMS-0245	7.5	GEMS-0256	8.6
GEMN-0254	8.4	GEMS-0258	7.3
GEMN-0257	8.8	GEMS-0273	6.7
GEMN-0259	8.5	GEMS-0274	7.9
GEMN-0270	7.2	GEMS-0281	6.5
GEMN-0271	7.5	GEMS-0293	8.0
GEMN-0272	8.5	GEMS-0294	7.8
GEMN-0287	8.3	GEMS-0295	8.2
GEMN-0292	7.8	GEMS-0311	7.2
GEMN-0310	8.9	GEMS-0312	7.8
		GEMS-0320	8.1
L.S.D.	0.6	GEMS-0321	8.5
Mean	7.9		

Table 21. Northern Leaf Blight ratings GEM-Raleigh

Ratings were taken at one location (Laurel Springs, NC) two weeks apart later in the season. Ratings were taken on a 1-9 scale, with 9 being resistant and 1 being almost dead. Three replications per entry. For comparison, LH283.LH287 was 9 and LH132.PHG39 was 3 in a separate experiment run at the same location. Conditions were good for disease spread, as evidenced by the ratings.

GEMN-0104	8.0	GEMS-0072	4.5
GEMN-0108	8.7	GEMS-0215	5.0
GEMN-0213	6.8	GEMS-0253	3.8
GEMN-0242	7.7	GEMS-0255	5.5
GEMS-0245	2.7	GEMS-0256	2.3
GEMN-0254	8.0	GEMS-0258	3.8
GEMN-0257	7.2	GEMS-0273	6.0
GEMN-0259	7.8	GEMS-0274	4.8
GEMN-0270	6.0	GEMS-0281	5.8
GEMN-0271	6.7	GEMS-0293	5.2
GEMN-0272	8.5	GEMS-0294	8.0
GEMN-0287	8.7	GEMS-0295	5.8
GEMN-0292	7.0	GEMS-0311	3.5
GEMN-0310	7.8	GEMS-0312	4.3
		GEMS-0320	8.2
L.S.D.	1.1	GEMS-0321	8.7
Mean	6.2		

ENTRY	PEDIGREE	ln(y+1)	ng/g
NCG2101	GEMS-0027	4.40	81
NCG2102	GEMS-0032	2.63	13
NCG2103	GEMS-0050	6.35	569
NCG2104	GEMS-0232	7.19	1330
NCG2105	GEMS-0273	3.82	44
NCG2106	GEMS-0274	5.92	370
NCG2107	GEMS-0281	6.61	743
NCG2108	GEMS-0294	6.24	514
NCG2109	GEMS-0312	5.14	170
NCG2110	GEMS-0320	7.02	1113
NCG2111	GEMS-0321	7.49	1783
NCG2112	PHMKO	6.81	902
NCG2113	T173	7.11	1220
NCG2114	Mp313E	3.19	23
NCG2115	Mp717	2.43	10
LSD (0.05)		1.72	

Table 22. Primary ears were inoculated with *Aspergillus flavus* spore suspension using side needle technique 7 days after mid-silk. After harvest, ears were dried, kernels ground, and aflatoxin concentration determined by the VICAM AflaTest. Data were transformed $[\ln(y+1)]$, where y = concentration of aflatoxin in a sample] before analysis. Geometric means were calculated by converting transformed means to the original scale.

ENTRY	CLASSIFICATION	FAW Rating
GEMN-0104		4.96
GEMN-0124		5.56
GEMN-0135		3.91
GEMN-0137		4.82
GEMN-0232		5.82
GEMS-0243		5.97
GEMS-0245		5.50
GEMN-0254		5.99
GEMS-0255		5.79
GEMN-0259		5.85
GEMN-0270		4.34
GEMN-0271		5.31
GEMN-0292		4.14
GEMS-0293		5.57
GEMS-0294		4.37
GEMS-0295		5.45
GEMS-0311		4.93
GEMS-0312		5.09
GEMS-0320		5.33
GEMS-0321		5.68
Ab24E	Susceptible ck.	5.85
SC212M		3.79
SC229	Susceptible ck.	6.23
Tx601	Susceptible ck.	5.76
Va35	Susceptible ck.	4.18
Mp707	Resistant ck.	3.17
Mp708	Resistant ck.	3.10
Mp713	Resistant ck.	2.82
Mp714	Resistant ck.	2.67
Mp716	Resistant ck.	2.81
LSD		0.95

Table 23. Plants were infested at the V-7 stage of development with 40 fall armyworms neonates. Damage was visually rated 14 days later using a scale of 0 (no damage) to 9 (very heavy damage with many holes and large portions eaten away)

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
1	B73	B73	5	201		94.7	5	3.0	
2	LH195	LH195	7	166	5	100.0	5	3.0	
3	PHW52	PHW52	8	195	3	95.7	3	2.3	
4	LH213	LH213	8	208		83.3			
5	LH283	LH283	8	166	2	100.0	5	4.3	
6	MO17	Mo17	8	187		95.5	6	5.5	
7	GEMS-0002	FS8A(S):S09-43-2			7				
8	GEMS-0032	DKXL380:S11-B-029-001-B-B				89.3			26
9	GEMS-0050	DKB844:S1601-517-1-B	7	205	5	89.9	6	4.3	469
10	GEMN-0096	DKXL370-:N11a20-322-001				95.8			46
11	GEMN-0097	FS8B(T):N11a-087-001	8	200	6	90.0		3.3	588
12	GEMS-0115	DKB844:S1601-073-001	6	206	5	75.8		4.5	2575
13	GEMN-0178	DK888:N11a08a-440-001-B-B-SIB-SIB	7	217	6	86.5	7	7.3	2174
14	GEMS-0227	NEI9004:S2809-B-022-B-B-B-SIB	3	201	5	87.3		3.5	1144
15	GEMS-0248	AR16042:S2028-B-012-B-B	8	187		100.0	5	4.8	2738
16	GEMS-0251	CL-G1703:S17c43-B-026-B-B-B	5	215	6	90.8		4.0	980
17	GEMS-0258	DKB830:S19-009-004-SIB	8	242	6	87.2	5	6.8	507
18	GEMN-0260	(GEMN-0140/GEMN-0097)-B-B-026-B-002				100.0			
19	GEMS-0262	(GEMS-0147/GEMS-0180)-B-104-001-B-B				96.7			
20	GEMS-0263	BR105:S1626(GEMS-0175)-B-049-B-002				49.9			
21	GEMS-0264	BR105:S1643-078-001-B-002-SIB	7	203	5	91.9	5	3.0	763
22	GEMN-0266	NEI9008:N0826(GEMN-0155)-B-074-B-002				71.7			
23	GEMN-0267	NEI9008:N0826(GEMN-0155)-B-095-B-B	7	215	3	93.4		4.3	3575
24	GEMS-0268	NS1:S0852-B-021-B-B	8	227		98.0		4.3	976
25	GEMS-0269	NS1:S0852-B-054-B-B	5	184	5	70.8		4.5	1388
26	GEMS-0275	((KO679Y/GEMS-0115)/GEMS-0162)-008-001-001-SIB	8	168		75.0			
27	GEMS-0276	(53SS4/GEMS-0026)-SIB-B-003-B-SIB				100.0			
28	GEMS-0278	(GEMS-0115/S49w)-B-B-036-002-SIB				89.9			
29	GEMS-0280	BR52051:S172641-B-018-001-SIB	2	177	5	54.2	5	4.5	133
30	GEMS-0281	BR52051:S172641-B-054-002-SIB				84.1	5		
31	GEMS-0282	CHIS740:S(PHW17)(87916W)-126-001-002-SIB				90.5			
32	GEMS-0283	UR11002:S1409-068-001-001-SIB							
33	GEMS-0284	AR17056:S1217-B-025-001-SIB				84.3			
34	GEMN-0287	(GEMN-0108xGEMN-0178)-B-04%B	8	250	5	96.9	7	7.5	850
35	GEMS-0288	(GEMS-0147/GEMS-0115)-B-002-001-001-SIB-SIB-SIB	4	187		81.9		3.5	918
36	GEMS-0289	(GEMS-0147/GEMS-0180)-B-033-001-001-002-SIB-SIB	8	184	6	100.0		4.0	604
37	GEMS-0290	BR52051:S172641-B-050-001-001-SIB-SIB-SIB	8	193	4	88.5		3.8	1534
38	GEMS-0291	Ki21:S(DJ7)(GEMS-0115)-B-051-002-002-SIB-SIB-SIB	8	212	4	100.0	2	5.5	3340
39	GEMN-0292	(GEMN-0097/GEMN-0136)-B-008	8	230	5	100.0	6	7.3	1394
40	GEMS-0293	CML341:S42-B-124	4	202	6	100.0	5	4.5	225

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
41	GEMS-0294	DKB844:S16-005-022-012	5	217	5	61.8	7	6.3	375
42	GEMS-0295	DKB830:S51-031-003	8	204	7	100.0		5.8	1400
43	GEMS-0296	(GEMS-0113/GEMS-0162)-B-B-054-001-001-SIB	3	185	5	95.5	5	3.0	646
44	GEMS-0297	(GEMS-0115/GEMS-0222)-B-B-033-001-002-SIB	6	191	5	59.6	3	5.0	2798
45	GEMS-0298	(GEMS-0219/GEMS-0227)-B-015-001-001-SIB	2	204	5	95.7	6	7.3	575
46	GEMS-0299	(H8431/((GEMS-0115/Mp717)/TZAR101))-SIB-B-005-001-002-SIB	5	193	6	97.4		3.5	519
47	GEMS-0300	NS1:S(GEMS-0149)41-051-001-001-002-SIB	2	178	5	47.3	3	6.3	839
48	GEMS-0301	NS1:S(GEMS-0149)41-066-001-001-002-SIB	3	189	5	88.0	4	6.5	526
49	GEMN-0302	ATL100:N(LH82)(GEMN-0097)-041-001-001-SIB	8	154	4	100.0	5	2.8	635
50	GEMS-0303	(GEMS-0162/GEMS-0227)-040-002-001-001%SIB	6	190		97.8	6	5.5	2625
51	GEMS-0304	(GEMS-0162/GEMS-0227)-046-001-001-002%SIB	8	187	2	72.8	4	6.0	5185
52	GEMS-0305	(GEMS-0227/PHP38)-018-001-001-001%SIB	6	195	4	95.2	5	6.5	1608
53	GEMS-0306	((LH195/KO679Y)/GEMS-0227)-010-001-002-002%SIB	5	175	6	92.1	2	4.0	215
54	GEMS-0307	((PHB47/CML373)/GEMS-0162)-SIB-053-002-002%SIB	8	174	5	75.2	6	5.0	1083
55	GEMS-0308	((PHB47/CML373)/GEMS-0162)-SIB-086-001-001%SIB	6	208	5	84.6	5	5.5	1127
56	GEMN-0309	ATL100:N(LH82)(GEMN-0097)-090-001-002%SIB	1	178	4	86.1		5.0	1326
57	GEMN-0310	(GEMN-104/GEMN-0097)-070-003-Sib				69.8			
58	GEMS-0311	BR106:S42-063-002-Sib				95.0			
59	GEMS-0312	Pasco14:S11a-128-003-Sib				68.1			
60	GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001-B-SIB	6	193	6	93.5		6.8	697
61	GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002-B-SIB	3	206	5	100.0	5	7.0	196
62	GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002-B-SIB	3	173	5	95.7		4.5	400
63	GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001-B-SIB	4	181	5	100.0	4	5.5	815
64	GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002-B-SIB	6	208	5	100.0		6.5	861
65	GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002-B-SIB	8	207	6	90.5		5.5	883
66	GEMN-0319	Ki14:N4212-185-001-002-B-SIB	5	195		95.8	5	3.5	577
67	GEMS-0320	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-031-B	4	211		100.0			
68	GEMS-0321	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-018-B	4	251		100.0			
69		((B126xB84)/(GEMS-0147/GEMS-0227))-B-083-B	8	168	5	100.0	5		
70		((B126xB84)/(GEMS-0147/GEMS-0227))-B-086-B	6	179		88.2			
71		((B126xB84)/(GEMS-0147/GEMS-0227))-B-088-B	7	192	5	100.0			
72		((B126xB84)/(GEMS-0147/GEMS-0227))-B-102-B	3	165	5	97.9			
73		((B126xB84)/(GEMS-0147/GEMS-0227))-B-125-B	4	176	4	97.6	3		
74		((B126xB84)/(GEMS-0147/GEMS-0227))-B-128-B	6	188	4	87.8	4		
75		((B126xB84)/(GEMS-0147/GEMS-0227))-B-133-B	6	183	3	88.5			
76		(GEMS-0203/GEMS-0226)/PHG39-033-001	6	211	5	97.4			
77		(GEMS-0203/GEMS-0226)/PHG39-056-002	6	192	4	100.0			
78		(GEMS-0203/GEMS-0226)/PHG39-061-001	5	203	4	97.9			
79		(GEMS-0203/GEMS-0226)/PHW52-007-001	5	192	4	97.9			
80		(GEMS-0203/GEMS-0226)/PHW52-025-002	8	198	4	93.8			

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
81		(GEMS-0203/GEMS-0226)/PHW52-063-001	7	214					
82		(GEMS-0203/GEMS-0226)/PHW52-074-001	8	229	4				
83		(GEMS-0203/GEMS-0226)/PHW52-079-002	4	216	5	90.5			
84		(GEMS-0203/GEMS-0226)/PHW52-093-001	7	211	4	93.2			
85		(GEMS-0203/GEMS-0226)/PHW52-104-001	4	181					
86		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-011-001			3				
87		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-019-001			5		5		
88		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-021-001			5				
89		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-031-001			4		5		
90		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-032-001			3	90.9	5		
91		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-033-001			4	78.8			
92		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-036-001			5	92.9			
93		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-046-001			4	98.0	3		
94		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-050-001			4	100.0	5		
95		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-052-001			4		3		
96		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-060-001			4	89.7	4		
97		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-066-001					5		
98		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-067-001			5		4		
99		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-086-001					4		
100		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-091-001			5		3		
101		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-102-001			4		4		
102		(GEMS-0219/(GEMS-0147/GEMS-0227))-SIB-B-122-001			5		5		
103		((GEMS-0219)/(KO679Y/GEMS-0030))-043-003-B-B	7	199	6	90.0	5	6.5	
104		((GEMS-0219)/(KO679Y/GEMS-0030))-083-001-B-B	7	183	6	97.9	5	7.3	
105		((GEMS-0219)/(KO679Y/GEMS-0030))-093-001-B-B	8	180		84.7	6	6.8	
106		((GEMS-0219)/(KO679Y/GEMS-0030))-117-002-B-B	4	196	5	85.3	6	6.0	
107		((GEMS-0219)/(KO679Y/GEMS-0030))-126-002-B	3	200	6	94.7		7.5	
108		(GEMS-0219/(N28/KO679Y))-074-001-B-B	7	199	5	91.1		3.5	
109		(GEMS-0219/(N28/KO679Y))-076-002-B-B	6	207	5	89.9		5.8	
110		(GEMS-0219/(N28/KO679Y))-080-002-B-B	6	191	5	94.3	6	6.8	
111		(GEMS-0219/(N28/KO679Y))-123-001-B-B	4	198	4	97.6	4	5.0	
112		(GEMS-0227/GEMS-0219)-B-005-B	5	185	5	83.5			
113		(GEMS-0227/GEMS-0219)-B-018-B	5	190	5	97.7			
114		(GEMS-0227/GEMS-0219)-B-041-B	5	201	5	100.0			
115		(GEMS-0227/GEMS-0219)-B-043-B	3	181	5	80.0			
116		(GEMS-0227/GEMS-0219)-B-063-B	5	201	5	87.5			
117		(GEMS-0227/GEMS-0219)-B-068-B	6	178	5	72.5			
118		(GEMS-0227/GEMS-0219)-B-071-B	7	190	5	100.0			
119		(GEMS-0227/GEMS-0219)-B-074-B	5	193	4	92.3			
120		(GEMS-0227/GEMS-0219)-B-088-B	3	193	5	80.0			

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
121		(GEMS-0227/GEMS-0219)-B-139-B	5	193	4	67.6			
122		(GEMS-0227/GEMS-0219)-B-146-B	5	207	5	85.7			
123		(GEMS-0227/GEMS-0219)-B-152-B	4	204	5	87.2			
124		(GEMS-0227/Ki14)/41-002-001	5	202	5			4.0	
125		(GEMS-0227/Ki14)/41-002-002	6	209		100.0		5.0	
126		(GEMS-0227/Ki14)/41-009-002	3	181	5			5.3	
127		(GEMS-0227/Ki14)/41-013-001	5	190	5			3.8	
128		(GEMS-0227/Ki14)/41-014-001	7	193				5.3	
129		(GEMS-0227/Ki14)/41-025-001	7	195			6	6.5	
130		(GEMS-0227/Ki14)/41-041-002					4	7.5	
131		(GEMS-0227/Ki14)/41-048-001	8	210	4	100.0		6.5	
132		(GEMS-0227/Ki14)/41-049-001	6	189	6	100.0	6	7.3	
133		(GEMS-0227/Ki14)/41-052-001	5	191				4.3	
134		(GEMS-0227/Ki14)/41-053-001	5	182	5	97.2	6	5.0	
135		(GEMS-0227/Ki14)/41-055-002	7	200	5	100.0		6.5	
136		(GEMS-0227/Ki14)/41-064-001	4	208			4	7.0	
137		(GEMS-0227/Ki14)/41-064-002	6	200	4			5.0	
138		(GEMS-0227/Ki14)/41-066-001	7	173	5			5.3	
139		(GEMS-0227/Ki14)/41-067-001	4	208	6	93.8	6	6.0	
140		(GEMS-0227/Ki14)/41-070-001	3	209	6		4	5.5	
141		(GEMS-0227/Ki14)/41-071-001	7	193	5			6.3	
142		(GEMS-0227/Ki14)/41-073-001	4	192	6	97.5		5.0	
143		(GEMS-0227/Ki14)/41-075-001	6	196				3.5	
144		(GEMS-0227/Ki14)/41-078-001	7	177	6	100.0	7	6.5	
145		(GEMS-0227/Ki14)/41-085-001	6	197	4	100.0	6	4.0	
146		(GEMS-0227/Ki14)/41-086-001	6	224	5	100.0	5	7.5	
147		(GEMS-0227/Ki14)/41-096-002	8	215	5	95.1	8	5.3	
148		(GEMS-0227/Ki14)/41-096-003	8	208	5	100.0	6	4.8	
149		(GEMS-0227/Ki14)/41-097-001	5	207	5	100.0	6	5.0	
150		(GEMS-0227/Ki14)/41-098-001	5	215	4	100.0	6	7.0	
151		(GEMS-0227/Ki14)/41-100-002	3	190	5	88.1	5	4.3	
152		(GEMS-0227/Ki14)/41-101-002	7	196	6	100.0		6.8	
153		(GEMS-0227/Ki14)/41-104-001	5	205	5	100.0	3	4.5	
154		(GEMS-0227/Ki14)/41-109-001	6	203	3	96.9		5.5	
155		(GEMS-0227/Ki14)/41-109-002	5	195	5		6	5.8	
156		(GEMS-0227/Ki14)/41-112-001	7	195	5		6	6.0	
157		(GEMS-0227/Ki14)/41-116-001	4	171	5	100.0		4.0	
158		(GEMS-0227/Ki14)/41-124-001	5	189	4	93.8		4.3	
159		((GEMS-0227/Ki14)/GEMS-0115)-015-002	5	201		100.0	6	6.5	
160		((GEMS-0227/Ki14)/GEMS-0115)-023-001	5	201	4	73.8		4.0	

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
161		((GEMS-0227/Ki14)/GEMS-0115)-025-001	2	194			6	3.5	
162		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-006-B-B	7	184	4	80.8		4.5	
163		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-011-B-B	4	181	5	87.5		4.5	
164		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-028-B-B	8	210	5	100.0		5.0	
165		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-037-B-B	5	198		97.5		4.3	
166		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-068-B-B	7	186	5	100.0		6.5	
167		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-089-B-B	6	206	5	88.2	4	4.0	
168		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-135-B-B	5	199	5	85.0		5.8	
169		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-149-B-B	2	168		78.8		3.0	
170		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-160-B-B	8	216	4	100.0		5.3	
171		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-170-B-B	8	200		100.0		5.0	
172		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-171-B-B	6	211	5	100.0	5	7.0	
173		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-172-B-B	3	203		97.5		4.0	
174		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-212-B-B	7	171	5	97.1	4	2.5	
175		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-244-B-B	7	167	5	100.0		3.8	
176		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-251-B-B	4	194	5	90.9	6	7.5	
177		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-318-B-B	8	199	5	89.3	4	3.0	
178		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-371-B-B	4	173		100.0	6	4.5	
179		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-377-B-B	6	169	6	75.7	6	3.0	
180		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-B-003-B	4	201	5	94.4		4.8	
181		((GEMS-0227/Ki14)/GEMS-0115)-(2n)-B-005-B	7	177	4	97.7	5	4.0	
182		(GEMS-0227/Ki14)/PHG39-026-002	7	218		98.0		6.3	
183		(GEMS-0227/Ki14)/PHG39-031-001	4	205			6	4.8	
184		(GEMS-0227/Ki14)/PHG39-031-002	5	195			5	7.3	
185		(GEMS-0227/Ki14)/PHG39-040-001	8	190				6.8	
186		(GEMS-0227/Ki14)/PHG39-046-001						4.5	
187		(GEMS-0227/Ki14)/PHG39-113-001	3	205			4	7.0	
188		(GEMS-0227/Ki14)/PHG39-116-001	7	193		100.0		6.8	
189		(GEMS-0227/Ki14)/PHG39-133-001	4	206		87.5		7.3	
190		(GEMS-0227/Ki14)/PHG39-150-002	5	198			5	6.3	
191		(GEMS-0227/Ki14)/PHW52-004-001	4	216				7.0	
192		(GEMS-0227/Ki14)/PHW52-009-001	5	191		100.0		7.3	
193		(GEMS-0227/Ki14)/PHW52-009-002	6	182		92.1	6	5.3	
194		(GEMS-0227/Ki14)/PHW52-028-001	5	216				6.5	
195		(GEMS-0227/Ki14)/PHW52-035-001	2	211			3	4.0	
196		(GEMS-0227/Ki14)/PHW52-037-001	7	201		97.7	7	3.5	
197		(GEMS-0227/Ki14)/PHW52-045-002	6	179		95.2	7	6.3	
198		(GEMS-0227/Ki14)/PHW52-046-001	7	202				4.5	
199		(GEMS-0227/Ki14)/PHW52-050-002	3	215		95.8	4	6.3	
200		(GEMS-0227/Ki14)/PHW52-057-001	7	189		92.9		7.3	

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Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
201		(GEMS-0227/Ki14)/PHW52-061-001	4	208				5.0	
202		(GEMS-0227/Ki14)/PHW52-081-001	6	205		79.7	5	5.8	
203		(GEMS-0227/Ki14)/PHW52-082-001	8	188		89.2	5	7.0	
204		(GEMS-0227/Ki14)/PHW52-083-002	5	217		100.0	5	7.5	
205		(GEMS-0227/Ki14)/PHW52-090-001					5	5.0	
206		(GEMS-0227/Ki14)/PHW52-104-001	4	206			5	7.3	
207		(GEMS-0227/Ki14)/PHW52-108-001	6	188		98.0		4.8	
208		(GEMS-0227/Ki14)/PHW52-112-001	6	227		85.4	5	5.0	
209		((KO679Y/GEMS-0030)/794)-015-001-B-B	6	177	5	97.6	4	6.5	
210		((KO679Y/GEMS-0030)/794)-016-003-B-B	7	203	5	100.0	5	5.5	
211		((N28/KO679Y)/4676A)-053-001-B-B	4	181	4	94.4	6		
212		(PHP38/(GEMS-0227/Ki14))-099-002-B-B	6	197		94.7	5		
213		SX2788:S(794)(GEMS-0188)(PHW52)-005-001	6	215	3	97.7			
214		SX2788:S(794)(GEMS-0188)(PHW52)-013-001	7	189	5	100.0	5		
215		SX2788:S(794)(GEMS-0188)(PHW52)-025-001	6	212	5	100.0	5		
216		SX2788:S(794)(GEMS-0188)(PHW52)-032-001	4	176	5	100.0	4		
217		SX2788:S(794)(GEMS-0188)(PHW52)-046-001	6	190	4	94.0	6		
218		SX2788:S(794)(GEMS-0188)(PHW52)-078-001	4	200	4	100.0	4		
219		((Tuxpeno Comp.(M)C5xB126)/GEMS-0219)-072-001-B-B			5	91.3			
220		(3IIH6 /MBRC10:N1730-B-128-B)-044-001	3	199					
221		(3IIH6 /MBRC10:N1730-B-128-B)-048-001	4	176			5		
222		(3IIH6 /MBRC10:N1730-B-128-B)-061-003	3	205	5	56.3			
223		(3IIH6 /MBRC10:N1730-B-128-B)-072-002	3	177					
224		(3IIH6 /MBRC10:N1730-B-128-B)-085-001	3	183	3	95.5	5		
225		(3IIH6 /MBRC10:N1730-B-128-B)-092-002	2	196	5	80.7			
226		(3IIH6 /MBRC10:N1730-B-128-B)-099-001	2	177	5		4		
227		(3IIH6 /MBRC10:N1730-B-128-B)-103-001	3	186	4	83.7	4		
228		(3IIH6 /MBRC10:N1730-B-128-B)-119-001	2	171	5		4		
229		(3IIH6 /MBRC10:N1730-B-128-B)-122-002	3	192	3	92.5			
230		(3IIH6 /MBRC10:N1730-B-128-B)-125-002	5	202	5				
231		(3IIH6 /MBRC10:N1730-B-128-B)-151-001	2	186	4	97.4			
232		(3IIH6 /MBRC10:N1730-B-128-B)-175-001	3	199	4				
233		(3IIH6 /MBRC10:N1730-B-128-B)-181-001	2	194			4		
234		(3IIH6 /MBRC10:N1730-B-128-B)-181-002	3	217	4	94.9	3		
235		(3IIH6 /MBRC10:N1730-B-128-B)-182-002	1	178	6				
236		(3IIH6 /MBRC10:N1730-B-128-B)-184-001	3	173	4	89.5	5		
237		BG002:T26aN(GEMN-0155)(PHGG7)-017-001	4	201					
238		BG002:T26aN(GEMN-0155)(PHGG7)-022-001	2	178	4				
239		BG002:T26aN(GEMN-0155)(PHGG7)-022-002	2	182	5		2		
240		BG002:T26aN(GEMN-0155)(PHGG7)-037-001					4		

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
241		BG002:T26aN(GEMN-0155)(PHGG7)-052-002	4	171	3	32.1	3		
242		BG002:T26aN(GEMN-0155)(PHGG7)-062-002	4	173	3		3		
243		BG002:T26aN(GEMN-0155)(PHGG7)-062-003	7	189	4	94.3	5		
244		BG002:T26aN(GEMN-0155)(PHGG7)-066-001	2	204	5	80.3			
245		BG002:T26aN(GEMN-0155)(PHGG7)-071-001	3	181	5				
246		BG002:T26aN(GEMN-0155)(PHGG7)-080-002	7	176	6	91.7			
247		BG002:T26aN(GEMN-0155)(PHGG7)-107-001	4	191	5	57.2	4		
248		BG002:T26aN(GEMN-0155)(PHGG7)-113-002	3	189					
249		BG002:T26aN(GEMN-0155)(PHGG7)-115-001	4	210	5	97.5			
250		BG002:T26aN(GEMN-0155)(PHGG7)-117-002	4	191					
251		BG002:T26aN(GEMN-0155)(PHGG7)-122-001	3	210	5	45.2	5		
252		BG002:T26aN(GEMN-0155)(PHGG7)-124-002	4	196		59.8	4		
253		BG002:T26aN(GEMN-0155)(PHGG7)-126-001	2	183					
254		(GEMN-0097/Ki14)/PHGG7-004-001	3	188				3.5	
255		(GEMN-0097/Ki14)/PHGG7-040-001	1	171				1.8	
256		(GEMN-0097/Ki14)/PHGG7-041-002	2	186		60.1		1.8	
257		(GEMN-0097/Ki14)/PHGG7-042-001						1.3	
258		(GEMN-0097/Ki14)/PHGG7-047-002						2.3	
259		(GEMN-0097/Ki14)/PHGG7-049-001	3	174		38.6		3.0	
260		(GEMN-0097/Ki14)/PHGG7-054-001	4	200		31.8		1.3	
261		(GEMN-0097/Ki14)/PHGG7-064-001	4	202		69.5		3.3	
262		(GEMN-0097/Ki14)/PHGG7-065-001	5	202				2.5	
263		(GEMN-0097/Ki14)/PHGG7-084-001						3.8	
264		(GEMN-0097/Ki14)/PHGG7-084-002	7	207			3	3.0	
265		(GEMN-0097/Ki14)/PHGG7-087-002						4.0	
266		(GEMN-0097/Ki14)/PHGG7-109-001	6	192				3.0	
267		(GEMN-0097/Ki14)/PHGG7-110-001	2	197				2.5	
268		(GEMN-0097/Ki14)/PHGG7-116-001	3	172		70.4		2.5	
269		(GEMN-0097/Ki14)/PHGG7-117-002						5.5	
270		(GEMN-0097/Ki14)/PHGG7-124-002						1.3	
271		(GEMN-0097/Ki14)/PHGG7-124-003	5	194			3	2.0	
272		(GEMN-0097/PHN46)/PHGG7-007-001			2	92.1			
273		(GEMN-0097/PHN46)/PHGG7-009-001			2	20.0			
274		(GEMN-0097/PHN46)/PHGG7-015-002			3				
275		(GEMN-0097/PHN46)/PHGG7-017-001			4	52.4			
276		(GEMN-0097/PHN46)/PHGG7-022-001			6	66.1			
277		(GEMN-0097/PHN46)/PHGG7-022-002			4	79.4			
278		(GEMN-0097/PHN46)/PHGG7-040-002			5	74.6			
279		(GEMN-0097/PHN46)/PHGG7-049-001			4	94.8			
280		(GEMN-0097/PHN46)/PHGG7-051-001			2	58.3			

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
281		(GEMN-0097/PHN46)/PHGG7-059-002			3	39.2			
282		(GEMN-0097/PHN46)/PHGG7-078-001			3	96.9			
283		(GEMN-0097/PHN46)/PHGG7-091-001			5	93.3			
284		(GEMN-0097/PHN46)/PHGG7-103-001			4	66.8			
285		(GEMN-0097/PHN46)/PHGG7-105-001			5	88.9			
286		(GEMN-0097/PHN46)/PHGG7-110-001			3	57.9			
287		(GEMN-0097/PHN46)/PHGG7-112-001			4	47.4			
288		(GEMN-0097/PHN46)/PHGG7-119-001			3	67.1			
289		(GEMN-0097/PHN46)/PHGG7-135-003			5				
290		(GEMN-0097/PHN46)/PHGG7-140-002			4				
291		(GEMN-0097/PHN46)/PHGG7-140-003			4	74.5			
292		(GEMN-0097/PHN46)/PHR03-008-001			5	89.4			
293		(GEMN-0097/PHN46)/PHR03-012-001			6	35.7			
294		(GEMN-0097/PHN46)/PHR03-013-002			4	35.2			
295		(GEMN-0097/PHN46)/PHR03-026-001			5	91.2			
296		(GEMN-0097/PHN46)/PHR03-036-001			2	86.0			
297		(GEMN-0097/PHN46)/PHR03-047-001			3	100.0			
298		(GEMN-0097/PHN46)/PHR03-072-001			4	81.3			
299		(GEMN-0124 x GEMN-0043)/PHGG7-002-001			4	75.7			
300		(GEMN-0124 x GEMN-0043)/PHGG7-005-001			5	69.0			
301		(GEMN-0104 x GEMN-0187)/PHGG7-011-001			4	33.3			
302		(GEMN-0104 x GEMN-0187)/PHGG7-022-001			5	71.3			
303		(GEMN-0124 x GEMN-0043)/PHGG7-024-001			5	0.0			
304		(GEMN-0124 x GEMN-0043)/PHGG7-028-001			5	64.3			
305		(GEMN-0124 x GEMN-0043)/PHGG7-031-001			8	44.9			
306		(GEMN-0124 x GEMN-0043)/PHGG7-037-001			4	83.3			
307		(GEMN-0104 x GEMN-0187)/PHGG7-048-001			5				
308		(GEMN-0124 x GEMN-0043)/PHGG7-061-002			4	71.4			
309		(GEMN-0124 x GEMN-0043)/PHGG7-077-002			6	75.0			
310		(GEMN-0124 x GEMN-0043)/PHGG7-085-001				70.0			
311		((GEMN-0140/GEMN-0097)-B-B-034-B/GEMN-0205)-116-001-B-B			5	100.0			
312		((GEMN-0173/KO679Y)/(GEMN-0140/GEMN-0097)-B-B-034-B)-022-001-B-B	8	190	4	100.0	7		
313		((GEMN-0173/KO679Y)/(GEMN-0140/GEMN-0097)-B-B-034-B)-066-002-B-B	7	173	5	85.3	6		
314		((GEMN-0173/KO679Y)/(GEMN-0140/GEMN-0097)-B-B-034-B)-218-001-B	4	191	6	91.7			
315		((GEMN-0173/KO679Y)/(GEMN-0140/GEMN-0097)-B-B-034-B)-218-002-B-B	6	185	5	84.6			
316		(GEMN-0225/GEMN-0179//GEMN-0157/GEMN-0192-(2n)-5029-B-B)-001-B-B	8	173	5	100.0			
317		(GEMN-0239/(GEMN-0097/Ki14))-034-001-B-B	8	181	4	93.3	7	4.3	
318		(GEMN-0239/(GEMN-0097/Ki14))-053-001-B-B	8	174		53.6	6	7.3	
319		(GEMN-0239/(GEMN-0097/Ki14))-053-002-B-B	8	191		92.1		5.3	
320		(LH61/(GEMN-0130/MP494))/PHN46-003-001	7	218	5	39.4	7	6.0	

Table 24. 2021 GEM-Ames Disease Trial Summary

Entry	Code	Pedigree	Bayer		Corteva			USDA	
			Goss Wilt	Plant Height	Fusarium Ear Rot	Head Smut	NLB	SLB	Aflatoxin (ng/g)
321		(LH61/(GEMN-0130/MP494))/PHN46-052-002	6	204	5	89.1		4.0	
322		(LH61/(GEMN-0130/MP494))/PHN46-057-001	6	207	3	83.6		5.5	
323		(LH61/(GEMN-0130/MP494))/PHN46-072-001	5	212	5	78.1	4	4.0	
324		(LH61/(GEMN-0130/MP494))/PHN46-096-001	5	190	5	76.3		2.8	
325		(LH61/(GEMN-0130/MP494))/PHN46-102-001	7	205			4	5.8	
326		(LH61/(GEMN-0130/MP494))/PHN46-110-001	6	207	5	89.6		5.5	
327		(LH61/(GEMN-0130/MP494))/PHN46-113-001	4	190	5		5	3.5	
328		(LH61/(GEMN-0130/MP494))/PHN46-124-001	3	176	5	69.8	2	4.5	
329		((NKS8326/CML373)/GEMN-0097)-SIB/3IIH6)-061-001-B-B	4	196	5	86.1		4.5	
330		(PHN46/(GEMN-0130/MP494))/41-002-001	5	183				7.0	
331		(PHN46/(GEMN-0130/MP494))/41-023-001	7	207	5		4	2.3	
332		(PHN46/(GEMN-0130/MP494))/41-026-001	4	199			5	4.0	
333		(PHN46/(GEMN-0130/MP494))/41-033-001	5	191	5	88.9	2	1.8	
334		(PHN46/(GEMN-0130/MP494))/41-033-002	6	211	4	58.3	4	2.0	

Bayer Legend:

Goss's Wilt: 1-9 rating, 9 is the best

Corteva Legend:

Fusarium Ear Rot: 1-9, 9 is the best

Head Smut: % plants without smut

NLB: 1-9, 9 is the best

USDA-ARS Legend:

Aflatoxin: ng/g of toxin

SLB: 1-9, 9 is the best

Yield Trials

**Table 25. 2021 Yield Trial Data (Top 24
Entries Ranked) Experiment 21NCG01
Tester: LH132.PHG39**

Entry	Pedigree	Yield	% Yield /CHK[#]	Moist	Yield/ Moist	Test Weight	Stalk Lodging	Root Lodging	Erect Plants	Plant Height	Ear Height
		bu/ac		%		lb/bu	%	%	%	cm	cm
32	DeKalb 68-69	225	105	22.1	10.5	57.1	4.3	3.4	92	262	131
36	Pioneer 1637R	224	105	19.9	11.3	56.8	2.8	0.6	96	286	140
39	Pioneer 2088R	215	101	20.6	10.6	56.3	2.2	1.9	96	269	131
31	DeKalb 67-44	215	101	20.1	10.8	57.6	0.6	0.0	99	256	122
29	DeKalb 65-99	213	100	19.4	11.3	57.2	1.1	0.0	99	247	124
40	Pioneer 2160YHR	209	98	22.0	9.5	58.2	5.3	9.6	84	272	131
33	DeKalb 69-16	209	98	20.7	10.3	57.1	1.2	1.6	97	259	128
38	Pioneer 1870YHR	208	98	20.5	10.4	57.4	0.4	1.1	98	261	125
28	DeKalb 63-57	207	97	18.8	11.1	56.8	1.2	2.7	96	249	127
30	DeKalb 66-29	207	97	20.5	10.4	57.1	0.7	0.4	99	257	131
37	Pioneer 1794VYHR	205	96	19.8	10.6	56.3	6.9	3.5	89	282	135
34	Pioneer 1197R	191	89	17.5	11.0	56.6	0.2	0.2	100	241	113
10	(GEMN-0257/GEMN-0048)-010-03	181	85	21.1	8.7	57.3	0.4	1.2	98	275	144
9	(GEMN-0257/GEMN-0048)-008-01	179	84	19.2	9.3	56.5	2.7	2.0	95	289	146
24	GEMN-0272//LH132/PHG39	178	84	19.0	9.5	55.3	2.6	7.6	89	277	140
16	(GEMN-0104/GEMN-0048)-010-01	177	83	20.6	8.7	55.6	1.1	5.1	94	281	139
35	Pioneer 1498	177	83	19.3	9.2	57.3	0.4	2.4	97	249	121
1	(GEMN-0135/GEMN-0137)-002-02	177	83	20.8	8.6	55.9	5.3	2.6	91	289	153
14	(GEMN-0124/GEMN-0104)-033-03	175	82	20.3	8.7	56.2	5.3	3.5	90	283	152
23	GEMN-0257//LH132/PHG39	175	82	21.0	8.6	56.2	1.8	2.0	96	287	145
22	GEMN-0232//LH132/PHG39	174	82	20.0	8.7	55.7	3.7	0.8	95	283	155
7	(GEMN-0048/GEMN-0257)-018-01	173	81	21.0	8.4	55.9	2.3	4.9	92	268	139
25	GEMN-0287//LH132/PHG39	173	81	20.1	8.6	55.8	2.0	6.9	91	288	140
3	(GEMN-0232/GEMN-0048)-016-02	172	81	19.4	9.1	55.1	1.9	1.0	97	281	139
	Replications	15		15	15	12	9	8	8	11	6
	Check Means	213		20.2	10.7	57.0	2.0	1.1	96.6	265	130
	Overall Means	183		20.2	9.2	56.5	3.0	3.4	93.3	274	138
	CV	10.7		5.6	12.6	2.0	182	207	9.6	4.1	7.9
	LSD (p=0.05)	12.8		0.7	0.8	0.7	3.6	4.6	5.8	7.3	7.2

[#] Commercial hybrids in bold were included in calculation of check mean

**Table 26. 2021 Yield Trial Data (Top 24
Entries Ranked) Experiment 21NCG02
Tester: LH283.LH287**

Entry	Pedigree	Yield	% Yield /CHK[#]	Moist	Yield/ Moist	Test Weight	Stalk Lodging	Root Lodging	Erect Plants	Plant Height	Ear Height
		bu/ac		%		lb/bu	%	%	%	cm	cm
30	DeKalb 67-44	226	1.06	20.3	11.5	57.5	0.8	2.6	96.6	258	136
36	Pioneer 2088R	217	1.02	20.1	11.0	56.4	2.7	1.6	95.6	274	133
33	Pioneer 1637R	215	1.01	19.7	11.1	56.7	1.8	10.0	88.2	278	145
31	DeKalb 69-16	212	0.99	20.9	10.4	57.5	0.8	2.5	96.7	247	117
34	Pioneer 1794VYHR	211	0.99	19.5	11.1	56.7	10.3	4.9	84.8	278	136
29	DeKalb 65-99	208	0.98	19.3	11.1	56.5	2.2	2.4	95.4	242	122
35	Pioneer 1870YHR	203	0.96	21.0	9.8	57.6	1.3	1.0	97.7	258	138
28	GEMS-0321	197	0.92	19.1	10.5	55.9	2.8	11.9	85.3	274	138
19	GEMS-0244	192	0.90	20.8	9.5	54.9	3.3	11.4	85.3	281	147
23	GEMS-0311	191	0.89	20.2	9.5	55.8	5.0	6.1	88.9	275	155
32	Pioneer 1197R	189	0.89	17.2	11.0	56.3	0.6	1.3	98.1	240	103
1	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-012	188	0.88	19.2	10.1	54.6	4.4	3.2	92.4	271	140
18	GEMS-0243	185	0.87	20.3	9.2	55.7	4.8	9.2	86.0	279	147
25	GEMS-0314	185	0.87	19.5	9.6	56.4	10.1	8.7	81.3	265	139
8	CML343:S(LH193)-04-02	185	0.87	19.5	9.6	55.7	9.2	8.0	82.8	266	126
21	GEMS-0293	183	0.86	20.2	9.3	55.2	9.1	3.9	87.0	264	143
22	GEMS-0298	183	0.86	18.6	10.1	56.0	1.4	5.1	93.5	254	121
6	CML343:S(LH193)-02-10	182	0.85	20.6	9.0	54.8	4.0	6.7	89.3	264	138
15	CML341:S42-B-004	181	0.85	20.6	8.8	55.4	1.8	9.2	89.5	284	149
20	GEMS-0281	181	0.85	19.3	9.5	55.5	3.9	13.0	83.1	262	135
17	CML343:S(NS701)-B-019	181	0.85	18.6	9.9	54.9	5.9	12.1	82.0	272	130
3	(GEMS-0113//GEMS-0006)-01-01	178	0.83	19.3	9.4	57.2	6.9	11.3	81.8	269	137
14	BR106:G39-012-002	173	0.81	18.1	9.6	56.9	4.9	8.3	86.8	274	150
7	CML343:S(LH193)-03-11	171	0.80	20.5	8.5	54.2	6.7	10.1	83.3	272	136
	Replications	15		15	15	12	9	8	8	11	5
	Check Means	213		20.1	10.9	57.0	2.8	3.6	93.6	262.1	132
	Overall Means	183		19.8	9.5	55.9	4.8	6.6	88.5	264.1	134
	CV	10.6		6.5	12.7	1.9	143.3	147.3	12.7	3.5	10.0
	LSD (p=0.05)	12.8		0.8	0.8	0.7	4.6	6.4	7.4	6.0	8.8

Commercial hybrids in bold were included in calculation of check mean

**Table 27. 2021 Yield Trial Data (All
Entries Ranked) Experiment 21NCG03
Testers: LH283.LH287 and MBS8731**

Entry	Pedigree	Yield	% Yield /CHK #	Moist	Yield/ Moist	Test Weight	Stalk Lodging	Root Lodging	Erect Plants	Plant Height	Ear Height
		bu/ac		%		lb/bu	%	%	%	cm	cm
25	DeKalb 67-44	230	1.07	19.6	12.0	57.8	1.2	1.2	97.5	259	125
29	Pioneer 1794VYHR	220	1.03	19.1	11.8	57.2	1.8	2.6	95.5	287	148
28	Pioneer 1637R	219	1.03	19.3	11.6	56.9	2.2	0.9	96.5	286	143
21	LH235/MBS8731	215	1.00	18.5	11.9	53.4	4.9	1.4	92.9	279	142
1	(GEMS-0050/CL-G1501:S17b-B-020)-003-01//MBS8731	213	1.00	17.9	11.8	51.3	-	-	-	274	-
30	Pioneer 1870YHR	212	0.99	20.6	10.6	57.5	1.7	1.5	96.5	261	129
12	(GEMS-0027/GEMS-0220)-03-05//MBS8731	208	0.97	18.8	11.3	54.3	0.6	2.6	96.7	262	132
23	DeKalb 63-57	207	0.97	18.5	11.6	57.2	0.8	0.5	98.5	252	130
24	DeKalb 65-99	206	0.96	19.0	11.3	56.6	0.4	0.0	99.5	248	122
6	(CL-G1501:S17b-B-020/GEMS-0050)-011-02//MBS8731	203	0.95	18.8	11.0	53.6	2.0	1.6	96.1	281	147
22	DK_8F196/MBS8731	201	0.94	17.1	11.9	55.8	2.5	1.2	95.9	276	124
3	(GEMS-0050/CL-G1501:S17b-B-020)-003-04//MBS8731	196	0.92	18.6	10.7	53.7	1.2	1.3	97.4	269	126
15	GEMS-0050//MBS8731	195	0.91	17.9	11.1	55.5	1.4	0.9	97.5	273	135
16	GEMS-0220//MBS8731	192	0.90	18.1	10.8	54.6	0.4	0.0	99.5	265	126
8	(CL-G1501:S17b-B-020/GEMS-0050)-013-01//MBS8731	192	0.90	18.5	10.6	53.5	3.7	6.9	88.9	276	145
9	(CL-G1501:S17b-B-020/GEMS-0050)-013-01//LH283.LH287	191	0.89	18.5	10.6	55.4	7.2	12.9	78.9	277	141
10	(GEMS-0220/GEMS-0027)-03-03//MBS8731	190	0.89	18.2	10.7	55.9	1.0	0.5	98.3	269	129
27	Pioneer 1498	188	0.88	19.0	10.2	57.6	0.0	0.0	100.0	254	124
2	(GEMS-0050/CL-G1501:S17b-B-020)-003-01//LH283.LH287	185	0.86	18.9	10.0	54.3	2.7	9.6	87.4	273	143
17	CL-G1501:S17b-B-020)%B//LH283.LH287	183	0.86	18.2	10.4	56.0	3.4	13.3	82.8	276	143
7	(CL-G1501:S17b-B-020/GEMS-0050)-011-02//LH283.LH287	183	0.85	19.1	9.6	54.6	4.7	14.7	79.8	270	141
4	(GEMS-0050/CL-G1501:S17b-B-020)-003-04//LH283.LH287	182	0.85	19.9	9.3	55.9	5.0	11.0	82.5	266	133
26	Pioneer 1197R	180	0.84	17.3	9.9	56.9	1.1	2.9	95.9	245	122
13	(GEMS-0027/GEMS-0220)-03-05//LH283.LH287	179	0.84	19.0	9.7	55.4	5.2	12.7	81.4	266	135
5	(CL-G1501:S17b-B-020/GEMS-0050)-011-01//LH283.LH287	179	0.84	18.0	10.1	54.1	7.8	8.2	82.9	269	133
14	GEMS-0027//MBS8731	179	0.84	19.1	9.6	54.6	2.3	3.3	94.1	284	142
11	(GEMS-0220/GEMS-0027)-03-03//LH283.LH287	176	0.82	18.3	9.8	56.3	2.1	10.1	87.5	265	124
19	GEMS-0050//LH283.LH287	168	0.79	19.5	8.9	55.5	8.1	12.1	78.7	260	143
20	GEMS-0220//LH283.LH287	168	0.78	17.8	9.6	55.9	2.3	4.8	92.6	265	131
18	GEMS-0027//LH283.LH287	165	0.77	18.5	9.0	55.9	2.0	13.3	84.6	282	138
	Replications	15		15	15	12	8	7	7	11	6
	Check Means	214		19.3	11.5	57.2	1.4	1.1	97.4	265	132
	Overall Means	193		18.7	10.5	55.6	2.7	5.1	91.9	269	134
	CV	10.4		5.8	13.7	2.3	193	205	12.9	3.8	10.2
	LSD (p=0.05)	13.2		0.7	0.9	0.9	3.4	6.9	7.8	6.7	9.0

Commercial hybrids in bold were included in calculation of check mean

**Table 28. 2021 Yield Trial Data (All
Entries Ranked) Experiment 21NCG06**

Tester: LH235

<i>Entry</i>	<i>Pedigree</i>	<i>Yield</i>	<i>% Yield /CHK #</i>	<i>Moist</i>	<i>Yield/ Moist</i>	<i>Test Weight</i>	<i>Stalk Lodging</i>	<i>Root Lodging</i>	<i>Erect Plants</i>	<i>Plant Height</i>	<i>Ear Height</i>
		<i>bu/ac</i>		<i>%</i>		<i>lb/bu</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>cm</i>	<i>cm</i>
23	Pioneer 1870YHR	209	102	19.6	10.6	56.7	0.0	0.0	100	257	127
22	Pioneer 1794VYHR	208	102	18.5	11.2	57.3	1.1	0.0	99	288	140
18	DeKalb 69-16	205	101	19.1	10.7	57.7	0.4	0.0	99	253	127
21	Pioneer 1637R	205	100	18.4	11.1	57.2	0.0	0.5	100	285	134
17	DeKalb 67-44	203	99	19.1	10.6	57.6	0.0	0.0	100	259	117
24	Pioneer 2088R	200	98	19.0	10.7	55.9	0.0	0.0	100	279	132
16	DeKalb 65-99	199	98	18.3	11.0	56.9	0.0	0.0	100	253	132
11	GEMN-0310	189	93	17.0	11.1	55.9	0.0	0.5	100	284	149
7	GEMN-0271	189	93	18.7	10.0	56.7	0.0	0.5	100	316	172
3	GEMN-0254	188	92	18.3	10.3	57.2	0.2	0.0	100	291	160
1	GEMN-0232	186	91	18.1	10.6	55.6	0.4	0.0	100	295	171
20	Pioneer 1498	184	90	18.1	10.3	57.6	0.0	0.0	100	251	120
6	GEMN-0270	183	90	18.7	9.7	55.1	1.2	0.0	99	297	153
2	GEMN-0242	181	89	18.9	9.7	57.2	0.0	0.5	100	300	162
10	GEMN-0292	180	88	18.2	10.0	55.8	0.4	0.0	100	306	157
13	Pioneer 1498	180	88	18.0	10.0	58.7	0.0	0.0	100	251	119
19	Pioneer 1197R	178	87	17.0	10.7	56.6	0.0	0.0	100	240	119
8	GEMN-0272	178	87	17.9	10.0	54.9	0.0	0.5	100	300	150
4	GEMN-0257	177	87	18.9	9.4	55.4	0.4	2.4	97	290	159
14	LH214	177	87	18.3	9.6	56.5	0.0	0.0	100	281	135
9	GEMN-0287	172	84	17.9	9.5	55.1	0.2	1.7	98	288	138
12	Pioneer 1197R	171	84	16.9	10.1	57.2	0.0	0.0	100	240	116
15	LH216	164	80	17.7	9.3	57.1	0.0	0.0	100	279	148
5	GEMN-0259	148	72	18.2	8.1	57.7	0.0	0.6	99	309	168
	Replications	9		9	9	7	6	5	5	8	5
	Check Means	204		18.9	10.9	57.0	0.2	0.1	99.7	268	130
	Overall Means	186		18.3	10.2	56.6	0.2	0.3	99.5	279	142
	CV	9.9		4.9	10.9	1.9	500	377	1.5	3.6	9.9
	LSD (p=0.05)	14.8		0.7	0.9	0.9	0.7	0.9	1.2	8.1	11.4

Commercial hybrids in bold were included in calculation of check mean

Table 29. 2021 GEM-Ames Yield Trial Summary

Experiment	Matieral	Tester	Entries	Locations	Plots	Usable Reps	H ² Yield
2113101	CML375/PHKE6//3IIH6 ; CML449/PHN37//3IIH6	MBS3520	84	6	504	6	0.61
2113102	CML449/PHG47//LH82; PHN37/CA00370//PHG35	MBS3520	72	6	432	6	0.80
2113103	CML449/PHN37//LH82	MBS3520	72	6	432	6	0.56
2113104	CML449/PHN73//3IIH6	MBS3520	72	6	432	6	0.61
2113105	CML494/GEMN-0097//LH185; DK HBA1/Ki21//PHG47	MBS3520	84	6	504	6	0.71
2113106	Ki43/PHKE6//3IIH6	MBS3520	48	6	288	6	0.64
2113107	LH185/Ki21//PHG47; NKS8326/CML373//GEMN-0097///LH185	MBS3520	72	6	432	6	0.73
2113108	PHN37/CML313//LH82; PHN37/CML313//PHG35	MBS3520	60	6	360	6	0.75
2113109	GEMS-0113/CML103//GEMS-0227; GEMS-0113/CML103//PHG39	MBS8731	72	6	432	6	0.47
2113110	GEMS-0220/CML373//R3212Z	MBS8731	96	6	576	6	0.50
2113111	GEMS-0227/CML373//R3212Z	MBS8731	84	6	504	6	0.62
2113112	GEMS-0227/Ki14//GEMS-0218; PHP38/CML287//R3212Z	MBS8731	60	6	360	6	0.69
2113113	GEMS-0227/Ki14//PHW51	MBS8731	72	6	432	6	0.76
2113114	PHP38/CML287//LH195	MBS8731	60	6	360	6	0.29
2113115	La Posta Seq C7 F64-1-1-1-1-B-B/LH193//F9214Z	MBS8488	36	6	216	6	0.53
2113116	PHP38/CML423//F9214Z	MBS8488	48	6	288	6	0.67
2113117	PHP38/Ki43//2FACC	MBS8488	60	6	360	6	0.76
2113118	PHP38/Ki43//LH195	MBS8488	72	6	432	6	0.65
2114101	SX2788:S/794//GEMS-0188//PHG39; SX2788:S/794//GEMS-0188//PHW51	MBS8488; MBS8814	60	6	360	6	0.66
2153101	GEMS-0203/GEMS-0226//PHW51	MBS8488	48	6	288	6	0.78
2153102	GEMS-0227/GEMS-0091//2FACC	MBS8488	48	6	288	6	0.66
2154101	PHN46//GEMN-0130/MP494///LH185	MBS3520	60	6	360	6	0.87
2164201	Retest 1	MBS3520	72	10	720	10	0.87
2164202	Retest 2	MBS2655; TR7438; MBS3520	72	10	720	9	0.84
2164203	Retest 3	MBS5562; MBS8488	60	10	600	9	0.69
2164204	Retest 4	MBS5562; MBS8488	48	10	480	9	0.83
2164205	Retest 5	MBS8488	48	10	480	10	0.85
2164206	Retest 6	MBS8731	60	10	600	10	0.69
2164207	Retest 7	MBS8731	60	10	600	10	0.77
2164208	Retest 8	TR6828; MBS8814; MBS8731	60	10	600	10	0.9
2164209	Retest 9	Misc.	36	10	360	10	0.81
2164301	GEM Coded Line Trial	Misc.	48	11	528	9	0.78
2164302	GEM Coded Line Trial	Misc.	60	11	660	8	0.78

Table 30. 2021 GEM-Ames Coded Line Trials (2164301)

GEM Line	Tester	% CK Avg YLD	Yield (bu/ac)	Y/M	MST	% Stalk Ldg	%Root Ldg	TWT
GEMS-0288	MBS9530	101.9	230.6	12.3	19.0	2	4	54.6
GEMS-0289	MBS5562	87.2	197.2	11.1	18.0	8	5	56.1
GEMS-0289	MBS9530	101.7	230.2	12.3	19.1	2	2	55.4
GEMS-0290	MBS5562	85.3	193.0	11.9	16.5	1	4	55.1
GEMS-0290	MBS9530	92.0	208.1	11.6	18.2	1	1	55.5
GEMS-0291	MBS5562	80.0	180.9	10.9	16.8	7	26	56.0
GEMS-0291	MBS9530	102.4	231.6	12.3	19.0	4	9	55.8
GEMS-0296	MBS5562	79.2	179.1	10.6	17.0	2	13	57.8
GEMS-0296	MBS9530	97.6	220.8	12.6	17.9	2	3	58.7
GEMS-0297	MBS5562	84.6	191.3	11.4	17.0	1	3	56.8
GEMS-0297	MBS9530	97.0	219.3	12.5	17.8	1	1	56.5
GEMS-0298	MBS5562	92.7	209.8	12.5	16.9	1	2	56.5
GEMS-0298	MBS9530	84.8	191.9	10.7	18.2	1	1	56.1
GEMS-0299	MBS5562	87.1	197.0	11.8	16.9	15	14	54.3
GEMS-0299	MBS9530	89.9	203.5	11.7	17.6	2	4	54.8
GEMS-0300	MBS5562	94.5	213.8	11.3	19.2	1	7	57.0
GEMS-0300	MBS9530	109.5	247.6	12.6	19.9	1	1	55.2
GEMS-0301	MBS5562	93.9	212.4	12.4	17.3	1	9	58.1
GEMS-0301	MBS9530	87.4	197.6	10.4	19.2	1	0	56.1
GEMN-0302	MBS3628	88.1	199.2	11.9	16.9	4	6	56.4
GEMS-0303	MBS8657	104.7	236.8	13.8	17.4	2	2	56.7
GEMS-0303	MBS9530	84.0	190.0	10.9	17.6	0	0	57.8
GEMS-0304	MBS5562	85.5	193.3	11.5	17.0	2	7	57.4
GEMS-0304	MBS8657	87.1	197.1	11.6	17.3	8	7	56.7
GEMS-0304	MBS9530	92.9	210.1	11.8	17.9	0	4	57.9
GEMS-0305	MBS5562	93.6	211.8	12.6	17.0	2	1	56.8
GEMS-0306	MBS5562	83.5	188.8	11.2	17.1	4	7	56.7
GEMS-0306	MBS8657	96.7	218.8	12.2	18.2	4	1	56.6
GEMS-0306	MBS9530	89.0	201.4	11	18.5	2	1	57.4
GEMS-0307	MBS8657	95.5	216.0	11.7	18.7	15	8	56.0
GEMS-0308	MBS8657	95.0	214.9	11.8	18.3	2	5	57.5
GEMS-0308	MBS9530	92.8	210.0	11.4	18.7	1	3	58.2
GEMN-0309	MBS3628	82.2	186.0	9.9	18.9	11	43	55.3
GEMS-0313	MBS8657	103.4	233.8	13.7	17.3	4	2	57.6
GEMS-0313	MBS9530	99.1	224.1	12.7	17.8	2	0	58.3
GEMS-0314	MBS8657	101.8	230.2	13.1	17.8	12	4	56.3
GEMS-0314	MBS9530	97.8	221.3	12	18.6	1	1	56.3
GEMS-0315	MBS9530	92.3	208.7	11.8	17.9	1	0	55.9
GEMS-0316	MBS8657	93.3	211.0	12.4	17.2	4	3	56.8
GEMS-0316	MBS9530	91.6	207.1	11.5	18.2	2	0	55.9
GEMN-0317	MBS3628	92.9	210.1	11.9	17.9	8	5	57.0
GEMN-0318	MBS3628	94.0	212.6	11.7	18.6	17	4	55.6
GEMN-0319	MBS3628	94.4	213.6	11.2	19.4	1	8	54.9

Table 30. 2021 GEM-Ames Coded Line Trials (2164301)

GEM Line	Tester	% CK Avg YLD	Yield (bu/ac)	Y/M	MST	% Stalk Ldg	%Root Ldg	TWT
Number of Locations			9	9	9	6	6	9
Non Check Mean			209.4	11.8	17.9	3.8	5.4	56.5
Check Mean			226.2	12.4	18.5	3.7	4.2	57.0
H ²			0.78	0.66	0.92	0.74	0.88	0.94

Table 31. 2021 GEM-Ames Coded Line Trials (2164302)

GEM Line	Tester	% CK Avg YLD	Yield (bu/ac)	Y/M	MST	% Stalk Ldg	%Root Ldg	TWT
GEMN-0309	MBS2655	94.1	214.6	12.5	17.4	7	5	56.3
GEMN-0302	MBS2655	92.4	210.8	12.0	17.7	7	3	56.2
GEMN-0302	MBS3520	86.6	197.5	11.3	17.6	5	11	56.4
GEMS-0299	MBS8731	94.0	214.6	12.5	17.3	11	6	54.9
GEMN-0302	MBS2887	92.9	212.0	12.0	17.8	5	8	56.7
GEMS-0303	MBS8814	107.5	245.4	13.2	18.8	3	4	56.1
GEMS-0304	MBS8814	100.3	228.9	12.1	19.0	4	1	56.9
GEMS-0305	MBS8814	104.9	239.3	12.6	19.2	4	5	56.2
GEMS-0308	MBS8814	96.5	220.2	10.7	20.8	1	3	55.9
GEMS-0307	MBS8814	96.9	221.2	10.9	20.6	2	10	55.0
GEMS-0297	MBS8814	99.4	226.9	12.1	19.0	4	4	55.9
GEMS-0298	MBS8814	108.7	248.0	12.9	19.4	2	4	55.6
GEMS-0299	MBS8814	93.1	212.4	11.8	18.3	20	14	54.6
GEMS-0300	MBS8814	104.9	239.3	11.6	21.0	7	2	54.8
GEMS-0301	MBS8814	104.4	238.3	12.8	18.9	5	8	55.8
GEMS-0304	MBS8731	91.5	208.8	11.9	17.8	7	3	57.8
GEMS-0305	MBS8731	98.9	225.8	12.4	18.3	3	1	56.1
GEMS-0308	MBS8731	90.3	206.1	10.9	19.1	5	2	56.2
GEMS-0307	MBS8731	94.5	215.7	11.3	19.3	4	5	55.8
GEMS-0303	TR6828	89.0	203.0	11.0	18.6	1	0	57.4
GEMS-0304	TR6828	97.2	221.7	11.8	19.0	2	1	58.9
GEMS-0305	TR6828	88.5	201.9	11.2	18.2	1	1	58.3
GEMS-0308	TR6828	89.4	204.1	10.5	19.7	4	2	57.6
GEMS-0307	TR6828	88.4	201.7	10.3	19.9	4	6	56.9
GEMS-0296	TR6828	85.7	195.6	10.9	18.2	22	2	58.4
GEMS-0297	TR6828	90.6	206.7	11.6	18.1	10	5	57.2
GEMS-0298	TR6828	98.0	223.7	11.7	19.3	3	8	55.7
GEMS-0299	TR6828	82.1	187.3	10.3	18.4	15	11	55.0
GEMS-0303	MBS9508	94.6	215.9	12.3	17.8	1	3	59.9
GEMS-0304	MBS9508	94.5	215.6	12.3	17.7	6	7	59.5
GEMS-0305	MBS9508	103.3	235.7	13.4	17.7	5	9	58.8
GEMS-0306	MBS9508	97.2	221.8	12.1	18.5	6	8	59.1
GEMS-0307	MBS9508	79.6	181.6	10.0	18.6	5	17	57.9
GEMS-0308	MBS9508	92.7	211.5	11.5	18.5	5	8	60.3
GEMS-0313	MBS9508	93.8	214.0	12.3	17.6	7	9	60.0
GEMS-0314	MBS9508	102.8	234.7	13.1	18.1	5	8	59.2
GEMS-0315	MBS9508	92.7	211.5	12.5	17.2	4	6	58.7
GEMS-0316	MBS9508	81.6	186.3	10.8	17.5	13	6	58.2
GEMN-0309	MBS2691	84.5	192.7	9.3	20.8	24	20	54.8
GEMN-0309	MBS2747	86.7	197.8	10.0	19.9	15	7	56.4
GEMN-0309	MBS2887	83.4	190.3	10.0	19.1	14	43	55.5
GEMN-0317	MBS2691	97.9	223.4	12.0	18.9	7	13	56.2
GEMN-0317	MBS2747	99.9	227.9	12.4	18.6	4	1	58.0
GEMN-0317	MBS2887	102.4	233.7	13.5	17.4	10	3	57.0
GEMN-0318	MBS2691	97.7	223.0	11.4	19.5	21	7	55.2
GEMN-0318	MBS2887	104.0	237.3	13.0	18.4	16	11	56.5

Table 31. 2021 GEM-Ames Coded Line Trials (2164302)

GEM Line	Tester	% CK Avg YLD	Yield (bu/ac)	Y/M	MST	% Stalk Ldg	%Root Ldg	TWT
GEMN-0319	MBS2691	94.7	216.1	11.1	19.8	3	1	55.4
GEMN-0319	MBS2887	104.4	238.3	12.5	19.1	5	7	56.2
GEMN-0309	MBS3520	77.4	176.7	9.2	19.4	4	21	55.6
GEMS-0306	MBS8814	106.2	242.3	12.3	20.0	4	3	54.9
GEMS-0313	MBS8814	98.6	225.1	12.1	18.8	14	5	57.4
GEMS-0314	MBS8814	107.1	244.4	12.2	20.3	5	5	54.2
GEMS-0315	MBS8814	102.5	233.8	12.4	19.0	5	2	55.0
GEMS-0316	MBS8814	96.0	219.0	11.6	18.9	16	3	55.3

Number of Locations			9	9	9	7	7	9
Non Check Mean			217.1	11.7	18.8	7.3	6.8	56.7
Check Mean			228.2	12.7	18.2	2.8	5.0	56.8
H2			0.77	0.79	0.94	0.69	0.69	0.96

