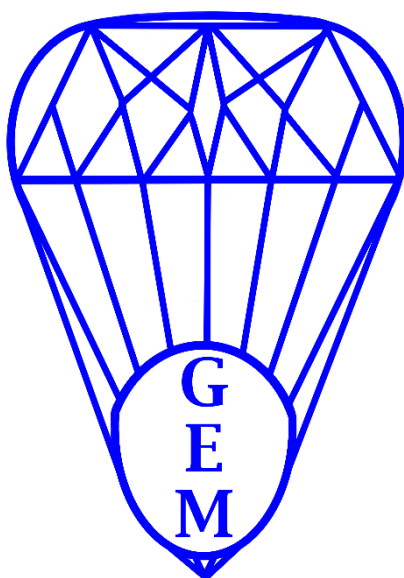


United States Department of Agriculture

Agricultural Research Service



Germplasm Enhancement of Maize

2019 GEM Cooperator Handout

December 11th 2019

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.

GEM Cooperator Meeting Booklet

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GEM WEBSITE

<http://www.public.iastate.edu/~usda-gem/>



**Germplasm
Enhancement of
Maize**

Cooperator Meeting:

DATE: December 11, 2019
HOURL: 8:30 – 12:00 AM
LOCATION: Regency Ballroom D
Hyatt Regency Hotel, Chicago

Meeting called by: W. Trevisan, GEM Technical Steering Group Chair

Agenda Topics

Welcome, and Minutes of Dec 5, 2018; Elections Update	W. Trevisan, Chair & Moderator	8:30-8:35
Project updates: GEM releases, breeding cross eval, germplasm input request, Ki14-derived DH Population update	D. Peters, M. Krakowsky	8:35-9:10
GEM Top 10 Project	J. Edwards, D. Peters	9:10 – 9:35
Updates - GEM Project Participation: Website redesign, GEM membership, In-Kind support, Cooperator rights and privileges	GEM Team	9:35 - 9:50
Appreciation for all Past Cooperators	GEM Team	9:50 – 10:00
Break		10:00 – 10:15
GEM's Role in the Commercial Hybrid Maize World	D. Butruille	10:15 – 10:55
Discussion		10:55 – 11:10
The Genetics of Phospholipid Metabolism in Highland Corn	R. Rellán-Álvarez	11:10 – 11:50
Discussion		11:50 - 12:00
Adjourn	W. Trevisan	12:00

December 5, 2018 GEM Cooperator Meeting Minutes

The meeting was called to order by Chair Walter Trevisan at 8:30 am.

Minutes from the 2017 meeting were provided by Idris Amusan. Wenwei Xu made motion to approve the minutes and they were approved.

GEM Project reports: David Peters and Matt Krakowsky reported on three new GEM released lines from Raleigh and seven from Ames, discussed the testing program, breeding cross evaluations, and requested Cooperator input on germplasm performance experience. Walter commented on the elite appearance of newer GEM lines.

Top 10 Trials: We were unable to present results of 2nd year testing of the 'Top 10' trials due to incomplete data access at the time. The value the project brings to stakeholders and to ARS team members was briefly discussed. Obtaining estimates of GEM release performance on proprietary testers had not been done before and is valuable in determining whether the program is meeting targets as well as facilitating use of GEM germplasm in proprietary programs.

Appreciation was expressed to all cooperators for their efforts to support the objectives of the GEM Projects at Raleigh and in Ames. Peter Bretting commented on the knowledge, tools, innovations that Cooperators bring and the unique, successful nature of the collaboration.

Terry Molnar of CIMMYT presented a summary of CIMMYT activities and an update on tar spot incidence and research (co-authored with Marcela Carvallo Andrade). He provided a brief history of the SeeDs project, started in 2011; in 2019 CIMMYT released its first germplasm resulting from this program, non-CML lines derived germplasm for drought tolerance and tar spot resistance. CGIAR breeding system software development is a significant. Efforts are designed to help breeders utilize genebank germplasm and bridge the gulf. About 30-40% of CIMMYT's maize genebank collection is derived from Mexico. Drought tolerant trials of 12% exotic hybrids were conducted in Sinaloa in 2017. Heat tolerant trials were conducted in Los Moches in 2018; the site was planted in April and temperatures exceeded 38C. Germplasm with varying levels of MCMV resistance has been identified; Caribbean material, and two CML lines, 494 and 550 were quite good. The best GEM lines were GEMS-0074 and GEMS-0075, which were crossed with CML494 or CML550 for hybrid testing.

North Carolina State Univ. lines (77) and GEM lines (71) were evaluated using CML264 as a tester in four subtropical locations. NCSU and GEM lines were later flowering and faster drying than the CML lines.

Tar spot complex (TSC), caused by *Phyllachlora maydis* and *Monographella maydis*, has expanded its area of incidence from Hidalgo to Guatemala and Columbia. Disease pressure varies from year to year. There are issues with developing a testing network in unsecure, dangerous areas. Martha Willcox' work indicated that Oaxaca 280 and Guatemala 153 offer some resistance; BC1 derivatives have been developed. CML576 is in a significant number of Latin American hybrids, is resistant to the *Phyllachlora* pathogen, and may be useful as a source of TSC resistance. SNPs have been identified in association with percent of leaf area saved, and a DH mapping population has been developed.

Jim Holland of USDA-ARS presented some historic achievement resulting from mining exotic germplasm for R genes (disease resistance). He discussion marker resampling models, joint-linkage mapping for QTLs in families, and the cloning of Zmcct10 which is associated with variation in flowering time. He discussed

whether association mapping in plants has identified major QTL alleles useful in cultivar development – it has not. Rather, genomic selection methods work with polygenic traits and can be implemented when one can't obtain good phenotypic data. Training models do not translate across populations unless there is good relationship between the populations. Jim indicated that selecting for adaptation in a population as a first step takes advantage of the fact that flowering is a polygenic trait. Jim suggested that GEM could apply genomic selection methods to 50% exotic population, apply within families, and predict best recycling crosses to make. Genomic selection is powerful if it can be done cheaply and rapidly, if you have the right training data, and is best for population improvement.

A teosinte allele at a locus on chromosome 10 has a bigger effect on flowering time in teosinte than it does in maize. For the Tuson population, the major effect gene went away in two cycles of selection, but improvement for flowering time continued through cycle 10 because of polygenic background.

Marilyn Warburton of USDA-ARS presented her research and described a pathway-based method to leverage GWAS results, assigning genes to pathways following tagging of SNPS via use of a decision tree. Gene effects were ranked and pathway enrichment scores were calculated, and when the enrichment scores exceed the significance threshold, the pathway is assumed to affect the trait of interest. A grain color example was used as proof of concept, and this concept has been expanded to apply to aflatoxin biosynthesis, oil biosynthesis, and corn ear worm resistance association. In the latter, significant pathways included those that modified cell wall components.

Final group discussion included thoughts about points from the first 25 years of GEM, and focus on the next 25 years. Tom Hoegemeyer commented on how complex maize genetics is, and the necessity of leveraging knowledge to increase genetic gain. Cycling of TSG membership, cooperators have all contributed to GEM success. It is still difficult to access plant genetic resources that are available without restrictions, and GEM provides germplasm access value.

The meeting adjourned at 12:00.

Table 1. Landraces Sampled in BGEM 2014 Releases (by Country of Origin)

Country	Races[%]	% of Total Races	Races with Acc.	Accessions	% of Total Acc.
ARGENTINA	33	8.9	27	28	7.2
BOLIVIA	39	10.5	29	32	8.2
BRAZIL	34	9.2	34	34	8.7
CHILE	17	4.6	17	17	4.4
COLOMBIA	23	6.2	23	34	8.7
COSTA RICA	3	0.8	3	3	0.8
ECUADOR	34	9.2	34	38	9.8
EL SALVADOR	1	0.3	1	1	0.3
GUATEMALA	20	5.4	19	22	5.7
MEXICO	55	14.8	53	56	14.4
PANAMA	1	0.3	1	1	0.3
PARAGUAY	7	1.9	7	7	1.8
PERU	52	14.0	51	56	14.4
UNITED STATES	17	4.6	17	17	4.4
URUGUAY	4	1.1	4	4	1.0
VENEZUELA	19	5.1	19	21	5.4
WEST INDIES	12	3.2	12	18	4.6
Grand Total	371	100	351	389	100

^{*} Unique races by country; some races are represented in more than one country

Table 2. Allelic Diversity Project Progress as of October 2017

	F₁ with PHB47	BC₁ with PHB47	BC₁F₂[#]	BC₁F₃	BC₁F₄	BC₁F₅	BC₁F₆	DH	F₁ with PHZ51	BC₁ with PHZ51	BC₁F₂	BC₁F₃	BC₁F₄	BC₁F₅	BC₁F₆	DH
ARGENTINA	27 races (28 acc.)	27 races (28 acc.)	5	1					27 races (27 acc.)	27 races (27 acc.)	10					
BOLIVIA	30 races (32 acc.)	30 races (32 acc.)	1	5	5	2			30 races (33 acc.)	30 races (33 acc.)	7	6	6	1		
BRAZIL	34 races (34 acc.)	34 races (34 acc.)	10						34 races (34 acc.)	34 races (34 acc.)	10	2				
CHILE	17 races (18 acc.)	16 races (17 acc.)		1					17 races (17 acc.)	16 races (16 acc.)	1					
COLOMBIA	23 races (34 acc.)	23 races (34 acc.)	3	8	1				22 races (32 acc.)	22 races (32 acc.)	3	9		1		
COSTA RICA	3 races (3 acc.)	2 races (2 acc.)							3 races (3 acc.)	2 races (2 acc.)						
ECUADOR	33 races (37 acc.)	33 races (37 acc.)	9	6	1				33 races (37 acc.)	33 races (37 acc.)	10	7		1		
EL SALVADOR	1 races (1 acc.)	1 races (1 acc.)							1 races (1 acc.)	1 races (1 acc.)						
GUATEMALA	20 races (22 acc.)	20 races (22 acc.)	7	2			2		20 races (21 acc.)	20 races (21 acc.)	8	4				
MEXICO	51 races (55 acc.)	50 races (54 acc.)	9	7			1		50 races (54 acc.)	50 races (54 acc.)	12	8				
PANAMA	1 races (1 acc.)	1 races (1 acc.)							1 races (1 acc.)	1 races (1 acc.)						
PARAGUAY	7 races (7 acc.)	7 races (7 acc.)	3						7 races (7 acc.)	7 races (7 acc.)	4					
PERU	51 races (55 acc.)	51 races (55 acc.)	12	8	4				51 races (54 acc.)	50 races (53 acc.)	12	9	4			
UNITED STATES	17 races (17 acc.)	17 races (17 acc.)							17 races (17 acc.)	16 races (16 acc.)						
URUGUAY	4 races (4 acc.)	4 races (4 acc.)							4 races (4 acc.)	4 races (4 acc.)						
VENEZUELA	19 races (20 acc.)	19 races (20 acc.)	7	1					19 races (21 acc.)	19 races (21 acc.)	12	2				
WEST INDIES	12 races (18 acc.)	12 races (18 acc.)		1					12 races (16 acc.)	12 races (16 acc.)		1				
2017 TOTAL	350 races (386 acc.)	348 races (382 acc.)							348 races (380 acc.)	345 races (373 acc.)						

Table 3. 2019 Doubled Haploid Lines (DH₀) Returned to GEM by the ISU Doubled Haploid Facility

Entry	Heterotic Group	Pedigree	Race *	Country	Lines
1	NS	Cateto sulino oscuro - URG V/PHZ51<2>	Cateto Sulino Oscuro	Uruguay	28
2	NS	Cubano Amarillo Duro-ECU 326/PHZ51<2>	Cubano Amarillo Duro	Ecuador	6
3	NS	Dentado branco - URZM 13 010/PHZ51<2>	Dentado blanco	Uruguay	8
4	NS	Diente de caballo-CHZM 06 002/PHZ51//PHZ51	Diente de Caballo	Paraguay	51
5	SS	PHB47/Patillo-BOV 502//PHB47	Patillo	Bolivia	2
6	SS	PHB47<2>/Chococeño-CHO 333	Chococeño	Columbia	0
7	SS	PHB47<2>/Chococeño-ECU 332	Chococeño	Ecuador	1
8	NS	PHZ51/Lenha-RGS XX//PHZ51	Lenha	Brazil	11
9	NS	PHZ51<2>/Andaqui-CAQ 333	Andaqui	Colombia	6
10	NS	PHZ51<2>/Avati_Pichinga-BR_2760	Avati Pichinga	Brazil	28
11	NS	PHZ51<2>/Blanco Harinoso Dentado-ECU 640	Blanco Harinoso Dentado	Ecuador	5
12	NS	PHZ51<2>/Bolita-OAX_44	Bolita	Mexico	5
13	NS	PHZ51<2>/Chococeño-ECU 332	Chococeño	Ecuador	7
14	NS	PHZ51<2>/Chococeño-PAN 97	Chococeño	Panama	11
15	NS	PHZ51<2>/Chuspillu-BOV 883	Chuspillu	Bolivia	2
16	NS	PHZ51<2>/Colorado-LIB 8	Colorado	Peru	3
17	NS	PHZ51<2>/Dourados_saboro-BR_50	Dourados Saboro	Brazil	10
18	NS	PHZ51<2>/Elotes Conicos-PUE 403	Elotes Conicos	Mexico	5
19	NS	PHZ51<2>/Entrelacado-MT VI	Entrelacado	Brazil	11
20	NS	PHZ51<2>/Gallina-ECU 329	Gallina	Ecuador	11
21	NS	PHZ51<2>/Haitian Yellow-HTI 14	Haitian Yellow	Haiti	17
22	NS	PHZ51<2>/Huilcaparu-BOV_685	Huilcaparu	Bolivia	5
23	NS	PHZ51<2>/Imbricado-GUA_922]	Imbricado	Guatemala	11
24	NS	PHZ51<2>/Moroti_Precoce-BOL_I	Moroti Precoce	Bolivia	10
25	NS	PHZ51<2>/Quicheno late-GUA 863	Quicheno Late	Guatemala	3
26	NS	Semi-dentado rugoso - URZM 13 052/PHZ51<2>	Semi-dentado rugoso	Uruguay	25
27	SS	PHB47<2>/Hualapai-PI213741	Hualapai Tribe	USA-Arizona	11
28	NS	PHZ51/Cochiti Pueblo-PI218151//PHZ51	Cochiti Pueblo	USA-New Mexico	21
29	NS	PHZ51/Isleta-Tiwa-PI218148//PHZ51	Isleta-Tiwa	USA-New Mexico	16
30	NS	PHZ51/Moencopi Pueblo-PI218175//PHZ51	Moencopi Pueblo	USA-Arizona	26
31	NS	PHZ51/Papago-Pimans-PI217410//PHZ51	Papago-Pimans	USA-Arizona	14
32	NS	PHZ51<2>/#Jemez Pueblo - PI218173	Jemez Pueblo	USA-New Mexico	10
33	NS	PHZ51<2>/#Tesuque Pueblo - PI218137	Tesuque Pueblo	USA-New Mexico	21
34	NS	PHZ51<2>/Havasupai-PI317675	Havasupai Tribe	USA-Arizona	13
35	NS	PHZ51<2>/Kokoma-PI213733	Kokoma	USA-Arizona	11
36	NS	PHZ51<2>/Pueblo 12-Row Hopi Kokoma-PI503564	Pueblo	USA-Arizona	14

* All accessions previously unsampled by the Allelic Diversity Project.

Table 4. BGEM Candidates Eligible for 2020 Release

Entry	Heterotic Group	Pedigree	Race	Country	Lines
1	SS	(Arizona - LIB 16/PHB47)/PHB47	Arizona	Peru	3
2	NSS	(CUZCO CUZ217/PHZ51)/PHZ51	Cuzco	Peru	3
3	NSS	(CUZCO CUZ363/PHZ51)/PHZ51	Cuzco Cristalino Amarillo	Peru	1
4	SS	(Dentado blanco-ARZM 14 090/PHB47)/PHB47	Dentado Blanco	Argentina	1
5	SS	(PATILLO GRANDE BOV649/PHB47)/PHB47	Patillo Grande	Bolivia	4
6	SS	(PHB47/(PHB47/(Chillo - ECU 411)	Chillo	Ecuador	1
7	SS	(PHB47/Amagaceño - ANT 343)/PHB47	Amagaceño	Colombia	2
8	SS	(PHB47/Cacahuacintle - MEX 7)/PHB47	Cacahuacintle	Mexico	1
9	SS	(PHB47/Celaya - GTO 36)/PHB47	Celaya	Mexico	3
10	SS	(PHB47/Conico - PUE 48)/PHB47	Conico		2
11	SS	(PHB47/Cuzco - CUZ 217)/PHB47	Cuzco	Peru	4
12	SS	(PHB47/Cuzco Cristalino Amarillo - CUZ 363)/PHB47	Cuzco Cristalino Amarillo	Peru	3
13	SS	(PHB47/Harinoso de Ocho - NAY 24)/PHB47	Harinoso de Ocho	Mexico	2
14	SS	(PHB47/Navajo-PI218163)/PHB47	Navajo	U.S.	2
15	SS	(PHB47/San Marceño - GUA 506)/PHB47	San Marceño	Guatemala	1
16	SS	(PHB47/Tuxpeño - VER 143)/PHB47	Tuxpeño	Mexico	3
17	NSS	(PHZ51/Amagaceño - ANT 343)/PHZ51	Amagaceño	Colombia	1
18	NSS	(PHZ51/Cacahuacintle - MEX 7)/PHZ51	Cacahuacintle	Mexico	2
19	NSS	(PHZ51/Celaya - GTO 36)/PHZ51	Celaya	Mexico	2
20	NSS	(PHZ51/Conico - PUE 48)/PHZ51	Conico		2
21	NSS	(PHZ51/CORO BOV1064)/PHZ51	Coroico	Bolivia	1
22	NSS	(PHZ51/Harinoso de Ocho - NAY 24)/PHZ51	Harinoso de Ocho	Mexico	2
23	NSS	(PHZ51/Huancavelicano - HVC 179)/PHZ51	Huancavelicano	Peru	2
24	NSS	(PHZ51/San Marceño - GUA 506)/PHZ51	San Marceño	Guatemala	2
25	NSS	(PHZ51/Tuxpeño - VER 143)/PHZ51	Tuxpeño	Mexico	2
26	SS	(Puya Grande - VEN 651/PHB47)/PHB47	Puya Grande		2
27	NSS	(Puya Grande - VEN 651/PHZ51)/PHZ51	Puya Grande		3
28	NSS	(SABANERO CUN342/PHZ51)/PHZ51	Sanbanero	Colombia	1
29	NSS	(Sin Clasificación - CAU454/PHZ51)/PHZ51	Sin Clasificación	Colombia	4

* BGEM lines jointly released by Iowa State University and USDA-ARS

Highlighted lines represent previously unsampled landraces in the Allelic Diversity Project

Table 5. BGEM* Candidate Lines Eligible for 2021 Release

Entry	Heterotic Group	Pedigree	Race	Country	Lines
1	NS	(Amargo-ARZM 03 014/PHZ51)/PHZ51	Amargo	Argentina	8
2	NS	(Amarillo salvadoreño-CIMMYT Comp./PHZ51)/PHZ51	Amarillo salvadoreño	Mexico	6
3	NS	(Araguito-VEN 568/PHZ51)/PHZ51	Araguito	Venezuela	4
4	NS	(Camelia-ARZM 03 025/PHZ51)/PHZ51	Camelia	Argentina	5
5	NS	(Camelia-CHZM 04 011/PHZ51)/PHZ51	Camelia	Chile	19
6	NS	(Canario de formosa-ARZM 06 016/PHZ51)/PHZ51	Canario de Formosa	Argentina	6
7	NS	(Conejo-GRO_157/PHZ51)/PHZ51	Conejo	Mexico	11
8	NS	(Cuban_Flint-CUB_63/PHZ51)/PHZ51	Cuban Flint	Cuba	10
9	NS	(Nal-tel BTB-GUA 145/PHZ51)/PHZ51	Nal-Tel Blanco Tierra Baja	Guatemala	5
10	NS	(Nal-tel_ATB-GUA_111/PHZ51)/PHZ51	Nal-Tel Amarillo de Tierra Baja	Guatemala	20
11	NS	(Nal-Tel-CAM 48/PHZ51)/PHZ51	Nal-Tel	Mexico	23
12	SS	(PHB47/Sabanero Ecuatoriano-ECU 433)/PHB47	Sabanero Ecuatoriano	Ecuador	3
13	NS	(PHZ51/(PHZ51/Pira-CUN 327)	Pira	Columbia	11
14	NS	(PHZ51/Aleman-HCO 38)/PHZ51	Aleman	Peru	7
15	NS	(PHZ51/Amarillo de Malleco-CHZM 09 002)/PHZ51	Amarillo de Malleco	Chile	8
16	NS	(PHZ51/Arrocillo_Amarillo-VER_311)/PHZ51	Arrocillo Amarillo	Mexico	5
17	NS	(PHZ51/Avati moroti-PAG 136)/PHZ51	Avati Moroti	Paraguay	6
18	NS	(PHZ51/Avati Tupi-PAG 129)/PHZ51	Avati Moroti	Paraguay	3
19	NS	(PHZ51/Brazil-1694 (USDA))/PHZ51		Brazil	10
20	NS	(PHZ51/Cateto-BAI I)/PHZ51	Cateto	Brazil	11
21	NS	(PHZ51/Coastal Tropical Flint-BVIR 104)/PHZ51	Coastal Tropical Flint	British Virgin Islands	8
22	NS	(PHZ51/Coscomatepec-VER 110)/PHZ51	Coscomatepec	Mexico	10
23	NS	(PHZ51/Cristal_de_Chihuahua-CHH_128)/PHZ51	Cristalino de Chihuahua	Mexico	9
24	NS	(PHZ51/Cubano Amarillo-BVIR 102)/PHZ51	Cubano Amarillo	British Virgin Islands	6
25	NS	(PHZ51/Dulce-ARZM 20 005)/PHZ51	Dulce	Argentina	24
26	NS	(PHZ51/Sabanero-VEN_514)/PHZ51	Sabanero	Venezuela	1
27	NS	(PHZ51/Tuson-BAI III)/PHZ51	Tuson		16
28	NS	(PHZ51/Tuson-CUB 67)/PHZ51	Tuson	Cuba	4
29	NS	(PHZ51/Tuxpeño-BVIR_153)/PHZ51	Tuxpeño	British Virgin Islands	8
30	NS	(PHZ51/Zapalote Chico-OAX 50)/PHZ51	Zapalote Chico	Mexico	5
31	NS	(Tuxpeño-ECU 942/PHZ51)/PHZ51	Tuxpeño	Ecuador	11
32	SS	PHB47/(PHB47/Paru-BOV)	Paru	Bolivia	1
33	NS	PHZ51/(PHZ51/Cuzco Ecuatoriano-ECU 530)	Cuzco Ecuatoriano	Ecuador	1
34	NS	PHZ51/(PHZ51/Nal-tel de ocho-GUA 458	Nal-Tel de Ocho	Guatemala	6
35	NS	PHZ51/(PHZ51/Zamorano Amarillo-MIC 66	Zamorano Amarillo	Mexico	4
* BGEM lines jointly released by Iowa State University and USDA-ARS					

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec[#]
1	Celaya-GTO69:S(PHP38)GEMS-0220	64	1502	64	1495	100	249	8	8		
2	Celaya-GTO69:S(PHP38)GEMS-0227	63	1460	62	1434	103	251	8	8		
3	Celaya-GTO69:S(PHP38)PHHB4	69	1638	67	1580	94	255	8	8		N
4	Celaya-GTO69:S(PHP38)PHHB9	67	1586	66	1551	101	261	9	9		
5	Celaya-GTO69:S(PHP38)PHMK0	66	1559	65	1538	115	270	9	9		
6	Celaya-GTO84:S(PHP38)GEMS-0220	65	1530	64	1495	113	273	8	8		
7	Celaya-GTO84:S(PHP38)GEMS-0227	63	1474	63	1467	93	269	7	7		
8	Celaya-GTO84:S(PHP38)PHHB4	68	1608	64	1508	108	271	8	8		N
9	Celaya-GTO84:S(PHP38)PHHB9	64	1502	64	1488	106	268	9	9		
10	Celaya-GTO84:S(PHP38)PHMK0	69	1644	66	1551	120	283	8	8		
11	Celaya-JAL167B:S(PHP38)GEMS-0220	63	1481	63	1467	95	261	8	7		
12	Celaya-JAL167B:S(PHP38)GEMS-0227	62	1438	61	1418	90	266	8	7		
13	ICA V-156:S(PHP38)GEMS-0220	65	1530	63	1474	104	259	8	8		
14	ICA V-156:S(PHP38)GEMS-0227	64	1495	64	1488	93	261	8	8		Y*
15	Tuxpeno-CHS462:S(PHP38)GEMS-0220	65	1515	64	1488	100	249	9	9		
16	Tuxpeno-CHS462:S(PHP38)GEMS-0227	64	1488	63	1474	90	266	8	7		Y*
17	Tuxpeno-CHS462:S(PHP38)PHHB4	68	1601	66	1558	106	266	8	8		
18	Tuxpeno-CHS462:S(PHP38)PHHB9	67	1579	66	1551	104	260	9	9		
19	Tuxpeno-CHS462:S(PHP38)PHMK0	67	1594	65	1537	119	278	8	9		
20	Tuxpeno-SLP146:S(PHP38)PHHB4	67	1594	65	1530	108	259	9	8		N
21	Tuxpeno-SLP146:S(PHP38)PHHB9	67	1587	67	1573	110	280	9	8		
22	Tuxpeno-SLP146:S(PHP38)PHMK0	70	1679	68	1601	125	288	9	9		
23	CML178:S(PHP38)PHMK0	64	1508	64	1502	111	255	9	9		Y
24	CM287:S(NK_H8431)PHHB9	66	1551	66	1544	111	280	9	8		
25	CM287:S(NK_H8431)PHP38	64	1502	63	1481	93	260	9	9		
26	CM287:S(PHP38)LH195	68	1601	66	1565	104	239	9	9		Y
27	CML339:S(LH195)PHHB9	66	1551	66	1565	103	248	9	9		Y
28	(KO679Y/CML287):S(GEMS-0220)	66	1565	65	1529	120	265	9	8		
29	(KO679Y/CML287):S(GEMS-0227)	65	1523	65	1516	113	289	9	8		
30	(CML277/CML341)-1-Sib/01-2-#:S(GEMS-0220)	67	1580	66	1565	119	263	9	9		
31	CML343:S(GEMS-0032)GEMS-0220	68	1615	67	1594	105	266	9	9		
32	CML343:S(GEMS-0032)GEMS-0227	65	1515	64	1508	109	274	9	8		
33	CML343:S(GEMS-0032)PHHB4	69	1651	68	1609	100	263	9	9		N
34	CML343:S(GEMS-0032)PHHB9	68	1616	67	1594	104	250	9	9	M	Y
35	CML343:S(GEMS-0032)PHMK0	69	1651	68	1622	119	285	9	9	M	N
36	(CML343/NC320):S(GEMS-0255)PHHB9	65	1536	65	1515	113	263	9	9	M	
37	(CML343/NC320):S(GEMS-0255)PHP38	65	1536	64	1502	108	250	9	9		
38	CML494:S(PHP38)PHHB4	65	1515	64	1502	86	250	9	9		N
39	La Posta Seq C7 F64-1:S(PHP38)PHHB9	66	1551	65	1530	85	243	8	8		

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
40	KS23-6:S(LH204)PHHB9	64	1487	63	1460	88	245	9	9	M	
41	DK_XL212:S(PHMK0)	66	1558	64	1502	113	271	9	9	M	
42	(GEMS-0243/GEMS-0032)/GEMS-0220	66	1565	65	1529	108	266	8	8		
43	(GEMS-0243/GEMS-0032)/GEMS-0227	65	1516	64	1502	96	271	7	7		Y
44	(GEMS-0032/GEMS-0243)/PHHB10	66	1558	65	1537	103	255	9	9		
45	(GEMS-0032/GEMS-0243)/PHMK1	67	1587	65	1515	109	274	9	8	M	
46	(GEMS-0255/GEMS-0032):S(PHHB9)	64	1501	63	1481	108	251	9	8		
47	(GEMS-0255/GEMS-0032):S(PHP38)	62	1439	61	1425	94	251	8	8	M	
48	(GEMS-0243/GEMS-0255):S(PHHB9)	67	1572	66	1551	105	260	9	8		
49	(GEMS-0243/GEMS-0255):S(PHP38)	66	1543	64	1502	96	255	9	9		
50	Cubano Amarillo Duro-ECU 904:N(GEMN-0048)PHBE2	64	1502	63	1474	110	271	7	8	M	N
51	Cubano Amarillo Duro-ECU 904:N(GEMN-0048)LH213	66	1544	64	1509	104	275	9	9		
52	Cubano Amarillo Duro-ECU 904:N(GEMN-0097)GEMN-0048	64	1508	63	1466	108	273	9	9		
53	Coastal Tropical Flint-Barbados GP2:N(GEMN-0048)PHBE2	68	1601	66	1558	128	275	9	9	M	N
54	Coastal Tropical Flint-Barbados GP2:N(GEMN-0048)LH213	68	1601	67	1587	111	289	9	9		
55	Canilla-VEN 981:N40x(GEMN-0097)	63	1480	62	1453	109	273	9	8		
56	Canilla-VEN 981:N(GEMN-0097)GEMN-0048	63	1481	63	1467	100	255	9	9		
57	Comun-VAL 343:N40x(GEMN-0097)	62	1445	61	1418	96	266	9	8		
58	Comun-VAL 343:N(GEMN-0097)GEMN-0048	66	1544	62	1446	100	260	9	8		
59	Cubano Amarillo-UCA 12:N40x(GEMN-0097)	64	1488	62	1439	110	273	9	8		
60	Cubano Amarillo-UCA 12:N(GEMN-0097)GEMN-0048	63	1467	62	1439	99	249	9	9		
61	Criollo-GUA Group 21-18A:N(GEMN-0097)GEMN-0048	65	1537	63	1474	96	265	9	9		
62	Criollo-GUA Group 21-18A:N(GEMN-0048)GEMN-0097	62	1453	61	1419	101	265	8	8	M	
63	Perla-LIM 13:N(GEMN-0097)GEMN-0048	65	1523	62	1439	106	274	9	8	M	
64	Population 32:N(GEMN-0097)GEMN-0048	61	1417	60	1397	108	263	9	8	M	
65	Population 32:N(GEMN-0048)GEMN-0097	61	1417	60	1391	96	266	9	9		
66	Population 35:N(GEMN-0097)GEMN-0048	61	1411	60	1385	90	260	9	9		
67	Population 35:N(GEMN-0048)GEMN-0097	60	1392	60	1378	94	264	9	9	M	
68	CML313:N(GEMN-0048)GEMN-0097	64	1494	63	1460	103	264	8	8	M	
69	CML395:N(GEMN-0048)GEMN-0097	63	1481	63	1460	99	278	8	8	M	
70	GEMN-0104:N(DK_HBA1)	65	1516	64	1495	104	255	9	9	M	
71	GEMN-0104:N(LH213)	65	1523	64	1508	90	249	9	9	M	
72	GEMN-0135:N(DK_HBA1)	65	1536	64	1508	108	253	9	9	M	
73	GEMN-0232:N(DK_HBA1)	63	1459	63	1460	109	268	9	9	M	
74	CL-02450:S(DK_WQCD10)	70	1673	68	1616	104	241	9	9	M	
75	CL-02450:S(HC33)	68	1609	67	1594	111	259	9	9	M	
76	CL-02450:S(PHAG6)	69	1644	68	1608	110	234	9	9		
77	CL-02450:S(PHEW7)	68	1608	67	1587	113	255	9	9	M	N
78	CL-02450:S(PHHB4)	72	1715	70	1659	110	249	9	9		

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
79	CL-02450:S(GEMS-0220)	73	1745	70	1666	121	261	9	9		N
80	CML373:S(DK_84QAB1)	66	1558	65	1529	105	261	9	9		
81	CML373:S(DK_WQCD10)	64	1508	64	1502	98	238	9	9		
82	CML373:S(HC33)	65	1537	65	1515	115	261	9	9		
83	CML373:S(LH235)	68	1608	67	1587	120	265	9	9		
84	CML373:S(LH236)	68	1601	67	1573	100	249	9	9		Y
85	CML373:S(LH242)	68	1623	67	1580	104	240	9	9		Y
86	CML373:S(PHAG6)	65	1529	64	1502	113	253	9	9		
87	CML373:S(PHEW7)	63	1474	63	1474	109	260	9	9		
88	CML380:S(DK_84QAB1)	67	1587	67	1594	113	264	9	9		
89	CML380:S(DK_WQCD10)	64	1488	63	1481	98	256	9	9		Y
90	CML380:S(HC33)	68	1608	66	1565	118	266	9	8		
91	CML380:S(LH235)	70	1679	70	1658	118	268	9	9		
92	CML380:S(LH236)	71	1694	70	1665	104	254	9	9		Y
93	CML380:S(LH242)	70	1658	69	1636	108	245	9	9	M	
94	CML380:S(PHAG6)	69	1651	68	1616	124	251	9	9	M	
95	CML380:S(PHEW7)	67	1594	68	1602	114	271	9	9		
96	CML380:S(PHHB4)	71	1708	69	1644	111	266	9	9	M	
97	CML494:S(DK_84QAB1)	67	1573	66	1558	122	263	9	8		
98	CML494:S(DK_WQCD10)	63	1481	63	1474	109	249	9	9	M	
99	CML494:S(HC33)	65	1529	64	1508	124	275	9	8	M	
100	CML494:S(LH235)	67	1580	66	1565	125	273	9	9		
101	CML494:S(LH236)	67	1594	67	1572	105	264	9	9		
102	CML494:S(LH242)	67	1587	67	1572	116	259	9	9		
103	CML494:S(PHAG6)	66	1565	65	1537	115	253	9	9		
104	CML494:S(PHEW7)	64	1508	64	1508	115	261	9	9		
105	CML494:S(PHHB4)	68	1616	67	1580	119	265	9	9		
106	D940Y:S(DK_84QAB1)	70	1658	69	1630	98	238	9	8		
107	D940Y:S(DK_WQCD10)	65	1522	64	1495	91	233	9	9		
108	D940Y:S(HC33)	68	1622	66	1544	91	252	8	8		
109	D940Y:S(LH235)	71	1694	69	1644	93	240	9	9		
110	D940Y:S(LH236)	69	1644	67	1594	88	239	9	9		Y
111	D940Y:S(LH242)	70	1658	68	1622	104	243	9	9		
112	D940Y:S(PHAG6)	69	1651	67	1594	101	234	9	9		
113	D940Y:S(PHEW7)	66	1565	65	1537	100	259	9	8		
114	D940Y:S(PHHB4)	70	1658	68	1601	104	271	9	9		
115	KO679Y:S(DK_84QAB1)	66	1558	66	1543	100	249	8	8		
116	KO679Y:S(DK_WQCD10)	64	1495	63	1481	81	238	9	8		
117	KO679Y:S(HC33)	67	1587	65	1522	90	243	8	7		

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
118	KO679Y:S(LH235)	70	1672	68	1601	96	231	8	8		
119	KO679Y:S(LH236)	68	1615	66	1544	85	225	9	8		
120	KO679Y:S(LH242)	68	1608	67	1580	86	223	8	8		
121	KO679Y:S(PHAG6)	67	1572	64	1502	98	239	8	8		
122	KO679Y:S(PHEW7)	64	1502	63	1467	98	253	8	7		
123	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(DK_84QAB1)	69	1651	66	1565	105	249	9	9		
124	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(DK_WQCD10)	65	1531	64	1509	95	241	9	9		
125	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(HC33)	67	1594	66	1558	104	259	9	9	M	
126	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(LH235)	69	1651	68	1622	113	258	9	9		
127	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(LH236)	69	1651	68	1615	103	246	9	9	S	
128	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(LH242)	68	1623	68	1616	108	251	9	9		
129	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(PHAG6)	65	1537	64	1502	115	250	9	9	S	
130	La Posta Seq C7 F71-1-1-1-2-B-B-B:S(PHEW7)	64	1508	64	1502	95	251	9	9	S	
131	Ki20:S(HC33)	69	1651	68	1601	113	273	9	9		
132	Ki20:S(LH195)	72	1730	70	1680	115	266	9	9		
133	Ki20:S(LH204)	71	1708	69	1637	114	273	9	9		
134	Ki20:S(LH227)	73	1752	71	1688	108	270	9	9		
135	Ki20:S(PHHB4)	70	1665	69	1644	124	288	9	9		
136	Ki20:S(PHHB9)	69	1652	69	1630	116	285	9	9		
137	Ki20:S(PHW52)	68	1616	66	1566	116	273	9	9		
138	Ki30:S(HC33)	68	1601	66	1565	103	255	9	9	M	
139	Ki30:S(LH195)	71	1701	70	1680	108	263	9	9		
140	55T1:S(PHP38)	65	1516	64	1488	96	246	9	9		Y
141	55T2:S(PHP38)	66	1544	65	1522	101	238	9	9		
142	55T3:S(PHP38)	68	1616	66	1558	98	236	9	9		
143	55T4:S(HC33)	68	1601	66	1558	113	246	9	9	M	
144	55T4:S(LH195)	67	1594	67	1587	118	268	9	9		
145	55T4:S(LH204)	65	1536	65	1536	114	249	9	9		
146	55T4:S(LH227)	66	1565	66	1551	111	251	9	9		
147	55T4:S(PHHB4)	68	1608	68	1616	113	270	9	9		
148	55T4:S(PHHB9)	66	1565	67	1587	120	258	9	9		
149	55T4:S(PHMK0)	70	1658	68	1623	134	268	9	9		
150	55T4:S(PHW52)	63	1481	64	1495	109	253	9	9		
151	55T5:S(HC33)	69	1630	66	1558	110	248	9	8		
152	55T6:S(HC33)	67	1579	65	1537	106	248	8	8	S	
153	55T6:S(LH195)	66	1551	66	1558	111	255	9	9		
154	AC454:N(DK_MM402A)	66	1544	66	1551	114	270	9	8		
155	AC454:N(LH283)	62	1440	62	1439	108	240	6	6	S	N
156	AC454:N(LH284)	63	1459	62	1439	101	255	9	8		

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	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
157	AC454:N(PHBE2)	65	1523	64	1509	118	274	8	8	S	N
158	CML323:N(DK_MM402A)	65	1523	64	1502	91	246	9	9		
159	CML323:N(LH283)	62	1439	62	1439	96	235	9	8	S	
160	CML323:N(LH284)	63	1460	62	1432	84	233	9	8	S	
161	CML323:N(PHBE2)	64	1502	64	1488	98	246	9	8	S	N
162	CML384:N(DK_MM402A)	72	1730	72	1731	118	273	9	9		
163	CML384:N(LH283)	70	1673	70	1673	110	239	9	9		
164	CML384:N(LH284)	71	1701	70	1666	113	251	9	9		
165	CML384:N(PHBE2)	72	1738	72	1717	125	285	9	9		
166	CML449:N(DK_MM402A)	67	1573	66	1552	113	268	9	9		
167	CML449:N(LH283)	64	1488	63	1460	116	263	9	9		
168	CML449:N(LH284)	64	1488	63	1474	115	266	9	9		
169	CML449:N(PHBE2)	66	1558	66	1544	125	270	9	9	S	N
170	CML451:N(DK_MM402A)	72	1737	71	1687	105	275	9	9		
171	CML451:N(LH283)	68	1615	67	1594	106	245	9	9	M	
172	CML451:N(LH284)	70	1665	66	1565	96	255	9	9		
173	CML451:N(PHBE2)	71	1709	70	1680	116	274	9	9	M	
174	NEI9008:N(DK_MM402A)	69	1637	68	1623	111	276	9	9	M	
175	NEI9008:N(LH213)	68	1601	66	1551	100	263	9	9		
176	NEI9008:N(LH283)	67	1587	66	1565	113	256	9	9	S	
177	NEI9008:N(LH284)	67	1580	65	1537	108	260	9	9	M	
178	NEI9008:N(PHBE2)	70	1658	69	1644	123	268	9	9	M	
179	89291:N(LH213)	65	1523	63	1460	105	286	9	9	M	
180	89291:S(LH235)	71	1694	67	1594	125	275	9	9		
181	89291:N(PHBE2)	66	1544	67	1580	116	270	9	8	S	N
182	89291:S(PHHB9)	65	1529	63	1474	123	275	9	9	M	N
183	89343:N(LH213)	67	1572	64	1494	111	284	9	9		
184	89343:S(LH235)	71	1694	68	1602	116	268	9	9		
185	89343:N(PHBE2)	67	1594	66	1559	124	264	9	9	S	N
186	89343:S(PHHB9)	68	1623	67	1580	114	274	9	9	M	
187	CA00370:N(LH213)	69	1651	67	1587	119	270	9	9		
188	CA00370:S(LH235)	72	1738	71	1688	130	293	9	9		
189	CA00370:N(PHBE2)	67	1573	66	1565	134	281	9	9	M	
190	CA00370:S(PHHB9)	70	1658	69	1644	126	270	9	9		
191	CML125:N(LH213)	62	1431	61	1418	89	268	9	8		
192	CML125:S(LH235)	69	1644	67	1587	101	256	8	8		
193	CML125:N(PHBE2)	63	1459	62	1446	91	251	8	8	M	
194	CML125:S(PHHB9)	66	1565	64	1508	104	268	9	9		
195	CML169:N(LH213)	66	1565	65	1529	110	291	9	9		

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	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
196	CML169:S(LH235)	69	1637	67	1587	113	274	9	9		
197	CML169:N(PHBE2)	67	1579	66	1559	121	286	9	9	S	N
198	CML169:S(PHHB9)	68	1615	68	1601	111	260	9	9		
199	CML215:N(LH213)	70	1665	67	1587	123	289	8	8		
200	CML215:S(LH235)	71	1701	69	1637	124	279	9	9		
201	CML215:N(PHBE2)	69	1630	67	1594	128	280	8	8	S	N
202	CML215:S(PHHB9)	70	1673	69	1652	130	288	9	8		
203	CML312:N(LH213)	70	1666	66	1565	103	279	9	9		
204	CML312:S(LH235)	71	1694	70	1658	111	273	9	9		
205	CML312:N(PHBE2)	69	1651	68	1609	113	269	9	9		
206	CML312:S(PHHB9)	70	1672	69	1630	109	263	9	9		
207	CML375:N(LH213)	64	1509	63	1474	101	258	9	9		
208	CML375:S(LH235)	67	1587	66	1565	113	258	9	9		
209	CML375:N(PHBE2)	61	1424	61	1411	99	234	9	9	S	
210	CML375:S(PHHB9)	65	1522	64	1502	98	246	9	9		
211	CML453:N(LH213)	69	1637	67	1580	128	268	9	9		
212	CML453:S(LH235)	72	1716	70	1666	120	260	9	9		
213	CML453:N(PHBE2)	72	1715	69	1651	126	259	9	9	M	
214	CML453:S(PHHB9)	72	1724	70	1659	131	265	9	9		
215	TZI8:N(LH213)	62	1445	61	1418	103	264	9	8		
216	TZI8:S(LH235)	67	1586	64	1509	125	270	9	9		
217	TZI8:N(PHBE2)	63	1467	62	1432	115	248	9	9	S	N
218	TZI8:S(PHHB9)	66	1544	63	1467	100	254	9	9		
219	TZI9:N(LH213)	65	1516	64	1488	108	275	8	8		
220	TZI9:S(LH235)	69	1644	68	1616	124	268	8	8		
221	TZI9:N(PHBE2)	65	1516	64	1494	119	268	7	7	S	N
222	TZI9:S(PHHB9)	67	1580	64	1509	110	265	8	7		
223	Ki45:N(DK_MBWZ)	66	1558	64	1509	104	234	9	9		
224	Ki45:N(LH216)	69	1637	66	1551	108	241	9	9		
225	Ki45:N(PHJ33)	65	1530	63	1474	115	236	9	9		
226	Ki45:S(HC33)	68	1601	66	1558	101	243	9	9	M	
227	Ki45:S(LH204)	66	1559	64	1502	96	225	9	9	M	
228	Ki59:N(LH213)	69	1652	63	1467	96	250	9	8	M	
229	Ki59:N(LH216)	73	1745	67	1594	109	255	9	9		
230	Ki59:N(PHK56)	66	1559	61	1419	96	255	9	8	M	
231	Ki59:S(HC33)	67	1580	63	1481	93	248	8	7	M	
232	Ki59:S(LH195)	66	1550	65	1536	103	251	9	9		
233	Ki59:S(PHHB4)	69	1630	66	1544	95	265	9	8		
234	Kei1421:S(HC33)	67	1587	67	1573	95	245	9	9	M	

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
235	Kei1421:S(PHHB9)	66	1558	67	1572	105	260	9	9	M	
236	Kei1421:S(PHMK0)	72	1716	69	1644	128	279	9	9		
237	Kei1421:N(LH213)	68	1608	66	1565	104	268	9	9	M	
238	Kei1421:N(LH216)	69	1651	68	1609	115	260	9	9		
239	Kei1421:N(PHK56)	68	1601	66	1558	100	236	9	9	M	
240	55T5:N(LH213)	68	1608	67	1580	106	258	9	9	M	
241	CML341:S42-B-004/GEMS-0220	66	1544	66	1544	100	241	9	8		
242	CML341:S42-B-004/GEMS-0115	66	1558	67	1580	104	235	9	9	M	
243	CML341:S42-B-010/GEMS-0115	67	1572	67	1587	93	238	7	7	M	
244	CML341:S42-B-010/GEMS-0227	65	1529	66	1544	98	253	7	7	M	
245	GEMS-0220/CML343:S(NS701)-B-014	65	1522	64	1508	101	250	9	8		
246	CML343:S(NS701)-B-019/GEMS-0115	68	1608	67	1573	109	240	8	7	M	
247	CML343:S(NS701)-B-019/GEMS-0220	68	1609	66	1551	99	235	8	8	M	
248	CML343:S42-001-009/GEMS-0227	64	1509	64	1502	95	254	8	8		Y
249	CML343:S42-001-009/GEMS-0115	69	1637	68	1602	90	245	8	8		Y
250	CML343:S42-003-002/GEMS-0227	64	1487	64	1488	86	259	8	8		Y
251	CML343:S42-003-002/GEMS-0115	66	1565	67	1580	105	249	8	8		
252	DKB844:S51-036-002/GEMS-0147	64	1502	64	1502	114	268	9	9	M	
253	DKB844:S51-036-002/GEMS-0227	62	1432	63	1460	96	264	9	9		
254	BR106:G39-012-002/GEMS-0147	65	1522	65	1522	103	248	8	8	M	
255	BR106:G39-012-002/GEMS-0115	67	1594	67	1594	98	249	8	8	M	
256	BR106:G39-012-002/GEMS-0072	64	1488	65	1515	95	245	8	7	M	
257	GEMS-0293/GEMS-0072	65	1536	65	1529	91	229	7	7	M	
258	GEMS-0293/GEMS-0115	67	1580	68	1601	98	241	8	8	M	
259	GEMS-0293/GEMS-0147	67	1586	67	1587	90	226	8	8	M	
260	GEMS-0255/GEMS-0220	65	1515	64	1502	93	250	9	9		
261	GEMS-0255/GEMS-0147	67	1573	66	1566	100	244	9	9	M	
262	GEMS-0255/GEMS-0115	68	1615	67	1587	105	240	9	8	M	
263	GEMS-0255/GEMS-0072	66	1559	65	1537	81	239	9	9	M	
264	GEMS-0147/GEMS-0032	67	1587	67	1572	105	256	9	9	M	
265	GEMS-0243/GEMS-0115	69	1629	69	1629	103	254	7	7		
266	GEMN-0257/GEMN-0272	65	1516	65	1516	93	250	9	9		Y
267	FL 4BT7:N(LH213)	65	1516	63	1481	104	255	9	9	M	
268	Canilla-BVIR 106:N(DK_MBWZ)	68	1601	67	1573	125	284	9	9		
269	Canilla-BVIR 106:N(LH213)	66	1544	63	1474	124	310	8	8		
270	Canilla-BVIR 106:N(LH216)	68	1608	65	1515	129	306	8	8	M	
271	Canilla-BVIR 106:N(PHJ33)	66	1545	62	1453	128	284	8	9	M	
272	Canilla-BVIR 106:N(PHK56)	65	1537	63	1474	118	300	8	8	S	
273	Canilla-BVIR 106:S(HC33)	68	1601	65	1537	120	284	7	7	M	

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec[#]
274	Canilla-BVIR 106:S(LH195)	70	1679	68	1608	110	268	8	8	M	
275	Canilla-BVIR 106:S(LH204)	66	1558	63	1481	128	289	9	8	M	
276	Canilla-BVIR 106:S(LH227)	69	1644	66	1558	120	278	8	8	M	N
277	Canilla-BVIR 106:S(PHHB4)	71	1694	68	1601	119	288	8	9		
278	Canilla-BVIR 106:S(PHHB9)	69	1644	67	1587	111	275	9	9		
279	Chandelle-BVIR 116:N(DK_MBWZ)	70	1658	68	1623	133	298	9	9	M	N
280	Chandelle-BVIR 116:N(LH213)	70	1658	68	1616	120	300	9	9	M	
281	Chandelle-BVIR 116:N(LH216)	71	1687	68	1601	144	308	9	9	M	
282	Chandelle-BVIR 116:N(PHJ33)	67	1580	63	1474	109	314	9	9	S	N
283	Chandelle-BVIR 116:N(PHK56)	68	1615	65	1529	109	285	9	9	M	
284	Chandelle-BVIR 116:S(HC33)	68	1608	66	1558	113	283	9	8		
285	Chandelle-BVIR 116:S(LH195)	71	1694	67	1594	111	266	8	8		
286	Chandelle-BVIR 116:S(LH204)	66	1559	64	1509	106	270	9	9	M	
287	Chandelle-BVIR 116:S(LH227)	71	1686	66	1565	118	265	9	9		
288	Chandelle-BVIR 116:S(PHHB4)	70	1658	65	1522	108	299	9	9	M	N
289	Chandelle-BVIR 116:S(PHHB9)	68	1623	67	1587	124	280	9	9		
290	Chandelle-BVIR 116:S(PHMK0)	72	1723	71	1702	143	318	9	9		
291	Coastal Tropical Flint-BVIR 104:N(DK_MBWZ)	68	1615	66	1565	129	289	9	9		
292	Coastal Tropical Flint-BVIR 104:N(LH213)	68	1608	65	1516	105	294	9	9		
293	Coastal Tropical Flint-BVIR 104:N(LH216)	67	1594	65	1529	143	301	9	9		
294	Coastal Tropical Flint-BVIR 104:N(PHJ33)	67	1572	63	1474	130	295	9	9	M	
295	Coastal Tropical Flint-BVIR 104:N(PHK56)	65	1516	60	1397	120	285	9	8	M	
296	Coastal Tropical Flint-BVIR 104:S(HC33)	66	1558	64	1509	126	301	9	9		
297	Cubano Amarillo-BVIR 102:N(DK_MBWZ)	69	1644	67	1594	133	286	9	9		
298	Cubano Amarillo-BVIR 102:N(LH213)	70	1659	66	1544	119	295	9	8		
299	Cubano Amarillo-BVIR 102:N(LH216)	69	1651	67	1572	131	288	9	9		
300	Cubano Amarillo-BVIR 102:N(PHJ33)	66	1558	62	1439	111	261	9	9	S	N
301	Cubano Amarillo-BVIR 102:N(PHK56)	68	1616	65	1530	110	279	9	9		
302	Early Carribean-BVIR 139:N(DK_MBWZ)	66	1565	64	1495	106	266	9	8	M	
303	Early Carribean-BVIR 139:N(LH213)	65	1537	63	1460	106	271	8	8	M	
304	Early Carribean-BVIR 139:N(LH216)	67	1587	65	1515	124	271	8	8		
305	Early Carribean-BVIR 139:N(PHJ33)	64	1494	61	1419	113	256	8	8	S	N
306	Early Carribean-BVIR 139:N(PHK56)	63	1473	62	1432	105	245	8	8	M	
307	KS23(S)C5:S(HC33)	67	1572	64	1508	105	266	8	8		
308	KS23(S)C5:S(LH195)	71	1687	70	1666	109	260	9	9		
309	KS23(S)C5:S(LH204)	68	1623	65	1537	110	249	9	9		
310	KS23(S)C5:S(LH227)	71	1687	68	1601	109	260	9	9		
311	KS23(S)C5:S(PHHB4)	71	1694	68	1601	110	274	9	9		
312	KS23(S)C5:S(PHHB9)	71	1688	69	1630	113	261	9	9		

Table 8. 2019 Breeding Cross Observation - GEM Raleigh

	Pedigree	SIL (days)	SIL (GDD)	ANT (days)	ANT (GDD)	EHT (cm)	PHT (cm)	DIS #1 (July 22)	DIS #2 (Aug 12)	Stalk Rot	Rec [#]
313	KS23(S)C5:S(PHMK0)	73	1760	70	1673	134	284	9	9		
314	Chandelle-BVIR 116:S(PHW52)	65	1538	63	1460	116	274	9	9		
315	Tuson/Criollo-BVIR 155:N(DK_MBWZ)	76	1841	72	1730	159	323	9	9		
316	Tuson/Criollo-BVIR 155:N(LH213)	74	1790	70	1680	138	324	9	9		
317	Tuson/Criollo-BVIR 155:N(PHJ33)	71	1687	69	1630	158	313	9	9	M	
318	Tuson/Criollo-BVIR 155:S(HC33)	72	1716	68	1608	139	323	9	9		
319	Tuson/Criollo-BVIR 155:S(LH195)	74	1781	71	1709	136	311	9	8		
320	Tuson/Criollo-BVIR 155:S(LH204)	72	1738	69	1637	150	301	9	9		
321	Tuson/Criollo-BVIR 155:S(LH227)	73	1760	71	1688	151	303	9	9		
322	Tuson/Criollo-BVIR 155:S(PHHB4)	74	1789	72	1731	150	325	9	9		
323	Tuson/Criollo-BVIR 155:S(PHHB9)	73	1745	71	1708	136	319	9	9		
324	Tuxpeño-BVIR 153:S(HC33)	72	1723	70	1666	136	299	9	9		
325	Tuxpeño-BVIR 153:S(LH195)	73	1753	72	1716	126	296	9	9		
326	Tuxpeño-BVIR 153:S(LH204)	74	1782	71	1709	149	315	9	9		
327	Tuxpeño-BVIR 153:S(LH227)	75	1812	72	1738	149	308	9	9		
328	Tuxpeño-VER 147:S(HC33)	67	1594	66	1559	121	289	9	9		
329	Tuxpeño-VER 147:S(LH195)	72	1716	69	1644	128	280	9	8		
330	Tuxpeño-VER 147:S(LH204)	69	1637	66	1558	124	280	9	9	M	
331	Tuxpeño-VER 147:S(LH227)	70	1673	67	1573	119	268	8	9	M	
332	Tuxpeño-VER 147:S(PHMK0)	74	1775	70	1659	140	301	9	9		
333	KS23(S)C5:S(PHW52)	65	1537	64	1501	108	256	9	8		

DIS = Disease rating, 9= no disease, 1 = dead

Rec[#] = Recommended (Yes, No, or no comment)

Y*= Recommended for midwestern locations, as GEMS-0227 is not entirely suitable for breeding work in Raleigh

Table 7. 2019 Breeding Cross Observation - GEM Ames, AgReliant - Ft. Branch, IN, Longping - Capron, IL

Ent	HG	Pedigree	Pollen GDU Ames	Silk GDU Ames	Pollen GDU AgR	Silk GDU AgR	Plant Ht Ames	Ear Ht Ames	Plant Ht LP	Ear Ht LP	Root Ldg AgR	Stay Green AgR	Beeder Rating LP	Intact Score Ames	Ear Pos Harv Ames	Husk Tight Ames	Husk Lng Ames	Ear Size Ames	Ear Qual Ames	K Color Ames	Ear Text Ames	Field Comments
1	Ck	Mo17/B73	1484	1515	1502	1502	233	118	274	131		2	4	7	1	7	6	7	4	Y	D	
2	Ck	Pioneer P1151	1344	1371	1502	1502	218	95	250	84		7	8	6	4	8	7	6	5	Y	D	
3	Ck	Pioneer 31D58	1527	1527	1502	1502	243	105	272	113		7	5	6	1	6	7	7	6	Y	D	stalk lodged
4	Ck	MBS2655/MBS9508	1413	1399	1502	1502	233	90	276	108		2	5	6	1	6	6	6	5	Y	D	tops gone
5	Ck	MBS3520/MBS8814	1441	1457	1555	1555	235	100	295	112		7	5	7	6	6	6	8	3	Y	D	big ear
6	SS	(GEMS-0113/GEMS-0011)/F9214Z	1499	1530	1529	1580	240	115	297	130		6	6	6	8	2	5	4	7	Y	D	stalk lodged
7	SS	(PHP38/89291)/FBLL	1472	1485	1555	1555	240	115	273	123		4	5	6	2	6	6	7	6	Y	D	
8	SS	BR106:PHG39-012-002)%B:S(PHHB9)-SIB	1646	1659	1633	1580	223	98	290	138		6	6	7	4	8	8	3	4	Y	D/SF	tops gone but intact
9	SS	BR106:PHG39-012-002)%B:S(PHW52)-SIB	1610	1623	1607	1580	205	90	256	123		3	8	5	6	6	7	3	4	Y	D	poor stand, appearance
10	SS	CML178:S(PHP38)PHMK0-SIB	1570	1604	1529	1502	233	108	273	130	7	4	4	9	4	5	9	6	6.5	Y	D	
11	SS	(CML287/NKH8431):S(PHHB9)-SIB	1632	1646	1580	1529	245	113	308	137	8	7	4	7	4	7	6	4	4	Y	D	mostly barren
12	SS	(CML287/NKH8431):S(PHP38)-SIB	1537	1537	1580	1607	235	108	287	139		4	6	6	2	4	6	4	4	Y	D	low ear
13	SS	(CML287/NKH8431):S(PHW52)-SIB	1604	1600	1580	1607	240	113	318	142		6	7	7	7	4	6	4	4	Y	D	
14	SS	(CML287/PHEW7):S(PHW52)-SIB	1570	1570	1580	1555	223	98	275	150	7	4	4	5	6	6	6	2	3	Y	D	discard
15	SS	(PHP38/CML287)/LH195	1592	1623	1555	1555	248	130	279	128		7	7	5	7	4	7	7	6	Y	D	stalk lodging
16	SS	CML339:S(LH195)PHHB9-SIB	1600	1610	1580	1580	238	118	283	121		5	5	7	7	8	6	3	5	Y/W	D	
17	SS	(GEMS-0227/CML343)/FBLL	1530	1511	1529	1529	245	110	287	131		5	5	6	4	4	6	5.5	6	Y	D	
18	SS	(CML373/LH204)/FBLL	1563	1553	1529	1555	243	118	298	137		8	8	7	4	4	7	7	4	Y	D	
19	SS	(GEMS-0227/CML373)/FBLL	1442	1546	1607	1580	243	108	279	115		7	7	5	4	3	6	6	7	Y	D	tops gone
20	SS	CML375/LH195//PHG39	1623	1610	1607	1607	235	103	286	121		9	8	7	6	7	6	7.5	4	Y	D	
21	SS	CML375/LH195//PHHB9	1582	1570	1607	1555	235	105	294	134		8	8	7	6	7	6	6	4	Y	D	
22	SS	CML375/LH195//PHK29	1600	1600	1555	1607	240	123	283	135		7	7	7	6	4	6	7	4	Y	D	big ear
23	SS	CML375/LH195//PHW51	1573	1573	1529	1502	238	120	284	125		7	8	7	7	5	7	5	6	Y	D	
24	SS	CML375/LH195//PHW52	1570	1537	1529	1555	233	108	281	130		4	4	6	5	5	6	6.5	5	Y	D	
25	SS	CML375/LH195//R3212Z	1553	1527	1529	1529	220	105	255	105		4	7	5	4	4	5	4	3	Y/W	D	
26	SS	CML375/LH204//PHHB4	1573	1601	1607	1607	233	108	313	137		7	8	6	5	7	7	7	5	Y	D	
27	SS	CML375/LH204//PHHB9	1583	1583	1529	1529	253	120	285	123		4	6	5	7	7	6	7.5	7	Y/W	D	variable
28	SS	CML375/LH204//PHK29	1552	1553	1529	1529	245	110	295	145	6	4	6	6	6	4	8	4	5	Y	D	stalk lodging; root lodged
29	SS	CML375/LH204//PHW52	1470	1484	1502	1502	230	110	261	99	3.5	3	1	5	3	6	6	4	6	Y/W	D	small statue; goosenecked
30	SS	CML375/PHMK0//2FACC	1527	1542	1529	1502	230	103	278	124	4	5	8	7	4	4	6	3.5	3	Y/W	D	
31	SS	CML375/PHMK0//F9214Z	1631	1628	1555	1607	253	120	306	133		7	6	5	7	3	7	7	5	Y/W	D	some stalk lodging
32	SS	CML375/PHMK0//FBLL	1570	1570	1580	1607	250	120	287	148		8	8	5	7	4	6	6	7	Y/W	D	big ear; some stalk lodging
33	SS	CML375/PHMK0//HC33	1546	1537	1529	1555	233	108	276	132	7	4	8	7	6	5	6	8	7	Y	D	
34	SS	CML375/PHMK0//LH204	1570	1570	1529	1502	248	115	305	146	8	7	6	9	6	4	6	5.5	4	Y	D	big ear
35	SS	CML375/PHMK0//LH227	1561	1573	1529	1529	243	118	303	135	7	4	8	7	4	5	6	6.5	3	Y	D	big ear; one stalk lodged
36	SS	CML375/PHMK0//R3212Z	1570	1582	1555	1529	235	115	294	144	7	5	8	7	3	7	6	7	6.5	Y	D	
37	SS	(PHP38/CML423)/FBLL	1472	1493	1529	1529	228	115	295	147		6	5	4	2	5	6	6	7	Y	D	stalk lodged. Ugly
38	SS	(PHP38/Ki43)/FBLL	1485	1499	1502	1502	235	113	263	125		6	8	6	3	4	6	5	6	Y	D	
39	SS	FBLL//KS23-6/LH204	1521	1539	1529	1502	238	105	290	137		7	6	4	3	4	6	6.5	4	Y	D	stalk lodged;
40	SS	FBLL//KS23-6/PHP38	1500	1484	1529	1502	240	120	293	129		6	7	4	2	4	6	6.5	5	Y	D	
41	SS	FBLL//KS23-6/PHW52	1515	1515	1555	1529	238	105	287	129		4	8	5	2	5	6	7	6	Y	D	
42	SS	KS23-6/LH195//PHG39	1619	1619	1580	1580	235	103	296	130		7	7	7	7	7	5	7	8	Y	D/SF	
43	SS	KS23-6/LH195//PHHB9	1646	1623	1607	1633	235	105	298	121		5	7	5	7	7	6	6	7	Y	SF/SD	small ear
44	SS	KS23-6/LH195//PHMK0	1632	1688	1607	1580	255	130	285	140		8	6	8	5	3	8	6.5	8	Y	D	
45	SS	KS23-6/LH195//PHW51	1573	1590	1580	1607	233	113	289	137		7	6	9	7	4	6	7.5	8	Y	D	

Table 7. 2019 Breeding Cross Observation - GEM Ames, AgReliant - Ft. Branch, IN, Longping - Capron, IL

Ent	HG	Pedigree	Pollen GDU Ames	Silk GDU Ames	Pollen GDU AgR	Silk GDU AgR	Plant Ht Ames	Ear Ht Ames	Plant Ht LP	Ear Ht LP	Root Ldg AgR	Stay Green AgR	Beeder Rating LP	Intact Score Ames	Ear Pos Harv Ames	Husk Tight Ames	Husk Lng Ames	Ear Size Ames	Ear Qual Ames	K Color Ames	Ear Text Ames	Field Comments
46	SS	KS23-6/LH195//R3212Z	1553	1563	1580	1607	233	108	273	127		5	6	4	2	4	6	5.5	5	Y	SD/SF	stalk lodged
47	SS	KS23-6/LH204//PHG39	1583	1582	1555	1555	235	110	298	139		4	5	6	4	8	6	7.5	6	Y	D/SF	
48	SS	KS23-6/LH204//PHHB4	1592	1610	1633	1633	238	108	313	142		7	5	6	4	6	6	5	4	Y	D	stalk lodged
49	SS	KS23-6/LH204//PHMK0	1655	1680	1633	1633	275	133	316	151		8	4	8	3	6	6	7.5	5	Y	D	big ear
50	SS	LH204//KS23-6/PHP38-SIB	1499	1499	1580	1580	225	103	250	112		7	6	4	1	6	6	4	5	Y	D	
51	SS	LH225//KS23-6/LH204	1457	1470	1529	1529	240	110	272	125		3	5	5	3	6	5	5	4	Y	D	
52	SS	LH225//KS23-6/PHP38	1468	1499	1502	1502	235	115	271	120	7	5	4	8	2	6	7	6	5	Y	D	
53	SS	PHHB4//KS23-6//2FACC	1515	1515	1502	1502	220	105	265	103	7.5	5	4	4	3	6	7	5	2	Y	D	stalk lodged, beaks
54	SS	PHHB4//KS23-6//LH204	1527	1552	1529	1529	248	115	305	142		7	6	6	5	6	6	4	6	Y	D	stalk & root lodged
55	SS	PHHB4//KS23-6//LH227	1537	1552	1529	1555	240	115	289	128		4	8	6	3	4	7	6.5	5	Y	D	
56	SS	PHMK0//KS23-6//2FACC	1537	1527	1555	1555	235	110	293	135		4	7	5	1	4	7	7.5	6	Y	D	some goosenecking
57	SS	PHMK0//KS23-6//FBL	1582	1600	1555	1555	260	125	330	153		6	4	7	3	3	8	7.5	7	Y	D	one stalk lodged
58	SS	PHMK0//KS23-6//R3212Z	1583	1592	1529	1502	235	110	315	129		6	8	7	4	7	6	6.5	6	Y	D	
59	SS	2FACC//KS23-6//PHW52	1506	1496	1529	1529	215	100	284	129		4	4	5	1	6	6	4	5.5	Y	D	short plt & ear ht
60	SS	KS23-6//PHW52//F9214Z	1600	1614	1580	1607	228	108	309	139	8	8	8	3	8	4	5	6.5	5	Y	D/SF	stalk lodged; late
61	SS	KS23-6//PHW52//LH204	1530	1553	1529	1529	223	98	276	116		7	6	7	6	5	7	5.5	6	Y/W	D	
62	SS	2FACC//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/LH204	1537	1537	1502	1529	225	105	276	134		3	6	6	3	4	5	6.5	3	Y/W	D	
63	SS	FBL//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/LH204	1500	1542	1529	1555	233	110	289	141		3	4	7	6	3	6	6	4	Y/W	D	
64	SS	FBL//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/PHP38	1484	1484	1502	1529	223	108	275	120		3	6	6	5	5	6	7	4.5	Y/W	D	nice
65	SS	LH225//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/PHP38-SIB	1506	1468	1502	1529	223	100	285	123		3	6	6	5	5	7	4	6.5	Y/W	D	ugly
66	NS	89343:N(LH82)PHK56-SIB	1499	1553	1555	1580	223	103	274	116		6	7	6	5	5	7	4	4.5	Y/W	D	intact, tops out
67	NS	LH82/89343//PHR03	1573	1600	1529	1529	240	113	301	142	6.5	2	6	4	1	7	6	7	4.5	Y/W	D	stalk lodged
68	NS	LH82/89343//PHW86	1426	1439	1477	1477	235	113	252	120	5.5	2	6	6	3	7	6	7	3	Y/W	D	poor ear development
69	NS	LH185/89343//3IHH6	1468	1499	1529	1555	255	123	308	130	7	3	5	6	2	8	6	6.5	5	Y/W	D	
70	NS	LH185/89343//MM402A	1537	1583	1555	1580	255	115	333	133	7	4	5	5	4	4	8	3	4.5	Y/W	D	
71	NS	LH185/89343//PHG35	1552	1552	1555	1529	230	108	304	134		2	6	6	3	6	6	7.5	5.5	Y/W	D	one stalk lodged; ugly
72	NS	LH185/89343//PHN18	1515	1515	1580	1580	245	118	308	144		7	4	7	4	5	7	8	3.5	Y/W		large ear
73	NS	LH185/89343//PHR03	1610	1632	1633	1633	248	130	325	154		5	6	5	3	6	5	4	3	Y/W	D	
74	NS	LH185/89343//PHV53	1592	1632	1580	1607	260	128	313	162	6	5	5	7	7	5	6	7	7	Y/W	SF/SD	stalk lodged
75	NS	LH185/89343//PHW86	1426	1457	1529	1529	228	108	277	124		3	5	6	6	6	6	4	5	Y/W	D	ugly; stalk lodged
76	NS	LH213/AC454//MM402A	1592	1600	1607	1607	248	113	295	118		2	5	6	5	6	7	7	5	Y		goosenecked
77	NS	LH213/AC454//PHR03	1552	1563	1607	1633	255	120	307	140		4	6	5	3	5	6	5	2	Y	D	stalk lodged, smut, ugly
78	NS	CML312:N(LH82)PHK56-SIB	1500	1515	1633	1607	210	98	310	141		5	5	6	2	5	6	7.5	6.5	O	SF	ugly
79	NS	CML425/LH185J01//PHG35	1530	1573	1580	1607	240	118	291	160		5	6	6	2	7	5	6.5	5	O	SF	stalk lodged; big ear
80	NS	CML425/LH185J01//PHR03	1537	1552	1633	1607	248	128	297	139		6	5	6	4	5	5	6.5	2	Y/O	D/SF	big ear, goosenecked
81	NS	CML425/LH185J01//PHW86	1412	1441	1502	1502	220	108	275	131		3	4	7	7	5	5	6.5	7.5	Y/O	D/SF	small ear, ugly
82	NS	CML430/LH185//PHG35	1515	1441	1580	1529	215	95	278	127		3	8	5	2	7	6	7	6.5	Y/O	D/SF	stalk lodged
83	NS	CML430/LH185//PHR03	1515	1530	1580	1607	240	123	297	140		2	6	6	2	6	6	5	4.5	Y	D	tops gone
84	NS	CML430/LH185//PHW86	1426	1472	1502	1529	220	100	251	115		6	6	7	5	5	5	7.5	4	Y/W	D	tops gone
85	NS	CML449/LH82//MBWZ	1542	1542	1502	1529	223	108	285	132		7	8	6	7	4	6	7.5	6	Y/W	D	
86	NS	CML449/LH82//PHG35	1553	1573	1555	1607	225	110	307	144		7	1	6	5	3	6	6.5	8	Y/W	D/SF	tops gone
87	NS	CML449/LH82//PHV53	1627	1632	1607	1607	253	130	303	144	7	8	5	6	7	7	6	7.5	7.5	Y/W	SF/SD	big ear
88	NS	LH185/CML449//3IHH6	1485	1500	1529	1529	243	118	285	138		5	5	4	6	5	6	6.5	4	Y/W	D	stalk lodged
89	NS	LH185/CML449//PHG35	1552	1583	1529	1580	240	113	301	144		7	7	5	5	4	6	6.5	8	Y/O/W	SF/SD	stalk lodged
90	NS	LH185/CML449//PHR03	1537	1570	1555	1555	245	108	295	141	5	4	5	4	3	5	7	7.5	6	Y/W	D/SD	stalk lodged

Table 7. 2019 Breeding Cross Observation - GEM Ames, AgReliant - Ft. Branch, IN, Longping - Capron, IL

Ent	HG	Pedigree	Pollen GDU Ames	Silk GDU Ames	Pollen GDU AgR	Silk GDU AgR	Plant Ht Ames	Ear Ht Ames	Plant Ht LP	Ear Ht LP	Root Ldg AgR	Stay Green AgR	Beeder Rating LP	Intact Score Ames	Ear Pos Harv Ames	Husk Tight Ames	Husk Lng Ames	Ear Size Ames	Ear Qual Ames	K Color Ames	Ear Text Ames	Field Comments
91	NS	LH185/CML449//PHW86	1426	1412	1502	1502	220	108	261	133		6	5	8	6	6	6	4	4.5	Y/W	D	1 root lodged
92	NS	PHN37/CML449//LH168	1426	1441	1529	1580	228	115	277	128		6	5	7	5	5	6	6.5	5	Y/W	D	ugly
93	NS	PHN37/CML449//MBWZ	1468	1484	1529	1529	238	108	325	162		8	5	7	5	6	6	5	4	Y	D	
94	NS	PHN37/CML449//MM402A	1457	1468	1529	1555	243	108	314	133		8	6	7	5	4	7	7.5	6	Y/W	D	
95	NS	FL_4BT7/LH185//PHG35	1542	1561	1607	1580	225	100	315	153		7	5	7	3	5	6	6.5	6	Y	D	
96	NS	FL_4BT7/LH185//PHR03	1515	1542	1529	1580	233	113	278	137		3	5	5	2	7	6	8	4	Y	D	stalk lodged
97	NS	FL_4BT7/LH185//PHV53	1610	1619	1607	1633	248	120	300	139		7	4	7	7	7	6	9	8	Y	D	
98	NS	FL_4BT7/LH82//PHG35	1573	1592	1502	1529	215	105	271	135		4	7	4	3	5	5	6.5	6.5	Y	D	stalk lodged
99	NS	FL_4BT7/LH82//PHR03	1542	1552	1529	1529	238	115	293	140		3	5	5	3	6	6	5	3	Y	D	
100	NS	YUCATAN TOL389 ICA/PHZ51//LH168	1570	1604	1633	1633	258	125	298	154		6	8	6	2	7	6	4	4	Y/W	D	

GEM-Ames Legend:

Planting Date: April 25, 2019

1-9 score, 9 is always best

Ear Position at Harvest: 1-9, 1 is upright, 9 is drooping

Husk Tightness: 1-9, 1 is loose, 9 is very tight with many thick husks

Husk Length: 1-9, 1 is very short with tip exposed, 5 is just covering tip

AgReliant Legend:

Planting Date: June 3, 2019

1-9 score, 9 is always best

Planting Location: Fort Branch, Indiana

Longping Legend:

1-9 score, 9 is always best

Planting Date: April 25, 2019

Planting Location: Capron, Illinois

Table 8. 2019 Breeding Cross Observation - GEM Ames (Set 2)

Entry	HG	Pedigree	Pollen GDU	Silk GDU	Plant Ht	Ear Ht	Stay Green	Field Score	Intact Score	Ear Pos Harv	Husk Tight	Husk Lenth	Ear size	Ear Qual	K Color	Ear Texture	Comments
1	Check	Mo17/B73	1349	1368	258	120	1	5	6	4	7	5	4	7	Y	D	some kernel mold
2	Check	Pioneer P1151	1285	1284	253	108	4	6	5	7	8	6	7	8	Y	D	
3	Check	Pioneer 31D58	1402	1402	275	123	7	8	8	5	4	7	9	8	Y	D	nice quality
4	Check	MBS2655/MBS9508	1259	1272	230	103	1	4	4	1	2	9	5	4	Y	D	soft texture, kernel shrink
5	Check	MBS3520/MBS8814	1349	1349	268	115	5	6	7	7	6	5	9	4	Y	D	soft texture, kernel shrink, tip mold
6	SS	PHK29/55T1//GEMS-0147	1473	1461	280	138	6	7	8	6	4	5	8	8	Y	D	big ear
7	SS	PHP38/55T1//GEMS-0147	1449	1425	268	125	7	7	7	7	2	6	6	7	Y	D	
8	SS	PHP38/55T1//GEMS-0226	1577	1577	283	148	9	8	8	8	4	8	5	8	Y	SD/SF	nice grain quality
9	SS	PHK29/55T1//GEMS-0227	1352	1358	270	130	4	5	6	7	3	6	6	8	Y	SF	
10	SS	PHP38/55T1//PHHB4	1473	1484	275	125	6	7	6	6	4	5	7	8	Y	SD/SF	
11	SS	PHP38/55T1//R3212Z	1402	1425	253	120	5	5	4	5	4	6	7	7	Y	D	
12	SS	2FACC/55T2//F9214Z	1436	1438	275	130	4	5	5	6	3	6	5	7	Y	D	
13	SS	2FACC/55T2//GEMS-0147	1448	1448	270	140	7	7	5	6	3	8	4	4	Y	D	soft texture, some insect damage
14	SS	PHP38/55T2//GEMS-0147	1449	1438	273	148	8	8	7	6	2	7	8	8	Y	D	short, very girthy ear; filled to tip
15	SS	PHP38/55T2//GEMS-0226	1552	1564	265	148	8	9	8	7	3	7	4	7	Y	D/SD	discard; super late, green, tall, small ear
16	SS	2FACC/55T2//GEMS-0227	1368	1390	265	130	6	6	5	5	6	6	7	7	Y	D	variable kernel color, yellow to orange
17	SS	2FACC/55T2//LH235	1448	1436	263	128	8	8	6	7	5	6	8	6	Y	D	
18	SS	PHP38/55T2//PHHB4	1473	1497	273	123	8	9	7	7	6	5	4	5	Y	SF/D	small ear, some insect damage
19	SS	2FACC/55T2//R3212Z	1402	1390	250	115	6	6	5	6	1	7	2	1	Y	SD	Diplodia/Fusarium ear rot
20	SS	PHP38/55T2//R3212Z	1380	1402	238	118	7	8	6	5	3	6	7	9	Y	SF/SD	very nice grain quality; mostly white cobs
21	SS	PHK29/55T3//GEMS-0227	1413	1413	280	123	6	6	6	7	3	6	5	7	Y	D	big ear
22	SS	PHK29/55T3//PHHB4	1461	1461	273	123	7	7	6	7	4	5	7	4	Y	D	insect damage to kernel caps
23	SS	PHK29/55T3//PHTP9	1424	1413	270	133	7	8	8	7	4	6	7	7	Y	D	nice
24	SS	LH195/CML373//GEMS-0147	1495	1497	270	138	8	7	7	7	1	7	5	6	Y/W	D	some insect damage
25	SS	PHHB9/CML373//GEMS-0147	1473	1473	270	138	8	7	7	7	4	6	7	6	Y/W	D	low ear ht
26	SS	PHG39/CML373//GEMS-0227	1401	1425	278	118	8	8	8	6	2	7	2	3	Y/W	D	discard, mold, badly nosed back
27	SS	PHHB9/CML373//GEMS-0227	1368	1378	273	123	7	8	7	7	6	7	4	4	Y/W/Blue Cap	D	discard, mold, badly nosed back
28	SS	PHW51/CML373//GEMS-0227	1340	1368	283	120	7	7	7	6	7	5	7	6	Y/W/Blue	D	lots of ears, variable kernel color
29	SS	LH195/CML373//HC33	1449	1473	263	115	8	8	6	7	3	7	7	8	Y/W	D	girthy ears, large kernels
30	SS	LH195/CML373//LH227	1391	1426	260	115	6	7	6	7	4	5	7	8	Y	D	soft texture, clean grain, moderate ear size
31	SS	PHG39/CML373//PHHB4	1508	1530	285	125	8	7	6	7	7	6	4	5	Y/Var	D	Insect damage, some mold, soft texture
32	SS	PHK29/CML373//PHHB4	1473	1495	290	135	8	8	8	7	6	5	7	7	Y/W	D	big ear; girthy; white kernels are clean white
33	SS	PHW51/CML373//PHHB4	1413	1460	290	130	9	8	7	6	6	5	7	4	Y/W	D	3/10 ears bad
34	SS	PHHB9/CML373//PHK29	1461	1473	293	135	8	8	8	7	3	6	8	7	Y	D/SD	girthy; some tip kernel damage
35	SS	PHG39/CML373//PHTP9	1402	1473	278	130	7	7	7	7	7	6	8	7	Y	D	nice ears: clean ears
36	SS	PHHB9/CML373//PHTP9	1413	1402	283	138	8	8	7	7	4	4	7	5	Y	D	ugly; root lodged
37	SS	PHW51/CML373//PHTP9	1368	1368	273	140	6	8	9	7	4	5	9	8	Y	D	big ear; great ears, quality
38	SS	LH195/CML373//R3212Z	1438	1413	258	120	6	6	6	5	4	7	7	7	Y/W	SD/D	
39	SS	PHK29/CML373//R3212Z	1448	1449	258	128	7	7	6	6	5	5	8	7	Y/W	D	some insect damage
40	SS	PHW51/CML373//R3212Z	1349	1390	255	120	5	6	7	7	7	4	7	5	Y/W	D	big ear; some insect damage
41	SS	PHG39/CML373//RQAA8	1473	1484	270	125	6	6	6	6	5	5	3	4	Var	D	discard - very smoky RxC kernels
42	SS	PHG39/CML373//WQCD10	1401	1424	265	113	7	6	6	6	5	5	8	8	Y	D/SF	seg R x C kernels; nice grain quality
43	SS	PHHB9/CML373//WQCD10	1402	1425	265	115	6	6	6	7	4	4	8	8	Y	D	ugly; very nice ears, quality
44	SS	PHK29/CML373//WQCD10	1413	1401	265	120	7	6	7	7	6	4	4	7	Y	D	
45	SS	PHW51/CML373//WQCD10	1342	1358	265	125	6	6	7	7	7	5	8	6	Y	D	some RxC kernels, tip damage, soft
46	SS	PHP38/KS23-5//F9214Z	1436	1508	275	128	4	6	5	8	6	2	7	3	O	SF/SD	ugly; moldy ear butts, Fusarium
47	SS	LH195/KS23-5//GEMS-0147	1461	1473	265	120	6	7	7	7	2	7	5	7	Y	SD/SF	very short, girthy ears
48	SS	PHP38/KS23-5//GEMS-0226	1473	1530	268	140	7	8	8	7	5	7	9	9	O	F/SF/SD	excellent ear quality; white cob

Table 8. 2019 Breeding Cross Observation - GEM Ames (Set 2)

Entry	HG	Pedigree	Pollen GDU	Silk GDU	Plant Ht	Ear Ht	Stay Green	Field Score	Intact Score	Ear Pos Harv	Husk Tight	Husk Lenth	Ear size	Ear Qual	K Color	Ear Texture	Comments
49	SS	LH195/KS23-5//GEMS-0227	1349	1378	278	125	5	5	5	6	8	5	5	7	Y	SF/SD	small ear, well-filled
50	SS	PHK29/KS23-5//GEMS-0227	1349	1364	270	118	4	5	5	7	5	6	5	7	Y	SD/D/F	
51	SS	LH195/KS23-5//HC33	1358	1390	253	108	4	5	6	8	4	6	7	7	Y	D/SD	barren plants; med length, girthy ears; clean
52	SS	LH195/KS23-5//LH227	1349	1368	250	110	3	5	6	7	4	7	5	6	Y	D/SD	some tip damage
53	SS	PHK29/KS23-5//PHHB4	1424	1449	278	125	5	6	6	7	4	5	8	7	Y	SF/SD/D	long ear; some insect damage
54	SS	PHP38/KS23-5//PHHB4	1449	1495	278	125	5	6	6	7	4	2	4	4	Y	SF	mostly barren; discard; small ear;
55	SS	PHP38/KS23-5//PHTP9	1358	1380	260	125	4	6	7	7	5	5	8	9	Y	D	excellent ears, filled to tip, clean
56	SS	LH195/KS23-5//R3212Z	1402	1448	255	125	5	5	5	6	6	7	5	7	Y/O	SF	good quality, well-filled
57	SS	PHK29/KS23-5//RQAA8	1390	1413	260	115	6	7	7	5	3	4	6	3	Y	SD	barren plants; discard; tip back
58	SS	PHK29/KS23-5//WQCD10	1340	1358	250	120	4	5	5	6	5	5	8	6	Y	SF/SD/D	good ears, some tip damage
59	SS	PHP38/KS23-6//F9214Z	1449	1438	273	128	7	6	5	7	4	6	8	7	Y	SF/SD	big ear; Fusarium kernels
60	SS	2FACC/KS23-6//GEMS-0147	1438	1401	270	135	4	5	4	3	3	6	9	9	Y	D	girthy ear; looks like a hybrid
61	SS	LH195/KS23-6//GEMS-0147	1484	1473	270	130	6	6	5	7	4	7	7	7	Y	D	Short, girthy ear, clean
62	SS	LH204/KS23-6//GEMS-0147	1461	1436	273	135	4	6	4	7	3	7	6	5	Y	D	diseased kernels, soft texture
63	SS	PHG39/KS23-6//GEMS-0147	1461	1449	273	138	4	6	5	6	3	6	8	8	Y	D	very nice
64	SS	PHHB9/KS23-6//GEMS-0147	1473	1425	275	133	5	6	4	6	4	6	6	4	Y	D/SF	reddish kernel discoloration
65	SS	PHP38/KS23-6//GEMS-0226	1530	1542	283	145	7	7	7	4	7	5	7	8	Y/O	SF	good quality; white cob
66	SS	2FACC/KS23-6//GEMS-0227	1378	1368	273	125	4	6	5	3	7	6	4	4	Y/O	SF/D	reddish kernel discoloration
67	SS	LH195/KS23-6//GEMS-0227	1390	1368	273	128	6	7	5	6	4	6	5	7	Y/O	D/SF	small, well-filled ear
68	SS	PHG39/KS23-6//GEMS-0227	1358	1342	265	123	7	6	7	6	7	6	7	7	Y/O	D	excellent quality, clean
69	SS	PHHB9/KS23-6//GEMS-0227	1368	1349	275	125	6	7	5	6	6	4	7	8	Y/O	SF/D	good ears; some tip insect damage
70	SS	LH195/KS23-6//HC33	1401	1413	255	118	5	6	5	7	6	6	4	4	Y	D	small ears - discard - moldy K
71	SS	LH204/KS23-6//HC33	1368	1378	275	128	4	6	4	7	3	7	4	7	Y	D/SF	small ears
72	SS	LH195/KS23-6//LH227	1402	1390	273	128	5	6	5	7	5	8	6	7	Y	D/SD	
73	SS	LH204/KS23-6//LH227	1349	1358	263	120	3	5	4	5	4	7	5	6	Y	D	tip kernel abortion
74	SS	2FACC/KS23-6//LH235	1461	1436	273	135	7	7	6	7	2	6	7	7	Y	D/SD	minor kernel insect damage
75	SS	2FACC/KS23-6//PHHB4	1424	1424	290	130	5	6	6	5	7	6	7	9	Y	D	nice quality
76	SS	LH204/KS23-6//PHHB4	1436	1449	295	128	6	6	5	7	2	7	7	6	Y	D/SD/SF	some barren; tip K abortion
77	SS	PHP38/KS23-6//PHHB4	1461	1436	288	128	7	6	5	6	4	6	7	5	Y	D	big ear
78	SS	PHG39/KS23-6//PHTP9	1368	1368	268	130	5	6	5	6	5	6	8	7	Y	D	tip kernel damage
79	SS	PHHB9/KS23-6//PHTP9	1358	1368	263	130	4	7	7	7	6	5	6	7	Y	D	nice, uniform ears
80	SS	PHP38/KS23-6//PHTP9	1368	1371	273	133	6	8	7	8	2	6	7	7	Y/O	D/SD	good ear; best of K23-6
81	SS	2FACC/KS23-6//R3212Z	1402	1390	260	123	5	5	5	3	3	5	4	6	Y	SF/SD/D	aborted tip kernels
82	SS	LH195/KS23-6//R3212Z	1402	1402	253	125	5	6	5	5	4	6	7	4	Y	D/SD	big ear; diseased kernels
83	SS	PHHB9/KS23-6//R3212Z	1380	1390	255	123	6	6	6	5	3	4	8	8	Y	SF/SD	nice ears; some nose back
84	SS	2FACC/KS23-6//WQCD10	1368	1358	263	118	2	4	4	3	4	6	6	7	Y	SF/SD	variable ear size, good quality
85	SS	LH204/KS23-6//WQCD10	1326	1318	265	115	3	4	5	4	5	6	7	7	Y	SD/D	
86	SS	PHG39/KS23-6//WQCD10	1358	1349	255	115	4	4	4	6	8	6	7	7	Y	SD/D/SF	bird damaged husks; nice qual
87	SS	PHHB9/KS23-6//WQCD10	1368	1349	258	118	5	6	6	6	5	6	5	6	Y	D/SF	mosed back; variable ear size
88	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//GEMS-0227	1352	1358	283	123	7	7	7	5	3	3	7	3	Y	D	discard; soft texture, moldy, scatter grain
89	SS	PHW52/La Posta Seq C7 F180-1-2-2-1-B-B-B//GEMS-0227	1358	1340	285	125	6	7	7	5	4	5	7	5	Y/W	D	one rotten ear
90	SS	PHW52/La Posta Seq C7 F180-1-2-2-1-B-B-B//HC33	1380	1403	270	118	6	7	5	7	3	6	7	4	Y/W/O	D	big ear; tip kernel mold
91	SS	PHW52/La Posta Seq C7 F180-1-2-2-1-B-B-B//LH227	1358	1402	275	130	4	7	6	7	5	5	6	4	Y/W	D	bad tips, some mold
92	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//PHHB4	1448	1484	285	133	9	9	8	8	4	5	5	4	Y/W	D	some kernel abortion
93	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//PHTP9	1390	1378	283	140	6	7	5	7	4	6	4	7	Y/W	D	very uniform, small ears
94	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//R3212Z	1425	1413	273	135	8	8	6	5	2	5	7	7	Y/W	D	ok
95	SS	PHW52/La Posta Seq C7 F180-1-2-2-1-B-B-B//R3212Z	1378	1380	265	125	7	8	6	5	2	4	7	7	Y/W	D	minor tip kernel damage; good overall
96	SS	LH195/La Posta Seq C7 F64-1-1-1-B-B-B//GEMS-0227	1402	1401	283	125	8	7	8	6	1	5	8	8	Y/W	D	ok; soft texture

Table 8. 2019 Breeding Cross Observation - GEM Ames (Set 2)

Entry	HG	Pedigree	Pollen GDU	Silk GDU	Plant Ht	Ear Ht	Stay Green	Field Score	Intact Score	Ear Pos Harv	Husk Tight	Husk Lenth	Ear size	Ear Qual	K Color	Ear Texture	Comments
97	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//HC33	1436	1448	273	123	7	8	7	7	4	8	6	5	Y/W	D	tip kernel insect damage
98	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//LH227	1413	1424	273	130	5	7	6	7	5	6	7	3	Y	D	shriveled k; nose back; soft, rough texture
99	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//R3212Z	1449	1424	263	130	6	6	6	6	4	7	8	7	Y/W	D	some nose back, generally quite good;
100	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//WQCD10	1380	1380	255	118	5	5	6	6	5	6	4	6	Y/W	D	Small ears
101	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//GEMS-0227	1359	1358	273	123	5	6	6	3	4	6	3	7	Y/W	D	Small ears
102	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//HC33	1390	1368	268	123	4	6	6	7	7	5	7	4	Y/W	D	fusarium on butt kernels; soft texture
103	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//R3212Z	1438	1449	250	125	5	7	5	5	4	4	7	4	Y/W	D	insect damage, mold
104	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//WQCD10	1358	1358	265	123	4	5	6	3	6	5	6	6	Y/W	D	variable ear size, quality; lots of ears
105	NS	PHJ33/55T1//GEMN-0097	1390	1413	265	120	5	6	5	7	5	6	7	6	Y	D	long, slender ear; soft texture
106	NS	PHJ33/55T1//GEMN-0178	1413	1448	280	130	7	8	8	8	3	6	8	8	Y	D	huge ears, good quality
107	NS	PHJ33/55T1//PHBE2	1378	1402	258	120	5	7	6	6	4	6	7	6	Y	D	variable ear size; tip kernel damage
108	NS	PHJ33/55T1//PHK56	1371	1390	273	118	3	6	6	4	4	8	9	7	Y	D	tip kernel mold, generally ok; soft texture
109	NS	PHJ33/55T1//PHR03	1425	1449	263	130	3	6	5	6	6	6	9	9	Y	D	Some aborted tip kernels
110	NS	3IIH6/CML311//GEMN-0097	1368	1390	283	135	5	5	5	4	3	7	8	7	Y/W	D	excellent ears
111	NS	HBA1/CML311//GEMN-0097	1413	1461	290	143	7	7	6	8	3	7	8	6	Y/W	D	3/15 ears bad
112	NS	LH168/CML311//GEMN-0097	1359	1378	280	130	5	6	5	5	4	6	6	6	Y/W	D	variable ear size, shape, with curvature
113	NS	LH82/CML311//GEMN-0097	1349	1401	275	133	4	5	3	4	6	7	7	7	Y/W	D	sheds in boot
114	NS	MBWZ/CML311//GEMN-0097	1413	1424	275	133	7	8	5	7	5	6	7	6	Y/W	D	segy Y/W kernels; stalk collapse; discard
115	NS	PHV53/CML311//GEMN-0097	1402	1461	290	145	6	8	5	7	4	6	8	7	Y/W	D	2/15+S116:S122 pmd ears
116	NS	LH82/CML311//GEMN-0178	1390	1448	293	135	6	7	4	7	3	7	8	8	Y/W	D	ok
117	NS	PHV53/CML311//GEMN-0178	1449	1484	303	150	8	8	6	7	2	7	8	6	Y/W	D	Some kernel shrink
118	NS	3IIH6/CML311//GEMN-0302	1349	1358	275	125	5	6	6	6	4	6	6	8	Y/W	D	small ears
119	NS	HBA1/CML311//GEMN-0302	1425	1438	265	123	8	8	6	7	3	6	8	6	Y/W	D	minor insect damage
120	NS	LH168/CML311//GEMN-0302	1380	1413	263	123	6	6	4	8	4	7	7	7	Y/W	D	ok
121	NS	MBWZ/CML311//GEMN-0302	1380	1401	270	125	8	8	5	7	3	6	6	6	Y	D	Some tip kernel damage; well-filled
122	NS	HBA1/CML311//LH216	1473	1495	298	145	7	8	6	6	7	6	8	8	Y/W	D	2 stalk lodged; 2 root lodged
123	NS	LH168/CML311//LH216	1426	1448	295	148	6	7	4	6	5	5	7	5	Y/W	D	2 stalk lodged, 1 root lodged
124	NS	LH82/CML311//LH216	1402	1424	275	135	5	5	4	6	4	5	8	7	Y/W	SD/SF	excessive plt ht, variable ear ht; nice ears
125	NS	3IIH6/CML311//LH283	1436	1472	293	140	5	6	4	5	4	6	5	7	Y/W	D/SF	var ear ht; big ears; intact; shriveled K ears
126	NS	LH168/CML311//LH283	1425	1436	275	130	7	6	5	7	3	8	6	7	Y/W	D	excessively late; kernel abortion
127	NS	LH82/CML311//LH283	1424	1449	265	125	6	4	5	3	7	7	6	6	Y/W	D	small ear
128	NS	PHV53/CML311//LH82	1333	1359	260	123	4	5	4	4	4	6	6	4	Y	D	bad nose back; discard
129	NS	HBA1/CML311//PHBE2	1448	1461	295	145	6	6	5	7	4	6	8	6	Y	D	stalk collapse; some tip kernel abortion
130	NS	3IIH6/CML311//PHJ33	1390	1436	300	150	4	6	4	7	3	6	6	7	Y	D/SF	stalk collapse; some tip kernel abortion
131	NS	LH168/CML311//PHJ33	1390	1413	290	135	5	6	5	3	5	6	5	5	Y	D	root lodged; kernel shriveling
132	NS	LH82/CML311//PHJ33	1378	1413	280	133	4	6	3	5	4	8	6	6	Y/W	D	barren plants; kernel shriveling
133	NS	MBWZ/CML311//PHJ33	1402	1425	285	145	4	6	5	6	2	7	7	7	Y/W	D	kernel shriveling, soft texture
134	NS	PHV53/CML311//PHJ33	1413	1449	300	150	6	7	6	5	3	6	7	7	Y	D	ok
135	NS	HBA1/CML311//PHK56	1424	1413	283	138	7	7	7	7	2	8	8	7	Y	D	stalk collapse; 2/15 ears moldy; girthy
136	NS	LH168/CML311//PHK56	1368	1378	280	135	6	7	6	7	4	6	5	5	Y	D	moldy or missing ear tips; soft texture
137	NS	LH82/CML311//PHK56	1342	1342	278	123	5	7	5	4	7	7	7	7	Y/W	D	ok
138	NS	MBWZ/CML311//PHK56	1342	1378	283	130	6	7	7	6	3	9	8	6	Y	D	one rotten ear; some kernel shrink
139	NS	3IIH6/CML323//GEMN-0097	1371	1359	273	130	3	5	7	3	5	6	6	4	Y	D	soft texture
140	NS	HBA1/CML323//GEMN-0097	1413	1390	283	138	5	7	7	7	6	4	8	7	Y	D	big ears, lots of them
141	NS	LH168/CML323//GEMN-0097	1333	1358	260	120	3	5	5	4	4	6	5	7	Y	D	
142	NS	LH185/CML323//GEMN-0097	1318	1349	260	118	3	6	6	6	5	6	8	7	Y	D	big ear; barren plants; girthy, good qual ears
143	NS	LH82/CML323//GEMN-0097	1333	1359	255	123	2	4	4	4	4	7	5	6	Y	D	barren plants
144	NS	PHN18/CML323//GEMN-0097	1352	1368	268	128	4	5	5	7	5	6	7	6	Y/O/W	D	barren plants; soft testure

Table 8. 2019 Breeding Cross Observation - GEM Ames (Set 2)

Entry	HG	Pedigree	Pollen GDU	Silk GDU	Plant Ht	Ear Ht	Stay Green	Field Score	Intact Score	Ear Pos Harv	Husk Tight	Husk Lenth	Ear size	Ear Qual	K Color	Ear Texture	Comments
145	NS	PHR55/CML323//GEMN-0097	1358	1368	258	125	3	5	4	4	3	6	6	6	Y	D	well-filled
146	NS	LH82/CML323//GEMN-0178	1402	1401	260	125	5	5	6	5	3	7	6	7	Y	D	bad ear tips
147	NS	PHR55/CML323//GEMN-0178	1425	1413	280	125	4	6	6	5	3	7	7	4	Y	D	girthy ears, moldy tips
148	NS	3IIH6/CML323//GEMN-0302	1333	1333	245	110	3	4	4	2	5	6	7	5	Y	D	lots of uniform ears, some Fusarium ear butts
149	NS	HBA1/CML323//GEMN-0302	1391	1380	265	120	6	6	7	7	6	4	8	5	Y	D	wild appearance
150	NS	LH168/CML323//GEMN-0302	1306	1342	238	113	3	5	5	7	8	6	7	6	Y	D	2/14 bad ears; insect damaged tips
151	NS	HBA1/CML323//LH216	1413	1401	273	133	6	7	5	6	4	5	9	7	Y	D	huge ears, well-filled
152	NS	LH168/CML323//LH216	1359	1401	258	133	3	5	6	2	8	6	6	7	Y	D	discard - bad ears; slender ears
153	NS	LH185/CML323//LH216	1380	1391	248	123	2	4	5	4	9	5	4	5	Y	D	low ear ht; scattered Fusarium kernels
154	NS	LH82/CML323//LH216	1349	1368	258	125	3	4	6	4	5	4	7	6	Y	D	lot of slender, long well-filled ears
155	NS	3IIH6/CML323//LH283	1390	1390	263	128	5	6	5	7	6	5	7	6	Y	D	3/16 bad ears; tips damaged
156	NS	LH168/CML323//LH283	1368	1380	250	125	6	6	5	6	4	6	7	7	Y	D/SD	ok
157	NS	LH82/CML323//LH283	1378	1378	240	113	4	5	4	7	6	6	4	6	Y	D/SF	badly aborted tip kernels
158	NS	HBA1/CML323//PHBE2	1368	1380	270	128	5	5	5	4	4	6	7	6	Y	D	stalk lodged; well filled big ears; Fus butt mold
159	NS	LH185/CML323//PHBE2	1349	1342	253	115	3	4	4	3	6	6	8	7	Y	D/SF	low ear ht; geed ears
160	NS	PHN18/CML323//PHBE2	1349	1359	248	125	5	6	5	7	3	7	8	7	Y/O/W	D/SF	girthy ears; some tip kernel damage
161	NS	PHR55/CML323//PHBE2	1349	1340	248	115	3	5	6	3	3	5	7	7	Y	D/SD/SF	girthy, ok
162	NS	3IIH6/CML323//PHJ33	1358	1380	263	128	2	5	5	5	6	5	8	6	Y	D/SD	some Diplodia
163	NS	LH168/CML323//PHJ33	1342	1371	263	130	3	6	4	7	7	6	8	4	Y	D	some mold on tip and butt kernels
164	NS	LH185/CML323//PHJ33	1340	1349	248	128	3	6	5	6	6	8	7	7	Y	D	ok
165	NS	LH82/CML323//PHJ33	1333	1349	258	133	3	5	3	7	7	6	7	5	Y	D	stalk collapse; some Fusarium
166	NS	PHN18/CML323//PHJ33	1349	1359	265	130	4	6	4	5	4	6	7	5	Y	D	root lodged; variable testure
167	NS	PHR55/CML323//PHJ33	1368	1368	263	128	3	6	6	5	3	6	5	7	Y	D	nice
168	NS	3IIH6/CML323//PHK56	1342	1359	263	110	2	5	5	3	4	6	4	4	Y	D	
169	NS	HBA1/CML323//PHK56	1380	1402	270	125	3	7	6	7	2	7	6	6	Y	D	
170	NS	LH168/CML323//PHK56	1318	1342	265	118	2	5	5	2	4	8	7	7	Y	D	
171	NS	LH185/CML323//PHK56	1318	1333	258	110	2	5	7	4	6	6	7	7	Y	D	ok
172	NS	LH82/CML323//PHK56	1309	1306	253	110	2	5	6	3	7	6	6	4	Y	D	Shriveled, small kernels
173	NS	PHN18/CML323//PHK56	1306	1334	253	118	2	5	5	1	3	6	8	6	Y/W	D	Tip kernel damage
174	NS	PHR55/CML323//PHK56	1349	1378	270	123	2	6	5	2	4	7	7	5	Y	D	Tip kernel damage
175	NS	PHN18/CML349//GEMN-0097	1390	1413	273	133	5	7	7	6	2	5	8	7	Y/W	D	big, hi ear; long, well filled ears, soft texture
176	NS	PHR55/CML349//GEMN-0097	1368	1391	280	133	4	6	6	7	3	7	6	3	Y/W	D	kernel mold, ear tips gone; soft texture
177	NS	PHN18/CML349//GEMN-0302	1340	1349	255	118	7	7	6	6	4	6	8	7	Y/W	D	filled to tip - lot of white kernels
178	NS	PHN18/CML349//PHBE2	1391	1413	283	133	7	7	6	5	3	6	8	6	Y/W	D/SF	intact; very tall; huge ear; high % white kernels
179	NS	PHR55/CML349//PHBE2	1390	1380	270	128	4	7	4	4	4	5	7	7	Y/W	D/SD	
180	NS	PHN18/CML349//PHJ33	1380	1413	273	133	4	6	7	7	2	6	7	5	Y/W	D	bad tips; kernel texture appears floury
181	NS	PHR55/CML349//PHJ33	1368	1390	270	133	5	5	5	4	3	6	7	4	Y/W	D	soft texture
182	NS	PHN18/CML349//PHK56	1358	1402	285	130	4	7	7	5	4	6	8	4	Y/W	D	big ear; kernel red streak; some ear mold
183	NS	PHR55/CML349//PHK56	1378	1402	285	130	4	6	6	6	4	7	4	7	Y/W	D	big ear; Y/W K
184	NS	LH185/CML384//GEMN-0097	1449	1438	283	135	4	7	7	5	4	5	4	4	Y/W	D	soft texture
185	NS	PHR55/CML384//GEMN-0097	1449	1449	285	135	6	7	7	7	5	4	8	4	Y/W	D	variable ear quality; tips damaged; soft texture
186	NS	LH185/CML384//GEMN-0302	1403	1438	263	120	7	6	5	6	4	6	5	4	Y/W	D	couple of Fusarium ears
187	NS	LH185/CML384//LH216	1424	1461	273	128	6	6	6	7	4	5	6	4	Y/W	D	
188	NS	LH185/CML384//PHBE2	1402	1449	273	130	7	6	4	4	7	6	7	7	Y/W	D	tip kernel damage
189	NS	PHR55/CML384//PHBE2	1461	1495	278	133	6	7	6	4	5	6	8	7	Y/W	D	girthy, long gear
190	NS	LH185/CML384//PHJ33	1482	1472	278	133	5	6	7	4	6	6	5	7	Y/W	D/SF	
191	NS	PHR55/CML384//PHJ33	1436	1436	285	135	5	7	7	6	4	6	7	4	Y/W	D	big ear; long, slender ear; nosed back
192	NS	PHR55/CML384//PHK56	1461	1461	290	133	7	8	7	7	4	5	7	3	Y/W	D	nosed back

Table 8. 2019 Breeding Cross Observation - GEM Ames (Set 2)

Entry	HG	Pedigree	Pollen GDU	Silk GDU	Plant Ht	Ear Ht	Stay Green	Field Score	Intact Score	Ear Pos Harv	Husk Tight	Husk Lenth	Ear size	Ear Qual	K Color	Ear Texture	Comments
193	NS	3IIH6/GTO 36//GEMN-0097	1340	1368	258	115	4	6	5	7	4	7	6	5	Y	D	clean tips, some kernel shrivel; short, girthy ear
194	NS	3IIH6/GTO 36//GEMN-0302	1352	1371	273	138	6	7	6	7	7	5	7	6	Y	D	huge ear, very tall; long slender ear; nosed back
195	NS	3IIH6/GTO 36//LH283	1425	1425	268	120	5	6	4	5	5	5	7	7	Y	SF/D	lustrous kernels; clean ears
196	NS	3IIH6/GTO 36//PHJ33	1380	1380	275	133	3	5	4	6	6	6	4	4	Y	D	stalk collapse; pmd kernels; soft, rough texture
197	NS	3IIH6/GTO 36//PHW86	1285	1306	260	140	3	5	4	4	7	4	4	4	Y	D	ugly, discard
198	NS	3IIH6/KO679Y//GEMN-0097	1368	1368	270	133	3	5	5	6	7	5	7	7	Y	D	nice
199	NS	LH168/KO679Y//GEMN-0097	1342	1349	263	130	5	5	6	7	4	6	7	7	Y	D	nice; long tapered ear
200	NS	3IIH6/KO679Y//GEMN-0178	1380	1401	283	140	5	7	5	5	3	6	8	7	Y	D	some kernel shrink; soft texture
201	NS	LH168/KO679Y//GEMN-0178	1402	1424	280	125	4	7	6	5	3	7	7	8	Y	D	clean
202	NS	LH168/KO679Y//LH216	1402	1401	260	130	4	5	5	2	7	3	6	7	Y	D	beaks, ugly; very slender ear
203	NS	3IIH6/KO679Y//LH283	1390	1425	265	128	5	6	4	7	4	5	6	7	Y/O	D	small ear
204	NS	3IIH6/KO679Y//PHBE2	1413	1413	260	128	4	6	4	4	5	5	7	5	Y	D	big ear; some kernel shrink; tip abortion
205	NS	LH168/KO679Y//PHJ33	1358	1378	265	130	4	6	5	5	2	7	6	6	Y	D	ok
206	NS	3IIH6/KO679Y//PHK56	1333	1371	255	115	3	6	6	1	3	8	4	4	Y	D	variable ear size
207	NS	LH168/KO679Y//PHK56	1297	1333	248	108	2	5	5	3	3	8	7	7	Y	D	consistent
208	NS	PHW86/KS23-5//GEMN-0097	1333	1390	250	120	4	6	6	6	4	3	7	5	Y	D	ugly; variable ear qual; well filled
209	NS	PHW86/KS23-5//GEMN-0302	1309	1368	240	115	5	6	6	7	4	5	7	5	Y	D	big ear
210	NS	PHW86/KS23-5//LH283	1364	1380	245	115	5	6	7	5	7	4	7	4	Y	D	tip kernel mold, good ears
211	NS	PHW86/KS23-5//PHBE2	1333	1352	245	123	3	7	4	7	4	6	8	8	Y	D	nice quality
212	NS	PHW86/KS23-5//PHJ33	1364	1390	253	123	3	6	7	5	5	5	7	6	Y	D	
213	NS	PHW86/KS23-6//GEMN-0097	1352	1371	273	138	6	8	6	6	3	7	7	6	Y	D	some kernel red streak, damaged tip kernels
214	NS	PHW86/KS23-6//GEMN-0302	1390	1382	245	120	5	5	5	6	6	6	7	5	Y	D	tip kernel damage
215	NS	PHW86/KS23-6//LH283	1390	1378	258	123	5	6	5	6	7	6	8	7	Y	D/SF	big ears, large kernels; nosed back
216	NS	PHW86/KS23-6//PHBE2	1402	1378	253	125	5	6	3	4	3	6	7	7	Y/O	SF/SD	tip kernel mold
217	NS	PHW86/KS23-6//PHJ33	1364	1371	265	130	4	6	4	5	6	6	8	7	Y	D	very large kernels, clean

GEM-Ames Legend:

Planting Date: June 3, 2019

1-9 score, 9 is always best

Ear Position at Harvest: 1-9, 1 is upright, 9 is drooping

Husk Tightness: 1-9, 1 is loose, 9 is very tight with many thick husks

Husk Length: 1-9, 1 is very short with tip exposed, 5 is just covering tip

Table 9. 2019 Breeding Cross Observation - GEM Ames (Set 3)

Entry	Het Group	Pedigree	Pollen GDU	Silk GDU	Plant Ht (cm)	Ear Ht (cm)	Stay Green	Breeder Rating	Ear Pos Harv	Husk Tight	Husk Length	Late Season Comments
1	Check	Mo17/B73	1349	1368	248	120	1	5	4	7	6	
2	Check	Pioneer P1151	1285	1284	245	108	5	7	7	6	6	
3	Check	Pioneer 31D58	1402	1402	270	125	7	9	5	6	6	
4	Check	MBS2655/MBS9508	1259	1272	260	105	5	7	7	9	6	
5	Check	MBS3520/MBS8814	1349	1349	270	110	6	7	6	5	6	
6	SS	(PHP38/89291)/FBLL	1359	1366	270	125	6	7	6	4	6	
7	SS	(GEMS-0227/CML373)/FBLL	1414	1427	268	120	7	7	5	4	6	
8	SS	PHHB9/CML373//GEMS-0147	1473	1473	278	128	8	8	7	8	5	
9	SS	PHG39/CML373//GEMS-0227	1401	1425	288	120	8	9	6	6	6	
10	SS	PHHB9/CML373//GEMS-0227	1368	1378	278	125	7	7	6	4	5	ugly
11	SS	LH195/CML373//HC33	1449	1473	258	120	7	7	6	3	7	ugly
12	SS	LH195/CML373//LH227	1391	1426	273	125	7	7	7	6	6	
13	SS	PHG39/CML373//PHHB4	1508	1530	280	128	7	7	6	5	6	
14	SS	PHHB9/CML373//PHK29	1461	1473	275	130	8	8	7	4	6	big ear
15	SS	PHG39/CML373//PHTP9	1402	1473	268	138	7	8	6	7	5	
16	SS	PHHB9/CML373//PHTP9	1413	1402	263	125	6	8	8	7	5	
17	SS	PHK29/CML373//R3212Z	1448	1449	260	125	6	7	4	5	6	
18	SS	PHG39/CML373//RQAA8	1473	1484	265	123	8	7	6	9	6	ugly
19	SS	PHHB9/CML373//WQCD10	1402	1425	268	123	6	5	6	5	5	
20	SS	PHK29/CML373//WQCD10	1413	1401	265	123	7	6	5	4	6	
21	SS	CML375/PHMK0//F9214Z	1518	1509	280	133	8	8	8	4	5	root lodged
22	SS	CML375/PHMK0//HC33	1433	1418	263	125	7	7	7	7	7	root lodged
23	SS	CML375/PHMK0//LH227	1448	1454	263	123	7	7	4	4	5	big ear
24	SS	CML375/LH195//PHG39	1510	1491	270	125	7	7	5	5	6	
25	SS	CML375/LH204//PHHB4	1460	1482	285	125	7	7	7	3	5	
26	SS	CML375/LH195//PHHB9	1469	1451	258	120	7	5	7	4	6	
27	SS	CML375/LH204//PHHB9	1470	1464	268	120	8	7	7	5	5	bird damage
28	SS	CML375/LH195//PHW52	1457	1418	265	120	5	5	5	9	5	big ear
29	SS	CML375/LH204//PHW52	1357	1365	260	120	3	4	4	4	6	
30	SS	CML375/LH195//R3212Z	1440	1408	253	110	5	5	6	5	5	
31	SS	CML375/PHMK0//R3212Z	1457	1463	260	120	8	7	6	4	6	big ear
32	SS	LH195/KS23-5//GEMS-0147	1461	1473	265	130	7	7	7	5	6	
33	SS	PHP38/KS23-5//GEMS-0226	1473	1530	268	125	8	9	7	8	7	nice
34	SS	LH195/KS23-5//GEMS-0227	1349	1378	270	123	6	7	6	6	6	
35	SS	PHK29/KS23-5//GEMS-0227	1349	1364	258	110	6	6	7	7	4	
36	SS	LH195/KS23-5//HC33	1358	1390	250	113	6	6	7	5	5	split husks
37	SS	LH195/KS23-5//LH227	1349	1368	255	118	4	4	5	5	6	split husks
38	SS	PHK29/KS23-5//PHHB4	1424	1449	275	120	6	8	7	7	6	split husks
39	SS	LH195/KS23-5//R3212Z	1402	1448	258	115	5	6	7	4	5	discard; severe nose back
40	SS	PHK29/KS23-5//RQAA8	1390	1413	265	118	6	7	7	8	5	

Table 9. 2019 Breeding Cross Observation - GEM Ames (Set 3)

Entry	Het Group	Pedigree	Pollen GDU	Silk GDU	Plant Ht (cm)	Ear Ht (cm)	Stay Green	Breeder Rating	Ear Pos Harv	Husk Tight	Husk Length	Late Season Comments
41	SS	PHK29/KS23-5//WQCD10	1340	1358	243	103	5	5	6	6	3	discard; severe nose back
42	SS	PHHB4/KS23-6//2FACC	1402	1396	260	128	4	6	4	7	6	big ear
43	SS	2FACC//KS23-6/PHW52	1393	1377	245	110	5	6	6	6	5	stalk lodged
44	SS	KS23-6/PHW52//F9214Z	1487	1495	273	130	7	7	7	3	6	big ear
45	SS	2FACC/KS23-6//GEMS-0147	1438	1401	223	123	5	6	3	4	7	stalk lodged
46	SS	LH204/KS23-6//GEMS-0147	1461	1436	280	130	7	6	3	5	6	
47	SS	PHHB9/KS23-6//GEMS-0147	1473	1425	273	125	7	6	6	6	6	excellent appearance
48	SS	2FACC/KS23-6//GEMS-0227	1378	1368	270	115	4	5	4	6	6	stalk lodged
49	SS	PHG39/KS23-6//GEMS-0227	1358	1342	268	120	5	6	5	6	5	
50	SS	PHHB9/KS23-6//GEMS-0227	1368	1349	263	115	6	6	6	5	5	big ear
51	SS	LH204/KS23-6//HC33	1368	1378	258	115	4	5	5	4	6	stalk lodged
52	SS	LH195/KS23-6//LH227	1402	1390	258	120	4	5	6	5	6	
53	SS	PHHB4/KS23-6//LH227	1424	1433	265	125	6	7	5	4	5	stalk lodged
54	SS	KS23-6/LH195//PHG39	1506	1500	278	128	7	7	5	7	5	
55	SS	2FACC/KS23-6//PHHB4	1424	1424	278	125	6	7	3	5	6	some root lodging
56	SS	KS23-6/LH195//PHHB9	1533	1504	253	120	8	7	7	5	6	
57	SS	PHHB9/KS23-6//PHTP9	1358	1368	265	130	6	7	7	4	5	big ear
58	SS	2FACC/KS23-6//R3212Z	1402	1390	250	113	6	6	3	4	7	
59	SS	KS23-6/LH195//R3212Z	1440	1444	260	123	6	6	6	3	6	
60	SS	PHHB9/KS23-6//R3212Z	1380	1390	253	118	6	6	7	4	4	
61	SS	PHMK0/KS23-6//R3212Z	1470	1473	263	123	7	8	4	4	7	
62	SS	2FACC/KS23-6//WQCD10	1368	1358	250	120	4	4	2	4	6	stalk lodged, ugly
63	SS	PHG39/KS23-6//WQCD10	1358	1349	255	115	5	5	4	6	6	
64	SS	PHHB9/KS23-6//WQCD10	1368	1349	265	125	5	6	5	4	5	
65	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//GEMS-0227	1352	1358	280	115	7	7	5	5	4	
66	SS	PHW52/La Posta Seq C7 F180-1-2-2-1-B-B-B//GEMS-0227	1358	1340	280	120	7	6	7	3	5	
67	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//PHHB4	1448	1484	273	125	7	8	6	7	4	girthy ear
68	SS	PHK29/La Posta Seq C7 F180-1-2-2-1-B-B-B//R3212Z	1425	1413	248	115	6	7	5	4	6	
69	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//GEMS-0227	1402	1401	268	120	8	8	7	4	6	
70	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//HC33	1436	1448	253	115	7	7	7	3	7	
71	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//LH227	1413	1424	258	118	6	6	6	4	5	
72	SS	LH195/La Posta Seq C7 F64-1-1-1-1-B-B-B//R3212Z	1449	1424	245	118	7	7	6	5	5	
73	SS	2FACC//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/LH204	1424	1418	245	110	4	7	5	4	6	
74	SS	FBLL//La Posta Seq C7 F64-1-1-1-1-B-B-B-1/LH204	1387	1423	253	118	5	6	5	4	5	
75	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//GEMS-0227	1359	1358	263	113	4	6	6	5	5	
76	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//HC33	1390	1368	263	128	5	7	7	6	5	
77	SS	PHW52/La Posta Seq C7 F64-1-1-1-2-B-B-B//WQCD10	1358	1358	260	120	5	5	6	5	4	
78	NS	PHG39/KS23-6//PHTP9	1368	1368	265	125	6	7	7	5	6	
79	NS	LH185/89343//3IIH6	1355	1380	273	123	3	5	2	7	6	stalk lodged
80	NS	LH185/89343//MM402A	1424	1464	265	123	3	5	7	6	6	moldy, root lodged

Table 9. 2019 Breeding Cross Observation - GEM Ames (Set 3)

Entry	Het Group	Pedigree	Pollen GDU	Silk GDU	Plant Ht (cm)	Ear Ht (cm)	Stay Green	Breeder Rating	Ear Pos Harv	Husk Tight	Husk Length	Late Season Comments
81	NS	LH185/89343//PHN18	1402	1396	270	125	6	5	6	6	6	stalk and root lodged
82	NS	LH185/89343//PHR03	1497	1513	278	133	5	5	1	7	6	root lodged
83	NS	LH82/89343//PHR03	1460	1481	273	130	4	5	3	5	6	root lodged
84	NS	LH82/89343//PHW86	1313	1320	255	123	5	5	3	6	5	stalk lodged, root lodged; split husks
85	NS	LH213/AC454//MM402A	1479	1481	265	120	7	8	6	5	6	
86	NS	LH213/AC454//PHR03	1439	1444	270	130	5	5	4	4	5	stalk lodged, ugly
87	NS	3IIH6/CML311//GEMN-0097	1368	1390	268	120	3	4	7	4	6	discard, stalk lodged; root lodged
88	NS	LH168/CML311//GEMN-0097	1359	1378	278	123	5	5	5	3	8	some stalk lodging & root lodging
89	NS	MBWZ/CML311//GEMN-0097	1413	1424	270	125	7	7	7	4	6	stalk lodged; some root lodging
90	NS	3IIH6/CML311//GEMN-0302	1349	1358	250	113	5	6	4	6	6	
91	NS	LH168/CML311//GEMN-0302	1380	1413	258	118	6	6	7	5	6	split husks
92	NS	MBWZ/CML311//GEMN-0302	1380	1401	263	120	8	8	7	4	6	big ear
93	NS	3IIH6/CML311//LH283	1436	1472	270	125	4	5	4	5	4	stalk lodged
94	NS	LH168/CML311//LH283	1425	1436	270	120	5	6	6	4	6	root lodged
95	NS	LH82/CML311//LH283	1424	1449	258	123	5	6	6	5	6	some root lodging
96	NS	3IIH6/CML311//PHJ33	1390	1436	280	138	4	4	5	8	5	root lodged; stalk lodged
97	NS	LH168/CML311//PHJ33	1390	1413	285	138	4	5	5	4	5	stalk lodged; root lodged
98	NS	MBWZ/CML311//PHJ33	1402	1425	285	140	6	5	7	6	6	root lodged
99	NS	LH168/CML311//PHK56	1368	1378	265	125	4	6	3	5	6	root lodged
100	NS	3IIH6/CML323//GEMN-0097	1371	1359	255	123	3	4	5	6	6	stalk lodged
101	NS	LH185/CML323//GEMN-0097	1318	1349	245	113	4	5	7	5	6	stalk lodged
102	NS	LH82/CML323//GEMN-0097	1333	1359	250	118	3	4	7	3	6	discard; stalk lodged
103	NS	PHN18/CML323//GEMN-0097	1352	1368	255	125	4	5	5	4	5	root lodged
104	NS	PHR55/CML323//GEMN-0097	1358	1368	258	118	4	5	4	4	6	stalk lodged
105	NS	PHR55/CML323//GEMN-0178	1425	1413	263	118	7	5	4	4	7	big ear
106	NS	3IIH6/CML323//GEMN-0302	1333	1333	233	105	3	5	6	5	6	
107	NS	LH168/CML323//GEMN-0302	1306	1342	223	103	4	4	4	5	6	
108	NS	LH185/CML323//LH216	1380	1391	240	105	4	5	6	6	5	
109	NS	3IIH6/CML323//LH283	1390	1390	230	110	3	4	6	5	5	stalk lodged
110	NS	LH82/CML323//LH283	1378	1378	248	113	3	4	3	6	5	stalk lodged
111	NS	PHN18/CML323//PHBE2	1349	1359	253	118	5	6	4	4	7	
112	NS	3IIH6/CML323//PHJ33	1358	1380	273	135	3	4	5	6	6	stalk lodged; root lodged
113	NS	LH82/CML323//PHJ33	1333	1349	255	123	3	4	5	5	6	
114	NS	3IIH6/CML323//PHK56	1342	1359	255	110	3	7	5	7	6	nice
115	NS	PHN18/CML323//PHK56	1306	1334	255	115	4	5	3	5	6	nice
116	NS	PHR55/CML323//PHK56	1349	1378	260	118	2	5	3	4	7	
117	NS	PHR55/CML349//GEMN-0097	1368	1391	275	125	4	6	6	7	5	big ear
118	NS	PHN18/CML349//PHBE2	1391	1413	283	128	6	8	6	6	5	big ear
119	NS	LH185/CML384//GEMN-0097	1449	1438	275	123	6	7	7	4	7	nice
120	NS	LH185/CML384//GEMN-0302	1403	1438	255	113	7	7	6	4	6	

Table 9. 2019 Breeding Cross Observation - GEM Ames (Set 3)

Entry	Het Group	Pedigree	Pollen GDU	Silk GDU	Plant Ht (cm)	Ear Ht (cm)	Stay Green	Breeder Rating	Ear Pos Harv	Husk Tight	Husk Length	Late Season Comments
121	NS	LH185/CML384/LH216	1424	1461	268	130	7	7	5	6	3	ugly
122	NS	PHR55/CML384/PHBE2	1461	1495	280	130	7	7	7	5	5	some root lodging
123	NS	LH185/CML384/PHJ33	1482	1472	285	135	7	8	6	5	6	
124	NS	PHR55/CML384/PHK56	1461	1461	288	135	7	8	4	8	5	nice; big ear
125	NS	CML430/LH185/PHR03	1402	1411	275	140	6	7	6	7	5	very nice
126	NS	LH185/CML449/3IIH6	1372	1381	273	128	3	5	6	5	7	
127	NS	PHN37/CML449/LH168	1313	1322	253	123	3	4	6	4	6	ugly
128	NS	CML449/LH82/MBWZ	1429	1423	265	125	7	8	7	5	7	big ear
129	NS	LH185/CML449/PHR03	1424	1451	273	133	5	6	5	7	7	nice; some root lodging
130	NS	3IIH6/GTO 36//GEMN-0097	1340	1368	283	130	6	7	6	6	4	discard
131	NS	3IIH6/GTO 36//GEMN-0302	1352	1371	265	128	5	6	7	7	5	
132	NS	3IIH6/GTO 36//LH283	1425	1425	295	130	5	6	5	6	5	high ear; root lodged
133	NS	3IIH6/GTO 36//PHJ33	1380	1380	303	143	4	6	7	4	5	nice; stalk lodged; some root lodging
134	NS	3IIH6/GTO 36//PHW86	1285	1306	270	145	3	6	4	9	6	poor ears
135	NS	PHW86/KS23-5//GEMN-0097	1333	1390	263	120	4	6	8	5	4	ugly
136	NS	PHW86/KS23-5//GEMN-0302	1309	1368	225	110	3	5	8	4	3	ugly, discard
137	NS	PHW86/KS23-5//LH283	1364	1380	258	125	5	6	6	7	5	some root lodging
138	NS	PHW86/KS23-5//PHJ33	1364	1390	258	123	3	7	6	5	5	
139	NS	PHW86/KS23-6//GEMN-0097	1352	1371	265	125	5	7	7	4	6	
140	NS	PHW86/KS23-6//GEMN-0302	1390	1382	250	123	6	7	7	8	5	
141	NS	PHW86/KS23-6//LH283	1390	1378	250	128	5	7	5	6	5	big ear
142	NS	PHW86/KS23-6//PHBE2	1402	1378	260	123	4	7	5	4	6	

GEM-Ames Legend:

Planting Date: June 3, 2019

1-9 score, 9 is always best

Ear Position at Harvest: 1-9, 1 is upright, 9 is drooping

Husk Tightness: 1-9, 1 is loose, 9 is very tight with many thick husks

Husk Length: 1-9, 1 is very short with tip exposed, 5 is just covering tip

2019 Annual Report of the GEM Project, Ames, IA and Raleigh, NC

PERSONNEL:

Ames: *USDA-ARS Plant Introduction Research*

Dr. David Peters, Ames GEM Coordinator
Mike Peters, GEM Technician
Dr. Mack Shen, IT Specialist
GEM Support Scientist (vice-Engstrom, Vacant)

Dr. Candice Gardner, Research Leader

Raleigh: *USDA-ARS Plant Science Res.*

Dr. Matt Krakowsky, Southeast GEM Coordinator
Dr. Peter Balint-Kurti, Research Geneticist
Dr. Jim Holland, Maize Research Geneticist
Mark McLaughlin, GEM Technician
Pedro Manjarrez, GEM Technician (temporary)
Dr. David Marshall, Research Leader

Raleigh: *North Carolina State University*

Dr. Major Goodman, William Neal
Reynolds Distinguished Professor
Dale Dowden, Technician

GEM - Ames Highlights

Midwest Germplasm releases and development:

- Three hundred and twelve (319) GEM releases will now be available to GEM Cooperators. A total of 336 have been released, including 17 from our university collaborators.
- Seven S4 lines from the Ames program are proposed for release to GEM Cooperators for the 2020 planting year (Table 10). Yield data for 2020 released lines can be found online following the meeting and in the handout. Ear and grain characteristics are presented in Table 11, and topcross maturity and ear height in Table 12. NIR results for protein, oil, and starch can be found online following the meeting.
- Six of the seven new releases are second cycle GEM lines. One is from GEMS-0162, derived from CUBA117, an Argentino line from Cuba; three are from GEMS-0227, derived from NEI9004, a tropical inbred from Thailand; two are from GEMN-0097, derived from Florida synthetic FS8B; one is GEMN-0130, derived from a tropical hybrid from Brazil; and GEMN-0140, derived from BR51675, a Dente Amarelo line from Brazil. Ki14, a tropical inbred from Thailand, is represented in a SS and a NS release.
- Summary tables of test cross data are presented in the section of this book tabbed 'Released Lines.'

Table 10. 2020 GEM-Ames Germplasm Releases (7)

GEM Code	Pedigree	Race	Country	Type	Het. Group
GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	Argentino / Trop Inbred	Cuba / Thailand	18% Exotic	SS
GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002	Trop Inbred	Thailand	30% Exotic	SS
GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	Tropical Inbred / Mississippi Inbred / Florida Synthetic	Thailand	18% Exotic	SS
GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001	Trop Inbred / Trop Hybrid	South Africa / Brazil	30% Exotic	SS
GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	Florida Synthetic // Dente Amarelo / Trop Hybrid	Brazil	25% Exotic	NSS
GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	Florida Synthetic / Mississippi Inbred	USA	12% Exotic	NSS
GEMN-0319	Ki14:N4212-185-001-002	Trop Inbred	Thailand	25% Exotic	NSS

Table 11. 2020 GEM-Ames Released Lines - Ear and Grain Traits

GEM Code	Poll GDU	Cob Color	Grain Color	Grain Texture
GEMS-0313	1448	Red	Yellow	Semi-Flint
GEMS-0314	1424	Red	Yellow	Semi-Dent
GEMS-0315	1402	Red	Yellow	Semi-Dent
GEMS-0316	1378	Seg R/W	Yellow	Semi-Dent
GEMN-0317	1495	White	Yellow	Dent
GEMN-0318	1448	Red	Yellow	Semi-Dent
GEMN-0319	1495	Red	Yellow	Semi-Dent
B73	1424			

Table 12. 2020 GEM-Ames Released Lines - Topcross RM and Ear Height

GEM Code	Pedigree	Average	
		Estimated RM	Ear Height (cm)
GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	112	112
GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002	111	116
GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	112	108
GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001	111	114
GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	110	126
GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	111	120
GEMN-0319	Ki14:N4212-185-001-002	112	116
	Hybrid Checks		
	MBS2655/MBS9508	~109	114
	MBS3520/MBS8814	~111	117
	Pioneer P0987	~109	100
	Pioneer P1151	~111	108
	31D58	~114	114

2019 Breeding Nursery Activities:

- Fourteen new breeding cross populations were sent to eight Cooperators for in-kind support.
- Thirty-one families of S1 ears were advanced to S2 in Ames. These S2s will be topcrossed in isolated blocks in 2020.
- Five families of S1 ears were advanced to S2 by Cooperators. The S2 ears will be topcrossed in 2020 within the Cooperators program and move to first year testing in 2021.
- Nursery planting delays caused by cool, wet conditions in May prevented planting the daylength control shade structure crossing set. Focus for breeding cross development shifted to South African inbreds in the NPGS system and tropical populations converted to temperate adaptation by Cargill. One hundred fourteen 50% exotic crosses were generated. Table 13 provides a summary of the lines included in the breeding crossing program.

Table 13. 2019 GEM-Ames Breeding Cross Program

Pollen Donors			Temperate Females	
Generation	Pedigree	Cross To	Heterotic Group	Pedigree
Inbred	BO165W	SS	SS	HC33
Inbred	BO394Y	SS	SS	LH227
Inbred	KO537Y	SS	SS	LH227
Inbred	KO679Y	SS	SS	LH235
Inbred	KO301Y	NSS	SS	PH42B
Inbred	KO326Y	NSS	SS	PHHB4
Accession	Cargill North Temperate Zone Caribbean	NSS	SS	PHHB9
Accession	Cargill North Temperate Zone Cateto	NSS	SS	PHTP9
Accession	Cargill North Temperate Zone Coroico	NSS	SS	PHW52
Accession	Cargill North Temperate Zone Cuzco	NSS	SS	WQCD10
Accession	Cargill North Temp Zone Mexican Dent	SS	SS	F298W
Accession	CG-Caribbean Flint	NSS	SS	PHN18
Accession	CG-Cateto Flint	NSS	NSS	01IBH10
Accession	CG-Coroico Flour	NSS	NSS	LH176
Accession	CG-Cuzco Flour	NSS	NSS	LH213
			NSS	LH216
			NSS	LH283
			NSS	PHBE2
			NSS	PHJ33
			NSS	PHK56
			NSS	PHR55

- 2018 winter nursery returns from Puerto Vallarta, Mexico were excellent. Breeding cross development to make new 25% tropical populations was highly successful with excellent quantities and quality. Hand pollination nurseries to support line advancement, breeding cross development, and expanded testing of released GEM lines have been sent to Puerto Vallarta for the current winter cycle.
- 2019 breeding nursery and isolations activities are summarized below:
 - Approximately 6,105 nursery rows were pollinated
 - 3,864 selection rows
 - 1,658 various types of increase rows
 - 100 crossing block rows
 - 483 development crossing rows
 - 1,568 observation rows
 - 200 isolation rows were contributed by CRD
 - 100 isolation rows were contributed by Master's Choice
 - 2,000 isolation rows were contributed by MBS 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.

- Ninety-five new breeding crosses were observed and evaluated for breeding potential in Ames, Iowa, Capron, Illinois (Cooperator), Clinton, Illinois (Cooperator), and Ft. Branch, Indiana (Cooperator). Results for this multi-site observation set are presented in the section labeled ‘Breeding Crosses’. Two hundred twelve additional new 25% breeding crosses were evaluated for breeding potential in Ames, Iowa. Results for this set can also be found in the ‘Breeding Crosses’ section. One hundred fourteen new 50% tropical breeding crosses were evaluated for breeding potential in Raleigh, North Carolina and Union City, Tennessee. This set was evaluated to select candidates for making new 25% breeding crosses in winter nursery. In total, 421 breeding crosses were observed. Summarized observations are presented in the breeding cross section of this handout and will be posted on the GEM website following the meetings.
- The 2019 Ames isolated crossing program was canceled in late May after repeated rain delays. Both planned isolated crossing sets were shifted to planting at Puerto Vallarta, Mexico. The planned males for the summer isolations were MBS2655 and MBS3520. The shift to Mexico production necessitated a shift from MBS2655 to MBS3495 to provide better pollen production at the winter site. Both sets were planted in late October and should return in time for summer 2020 yield trials.

Host Plant Resistance

- 2019 disease data will be posted online at our website (<http://www.public.iastate.edu/~usda-gem/>) in January. Nuo (Mack) Shen has added all historical disease evaluation information to the PRISM database.
- 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), Goss’s Bacterial Wilt (GW), Gray Leafspot (GLS), Fusarium ear rot (FUSERS), Anthracnose Stalk Rot (ASR), Aspergillus (aflatoxin and other mycotoxins), and Tar Spot.
- International collaborators evaluated GEM releases for Late Wilt, Tar Spot, agronomic traits, and ear mold.

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

- Corteva provided Fusarium ear mold data and head smut data (Marc Mancl) from their Woodland, California site. Northern leaf blight disease data (Scott Heuchlin and Rick Blum) were provided from their central Iowa site.
- Bayer Crop Science provided Goss’s Bacterial Wilt. Trials were also conducted for Tar Spot in northern Illinois, however infection levels were too low to provide meaningful data collection.
- Professional Seed Research (Jim Dodd) provided data for NLB.
- USDA-ARS-PSRU in Raleigh, NC provided data for GLS, SLB (Peter Balint-Kurti) and Fusarium ear rot (Jim Holland).
- USDA-ARS-CHPRRU, Mississippi State, MS (Paul Williams and Gary Windham) evaluated aflatoxin in grain.
- University of Illinois conducted Tar Spot trials with GEM and BGEM germplasm. Data from this study will be posted as it becomes available.
- Michigan State University conducted Tar Spot trials with GEM and BGEM germplasm. Data from this study will be posted as it becomes available.
- Wyffels Hybrids (Chris Eichhorn) planted a trial of GEM lines for GW screening. Disease development was too poor this year for meaningful data collection.
- Trimble Genetics conducted a Tar Spot trial at their site in southern Mexico. The level of infection was too low this year for meaningful data collection.

Ames 2019 Allelic Diversity (AD) and Double Haploids (DH):

- The Iowa State University Doubled Haploid Facility continues to partner with the GEM Project on development of DH lines. Approximately 204 lines (representing ~52 races) were jointly released by ISU and USDA-ARS in 2014 as part of the Allelic Diversity Project. Approximately 24 sets of these lines have been distributed to requestors, and numerous small subsets have been requested. They provide unique genetic resources for a wide variety of research applications. A new set will be released in 2020, pending processing and quality assurance.

- DH₂ lines were increased (248 rows), 18 lines assigned BGEM codes were increased for distribution and 44 candidates for coding were increased and evaluated.
- DH₂ lines generated by Monsanto from AD BC₁'s supplied by the Raleigh program were planted in the nursery for increase and observation. Three hundred rows involving 35 landraces in 36 populations were included.
- A subset of 50 DH₂ lines of from AgReliant that were grown and selected in 2017 were evaluated for Fusarium ear mold evaluation in replicated trials at Ames, Iowa and Raleigh, North Carolina.
- Dr. Uschi Frei provided space in her haploid doubling program to advance 5,000 candidate haploid kernels. The resulting 439 DH₀ lines will be evaluated and increased in the 2020 nursery.
- We did not advance any BC₁F₇ allelic diversity project germplasm in 2018. This effort has been tabled for now.
- Please see Raleigh-GEM's report on their AD efforts, as Raleigh generates the BC₁ lines that are transferred to Ames for induction.

Ames 2019 Yield Test:

- Approximately 18,526 plots (3018 entries) were managed or coordinated through Ames in 2019 (Table 14).
- Of the core development program, 3,552 plots (26.7%) were devoted to 2nd year trials and 9,792 (73.3%) were in 1st year trials. We lost ten test replications due to weather or site variability.
- Yield trials at the Ames, Atlantic, and Carroll locations were planted in late April, however cool, wet conditions in late April and most of May resulted in planting delays for the Keystone and Crawfordsville locations. Crawfordsville was the last site planted, completed on June 7. Stand establishment at all sites was very good to excellent, but cool, wet fall conditions delayed harvest and resulted in elevated moisture levels late into the harvest season. Data returned for all sites was of high quality.
- All types of Cooperator in-kind trial support contributions are detailed in Table 15.

Table 14. Ames and Cooperator Yield Trial Resource Summary

Trial Type	# Entries	# Plots GEM-Ames	# Plots Private Coops	# Plots GEM-Raleigh	Total Plots
1st Year Trials	1632	8160	1632	0	9792
2nd Year Trials	444	2220	1332	0	3552
Released Line Trials	180	900	300	360	1560
BGEM Trials	312	1560	312	0	1872
Collaborator Trials	450	1750	0	0	1750
Totals	3018	14590	3576	360	18526

- Two hundred fifty-two (252) top crosses out of 2,076 GEM entries exceeded the mean yield of the check hybrids in Midwest trials in 2019. Of the 252 hybrids that exceeded the mean, 188 were from first year trials, and 64 from second year trials.
- The five standard checks used in this year's trials included:
MBS2655/MBS9508 MBS3520/MBS8814
Pioneer P0987 Pioneer P1151 Pioneer 31D58.
- As you review the yield trial information, keep in mind the nomenclature of the GEM trial naming system:
 - First two digits are the year, i.e. "15" for year 2015
 - Third digit is for homologous area (1=tropical, 5=temperate, 6=both, 7=other)
 - Fourth digit indicates percentage of exotic; 0 = mix of 25% or 50% exotic derived; 2=50% exotic; 3 = 25% exotic; 4 = other (i.e. GEM x GEM or Cooperator derived germplasm);
 - Fifth digit is the testing stage (1=1st year test, 2=2nd year test, 3=other)
 - Sixth and seventh digits are sequential numbers.

- For example: "1652102" would be a 1st year TPX trial grown in 2016, comprised of temperate 50% exotic crosses.

Quality Traits (including grain mold/mycotoxin)

- NIR data was collected on newly released lines and the BC observation open-pollinated ears. Data will be published on the GEM website. The newly released GEM lines were not noteworthy for protein, oil, or starch traits.
- Aflatoxin accumulation screening in Mississippi (Paul Williams) focused on GEM-Ames lines released since 2016. Two GEM-Ames lines (GEMS-0281 and GEMS-0289) showed low aflatoxin accumulation levels with 183 ng/g and 121 ng/g, respectively, as compared to PHW79 with 2676 ng/g and T173 with 3681 ng/g. Two additional GEM-Ames lines (GEMS-0280 and GEMS-0302) showed reduced aflatoxin accumulation levels with 353 ng/g and 372 ng/g, respectively. Two Raleigh lines (GEMS-0032 and GEMS-0215) were included based on 2018 results that showed good resistance. This year the Raleigh lines showed lower aflatoxin levels again with 26 ng/g and 246 ng/g, respectively.
- Fumonisin accumulation screening trials in North Carolina (Jim Holland) were similarly focused on GEM-Ames lines released since 2016. Two GEM-Ames lines (GEMS-0263 and GEMS-0293) showed low fumonisin accumulation with 10.6 ppm and 13.1 ppm. This compares to the susceptible check (B73) with 119.6 ppm and resistant checks (GEMS-0002 and GEMS-0032) with 23.9 ppm and 18.9 ppm, respectively.

New GEM Cooperators accepted in 2018/2019:

One new private U.S. Cooperator joined the GEM Project in 2019; Force Genetics, LLC, of Sycamore, Illinois was accepted at the end of 2018. One new international public Cooperator was accepted at the end of 2018; Maize Breeding Department, Centre for Agricultural Research, the Hungarian Academy of Sciences (MTA-ATK) from Hungary. Two new international private Cooperators joined the GEM Project in 2019. Novasem Innovaciones from Mexico and Sementes Shull, LLC, from Brazil were accepted at the end of 2018.

Ames, Iowa GEM Project 2019 Field Day: Approximately 80 visitors participated in the 2019 Ames GEM Field Day on Wednesday, September 18th. Several groups of students, breeders, and the general public continued to visit through mid-October, including numerous international visitors.

Top 10 Project:

- The purpose of the 'Top 10' project was to test the 48 released lines (Table 16) considered to be among the best of the SS and NSS GEM releases on an array of testers, sufficient to calculate GCA and SCA estimates. The information would be useful for assessing potential value of the top 10 SS and top 10 NSS lines for recycling in different breeding programs and other purposes and inform on best heterotic combinations. This project was started in 2016 with the first yield trials conducted in 2017 by AgReliant Genetics, Dow AgroSciences, DuPont-Pioneer, Monsanto, and Syngenta. The project was extended for a second year of testing to obtain period of years performance information.
- The top 48 GEM released lines (Table 16) were again distributed to four private sector TSG members for inclusion in 2017 winter nurseries. The lines were crossed to current proprietary elite testers from each program and tested in the 2018 companies' internal yield trials programs.
- Yield trials were planted at locations including sites inside and outside of the Corn Belt.
- Yield trial data and observations were received and evaluated. General combining ability (GCA) and specific combining ability (SCA) were determined for this set of top GEM releases. Analysis of the data showed more variation across company testers in the stiff stalk GEM coded lines than the non-stiff stalk lines. Variation was also noted from 2017 to 2018 within companies.
- Lines showing the best GCA and SCA response in 2017 performed similarly in 2018.
- Insights provided by this study will help guide and accelerate recycling within GEM and provide valuable guidance to GEM Cooperators for breeding and line development.
- Analyses continue, and results will be published.

Ames GEM Program Goals

The Ames GEM Program has identified several areas for changes planned for 2020 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 organized to evaluate 100-120 25% exotic populations each year at a minimum of three sites. Additional breeding cross observation sets will be grown for those not included in the multiple site trial.
- Calibrations for optical sorter acquired in 2018 will be developed to improve seed quality of coded lines and breeding population seed distributed to cooperators and collaborators.

Isolated Crossing:

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

Yield Trials:

- Continue yield trial plot quality progress through seed quality improvement, increased quality control focus during seed counting and distribution, plot scouting, and plot maintenance.
- Optical sorter calibrations will be further refined to improve compatibility of yield trial entry seed to research air-planters.
- Addition of a sixth Iowa trial site for use by the GEM-Ames project. First year trials would be sent to GEM sites and only second year and coded line trials would be sent across the Cooperator in-kind support network. Second year trials would be increased to 10 sites (possibly 12) with a focus on spreading trials across Iowa, Illinois, Indiana, and Nebraska. Coded line trial site goals would be expanded to optimize evaluation of lines across an expanded tester set. Restructuring yield trials would allow for more timely shipment of yield trial sets to cooperators during planting season. This change would improve sampling of corn belt environments through careful review and coordination of available Cooperator in-kind support yield testing resources.

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 sought who can contribute.

GEM Website:

- Refresh appearance of GEM website and restructure information organization to improve data access. Website changes will clearly outline the process for GEM membership application, the rights, privileges, and responsibilities associated with membership, access to meeting and field day handouts, the seed request process, and access to all yield and disease documentation generated by the project.
- The system for disease reaction evaluation of new and previously released GEM lines will be expanded to provide more complete characterization and documentation of germplasm potential. Data summary system to allow clear identification of disease documentation will be included on the website.

Table 15. Private In-Kind Support - Summer 2019

Collaborator	Breeding & Nursery Support	Breeding Cross Obs	Made Top Crosses	Yield Trials	Disease Screening	Top 10 Project' Trials
AgReliant Genetics, LLC		X		X		X
Bayer Crop Science	X		X	X	X	X
Becks Superior Hybrids				X		
Corteva			X	X		X
CRD			X	X		
DKD Genetics	X			X		
Force Genetics	X					
GEM-Raleigh		X		X		
Illinois Foundation Seed, Inc				X		
Longping NA	X	X		X		
Master's Choice				X		
MBS Genetics			X	X		
MDS				X		
Misr HyTech					X	
Professional Seed Research					X	
Renk Seed Company	X					
Syngenta	X	X	X	X		X
Terrell Seed Research	X	X				
USDA-ARS (Balint-Kurti)					X	
USDA-ARS (Holland)					X	
USDA-ARS (Williams)					X	
Wyffels Hybrids				X	X	

Sincere thanks for the dedication and efforts of the maize community to ensure the availability of useful maize genetic diversity, and especially for their support of the GEM projects in Ames and Raleigh.

Table 16. 48 Lines Included in the ‘Top 10’ Project

Origin	GEM NS lines	Background	Origin	GEM SS lines	Background
Ames	GEMN-0048	DKXL370 (Brazil)	Ohio State	GEMS-0002	FS8A(s)
Ames	GEMN-0096	DKXL370	Raleigh	GEMS-0027	DKXL370 (Brazil)
Ames	GEMN-0097	FS8B(T)	Raleigh	GEMS-0032	DKXL380 (Brazil)
Ames	GEMN-0098	FS8B(T)	Ames	GEMS-0049	DKB844 (Mexico)
Raleigh	GEMN-0104	DK888 (Thailand)	Ames	GEMS-0050	DKB844 (Mexico)
Raleigh	GEMN-0124	DK212T (Brazil)	Ames	GEMS-0061	Cristalino Colorado (Argentina)
Raleigh	GEMN-0135	DKXL380 (Brazil)	Ames	GEMS-0066	Argentino (Cuba)
Ames	GEMN-0144	Cuban Yellow (Peru)	Ames	GEMS-0072	Tuxpeño (Mexico)
Ames	GEMN-0157	Dente Amarello (Brazil)	Ames	GEMS-0093	Cuba 164 (Mixed Creole)
Ames	GEMN-0177	DK888 (Thailand)	Ames	GEMS-0113	Tuxpeño (Mexico)
Ames	GEMN-0178	DK888 (Thailand)	Ames	GEMS-0115	DKB844 (Mexico)
Ames	GEMN-0187	Antigua	Ames	GEMS-0142	Dente Amarelo (Brazil)
Ames	GEMN-0192	Tusón (St. Croix)	Ames	GEMS-0147	Thailand inbred
Ames	GEMN-0207	Cateto (Brazil)	Ames	GEMS-0200	Suwan Composite (Brazil)
Ames	GEMN-0225	Suwan Composite (Brazil)	Raleigh	GEMS-0215	Thailand inbred
Raleigh	GEMN-0232	Tusón (St. Croix)	Ames	GEMS-0219	GEM x GEMS-0002; Cuba 164 x FSA8(s)
Ames	GEMN-0238	Thailand inbred	Ames	GEMS-0220	GEM x GEM; Tuxpeño / Olotillo
Raleigh	GEMN-0257	Tuxpeño (Mexico)	Ames	GEMS-0226	Tuxpeño Composite (Brazil)
Raleigh	GEMN-0270	Criollo (Antigua)	Ames	GEMS-0227	Thailand inbred
Raleigh	GEMN-0271	Suwan Composite (Brazil)	Ames	GEMS-0235	Criollo / Tusón (Cuba)
		GEMN-0043 x GEMN-0097			
Raleigh	GEMN-0272	Cateto / FS8B(T)	Ames	GEMS-0237	DKXL370 (Brazil)
		GEMN-0108 x GEMN-0178			
Raleigh	GEMN-0287	DK888 / DK888	Raleigh	GEMS-0243	CML 287 (CIMMYT)
			Raleigh	GEMS-0245	DK888 (Thailand)
			Raleigh	GEMS-0255	FS8B(S)
			Raleigh	GEMS-0258	DKB830 (Mexico)
					GEMS-0032 x GEMS-0113
			Raleigh	GEMS-0274	DKXL380 / Tuxpeño

2019 Annual Report of the GEM Project

GEM-Raleigh Highlights

Germplasm releases:

- There will be no releases from Raleigh in 2020. While several entries from experiments N1 and P1 (see yield trial section of this book) were potentially worthy of release, we were unable to produce sufficient seed of any of the potential releases in our summer nursery due to a lack of moisture and an overabundance of heat. While some entries were sent to winter nursery, this too proved problematic for seed production. The best performing entries from N1 and P1 will be re-evaluated in 2020, and we will again attempt to produce seed for distribution.

Germplasm development:

- Approximately 1500 GEM nursery plots and 1000 GEM isolation plots were grown in Clayton, NC, while 860 nursery plots were planted in Homestead, Florida in September 2019 and 180 plots were sent to winter nursery in McAllen, Texas.
- S₁ families were developed from thirteen breeding crosses:

Population 33 (IST):N(LH213)	ICA V-156:S(PHP38)
HB 83:N(LH82)	Jalisco 167B:S(PHP38)
((NC258/NC296)/NC300):N(HBA1)	GEMS-0293/GEMS-0281
FL_4BT7:N(LH216)	GEMS-0032:S(LH200)
Population 24 (IST):S(PHP38)	GEMS-0032:S(PHKB9)
GEMS-0243:S(PHKB9)	GEMN-0124/GEMN-0287
(Pool17HS208+Pool33-128):N(LH213)	
- Families from eight GEM breeding crosses were advanced from S₁ to S₂:

AC454:N(LH213)	CML449:N(GEMN-0097)40x
F45:N(DK_HBA1)	(GEMN-0272/GEMN-0104)
F45:N(NC290)	(GEMN-0272/GEMN-0287)
Ki21:N(DK_HBA1)	(GEMS-256/GEMS-243)
- Nineteen new recycling combinations were attempted, but only a few were successful due to poor seed returns from the nursery. A few will be repeated in winter nursery and the rest will be planted again in 2020.
- Development of about 60 new breeding crosses is being attempted in winter nurseries (see table below).

Germplasm Evaluations:

- Overall, about 10500 yield plots were coordinated from Raleigh, with about sixty percent planted at five locations in NC and the rest planted by seven cooperators at fourteen locations throughout the Southeast and Midwest.
- Ninety experimental entries were evaluated at eighteen locations in second-year trials (experiments N1 and P1; see Yield Trials section).
- Nine hundred and sixty-one entries were evaluated in first-year trials, a small number of which will be evaluated in second-year trials in 2020, along with a few of the top performing entries from experiments N1 and P1.

First Year Trials			
Trial	Experimental Pedigree(s)	Tester	# of Experimental Entries
S1	GEMN-0124/GEMN-0135	LH132.PHG39	57
S2	CML313:N(LH185), CML449:N(LH185), Ki21:N(LH185), (CML422.CML313):N(LH185)	LH132.PHG39	50
S3	Pool 33-128-01-01:N(DK_HBA1)	LH132.PHG39	34
S4	Population 33 (IST) C2:N(DK_HBA1)	LH132.PHG39	39
S5	G17(C34)HS208-01-02-02-02:N(DK_HBA1)	LH132.PHG39	30
S6	GEMN-0097/GEM-0048	LH132.PHG39	35
S7	GEMN-0097/GEM-0048	LH132.PHG39	29
S8	CML449:N(PHG47)	LH132.PHG39	59
S9	CML449:N(PHN37)	LH132.PHG39	42
T1	CML449:N(PHN37)	LH132.PHG39	42
T2	GEMN-0104/GEMN-0232, FL_4BT7/DK_MM402A	LH132.PHG39	20
T3	BR106:S(PHG39), FS8B(S):S03, ANTIG01:S02	LH283.LH287	47
T4	La Posta Sequia C7 F64-1-1-1-1-B*3:S(LH193)	LH283.LH287	47
T5	La Posta Sequia C7 F71-1-1-1-2-B*3:S(LH193)	LH283.LH287	58
T6	CML277:S(PHP38), CML494:S(PHP38)	LH283.LH287	28
T7	La Posta Sequia C7 F64-1-1-1-1-B*3:S(PHP38)	LH283.LH287	36
T8	Population 45 (IST) C2:S(LH195), CML277:S(LH195)	LH283.LH287	53
T9	KO679Y:S(LH195), 89291:S(LH195)	LH283.LH287	55
W2	GEMS-0050/CL-G1501:S17b-B-020	MBS8731	37
W3	GEMS-0050/CL-G1501:S17b-B-020	MBS8731	37
W4	GEMS-0050/CL-G1501:S17b-B-020	MBS8731	37
W5	GEMS-0027/GEMS-0220	MBS8731	45
W6	GEMS-0027/GEMS-0220	MBS8731	44

- Evaluations of GEM releases from Raleigh and Ames were included in experiments N1 and P1 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, and complete results will be available on the GEM website after January 1.
- Over 300 breeding crosses were observed in Raleigh in the summer of 2019, and the results are presented in the breeding cross section. The following breeding crosses are currently being selfed in winter nursery:

CML343:S(LH236)	D940Y:S(LH236)	CML384:N(LH283)
CML373:S(LH236)	D940Y:S(LH242)	CML451:N(LH284)
CML373:S(LH242)	D940Y:S(PHAG6)	CML451:N(PHK56)
CML373:S(PHEW7)	KI30:S(LH195)	NEI9008:N(LH213)
CML380:S(LH236)	KO679Y:S(LH236)	CML343:S(DK_F274)
La Posta Seq C7 F71-1-1-1-2-B*4:S(LH236)	KO679Y:S(PHAG6)	
	La Posta Seq C7 F71-1-1-1-2-B*4:S(LH242)	

Several other promising breeding crosses will be selfed in the 2020 summer nursery, including:

CML178:S(PHP38)PHMK0
 CML287:S(PHP38)LH195
 CML339:S(LH195)PHHB9
 GEMS-0255/GEMS-0115
 GEMN-0257/GEMN-0272
 GEMS-0293/GEMS-0115

CML343:S42-001-009/GEMS-0115
 CML343:S(GEMS-0032)PHHB9
 Celaya-GTO69:S(PHP38)PHMK0
 Celaya-GTO84:S(PHP38)PHHB9
 Tuxpeno-CHS462:S(PHP38)PHHB9
 Tuxpeno-SLP146:S(PHP38)PHHB9

The Raleigh-GEM program has traditionally focused on 50% exotic breeding crosses and left the 25% exotic breeding crosses to the Ames program, but there are many exotic sources that cannot be effectively used at the 50% level even in Raleigh and so we are expanding our focus to look at 25% exotic breeding crosses for these accessions.

Allelic Diversity:

- There were no summer nursery rows dedicated to the development of F₁s or BC₁s for the Allelic Diversity project, but three accessions are planted in winter nursery for crossing to PHB47 and PHZ51.

Breeding crosses produced in summer 2019:

Pedigree	Notes
BR106:G39-012-002-#/(PHAG6.LH235)	BR106:G39-012-002-# is an unreleased experimental line from GEM-Raleigh
BR106:G39-012-002-#/(PHAG6.LH236)	
BR106:G39-012-002-#/(PHHB9.LH235)	
BR106:G39-012-002-#/(PHHB9.LH236)	
BR106:G39-012-002-#/(PHMK0.LH236)	
GEMS-0294/(PHHB9.LH235)	
GEMS-0294/(PHHB9.LH236)	
GEMS-0311/(PHAG6.LH235)	
GEMS-0311/(PHHB9.LH235)	
GEMS-0147/GEMS-0243	
GEMS-0147/GEMS-0312	
GEMS-0281/GEMS-0243	
GEMS-0311/GEMS-0281	
GEMS-0281/GEMS-0312	
GEMS-0311/GEMS-0115	
GEMN-0048/GEMN-0310	
GEMN-0178/GEMN-0272	
GEMN-0178/GEMN-0310	
GEMN-0232/GEMN-0272	
GEMN-0287/GEMN-0310	
CML343:S(GEMS-0281)	
La Posta Sequia C7 F71-1-1-1-2-B*3:S(GEMS-0281)	La Posta Sequia C7 F71-1-1-1-2-B*3 is an unreleased line form CIMMYT
CML343:S(DK_F274)	

Germplasm to be crossed in winter 2018:

Pedigree	Pattern to be crossed	Notes
CML287	SSS	CIMMYT inbred (Population 24)
CML373	SSS	CIMMYT inbred (Population 43)
CML380	SSS	CIMMYT inbred (Population 501)
La Posta Sequia C7 F64-1-1-1-2-B-B-B	SSS	CIMMYT unreleased inbred
La Posta Sequia C7 F71-1-1-1-2-B-B-B	SSS	CIMMYT unreleased inbred
Kei1421	SSS	Inbred from Kasetsart University in Thailand KS23, KS27 + ?)
AC454	NSSS	Inbred of unknown origin
CML323	NSSS	CIMMYT inbred (Population 33)
CML384	NSSS	CIMMYT inbred (Population 502)
CML449	NSSS	CIMMYT inbred (Population 32)
CML451	NSSS	CIMMYT inbred (Pool 25 + ??)
NEI9008	NSSS	Inbred from Nakon Suwan in Thailand (Suwan + ?)
Ki45	NSSS	Inbred from Kasetsart University in Thailand (Ki21 and Tzi15)
CHS462:S(PHP38)	SSS	Cross to LH236; CHS462 = Tuxpeno
SLP146:S(PHP38)	SSS	Cross to LH236; SLP146 = Tuxpeno
GTO69:S(PHP38)	SSS	Cross to LH236; GTO69 = Celaya
JAL167B:S(PHP38)	SSS	Cross to LH236; JAL167B = Celaya
CML287:S(NK_H8431)	SSS	Cross to LH236
CML287:S(PHP38)	SSS	Cross to LH236

The SSS ex-PVPs to be used in crosses are DK_F274, DK_RQAA8, NS815, LH236, LH244, and PHHB9, while the nSSS ex-PVPs to be used in crosses are LH177 and LH214. As well, GEMS-0281 will be used for SSS crosses and GEMN-0272 will be used for nSSS crosses.

Table 17. 2020 GEM-Ames Germplasm Releases (7)

GEM Code	Pedigree	Race	Country	Type	Het. Group
GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	Argentino / Trop Inbred	Cuba / Thailand	18% Exotic	SS
GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002	Trop Inbred	Thailand	30% Exotic	SS
GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	Tropical Inbred / Mississippi Inbred / Florida Synthetic	Thailand	18% Exotic	SS
GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001	Trop Inbred / Trop Hybrid	South Africa / Brazil	30% Exotic	SS
GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	Florida Synthetic // Dente Amarelo / Trop Hybrid	Brazil	25% Exotic	NSS
GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	Florida Synthetic / Mississippi Inbred	USA	12% Exotic	NSS
GEMN-0319	Ki14:N4212-185-001-002	Trop Inbred	Thailand	25% Exotic	NSS

Table 18. 2020 GEM-Ames Released Lines - Ear and Grain Traits

GEM Code	Poll GDU	Cob Color	Grain Color	Grain Texture
GEMS-0313	1448	Red	Yellow	Semi-Flint
GEMS-0314	1424	Red	Yellow	Semi-Dent
GEMS-0315	1402	Red	Yellow	Semi-Dent
GEMS-0316	1378	Seg R/W	Yellow	Semi-Dent
GEMN-0317	1495	White	Yellow	Dent
GEMN-0318	1448	Red	Yellow	Semi-Dent
GEMN-0319	1495	Red	Yellow	Semi-Dent
B73	1424			

Table 19. 2020 GEM-Ames Released Lines - Topcross RM and Ear Height

GEM Code	Pedigree	Average	
		Estimated RM	Ear Height (cm)
GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	112	112
GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002	111	116
GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	112	108
GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001	111	114
GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	110	126
GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	111	120
GEMN-0319	Ki14:N4212-185-001-002	112	116
	Hybrid Checks		
	MBS2655/MBS9508	~109	114
	MBS3520/MBS8814	~111	117
	Pioneer P0987	~109	100
	Pioneer P1151	~111	108
	31D58	~114	114

Table 20. 2020 GEM Ames Released Lines - Disease and Nursery Observations

GEM Code	Pedigree	Shed GDU	Silk GDU	Ames		Nurs Obs		Disease				Ear Notes		
				Plant Ht	Ear Ht	Early Rtg	Field Score	Goss's Wilt	NLB	SLB	Fus Ear Mold	Cob Color	K Color	K Rows
GEMS-0313	((GEMS-0162/PHP38)/GEMS-0227)-206-001-001	1448	1424	195	85	7	7	NT	6	NT	6	R	Y	18
GEMS-0314	((GEMS-0227/Ki14)/12)-080-001-002	1424	1424	215	92	7	7	7	9	6	3	R	Y	16
GEMS-0315	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002	1402	1424	180	75	7	6	4	4	4	6	R	Y	14
GEMS-0316	((KO679Y/GEMS-0030)/12)-090-001-001	1378	1378	162	65	6	7	8	7	5	4	R/W	Y	12
GEMN-0317	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002	1495	1520	188	95	8	8	8	9	7	4	W	Y	12
GEMN-0318	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002	1448	1495	190	92	8	7	8	6	5	4	R	Y	14
GEMN-0319	Ki14:N4212-185-001-002	1495	1520	178	100	7	8	8	5	6	5	R	Y	14
B73	Check	1436	1466	185	92	7	5	3	3	3	5			
LH195	Check	1495	1495	148	68	8	7	2	4	NT	NT			
LH82	Check	1336	1336	135	58	7	3	NT	NT	NT	NT			
Mo17	Check	1440	1517	175	86	7	6	2	7	6	NT			

Nursery Rating Scale: 9 = Best, 1 = Worst

Disease Rating Scale:

Goss's Wilt	9 = Resistant, 1 = Susceptable
NLB	9 = Resistant, 1 = Susceptable
SLB	9 = Resistant, 1 = Susceptable
Fus Ear Mold	9 = Resistant, 1 = Susceptable

GEMS-0313: ((GEMS-0162/PHP38)/GEMS-0227)-206-001-001

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	8	1964207	43	((GEMS-0162/PHP38)/GEMS-0227)-206-001/MBS8731	216.8	10.4	21.5	0.5	0.7	55.9	1.3	243	108
				% Check Mean	106.8%	106.1%	101.4%	100.0%	35.0%	100.9%	100.0%	100.0%	95.6%
2019	8	1964208	3	((GEMS-0162/PHP38)/GEMS-0227)-206-001/TR6828	198.4	9.4	21.4	1.6	0.0	56.3	0.0	245	115
				% Check Mean	100.0%	101.1%	98.6%	160.0%	0.0%	102.9%	0.0%	99.2%	100.0%
2018	6	1853103	9	((GEMS-0162/PHP38)/GEMS-0227)-206-001/TR6828	214.2	11.5	18.9	7.5	0.0	58.1	1.4	253	103
				% Check Mean	100.1%	102.7%	102.2%	192.3%	0.0%	103.0%	4.3%	99.6%	95.4%

Nursery Notes:

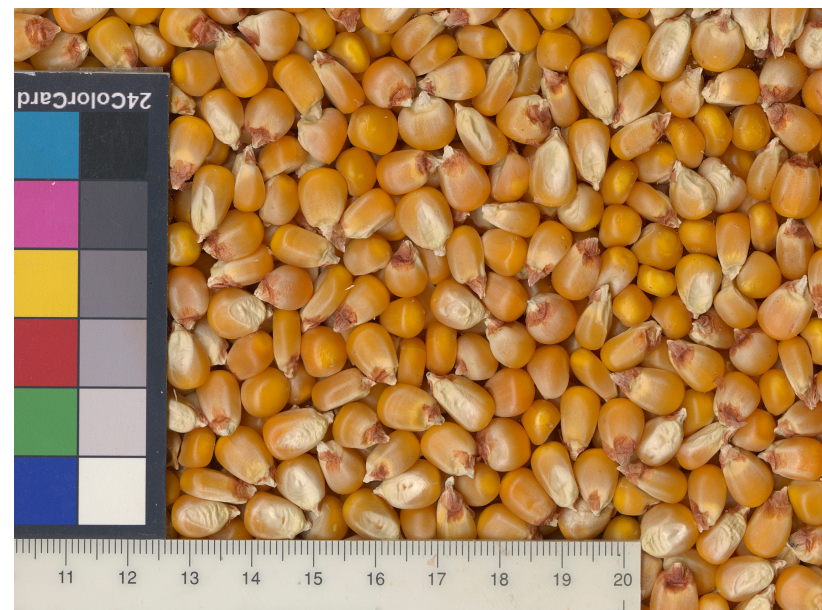
Average stalks and good roots; Good test weight

Low green snap potential; Average plant and ear height

Flowers 1 day later than B73

GEMS-0162 is derived from CUBA117, an Argentino line from Cuba

GEMS-0227 is derived from NEI9004, a tropical inbred from Thailand



GEMS-0314: ((GEMS-0227/Ki14)/12)-080-001-002

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	7	1964203	35	((GEMS-0227/Ki14)/12)-080-001/MBS5562	201.9	10.0	20.6	0.5	1.9	54.7	0.0	253	113
				% Check Mean	96.6%	107.5%	90.0%	55.6%	86.4%	100.2%	0.0%	104.1%	103.7%
2019	8	1964206	51	((GEMS-0227/Ki14)/12)-080-001/MBS8731	205.7	9.2	23.0	1.1	1.1	52.6	0.0	253	120
				% Check Mean	105.4%	98.9%	105.0%	183.3%	100.0%	96.0%	0.0%	104.5%	108.1%
2018	6	1813106	14	((GEMS-0227/Ki14)/12)-080-001/MBS8731	194.3	10.4	18.8	8.1	0.0	55.0	2.8	280	128
				% Check Mean	106.5%	102.0%	105.0%	155.8%	0.0%	97.7%	11.9%	108.9%	111.3%

Nursery Notes: Average stalks and good roots; Low green snap potential; Taller line with higher ear placement
 Good Goss's Wilt and NLB resistance; Susc to Fusarium ear mold
 Flowers 1 day earlier than B73

GEMS-0227 is derived from NEI9004, a tropical inbred from Thailand
 Ki14 is a tropical inbred from Thailand



GEMS-0315: (GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001-002

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	8	1964206	10	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS8731	205.9	9.6	22.3	0.4	1.4	52.3	0	238	108
				% Check Mean	105.5%	103.2%	101.8%	66.7%	127.3%	95.4%	0.0%	98.3%	97.3%
2019	7	1964203	1	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS9451	200.3	9.5	21.2	1.5	0.0	51.8	4.0	240	108
				% Check Mean	95.9%	102.2%	92.6%	166.7%	0.0%	94.9%	100.0%	98.8%	99.1%
2018	7	1864207	55	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS8731	196.4	10.9	18.4	6.9	2.9	54.8	6	273	122
				% Check Mean	98.2%	95.6%	104.0%	69.7%	76.3%	96.0%	29.8%	101.5%	97.6%
2018	8	1864213	9	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS9451	210.4	12.2	17.4	6.8	5.4	53.2	4.3	270	115
				% Check Mean	103.4%	109.9%	92.6%	147.8%	100.0%	94.2%	15.4%	100.0%	95.0%
2017	6	1714111	51	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS9451	183.2	10.2	18.2	9.9	1.0	53.2		277	103
				% Check Mean	90.6%	97.1%	91.9%	215.2%	125.0%	94.0%		98.6%	97.2%

Nursery Notes: Good grain quality, moderate test weight in hybrids; Taller line with moderate ear height
Good stalk and root quality. Flowers 1 day later than B73.

GEMS-0002 is derived from Florida Synthetic FS8A

GEMS-0227 is derived from NEI9004, a tropical inbred from Thailand

Mp494 was selected for root worm feeding resistance



GEMS-0316: ((KO679Y/GEMS-0030)/12)-090-001-001

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	8	1964204	47	((KO679Y/GEMS-0030)/12)-090-001/MBS5562	199.5	9.4	21.5	1.0	0.7	55.4	0.0	259	114
				% Check Mean	96.8%	101.1%	93.9%	125.0%	50.0%	99.8%	0.0%	102.4%	102.7%
2019	8	1964207	37	((KO679Y/GEMS-0030)/12)-090-001/MBS8731	213.7	9.5	22.8	0.0	1.4	53.1	0.0	243	113
				% Check Mean	105.3%	96.9%	107.5%	0.0%	70.0%	95.8%	0.0%	100.0%	100.0%
2018	6	1813108	21	((KO679Y/GEMS-0030)/12)-090-001/MBS8731	198.5	10.6	19.2	2.4	2.2	55.5	11.1	248	123
				% Check Mean	98.2%	93.0%	107.3%	49.0%	62.9%	97.5%	35.4%	97.6%	103.4%

Nursery Notes:

Good stalks and roots; Low green snap potential
 Moderate test weight; Average plant and ear height
 Good Goss's Wilt and NLB resistance
 Flowers 2-3 days earlier than B73

GEMS-0030 is derived from a tropical hybrid from Brazil
 KO679Y is a tropical inbred, a Teko Yellow line from South Africa



GEMN-0317: (GEMN-0097/(GEMN-0140/GEMN-0130))-002-001-002

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	7	1964201	3	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001/MBS2655	200.0	9.4	21.6	0.7	11.3	53.2	0.0	260	123
				% Check Mean	98.3%	102.2%	96.9%	77.8%	869.2%	97.4%	0.0%	108.8%	112.8%
2019	5	1964202	5	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001/MBS3520	202.9	9.2	22.5	3.7	0.5	53.6	0.0	263	130
				% Check Mean	98.0%	102.2%	96.6%	462.5%	23.8%	98.7%	0.0%	109.6%	118.1%
2018	6	1864103	15	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001/MBS3520	193.4	11.3	17.1	10.8	5.9	55.5	54.1	243	108
				% Check Mean	96.6%	99.1%	96.6%	140.3%	163.9%	98.4%	157.3%	101.3%	105.9%

Nursery Notes:

- Average stalks and good roots; Low green snap potential
- Line has average plant and ear height, hybrids are taller than checks
- Good Goss's Wilt, NLB, and SLB resistance
- Flowers 2-3 days later than B73
- GEMN-0097 is derived from Florida synthetic FS8B
- GEMN-0130 is derived from a tropical hybrid from Brazil
- GEMN-0140 is derived from BR51675 a Dente Amarelo line from Brazil



GEMN-0318: (GEMN-0097/TF-2-0-T3-P74-G121)-147-001-002

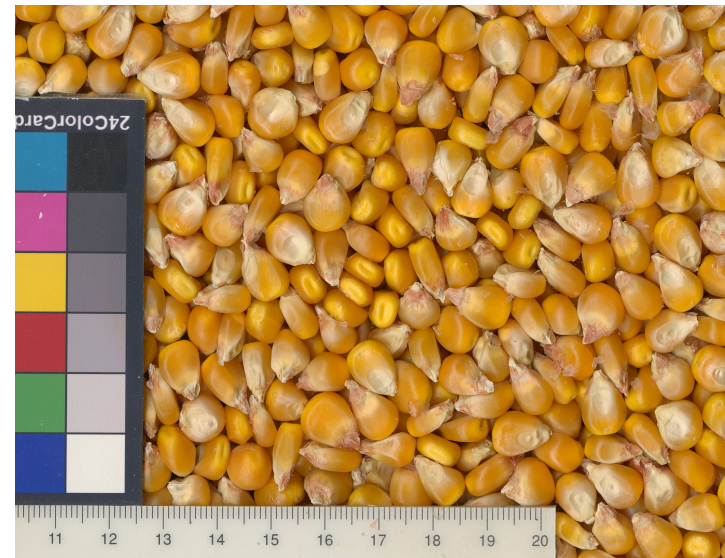
Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	7	1964201	10	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001/MBS2655	194.5	8.6	22.7	4.7	2.2	54.5	1.4	260	115
				% Check Mean	95.6%	93.5%	101.8%	522.2%	169.2%	99.8%	54.9%	108.8%	105.5%
2019	5	1964202	12	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001/MBS3520	194.4	8.8	22.4	2.8	0.6	54.4	0.0	258	125
				% Check Mean	93.9%	97.8%	96.1%	350.0%	28.6%	100.2%	0.0%	107.5%	113.6%
2018	6	1854101	66	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001/MBS3520	187.9	11.1	17.1	15.2	2.3	56.2	13.9	308	133
				% Check Mean	98.0%	101.8%	97.7%	167.0%	230.0%	96.9%	37.7%	108.1%	105.6%

Nursery Notes:

Average stalks and good roots; Low green snap potential
Average test weight; Higher plant and ear height in hybrids
Good Goss's Wilt resistance
Flowers 1 day later than B73

GEMN-0097 is derived from Florida synthetic FS8B

TF-2-0-T3-P74-G121 is an ARS line derived from Truckers Favorite in Mississippi



GEMN-0319: Ki14:N4212-185-001-002

Year	# Reps	Exp	Ent	Pedigree	Yield (bu/a)	Y/M	% MST	% Stalk Lodging	% Root Lodging	Test Weight	% Green Snap	Plant Height	Ear Height
2019	7	1964201	50	Ki14:N4212-185-001/MBS2655	191.9	8.6	22.7	0.9	3.1	54.4	8.3	243	115
				% Check Mean	94.3%	93.4%	101.8%	100.0%	238.5%	99.6%	296.4%	101.7%	105.5%
2019	5	1964202	35	Ki14:N4212-185-001/MBS3520	204.7	8.5	24.7	1.3	1.4	52.9	0.0	253	118
				% Check Mean	98.8%	94.4%	106.0%	162.5%	63.6%	97.4%	0.0%	105.4%	107.3%
2018	4	1813101	43	Ki14:N4212-185-001/MBS3520	170.7	9.0	19.1	3.9	3.4	56.2	11.8	255	120
				% Check Mean	94.6%	90.0%	104.9%	100.0%	377.8%	98.6%	53.4%	108.5%	109.1%

Nursery Notes: Average stalks and good roots; Low green snap potential
Line has moderate plant and ear height, hybrids are taller than checks
Good Goss's Wilt resistance
Flowers 2-3 days later than B73

Ki14 is a tropical inbred from Thailand



Table 21. 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	12	3	4	19
GEM Derived	11	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	13	2	0	15
Tropical Inbred / Mississippi Inbred / Florida Synthetic	1	0	0	1
Tropical Line	9	5	0	14
Tusón	10	2	1	13
Tusón/Canilla	1	0	0	1
Tuxpeño	3	9	0	12
Tuxpeño/Olotillo	2	0	0	2
Totals	192	122	19	333

Table 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
1	GEMS-001(PI503806xB94//B94)	GEMS-0001	Alazan	Peru	Ames	2001
2	GEMS-002 (FS8A(S):S09-43-2)	GEMS-0002	Mixed	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 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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	Mixed	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	Mixed	USA	Ames	2003
76	FS8B(S):S0316-802-001	GEMS-0079	Mixed	USA	Ames	2003
77	FS8B(S):S0316-814-001	GEMS-0080	Mixed	USA	Ames	2003
78	FS8B(T):N1802-382-001	GEMN-0081	Mixed	USA	Ames	2003
79	FS8B(T):N1802-525-001	GEMN-0082	Mixed	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 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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	Mixed	USA	Ames	2004
95	FS8B(T):N11a-110-001	GEMN-0098	Mixed	USA	Ames	2004
96	FS8B(T):N11a-322-001	GEMN-0099	Mixed	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 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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	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 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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	Mixed	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	GEM x GEM derived	USA	Ames	2011
215	(CUBA164:S2012-459-001-B/GEMS-0002)-B-B-031	GEMS-0219	GEM x GEM derived	USA	Ames	2011
216	(GEMS-0113/GEMS-0091)-B-058-001	GEMS-0220	GEM x GEM derived	USA	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 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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/Tuson	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	Mixed	USA	NC	2015
251	FS8B(S):S03-133-002	GEMS-0255	Mixed	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	GEM x GEM derived	USA	Ames	2015
257	(GEMN-0140/GEMN-0097)-B-B-027-B-B	GEMN-0261	GEM x GEM derived	USA	Ames	2015
258	(GEMS-0147/GEMS-0180)-B-104-001-B-B	GEMS-0262	GEM x GEM derived	USA	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	GEM x GEM derived	USA	NC	2016
269	(GEMS-0032xGEMS-0050)-B-007	GEMS-0273	GEM x GEM derived	USA	NC	2016
270	(GEMS-0032xGEMS-0113)-B-004	GEMS-0274	GEM x GEM derived	USA	NC	2016

Table 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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	GEM x GEM derived	USA	NC	2016
284	(GEMS-0147/GEMS-0115)-B-002-001-001-B	GEMS-0288	GEM recycle	USA	Ames	2017
285	(GEMS-0147/GEMS-0180)-B-033-001-001-B	GEMS-0289	GEM recycle	USA	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	GEM x GEM derived	USA	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	GEM recycle	USA	Ames	2018
293	(GEMS-0115/GEMS-0222)-B-B-033-001	GEMS-0297	GEM recycle	USA	Ames	2018
294	(GEMS-0219/GEMS-0227)-B-015-001	GEMS-0298	GEM recycle	USA	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	Brazil	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	Mixed	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 Inb	USA	Ames	2020
315	Ki14:N4212-185-001-002	GEMN-0319	Tropical Inbred	Thailand	Ames	2020

Table 22. GEM Germplasm Releases

Entry	Pedigree	Code	Race	Country	Site Released	Year Released
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

2019 Yield Trial Data (Top 20 Entries Ranked)

Experiment N1

Tester: LH132.PHG39

		<i>All location Means</i>								<i>Percent</i>		
<i>Entry</i>	<i>Pedigree</i>	<i>Yield</i>	<i>% Yield /CHK</i>	<i>Variance</i>	<i>Moist</i>	<i>Yield/ Moist</i>	<i>Test Weight</i>	<i>Plant Height</i>	<i>Ear Height</i>	<i>Stalk Lodging</i>	<i>Root Lodging</i>	<i>Erect Plants</i>
47	Pioneer 2160YHR	191	1	2687	20.1	9.6	58.4	264	99	1	4	95
48	DeKalb 67-44	186	1	1192	18.4	10.2	58.2	251	102	0	6	94
49	DeKalb 69-16	182	1	1848	19.6	9.5	57.7	240	101	0	0	100
55	Pioneer 1794VYHR	182	1	3371	18.7	9.5	57.0	263	98	5	9	88
54	Pioneer 2088R	180	1	2033	19.6	9.2	56.4	261	94	0	6	95
46	Pioneer 1870VHR	179	1	2055	19.9	9.1	58.3	247	91	3	2	96
53	Pioneer 1745R	177	1	2530	18.2	9.9	55.5	267	106	3	5	93
56	Pioneer 1637R	176	1	2056	19.1	9.4	56.6	268	100	1	4	96
50	DeKalb 65-20	168	1	1356	19.4	8.8	58.4	229	87	0	4	96
43	GEMN-0272/LH132.PHG39	163	1	2060	18.3	9.0	56.4	261	102	3	9	90
52	DeKalb 65-18	162	1	1455	18.4	8.9	58.4	229	84	0	3	97
51	Pioneer 1197R	160	1	2188	16.0	10.1	53.8	225	82	2	0	98
4	(GEMN-0104/GEMN-0048)-010-01	160	1	1963	20.2	8.0	55.1	267	105	2	1	97
2	(GEMN-0108xGEMN-0178)-B-01-04	159	1	1778	19.7	8.3	56.6	270	117	3	4	94
1	(GEMN-0108xGEMN-0178)-B-01-02	157	1	2177	19.6	8.0	57.0	274	113	5	2	93
24	(GEMN-0124/GEMN-0043)-010-02	155	1	2198	19.0	8.4	56.3	258	100	4	4	93
40	GEMN-0097/LH132.PHG39	155	1	2239	16.8	9.2	57.0	255	102	3	8	90
45	GEMN-0310/LH132.PHG39	153	1	2057	18.1	8.6	55.5	258	104	5	2	93
3	(GEMN-0108xGEMN-0178)-B-01-06	153	1	2042	19.9	7.8	56.3	273	115	4	3	94
27	(GEMN-0095/GEMN-0124)-003-02	152	1	2425	19.4	7.8	51.4	257	102	4	9	89
	Replications	16			16	16	10	10	5	7	8	9
	Test Entry Means	152			19.1	8.1	56.3	259	102	3	6	93
	Check Means	176			18.9	9.5	57.4	251	96	1	5	95
	Overall Means	152			19.0	8.1	56.4	259	102	2.6	5.6	93
	Range	131-191			16.0-20.9	6.7-10.2	50.6-60.6	225-282	82-117	0-7	0-13	85-100
	CV	11.7			6.1	13.9	8.2	3.4	6.6	136	178	10.8
	LSD (p=0.05)	11.3			0.7	0.7	2.9	5.6	4.3	2.3	6.4	6.4

2019 Yield Trial Data (Top 20 Entries Ranked)

Experiment P1

Tester: LH283.LH287

		All location Means								Percent		
Entry	Pedigree	Yield	% Yield /CHK	Variance	Moist	Yield/ Moist	Test Weight	Plant Height	Ear Height	Stalk Lodging	Root Lodging	Erect Plants
66	DeKalb 67-44	205	1.07	1781	19.3	10.8	57.8	247	95	1	2	97
70	Pioneer 2088R	196	1.03	2485	20.5	9.6	56.8	263	100	1	6	93
71	Pioneer 1794VYHR	192	1.01	1610	19.5	10.1	56.7	267	103	8	4	89
72	Pioneer 1637R	190	1.00	2223	19.9	9.8	56.4	267	100	3	5	92
69	Pioneer 1745R	190	0.99	1721	19.3	10.0	55.1	262	99	1	14	84
36	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-31	182	0.96	2105	19.6	9.1	55.3	256	107	10	9	81
47	La Posta Sequia C7 F64-1-1-1-2-B*4:S40a-B-09	174	0.91	1794	20.8	8.4	56.4	255	108	2	18	81
26	(GEMS-0220/GEMS-0032)-13-02	173	0.91	2021	19.0	9.2	55.5	265	103	5	15	80
30	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-09	173	0.91	1883	20.5	8.6	55.0	259	103	9	15	76
42	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-18	173	0.90	1508	19.7	9.0	55.2	264	107	6	24	70
68	DeKalb 65-18	173	0.90	2237	19.3	8.9	56.8	228	85	1	10	90
31	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-12	172	0.90	1491	19.3	9.0	54.3	254	102	7	10	84
37	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-02	171	0.89	1431	20.9	8.4	51.2	256	102	3	15	82
40	La Posta Sequia C7 F71-1-1-1-2-B*4:S40b-B-12	170	0.89	1968	20.2	8.5	55.3	252	106	5	12	82
32	La Posta Sequia C7 F71-1-1-1-2-B*4:S40a-B-18	170	0.89	1725	20.3	8.6	54.7	258	103	7	3	90
27	(GEMS-0220/GEMS-0032)-13-03	170	0.89	1645	19.2	8.9	55.6	249	98	8	9	84
67	Pioneer 1197R	169	0.88	1637	16.5	10.1	55.9	230	86	4	1	95
63	GEMS-0311	168	0.88	2379	19.8	8.5	55.8	263	112	11	17	73
3	BR51039:S15-B10-03	168	0.88	1942	20.4	8.3	54.2	261	105	5	18	77
62	GEMS-0294	168	0.88	2428	20.0	8.6	55.3	263	109	7	12	81
	Replications	16			16	16	11	9	5	7	7	7
	Test Entry Means	165			19.5	8.6	55	255	102	7	13	81
	Check Means	191			19.6	9.9	56.6	254	96	3	7	90
	Overall Means	165			19.5	8.7	55.3	255	102	7	13	81
	Range	145-205			16.5-21.0	7.7-10.8	51.2-57.8	228-270	85-115	1-19	1-26	67-97
	CV	10.6			5.0	11.6	4.3	3.5	7.5	91.5	88.5	15.8
	LSD (p=0.05)	11.1			0.6	0.6	1.5	5.6	4.9	4	7	8.1

Table 23. 2019 GEM-Ames Yield Trial Summary

Experiment	Family	Tester	Entries	Reps	Entry Yield Avg.	Check Yield Avg.	Overall Yield Avg.	CV (%)
1913101	3IIH6 //GEMN-0173/KO679Y	MBS3520	72	6	174.0	196.6	175.6	8.8
1913102	GEMN-0239//GEMN-0097/Ki14	MBS2655	60	6	174.6	190.2	175.9	9.3
1913103	Oh7B/KO679Y//GEMN-0205	MBS3520	84	6	165.0	202.0	167.2	10.8
1913104	Oh7B/KO679Y//LH185	MBS3520	36	5	167.2	204.0	172.3	9.5
1913105	GEMS-0219//KO679Y/GEMS-0030	MBS5562	96	6	183.2	213.4	184.8	7.7
1913106	KO679Y/GEMS-0030//4676A; KO679Y/GEMS-0030//794	MBS5562	84	6	180.1	212.9	182.1	8.8
1913107	Tuxpeno Comp.(M)C5xB126/GEMS-0219	MBS5562	60	6	180.0	220.7	183.4	8.5
1913108	Tuxpeno Comp.(M)C5xB126/GEMS-0219	MBS5562	60	6	176.9	224.7	180.8	8.5
1913109	CUBA164:T26aS41-B-040-B/GEMS-0115	MBS8731	72	6	201.8	197.2	201.5	9.7
1913110	GEMS-0219//N28/KO679Y	MBS8731	84	6	191.4	201.1	192.0	9.8
1913111	GEMS-0227/CUBA164:T26aS41-B-040-B	MBS8731	72	6	210.0	213.8	210.3	8.4
1913112	N28/KO679Y//4676A	MBS8731	36	6	198.5	202.6	199.1	9.0
1913113	PHP38//GEMS-0227/Ki14	MBS8731	72	6	191.9	203.0	192.7	8.7
1914101	BR105:N(GEMN-0174)(GEMN-0156)-101-001/GEMN-0178	MBS2655	84	5	181.5	197.0	182.4	10.3
1914102	GEMN-0173/KO679Y//(GEMN-0140/GEMN-0097)-B	MBS2655	84	6	176.6	186.0	177.1	9.8
1914103	GEMN-0173/KO679Y//(GEMN-0140/GEMN-0097)-B	MBS2655	84	6	175.3	189.1	176.1	10.4
1914104	NKS8326/CML373//GEMN-0097///3IIH6	MBS2655	60	6	174.0	201.5	176.3	8.6
1914105	PHP02/MBRC10:N1730-B-128-B	MBS2655	60	6	176.4	217.9	179.9	8.5
1914106	G39/SX2788:S(794)(GEMS-0188)	MBS8731	48	6	187.7	191.9	188.1	10.0
1914107	SX2788:S(794)(GEMS-0188)/GEMS-0226	MBS8731	48	6	193.8	197.5	194.2	9.4
1953101	(GEMN-0140/GEMN-0097)-B//GEMN-0205	MBS3520	72	6	177.2	200.1	178.8	9.3
1953102	(GEMN-0140/GEMN-0097)-B//GEMN-0205	MBS3520	60	6	178.9	209.4	181.4	8.9
1953103	(GEMN-0140/GEMN-0097)-B//GEMN-0205	MBS3520	60	6	176.6	206.8	179.1	9.1
1953104	GEMS-0147/GEMS-0227//GEMS-0219	MBS5562	48	6	184.9	209.1	187.4	9.1
1953105	GEMS-0226//GEMS-0182/GEMS-0227	MBS8731	36	6	193.0	198.7	193.8	9.2
1964201	Retest 1	MBS2655, TR6402	60	7	184.2	203.5	185.8	10.1
1964202	Retest 2	MBS3520	60	5	182.1	207.1	184.3	9.1
1964203	Retest 3	MBS5562, MBS9451	48	7	185.0	208.9	187.6	9.5
1964204	Retest 4	MBS5562, MBS9451	60	8	189.9	206.2	191.2	10.6
1964205	Retest 5	MBS5562	48	7	197.6	218.3	199.8	8.2
1964206	Retest 6	MBS8731	60	8	191.4	195.2	191.7	10.2
1964207	Retest 7	MBS8731	60	8	203.3	203.0	203.3	7.4
1964208	Retest 8	MBS8731, TR6828	48	8	195.1	197.2	195.3	9.0
1964301	GEM Line Trial	Various	60	7	189.2	203.6	190.5	9.5
1964302	GEM Line Trial	Various	60	7	185.8	192.5	186.4	11.0
1964101	BGEM Candidate Trials	MBS3520, MBS5562	60	6	171.8	204.8	174.2	12.0
1964102	BGEM Candidate Trials	MBS3520, MBS5562	84	5	161.7	198.0	163.9	11.1
1964103	BGEM Candidate Trials	MBS3520	84	5	164.9	197.1	166.8	11.5
1964104	BGEM Candidate Trials	MBS3520	84	5	166.5	199.6	168.3	11.4
1974301	Ex-PVP	Various	60	8	182.7	198.9	184.2	10.6

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964201

Tester: MBS2655, TR6402

		All Location Means									
Entry	Pedigree	Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
60	MBS3520/MBS8814	219.8	108.0	23.5	9.5	51.4	0.6	0.5	255	118	2
57	Pioneer P1151	209.5	102.9	21.8	9.7	55.0	1.5	0.0	230	98	0
33	((GEMN-0140/GEMN-0130)/GEMN-0097)-009-001//MBS2655	208.7	102.6	21.5	9.9	53.8	1.3	3.5	245	120	6
14	(GEMN-0205/(GEMN-0097/PHN46))-029-001/MBS2655	207.3	101.9	22.0	9.6	54.2	4.7	1.4	263	115	5
52	Ki14:N4212-204-001/MBS2655	203.7	100.1	22.8	9.0	52.7	1.0	3.3	263	130	7
58	Pioneer 31D58	200.4	98.5	24.1	8.4	54.7	5.4	1.5	245	120	1
3	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001/MBS2655 (GEMN-0317)	200.0	98.3	21.6	9.4	53.2	0.7	11.3	260	123	0
36	(GEMN-0186/DKXL370:N11a20-036-002-B-B-B-B)-028-001//MBS2655	198.1	97.3	22.1	9.1	52.9	0.0	2.2	248	123	0
9	(GEMN-0097/TF-2-0-T3-P74-G121)-110-001/MBS2655	197.9	97.2	24.0	8.3	53.6	9.5	8.1	263	130	1
59	MBS2655/MBS9508	197.9	97.2	21.2	9.4	55.8	0.5	3.5	248	113	7
41	(GEMN-0192/GEMN-0210)-025-002//MBS2655	197.5	97.1	22.6	8.8	52.8	4.1	3.4	250	118	2
32	((GEMN-0140/GEMN-0130)/GEMN-0097)-006-001//MBS2655	196.9	96.8	22.2	9.0	54.3	2.7	1.5	245	123	1
34	((GEMN-0140/GEMN-0130)/GEMN-0097)-023-001//MBS2655	195.4	96.0	20.0	10.0	52.9	0.5	7.8	253	120	19
10	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001/MBS2655 (GEMN-0318)	194.5	95.6	22.7	8.6	54.5	4.7	2.2	260	115	1
47	Ki14:N4212-149-001/MBS2655	192.6	94.6	24.8	7.8	51.8	0.5	5.5	270	123	0
17	(GEMN-0205/(GEMN-0140/GEMN-0097)-B-B-034-B)-007-002/MBS2655	192.3	94.5	22.0	8.8	54.1	4.8	0.7	255	118	0
50	Ki14:N4212-185-001/MBS2655 (GEMN-0319)	191.9	94.3	22.7	8.6	54.4	0.9	3.1	243	115	6
20	(GEMN-0205/(GEMN-0140/GEMN-0097)-B-B-034-B)-038-001/MBS2655	191.7	94.2	22.1	8.8	53.2	0.5	0.8	238	108	0
38	(DKXL370:N11a20-036-002-B-B-B-B/GEMN-0186)-008-001//MBS2655	191.5	94.1	22.3	8.7	53.0	2.6	0.8	255	120	2
37	(DKXL370:N11a20-036-002-B-B-B-B/GEMN-0186)-004-001//MBS2655	191.4	94.1	22.0	8.8	54.0	1.1	2.6	250	113	1
Number Locations		7		7	7	7	3	4	2	2	1
Mean		185.8		22.6	8.3	53.6	2.4	2.4	251	118	5
Non Check Mean		184.2		22.6	8.3	53.5	2.5	2.5	252	119	5
Check Means		203.5		22.3	9.2	54.6	0.9	1.3	239	109	2
CV		10.1		3.7	11.2	1.3	114.7	195.3	3.2	4.5	
Yield Range		157.8 - 219.8									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, Atlantic, Keota, and Keota in Iowa

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964202

Tester: MBS3520

		All Location Means									
<i>Entry</i>	<i>Pedigree</i>	<i>Yield B/A</i>	<i>% Yield /CHK</i>	<i>% Moist</i>	<i>Yield/ Moist</i>	<i>TWT</i>	<i>% S.L.</i>	<i>Late % R.L.</i>	<i>Plant Height</i>	<i>Ear Height</i>	<i>Green Snap (count)</i>
59	Pioneer P1498	220.9	106.7	23.0	9.8	54.6	1.0	0.0	248	120	0
56	Pioneer 31D58	220.4	106.4	25.3	9.0	54.4	1.5	6.5	240	110	0
55	Pioneer P1151	219.0	105.7	23.9	9.3	54.5	0.9	0.5	238	110	0
60	Pioneer 31N27	217.4	105.0	25.7	8.7	55.5	0.5	9.2	245	113	0
6	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-002/MBS3520	211.0	101.9	23.0	9.3	54.0	3.3	1.9	253	120	0
58	MBS3520/MBS8814	208.6	100.7	24.3	8.7	50.9	0.0	1.0	243	113	8
35	Ki14:N4212-185-001/MBS3520 (GEMN-0319)	204.7	98.8	24.7	8.5	52.9	1.3	1.4	253	118	0
25	(GEMN-0210/GEMN-0192)-022-001/MBS3520	203.1	98.1	23.7	8.7	53.5	2.0	0.5	250	118	0
5	(GEMN-0097/(GEMN-0140/GEMN-0130))-002-001/MBS3520 (GEMN-0317)	202.9	98.0	22.5	9.2	53.6	3.7	0.5	263	130	0
22	(GEMN-0205/(GEMN-0140/GEMN-0097)-B-B-034-B)-034-001/MBS3520	200.0	96.6	21.1	9.6	54.0	0.0	0.0	240	105	0
1	((GEMN-0140/GEMN-0130)/GEMN-0097)-006-001/MBS3520	199.0	96.1	23.2	8.7	53.9	5.1	1.4	245	115	0
57	MBS2655/MBS9508	199.0	96.1	21.6	9.3	55.2	0.5	2.0	243	103	2
11	(GEMN-0097/TF-2-0-T3-P74-G121)-088-001/MBS3520	196.0	94.6	22.0	9.0	54.2	2.4	0.0	250	105	0
42	(GEMN-0097/TF-2-0-T3-P74-G121)-110-001/MBS3520	195.0	94.2	24.6	8.1	53.8	2.5	6.9	270	125	0
12	(GEMN-0097/TF-2-0-T3-P74-G121)-147-001/MBS3520 (GEMN-0318)	194.4	93.9	22.4	8.8	54.4	2.8	0.6	258	125	0
17	(GEMN-0205/(GEMN-0097/PHN46))-029-001/MBS3520	192.8	93.1	22.6	8.6	54.1	1.6	0.0	253	123	4
24	(GEMN-0210/GEMN-0192)-013-001/MBS3520	191.7	92.6	22.8	8.5	53.9	0.0	0.0	250	113	0
37	Ki14:N4212-204-001/MBS3520	191.7	92.6	22.6	8.6	51.9	0.0	3.1	253	118	0
23	(GEMN-0205/(GEMN-0140/GEMN-0097)-B-B-034-B)-038-001/MBS3520	189.8	91.6	23.0	8.4	54.0	0.0	0.5	238	95	0
54	Pioneer P0987	188.8	91.2	21.4	8.9	56.6	0.9	0.5	238	113	1
Number Locations		5		5	5	5	3	3	2	2	1
Mean		184.3		22.8	8.2	53.6	1.3	1.9	249	115	2
Non Check Mean		182.1		22.8	8.1	53.5	1.3	1.9	250	116	2
Check Means		207.1		23.3	9.0	54.3	0.8	2.1	240	110	2
CV		9.1		4.0	10.7	1.1	153.2	173.4	2.9	5.9	
Yield Range		177.5 - 220.9									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, and Atlantic in Iowa

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964203

Tester: MBS5562, MBS9451

		All Location Means									
Entry	Pedigree	Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
47	MBS3520/MBS8814	226.4	108.4	24.4	9.4	50.6	0.5	0.0	250	113	0
45	Pioneer 31D58	222.9	106.7	25.5	9.0	54.1	0.9	7.6	245	113	0
48	Pioneer P1498	219.8	105.2	22.5	10.0	55.5	1.9	4.0	238	110	0
44	Pioneer P1151	207.6	99.4	21.9	9.6	55.3	0.4	0.3	233	95	2
3	((LH195/KO679Y)/GEMS-0227)-019-002/MBS9451	207.0	99.1	23.3	9.1	53.5	1.7	2.6	258	110	2
37	((GEMS-0227/Ki14)/12)-097-001/MBS5562	204.2	97.8	21.3	9.7	54.5	2.8	8.0	235	108	0
35	((GEMS-0227/Ki14)/12)-080-001/MBS5562 (GEMS-0314)	201.9	96.6	20.6	10.0	54.7	0.5	1.9	253	113	0
1	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS9451 (GEMS-0315)	200.3	95.9	21.2	9.5	51.8	1.5	0.0	240	108	3
8	((LH195/KO679Y)/794)-002-002/MBS5562	197.2	94.4	20.2	9.8	54.7	0.0	0.4	243	113	0
43	Pioneer P0987	196.7	94.2	21.2	9.4	56.8	1.6	2.1	240	113	0
33	((GEMS-0227/Ki14)/12)-056-001/MBS5562	194.4	93.1	21.0	9.4	54.6	0.5	0.0	230	108	0
24	((GEMS-0227/Ki14)/12)-006-001/MBS5562	194.3	93.0	21.5	9.1	55.0	0.9	3.6	235	103	0
31	((GEMS-0227/Ki14)/12)-044-001/MBS5562	194.3	93.0	22.3	8.7	55.0	0.9	0.7	233	103	0
18	(GEMS-0227/CUBA164:T26aS41-B-040-B)-030-001/MBS5562	193.3	92.5	20.6	9.5	55.0	0.9	1.4	240	98	0
2	(GEMS-0227/(Mp717/GEMS-0002)-001-001-001-001)-SIB-025-001/MBS9451	193.2	92.5	20.6	9.5	55.4	0.0	0.0	253	118	0
22	((GEMS-0227/Ki14)/12)-001-001/MBS5562	192.3	92.1	20.0	9.7	54.6	2.5	1.9	243	113	0
46	MBS2655/MBS9508	191.2	91.5	21.5	8.9	56.1	1.0	0.8	248	110	14
27	((GEMS-0227/Ki14)/12)-025-001/MBS5562	189.6	90.8	21.1	9.1	55.0	0.0	1.1	243	113	0
32	((GEMS-0227/Ki14)/12)-049-001/MBS5562	188.4	90.2	21.2	8.9	55.3	0.5	4.9	245	113	0
34	((GEMS-0227/Ki14)/12)-073-001/MBS5562	188.3	90.1	19.6	9.7	55.4	1.7	0.0	240	108	0
Number Locations		7		7	7	7	3	4	2	2	1
Mean		187.6		21.3	8.9	54.8	1.1	3.0	240	108	1
Non Check Mean		185.0		21.1	8.8	54.9	1.1	3.2	240	107	0
Check Means		208.9		22.9	9.3	54.6	0.9	2.2	243	109	3
CV		9.5		4.0	10.7	1.4	206.1	178.5	3.3	6.0	
Yield Range		165.2 - 226.4									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, Atlantic, and Keota in Iowa and Geneseo in Illinois

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964204

Tester: MBS5562, MBS9451

		All Location Means									
		Yield	% Yield	%	Yield/			Late %	Plant	Ear	Green
Entry	Pedigree	B/A	/CHK	Moist	Moist	TWT	% S.L.	R.L.	Height	Height	Snap (count)
59	Pioneer P1498	220.6	107.0	23.1	9.8	55.8	0.9	0.0	248	103	0
55	Pioneer 31D58	216.7	105.1	25.0	9.1	55.9	2.3	5.2	263	107	0
60	Pioneer 31N27	214.2	103.9	24.8	9.1	55.8	0.5	5.7	252	109	0
53	Pioneer P0987	208.2	101.0	21.2	9.9	57.4	0.5	0.4	246	148	0
57	MBS3520/MBS8814	207.9	100.8	24.1	9.0	52.6	1.0	0.0	268	117	2
39	((KO679Y/GEMS-0030)/12)-033-001//MBS5562	203.3	98.6	22.0	9.4	55.5	2.7	12.6	253	119	0
31	((GEMS-0147/GEMS-0227)/GEMS-0219)-021-001//MBS5562	202.4	98.2	20.6	10.1	55.5	0.9	3.1	250	115	0
54	Pioneer P1151	202.0	98.0	22.0	9.4	55.8	0.0	1.2	238	88	0
58	MBS2655/MBS5562	201.3	97.6	20.7	9.9	55.4	0.0	1.7	255	110	0
47	((KO679Y/GEMS-0030)/12)-090-001//MBS5562 (GEMS-0316)	199.5	96.8	21.5	9.4	55.4	1.0	0.7	259	114	0
21	(GEMS-0227/GEMS-0189)-098-001/MBS5562	199.0	96.5	20.2	10.0	56.5	0.5	4.9	258	107	0
2	((DJ7/CML373)/GEMS-0162)-079-001/MBS9451	198.9	96.5	22.4	9.0	55.6	0.5	2.0	263	114	0
26	(GEMS-0227/GEMS-0189)-183-001/MBS5562	198.8	96.4	19.6	10.3	57.2	1.4	1.1	256	105	0
34	((KO679Y/GEMS-0030)/12)-006-001//MBS5562	198.8	96.4	21.8	9.3	56.6	2.2	20.6	238	122	0
1	((DJ7/CML373)/GEMS-0162)-035-002/MBS9451	198.1	96.1	23.9	8.6	53.5	0.0	7.1	267	119	0
8	((GEMS-0182/GEMS-0227)/GEMS-0219)-045-001/MBS5562	197.2	95.6	20.1	10.0	57.3	1.5	5.3	265	116	0
9	(GEMS-0219/(GEMS-0182/GEMS-0227))-002-001/MBS5562	196.4	95.2	21.3	9.4	55.4	0.9	0.0	263	119	0
4	((GEMS-0182/GEMS-0227)/GEMS-0219)-019-001/MBS5562	196.3	95.2	20.2	9.8	55.5	0.5	2.4	248	111	0
56	MBS2655/MBS9508	196.3	95.2	22.5	9.1	56.0	0.0	0.4	247	93	5
18	(GEMS-0227/GEMS-0189)-063-002/MBS5562	195.9	95.0	20.8	9.5	56.0	2.8	2.2	248	109	0
Number Locations		8		8	8	7	3	4	3	3	1
Mean		191.2		21.0	9.3	56.1	1.0	4.2	252	112	0
Non Check Mean		189.9		20.8	9.3	56.1	1.0	4.5	252	112	0
Check Means		206.2		22.9	9.3	55.5	0.8	1.4	253	111	1
CV		10.6		5.9	11.4	1.5	165.3	156.0	5.2	10.2	
Yield Range		172.5 - 220.6									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, Atlantic, and Keota in Iowa; Arlington in Nebraska; and Capron in Illinois

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964205

Tester: MBS5562

		All Location Means									
		Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
Entry	Pedigree										
48	Pioneer P1498	230.6	105.6	22.2	10.4	55.1	0.0	2.3	235	105	0
44	Pioneer P1151	230.2	105.5	21.1	11.0	54.4	1.0	0.5	225	93	0
47	MBS3520/MBS8814	228.3	104.6	22.7	10.2	51.2	1.4	0.0	255	120	2
30	((GEMS-0162/PHP38)/GEMS-0227)-111-001//MBS5562	223.0	102.2	20.7	11.0	53.3	0.0	2.3	240	108	0
45	Pioneer 31D58	222.8	102.1	22.9	9.8	55.1	0.5	6.8	243	110	1
18	((GEMS-0147/GEMS-0227)/PHP38)-006-001//MBS5562	216.8	99.3	21.2	10.3	54.8	0.5	5.9	230	108	0
11	(GEMS-0227/(GEMS-0162/PHP38))-016-002/MBS5562	209.7	96.1	19.5	10.8	55.6	1.4	1.0	228	103	0
46	MBS2655/MBS9508	209.1	95.8	21.0	10.0	55.3	0.0	0.9	243	110	0
19	((GEMS-0162/PHP38)/GEMS-0227)-007-002//MBS5562	208.8	95.6	18.7	11.3	54.6	0.9	1.4	225	103	1
33	((GEMS-0162/PHP38)/GEMS-0227)-135-001//MBS5562	207.2	94.9	19.6	10.7	55.0	0.0	1.9	230	100	0
14	(GEMS-0162/GEMS-0227)-040-001/MBS5562	206.9	94.8	19.7	10.5	55.0	0.5	2.6	238	113	0
4	((GEMS-0227/PHP38)/GEMS-0226)-025-001/MBS5562	204.3	93.6	19.9	10.4	55.8	0.5	2.2	233	103	0
34	((GEMS-0162/PHP38)/GEMS-0227)-138-001//MBS5562	203.0	93.0	19.2	10.6	55.6	1.0	6.5	235	103	0
15	(GEMS-0162/GEMS-0227)-042-001/MBS5562	202.2	92.6	19.9	10.2	56.0	0.0	3.9	223	95	0
43	Pioneer P0987	201.2	92.2	20.7	9.8	56.1	0.0	0.0	223	103	2
13	(GEMS-0162/GEMS-0227)-039-001/MBS5562	200.5	91.8	19.6	10.4	54.8	0.5	1.4	230	100	0
37	((GEMS-0162/PHP38)/GEMS-0227)-183-001//MBS5562	200.4	91.8	18.9	10.7	54.9	0.9	4.4	233	105	0
8	(GEMS-0226/(GEMS-0227/PHP38))-013-001/MBS5562	199.7	91.5	20.1	10.0	54.8	2.6	5.7	230	105	0
21	((GEMS-0162/PHP38)/GEMS-0227)-020-003//MBS5562	199.0	91.2	19.4	10.3	55.5	1.5	2.5	253	115	0
35	((GEMS-0162/PHP38)/GEMS-0227)-146-002//MBS5562	198.7	91.0	19.4	10.3	56.7	0.5	7.3	225	100	0
Number Locations		7		7	7	7	3	3	2	2	1
Mean		199.8		19.9	10.1	55.2	0.9	3.5	232	102	0
Non Check Mean		197.6		19.7	10.1	55.3	1.0	3.7	231	102	0
Check Means		218.3		21.7	10.2	54.4	0.6	1.6	238	107	1
CV		8.2		3.5	9.4	1.4	154.6	170.7	3.1	5.5	
Yield Range		174.4 - 230.6									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, Atlantic, Keota, and Keota in Iowa

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964206

Tester: MBS8731

		All Location Means									
Entry	Pedigree	Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
56	Pioneer 31D58	218.1	111.7	23.5	9.9	55.7	1.1	0.0	245	115	0
40	(GEMS-0226/(GEMS-0182/GEMS-0227))-002-001//MBS8731	212.6	108.9	22.4	9.8	51.3	0.8	0.0	245	120	3
49	((GEMS-0227/Ki14)/12)-044-001//MBS8731	211.1	108.1	25.1	8.6	52.3	0.0	0.0	238	110	0
37	(GEMS-0226/(GEMS-0227/PHP38))-013-001//MBS8731	210.3	107.7	24.7	8.8	52.5	0.4	0.4	250	115	0
58	MBS3520/MBS8814	209.8	107.5	22.7	9.4	51.5	0.0	0.0	250	118	1
20	(GEMS-0227/CUBA164:T26aS41-B-040-B)-002-001//MBS8731	207.9	106.5	22.4	9.4	52.6	1.7	0.0	248	110	0
44	((GEMS-0227/Ki14)/12)-006-001//MBS8731	207.5	106.3	23.3	9.1	53.1	1.1	2.8	248	115	0
10	(GEMS-0227/(Mp494/GEMS-0002)-001-002-001-001)-SIB-138-001/MBS8731 (GEMS-0315)	205.9	105.5	22.3	9.6	52.3	0.4	1.4	238	108	0
51	((GEMS-0227/Ki14)/12)-080-001//MBS8731 (GEMS-0314)	205.7	105.4	23.0	9.2	52.6	1.1	1.1	253	120	0
13	((GEMS-0227/Ki14)/12)-049-001/MBS8731	204.1	104.6	23.8	9.0	52.1	0.4	0.0	245	115	6
59	Pioneer P1498	203.9	104.5	21.5	9.7	54.8	1.0	0.0	238	113	0
22	(GEMS-0227/CUBA164:T26aS41-B-040-B)-029-001//MBS8731	202.8	103.9	22.3	9.4	52.5	0.0	0.4	235	110	0
26	((GEMS-0227/PHP38)/GEMS-0226)-023-002//MBS8731	202.3	103.6	23.9	8.7	53.8	0.4	0.8	230	100	0
42	((GEMS-0227/Ki14)/12)-001-001//MBS8731	201.6	103.3	23.2	8.9	52.8	0.0	0.0	250	118	0
14	((GEMS-0227/Ki14)/12)-056-001/MBS8731	199.6	102.3	23.5	8.8	52.4	0.0	0.7	248	113	0
45	((GEMS-0227/Ki14)/12)-020-001//MBS8731	199.4	102.2	22.2	9.3	52.5	0.4	3.2	238	108	8
23	(GEMS-0227/CUBA164:T26aS41-B-040-B)-030-001//MBS8731	199.2	102.0	23.3	8.8	53.4	0.0	6.6	250	110	1
35	(GEMS-0219/(GEMS-0162/GEMS-0226))-023-002//MBS8731	198.6	101.7	23.5	8.8	53.9	0.0	7.1	255	118	0
43	((GEMS-0227/Ki14)/12)-002-001//MBS8731	198.2	101.5	24.6	8.3	52.6	0.7	1.9	243	115	0
3	(GEMS-0227/(GEMS-0162/PHP38))-016-002/MBS8731	197.8	101.3	22.9	8.9	52.8	0.0	0.4	240	110	7
Number Locations		8		8	8	7	4	4	2	2	1
Mean		191.7		22.9	8.6	53.4	0.4	1.3	244	113	3
Non Check Mean		191.4		23.0	8.6	53.2	0.4	1.3	244	113	3
Check Means		195.2		21.9	9.3	54.8	0.6	1.1	242	111	3
CV		10.2		4.8	12.1	1.4	290.6	253.3	2.6	5.4	
Yield Range		135.0 - 218.1									

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, and Atlantic in Iowa; and Elberfeld, Oaktown, and Farmersburg in Indiana

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964207

Tester: MBS8731

		All Location Means									
Entry	Pedigree	Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
55	Pioneer 31D58	222.9	109.8	22.7	10.1	55.7	1.5	1.6	245	115	0
43	((GEMS-0162/PHP38)/GEMS-0227)-206-001//MBS8731 (GEMS-0313)	216.8	106.8	21.5	10.4	55.9	0.5	0.7	243	108	1
58	Pioneer P1498	216.3	106.6	21.6	10.4	55.7	1.3	0.3	240	105	0
21	((GEMS-0162/PHP38)/GEMS-0227)-190-002/MBS8731	215.2	106.0	21.7	10.2	55.3	0.0	0.4	238	105	4
6	((GEMS-0162/PHP38)/GEMS-0227)-029-002/MBS8731	214.7	105.8	21.9	10.0	54.7	0.5	0.4	240	105	0
50	((KO679Y/GEMS-0030)/12)-033-001//MBS8731	214.7	105.8	21.8	10.1	54.5	1.0	0.8	240	110	0
22	((LH195/KO679Y)/794)-002-002/MBS8731	214.5	105.7	21.9	10.2	52.0	0.0	1.9	250	113	1
37	((KO679Y/GEMS-0030)/12)-090-001/MBS8731 (GEMS-0316)	213.7	105.3	22.8	9.5	53.1	0.0	1.4	243	113	0
60	MBS3520/MBS8731	212.6	104.7	21.5	10.3	52.4	0.5	0.0	250	110	3
2	((GEMS-0162/PHP38)/GEMS-0227)-007-002/MBS8731	212.0	104.4	20.9	10.4	54.7	1.0	0.0	238	103	0
57	MBS3520/MBS8814	211.8	104.3	22.2	10.0	51.9	0.0	0.0	245	118	1
9	((GEMS-0162/PHP38)/GEMS-0227)-061-002/MBS8731	211.7	104.3	22.1	9.9	53.2	0.0	2.5	255	113	1
13	((GEMS-0162/PHP38)/GEMS-0227)-111-001/MBS8731	211.5	104.2	23.2	9.3	53.0	0.0	0.4	238	103	0
44	((GEMS-0162/PHP38)/GEMS-0227)-234-001//MBS8731	211.3	104.1	21.1	10.3	55.0	1.0	0.0	245	110	0
1	(GEMS-0227/PHP38)-037-002/MBS8731	211.2	104.0	21.4	10.2	54.4	0.0	0.0	248	108	0
46	((GEMS-0162/PHP38)/GEMS-0227)-261-001//MBS8731	210.4	103.6	21.7	9.8	54.6	0.0	1.2	240	105	0
16	((GEMS-0162/PHP38)/GEMS-0227)-135-001/MBS8731	209.8	103.3	21.1	10.2	54.7	0.9	0.0	238	105	0
24	(KO679Y/GEMS-0227)-007-002/MBS8731	209.5	103.2	22.0	10.0	52.6	0.0	0.0	240	108	5
3	((GEMS-0162/PHP38)/GEMS-0227)-014-002/MBS8731	209.4	103.2	21.9	9.8	54.0	0.5	0.0	240	100	1
36	((KO679Y/GEMS-0030)/12)-087-001/MBS8731	209.3	103.1	21.9	9.9	54.1	0.9	1.7	240	110	0
Number Locations		8		8	8	8	3	4	2	2	1
Mean		203.3		21.9	9.5	54.5	0.5	1.5	243	109	1
Non Check Mean		203.3		22.0	9.5	54.4	0.5	1.4	243	109	1
Check Means		203.0		21.2	9.8	55.4	0.5	2.0	243	113	1
CV		7.4		4.3	8.9	1.4	181.0	198.7	2.5	4.4	
Yield Range											

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, and Atlantic in Iowa; Elberfeld in Indiana; and Ridgeway and Ridgeway in Illinois

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964208

Tester: MBS8731, TR6828

		All Location Means									
<i>Entry</i>	<i>Pedigree</i>	<i>Yield B/A</i>	<i>% Yield /CHK</i>	<i>% Moist</i>	<i>Yield/ Moist</i>	<i>TWT</i>	<i>% S.L.</i>	<i>Late % R.L.</i>	<i>Plant Height</i>	<i>Ear Height</i>	<i>Green Snap (count)</i>
48	Pioneer P1498	216.6	109.8	22.4	9.9	55.2	0.9	1.8	233	108	0
22	((GEMS-0182/GEMS-0227)/GEMS-0219)-031-001//MBS8731	212.8	107.9	21.2	10.2	53.4	0.5	1.0	243	115	0
16	((GEMS-0147/GEMS-0227)/PHP38)-006-001/MBS8731	209.9	106.4	23.9	9.1	53.5	0.5	10.4	243	118	0
44	Pioneer 31D58	207.7	105.3	22.9	9.3	55.1	2.0	2.7	250	118	0
47	MBS3520/MBS8731	207.6	105.3	21.9	9.8	51.4	0.0	0.9	243	115	6
30	(GEMS-0227/GEMS-0189)-079-001//MBS8731	207.5	105.2	19.7	10.7	54.9	0.8	0.0	253	110	1
25	(GEMS-0227/GEMS-0189)-027-001//MBS8731	207.0	105.0	21.9	9.6	53.5	0.9	0.0	253	113	0
18	(GEMS-0162/GEMS-0227)-042-001/MBS8731	206.0	104.5	21.6	9.7	53.7	0.5	0.5	245	105	2
12	((GEMS-0147/GEMS-0227)/GEMS-0219)-021-001/MBS8731	204.3	103.6	21.2	10.0	54.1	1.5	3.8	255	118	5
10	((GEMS-0147/GEMS-0227)/GEMS-0219)-019-001/MBS8731	204.1	103.5	21.4	9.7	54.9	0.0	0.0	240	105	7
14	((GEMS-0147/GEMS-0227)/PHP38)-002-001/MBS8731	203.3	103.1	22.2	9.4	53.2	0.0	1.0	245	105	0
20	((GEMS-0182/GEMS-0227)/GEMS-0219)-019-001//MBS8731	202.9	102.9	21.3	9.8	52.1	0.5	4.6	253	118	1
37	(GEMS-0227/GEMS-0189)-183-001//MBS8731	202.1	102.5	20.8	9.9	53.9	0.0	0.0	253	113	0
46	MBS3520/MBS8814	201.1	102.0	22.6	9.2	51.0	0.5	6.9	255	125	0
33	(GEMS-0227/GEMS-0189)-119-001//MBS8731	200.7	101.8	22.0	9.4	53.4	0.0	0.0	235	100	7
31	(GEMS-0227/GEMS-0189)-089-001//MBS8731	199.9	101.4	21.0	9.8	54.4	1.0	2.3	248	113	0
43	Pioneer P1151	199.9	101.4	20.7	9.8	55.0	1.0	0.0	235	100	0
15	((GEMS-0147/GEMS-0227)/PHP38)-002-002/MBS8731	199.6	101.2	22.1	9.3	53.8	1.0	1.0	235	103	0
23	((GEMS-0182/GEMS-0227)/GEMS-0219)-042-001//MBS8731	199.2	101.0	19.8	10.1	54.8	1.8	1.5	255	120	1
3	((GEMS-0162/PHP38)/GEMS-0227)-206-001/TR6828 (GEMS-0313)	198.4	100.6	21.4	9.4	56.3	1.6	0.0	245	115	0
Number Locations		8		8	8	7	3	3	2	2	1
Mean		195.3		21.8	9.2	54.1	0.7	2.4	245	112	2
Non Check Mean		195.1		21.8	9.2	54.0	0.7	2.4	245	111	2
Check Means		197.2		21.7	9.3	54.7	1.0	2.2	245	115	1
CV		9.0		5.4	10.6	1.7	155.3	213.3	5.3	5.3	
Yield Range											

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, and Atlantic in Iowa; Ridgeway in Illinois; Oaktown in Indiana; and Jackson in Tennessee

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964301

Tester: Various

		All Location Means									
Entry	Pedigree	Yield B/A	% Yield /CHK	% Moist	Yield/ Moist	TWT	% S.L.	Late % R.L.	Plant Height	Ear Height	Green Snap (count)
37	(GEMS-0219/GEMS-0227)-B-015-001-B//MBS8657	223.0	109.5	23.8	9.5	53.5	1.4	1.8	245	115	0
58	Pioneer 31D58	221.1	108.6	25.2	8.9	54.5	0.9	0.0	245	115	0
38	(H8431/((GEMS-0115/Mp717)/TZAR101))-SIB-B-005-001-B//MBS8657	220.3	108.2	21.1	10.6	52.7	0.8	12.5	250	125	0
60	MBS3520/MBS8814	215.1	105.6	24.3	9.1	50.8	1.4	0.0	250	113	2
41	(GEMS-0147/GEMS-0115)-B-002-001-001-001-SIB//MBS9530	211.2	103.7	23.7	9.1	53.1	0.0	0.5	258	125	0
42	(GEMS-0147/GEMS-0180)-B-033-001-001-002-SIB//MBS9530	208.8	102.6	24.1	8.9	52.5	1.4	3.4	248	110	5
7	GEMS-0288/MBS9451	207.3	101.8	23.0	9.1	52.1	1.8	0.0	248	108	0
46	(GEMS-0115/GEMS-0222)-B-B-033-001-B//MBS9530	202.6	99.5	22.3	9.2	54.2	2.3	0.0	243	115	0
36	(GEMS-0115/GEMS-0222)-B-B-033-001-001-SIB//MBS8657	202.0	99.2	22.4	9.2	54.4	3.2	4.2	253	135	1
39	NS1:S(GEMS-0149)41-051-001-001-B/MBS8657	199.8	98.1	24.5	8.3	54.0	0.9	5.3	253	123	1
34	(GEMS-0219/GEMS-0227)-B-015-001-B//MBS6445	199.6	98.0	23.0	8.9	53.0	2.2	0.0	250	118	0
10	GEMS-0290/MBS9451	198.9	97.7	23.5	8.6	52.3	0.9	1.3	253	118	0
49	NS1:S(GEMS-0149)41-051-001-001-B/MBS9530	198.4	97.4	26.4	7.6	52.7	0.0	2.4	248	128	0
59	MBS2655/MBS9508	198.3	97.4	21.9	9.1	55.9	0.5	2.0	253	128	3
32	(GEMS-0115/GEMS-0222)-B-B-033-001-001-SIB//MBS6445	197.6	97.1	21.9	9.1	54.0	3.8	1.4	255	130	0
9	GEMS-0291/MBS9451	197.4	97.0	22.2	8.9	53.6	5.2	6.3	250	120	0
35	NS1:S(GEMS-0149)41-051-001-001-B/MBS6445	197.2	96.9	25.5	7.8	54.6	0.0	2.3	245	133	10
51	(GEMS-0115/GEMS-0222)-B-B-033-001-B//MBS9451	196.0	96.3	22.3	8.9	53.2	1.0	0.0	253	128	0
18	(GEMS-0147/GEMS-0180)-B-033-001-001-002-SIB//MBS5562	195.7	96.1	21.6	9.1	54.0	0.0	11.7	248	115	0
57	Pioneer P1151	195.7	96.1	22.4	8.8	55.4	0.0	0.0	178	98	0
Number Locations		7		7	7	7	3	3	2	2	1
Mean		190.5		22.5	8.6	54.0	1.3	3.1	244	115	1
Non Check Mean		189.2		22.4	8.6	53.9	1.4	3.4	245	116	1
Check Means		203.6		23.1	8.9	54.7	0.7	0.4	231	111	1
CV		9.5		4.4	11.0	1.6	139.5	204.3	4.7	6.1	
Yield Range											

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, Atlantic, and Keota in Iowa; and Geneseo in Illinois

2019 GEM Ames Yield Trial Top Twenty Entries

Experiment: GEM 1964302

Tester: Various

		All Location Means									
<i>Entry</i>	<i>Pedigree</i>	<i>Yield B/A</i>	<i>% Yield /CHK</i>	<i>% Moist</i>	<i>Yield/ Moist</i>	<i>TWT</i>	<i>% S.L.</i>	<i>Late % R.L.</i>	<i>Plant Height</i>	<i>Ear Height</i>	<i>Green Snap (count)</i>
27	(GEMS-0147/GEMS-0180)-B-033-001-001-002-SIB//MBS8731	216.3	112.4	24.4	9.1	52.2	2.2	1.0	250	118	0
50	(GEMS-0147/GEMS-0180)-B-033-001-001-002-SIB//MBS6858	214.7	111.5	24.5	9.1	52.1	1.5	5.1	260	130	0
38	NEI9008:N0826(GEMN-0155)-B-095-B-B/TR7438	212.1	110.2	22.1	9.8	55.0	2.2	17.7	250	125	0
60	Pioneer P1498	204.3	106.1	22.5	9.3	55.2	0.4	0.9	230	100	0
25	NS1:S0852-B-054-B-B/MBS8731	201.6	104.7	22.6	9.1	52.9	1.4	5.1	238	115	2
9	(GEMS-0147/GEMS-0180)-B-104-001-B-B//MBS5562	201.4	104.6	22.6	9.1	54.1	0.5	6.4	233	113	0
5	GEMS-0297/MBS6858	201.3	104.6	22.8	9.2	53.6	2.3	8.6	258	123	0
24	NS1:S0852-B-021-B-B/MBS8731	200.2	104.0	25.1	8.5	50.2	4.9	11.2	245	120	3
57	Pioneer 31D58	199.9	103.8	24.0	8.7	54.7	1.4	1.9	250	113	0
3	GEMS-0305/MBS8731	198.9	103.3	23.8	8.5	53.2	1.5	0.0	248	113	2
28	Ki21:S(DJ7)(GEMS-0115)-B-051-002-002-SIB/MBS8731	198.3	103.0	25.7	8.0	51.1	1.4	6.5	255	125	0
43	(GEMS-0113/GEMS-0162)-B-B-054-001-B//MBS6780	197.6	102.6	22.8	8.9	55.8	1.5	8.0	250	120	0
49	(GEMS-0147/GEMS-0115)-B-002-001-001-001-SIB//MBS6858	197.1	102.4	24.3	8.5	51.5	0.9	16.7	268	135	0
59	MBS3520/MBS8814	196.6	102.1	23.3	8.8	51.3	0.5	0.0	248	120	1
35	(GEMN-0140/GEMN-0097)-B-B-026-B-B//TR7438	194.4	101.0	21.2	9.5	52.7	0.5	3.8	245	113	0
45	(GEMS-0219/GEMS-0227)-B-015-001-B//MBS6780	193.8	100.7	23.9	8.3	53.9	0.0	0.0	233	105	0
40	(GEMS-0147/GEMS-0115)-B-002-001-001-001-SIB//MBS6780	193.6	100.6	24.9	8.2	51.7	0.5	2.9	250	125	0
56	Pioneer P1151	193.4	100.5	21.3	9.3	55.7	1.3	0.0	230	103	0
19	NEI9008:N0826(GEMN-0155)-B-095-B-B/MBS3520	192.9	100.2	23.3	8.7	52.8	2.0	0.0	270	130	0
46	(H8431/((GEMS-0115/Mp717)/TZAR101))-SIB-B-005-001-B//MBS6780	192.9	100.2	22.2	9.1	52.7	1.4	9.5	250	135	0
Number Locations		7		7	7	7	3	3	2	2	1
Mean		186.4		23.5	8.3	53.3	1.4	6.4	246	118	1
Non Check Mean		185.8		23.6	8.2	53.2	1.4	6.9	247	118	1
Check Means		192.5		22.3	8.9	54.9	0.8	1.0	240	111	1
CV		11.0		5.4	12.5	1.8	150.5	152.2	3.2	5.2	
Yield Range											

* All trial data will be posted on the website

** Locations: Ames, Crawfordsville, Keystone, Carroll, and Atlantic in Iowa; and Ridgeway and Geneseo in Illinois

