Table S1. Families and individuals used in this experiment.

					F1 parentage	
new designation based on generation	**Designation**	**Generation**	**Designation-name**	**Previous Generation maternal parentage**	**maternal parent**	**paternal parent**
MNPS_IM_SEL_7	370	IM3F1	JA215D 7-5	JA215D for all generations	JA15	HA89
MNPS_IM_SEL_20	412	IM3F1	JA206D 3-10	JA206D for all generations	JA6	HA89
MNPS_IM_SEL_4	339	IM3F1	JA213A 6-5	JA213A for all generations	JA13	HA89
MNPS_IM_SEL_27	440	IM3F1	JA312E 11-15	JA312E for all generations	JA12	HA434
MNPS_IM_SEL_12	388	IM3F1	JA207E 4-6	JA207E for all generations	JA7	HA89
MNPS_IM_SEL_16	401	IM3F1	CMS210B 2-3	CMS210B for all generations	CMS HA 89	JA10
MNPS_IM_SEL_29	448	IM3F1	JA216B 7-8	JA216B for all generations	JA16	HA89
MNPS_IM_SEL_22	419	IM3F1	JA204A 3-4	JA204A for all generations	JA4	HA89
MNPS_IM_SEL_8	371	IM3F1	JA215D 7-5	JA215D for all generations	JA15	HA89
MNPS_IM_SEL_2	330	IM3F1	JA 211 A 5-16	JA211A for all generations	JA11	HA89
MNPS_IM_SEL_14	394	IM3F1	JA2-2B 3-3	JA2 for all generations	JAJA2	HA89
MNPS_IM_SEL_9	383	IM3F1	JA207C 4-5	JA207C for all generations	JA07	HA89
MNPS_ROS_SEL1	JA213_A 6-5.3	IM2F1	JA213A	JA213A for all generations	JA13	HA89
MNPS_ROS_SEL2	JA_207C 4.5	IM2F1	JA207C	JA207C for all generations	JA7	HA89
MNPS_ROS_SEL3	JA213_E 6-9	IM2F1	JA213E	JA213E for all generations	JA13	HA89
MNPS_ROS_SEL4	JA211B5	IM2F1	JA211B	JA211B for all generations	JA11	HA89
MNPS_ROS_SEL5	94e.1	IM2F1	JA 217 F	JA for all generations	JA17	HA89
MNPS_ROS_SEL6	JA210A5 _11.2	IM2F1	JA210A	JA210A for all generations	JA10	HA89
MNPS_ROS_SEL7	96.a.1	IM2F1	JA 217 H	JA217 for all generations	JA17	HA89
MNPS_IM_SEL_1	325	IM3F1	JA308A 10-16	JA308A for all generations	JA8	HA434
MNPS_ROS_SEL8	93	IM3F1	JA 217 E	JA217 for all generations	JA17	HA89
MNPS_ROS_SEL9	JA211F5 _11.6	IM2F1	JA211F	JA211F for all generations	JA11	HA89
MNPS_ROS_SEL10	JA212_E 5_11.2	IM2F1	JA212E	JA212E for all generations	JA12	HA89
MNPS_IM_SEL_21	415	IM3F1	JA205D 3-10	JA205D for all generations	JA5	HA89
MNPS_IM_SEL_15	395	IM3F1	JA213D 6-8	JA213D for all generations	JA13	HA89
MNPS_IM_POP2	7	IM2F1	CMS 212B, CMS 218B	population for all generations	HA89	Population 1
MNPS_IM_POP6	15	IM2F1	JA 208B, JA 208D	population for all generations	Population 2	HA89
MNPS_IM_POP1	5	IM2F1	CMS208A, CMS 208B, CMS 208C, CMS 208D, CMS 208E	population for all generations	HA89	Population 3
MNPS_IM_4	12	IM2F1	CMS208 A	CMS210B for all generations	CMS HA89	JA10
MNPS_IM_39	156	IM2F1	JA314 A	JA314A for all generations	JA14	HA434

MNPS_IM_11	25	IM2F1	CMS208 B	CMS208B for all generations	HA89	JA8
MNPS_IM_1	3	IM2F1	CMS201 C	CMS201C for all generations	HA89	JA1
MNPS_IM_19	63	IM2F1	JA212 H	JA212H for all generations	JA12	HA89
MNPS_IM_21	75	IM2F1	JA214 G	JA214G for all generations	JA14	HA89
MNPS_IM_10	23	IM2F1	CMS218 B	CMS218B for all generations	HA89	JA18
MNPS_ROS_SEL11	JA_314_AC-21	IM2F1	JA314A	JA314A for all generations	JA14	HA434
MNPS_IM_1	3	IM1F1	CMS201C	CMS201C for all generations	HA89	JA01
MNPS_IM_2	7	IM1F1	CMS205B	CMS205B for all generations	HA89	JA05
MNPS_IM_3	8	IM1F1	CMS205C	CMS205C for all generations	HA89	JA05
MNPS_IM_4	12	IM1F1	CMS208A	CMS208A for all generations	HA89	JA08
MNPS_IM_5	13	IM1F1	CMS208B	CMS208B for all generations	HA89	JA08
MNPS_IM_6	14	IM1F1	CMS208C	CMS208C for all generations	HA89	JA08
MNPS_IM_7	15	IM1F1	CMS208D	CMS200D for all generations	HA89	JA08
MNPS_IM_8	17	IM1F1	CMS209A	CMS209A for all generations	HA89	JA09
MNPS_IM_9	21	IM1F1	CMS212B	CMS212B for all generations	HA89	JA12
MNPS_IM_10	23	IM1F1	CMS218B	CMS218B for all generations	HA89	JA18
MNPS_IM_11	25	IM1F1	JA201A	JA201A for all generations	JA01	HA89
MNPS_IM_12	29	IM1F1	JA201E	JA201E for all generations	JA01	HA89
MNPS_IM_13	31	IM1F1	JA201H	JA201H for all generations	JA01	HA89
MNPS_IM_14	35	IM1F1	JA205D	JA205D for all generations	JA05	HA89
MNPS_IM_15	38	IM1F1	JA206C	JA206C for all generations	JA06	HA89
MNPS_IM_16	40	IM1F1	JA206E	JA206E for all generations	JA06	HA89
MNPS_IM_17	41	IM1F1	JA206G	JA206G for all generations	JA06	HA89
MNPS_IM_18	54	IM1F1	JA211B	JA211B for all generations	JA11	HA89
MNPS_IM_19	63	IM1F1	JA212H	JA212H for all generations	JA12	HA89
MNPS_IM_20	74	IM1F1	JA214E	JA214E for all generations	JA14	HA89
MNPS_IM_21	75	IM1F1	JA214G	JA214G for all generations	JA14	HA89
MNPS_IM_22	77	IM1F1	JA215B	JA215B for all generations	JA15	HA89
MNPS_IM_23	79	IM1F1	JA215D	JA215D for all generations	JA15	HA89
MNPS_IM_24	90	IM1F1	JA217B	JA217B for all generations	JA17	HA89
MNPS_IM_25	91	IM1F1	JA217C	JA217C for all generations	JA17	HA89
MNPS_IM_26	93	IM1F1	JA217E	JA217E for all generations	JA17	HA89

MNPS_IM_27	94	IM1F1	JA217F	JA217F for all generations	JA17	HA89
MNPS_IM_28	96	IM1F1	JA217H	JA217H for all generations	JA17	HA89
MNPS_IM_29	101	IM1F1	JA218E	JA218E for all generations	JA18	HA89
MNPS_IM_30	114	IM1F1	JA305A	JA305A for all generations	JA05	HA434
MNPS_IM_31	121	IM1F1	JA306E	JA306E for all generations	JA06	HA434
MNPS_IM_32	129	IM1F1	JA307F	JA307F for all generations	JA07	HA434
MNPS_IM_33	139	IM1F1	JA309C	JA309C for all generations	JA09	HA434
MNPS_IM_34	140	IM1F1	JA309D	JA309D for all generations	JA09	HA434
MNPS_IM_35	142	IM1F1	JA309F	JA309F for all generations	JA09	HA434
MNPS_IM_36	143	IM1F1	JA309G	JA309G for all generations	JA09	HA434
MNPS_IM_37	148	IM1F1	JA312B	JA312B for all generations	JA12	HA434
MNPS_IM_38	151	IM1F1	JA312E	JA312E for all generations	JA12	HA434
MNPS_IM_39	156	IM1F1	JA314A	JA314A for all generations	JA14	HA434
MNPS_IM_40	164	IM1F1	JA315C	JA315C for all generations	JA15	HA434
MNPS_IM_41	173	IM1F1	JA317A	JA317A for all generations	JA17	HA434
MNPS_IM_42	185	IM1F1	JA318F	JA318F for all generations	JA18	HA434
MNPS_IM_POP1	5	IM1F1-bulk	CMS 208A, CMS 208B, CMS 208C, CMS 208D, CMS 208E	population for all generations	HA89	Population 1
MNPS_IM_POP2	7	IM1F1-bulk	CMS 212B, CMS 218B	population for all generations	HA89	Population 2
MNPS_IM_POP3	9	IM1F1-bulk	JA 201A, JA 201B, JA 201C, JA 201D, JA 201E, JA 201F, JA 201H	population for all generations	Population 3	HA89
MNPS_IM_POP4	10	IM1F1-bulk	JA 202A, JA 202B	population for all generations	Population 4	HA89
MNPS_IM_POP5	13	IM1F1-bulk	JA 206 A, JA 206B, JA 206C, JA 206D, JA 206E, JA 206G, JA 206H	population for all generations	Population 5	HA89
MNPS_IM_POP6	15	IM1F1-bulk	JA 208B, JA 208D	population for all generations	Population 6	HA89
MNPS_IM_POP7	23	IM1F1-bulk	JA 216A, JA 216B, JA 216C, JA 216D, JA 216E, JA 216F, JA 216G	population for all generations	Population 7	HA89
MNPS_IM_POP8	37	IM1F1-bulk	JA 313 A, JA 313 B	population for all generations	Population 8	HA434
MNPS_IM_SEL_1	325	IM2F1	JA308A 10-16	JA308A for all generations	JA08	HA434
MNPS_IM_SEL_2	330	IM2F1	JA 211 A 5-16	JA211A for all generations	JA11	HA89
MNPS_IM_SEL_3	338	IM2F1	JA213A 6-5	JA213A for all generations	JA13	HA89
MNPS_IM_SEL_4	339	IM2F1	JA213A 6-5	JA213A for all generations	JA13	HA89
MNPS_IM_SEL_5	368	IM2F1	JA213A 6-5	JA213A for all generations	JA13	HA89
MNPS_IM_SEL_6	369	IM2F1	JA213B 6-9	JA213A for all generations	JA13	HA89
MNPS_IM_SEL_7	370	IM2F1	JA215D 7-5	JA215A for all generations	JA15	HA89
MNPS_IM_SEL_8	371	IM2F1	JA215D 7-5	JA215A for all generations	JA15	HA89

MNPS_IM_SEL_9	383	IM2F1	JA207C 4-5	JA207A for all generations	JA07	HA89
MNPS_IM_SEL_10	385	IM2F1	JA308A 10-14	JA308A for all generations	JA08	HA434
MNPS_IM_SEL_11	387	IM2F1	JA211A 5-13	JA211A for all generations	JA11	HA89
MNPS_IM_SEL_12	388	IM2F1	JA207E 4-6	JA207A for all generations	JA11	HA89
MNPS_IM_SEL_13	390	IM2F1	JA205C 3-11	JA205A for all generations	JA07	HA89
MNPS_IM_SEL_14	394	IM2F1	JA2-2B 3-3	JA2A for all generations	JA-5	HA89
MNPS_IM_SEL_15	395	IM2F1	JA213D 6-8	JA213A for all generations	JA-2	HA89
MNPS_IM_SEL_16	401	IM2F1	CMS210B 2-3	JA210A for all generations	HA89	JA13
MNPS_IM_SEL_17	408	IM2F1	JA201F 2-17	JA201A for all generations	JA01	HA89
MNPS_IM_SEL_18	409	IM2F1	JA201F 2-17	JA201A for all generations	JA01	HA89
MNPS_IM_SEL_19	411	IM2F1	JA206D 3-10	JA206A for all generations	JA06	HA89
MNPS_IM_SEL_20	412	IM2F1	JA206D 3-10	JA206A for all generations	JA06	HA89
MNPS_IM_SEL_21	415	IM2F1	JA205D 3-10	JA205A for all generations	JA05	HA89
MNPS_IM_SEL_22	419	IM2F1	JA204A 3-4	JA204A for all generations	JA04	HA89
MNPS_IM_SEL_23	421	IM2F1	JA316B 12-11	JA316A for all generations	JA16	HA434
MNPS_IM_SEL_24	429	IM2F1	318F 15-11	JA318A for all generations	JA18	HA434
MNPS_IM_SEL_25	430	IM2F1	JA316B 12-11	JA316A for all generations	JA16	HA434
MNPS_IM_SEL_26	433	IM2F1	JA308A 10-7	JA308A for all generations	JA08	HA434
MNPS_IM_SEL_27	440	IM2F1	JA312E 11-15	JA312A for all generations	JA12	HA434
MNPS_IM_SEL_28	447	IM2F1	JA206E 1-7	JA206A for all generations	JA06	HA89
MNPS_IM_SEL_29	448	IM2F1	JA216B 7-8	JA216A for all generations	JA16	HA89

*Population 1 is composed of full sib individuals with that are descended from JA8 and CMS HA89

*Population 2 is composed of half sib individuals with that are descended from JA12, JA18, and CMS HA89

*Population 3 is composed of full sib individuals with that are descended from JA1 and HA89

*Population 4 is composed of full sib individuals with that are descended from JA2 and HA89

*Population 5 is composed of full sib individuals with that are descended from JA6 and HA89

*Population 6 is composed of full sib individuals with that are descended from JA8 and HA89

*Population 7 is composed of full sib individuals with that are descended from JA16 and HA89

*Population 3 is composed of full sib individuals with that are descended from JA13 and HA434

Table S2. Heritability estimates from BLUP and Kantar et al., 2014

Trait	BLUP heritability	Kantar et al., 2014
Average Head Diameter	0.74	0.67
Largest Head Diameter	0.58	0.48
Seeds Per Head	0.23	0.31
Seed Weight	0.05	0.16
Individual seed weight	0.43	0.22

Figure S1. BLUP plotted vs line means with confidence intervals and prediction intervals A) Average Head Diameter B) Largest Head Diameter, and C) Seed Per Head. The interior set of blue lines represents a 95% prediction interval and the outer set of red lines represents a 95% confidence interval. The breeding populations that are included are the initial wild parents, F_1 plants, IM_1F_1 plants, and IM_2F_1 plants.

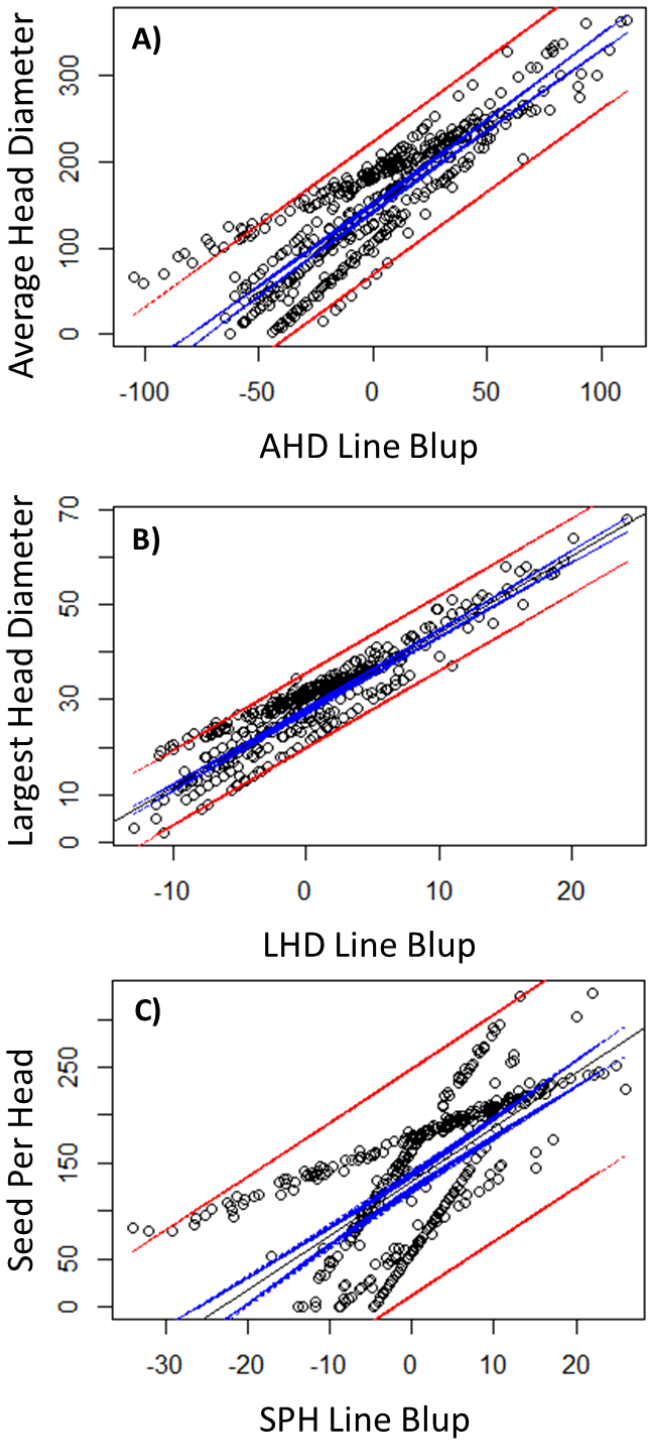

Figure S2. A) Sequencing depth across individuals, with red line indicating the median sequence coverage. Red line is the median number of sequences per line. B) Reads within interspecific Hybrid 101B, a small number of sequences take up a disproportionate number of the reads.