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Eberhart and Russell approach genotype by environment interaction (GEI) for yield and yield component traits in *Vigna radiata* L. Wilczek genotypes

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Abstract
Present study was carried out to identify stable mungbean genotype across various environments as the performance of each genotype tends to vary when grown in different seasons. Forty homozygous genotypes were tester over three season *viz*., *kharif* 2019, spring summer 2020 and summer 2020. Eberhart and Russell model of stability analysis was carried out which revealed significant effect of each environment on the genotypes, for all the ten agro-morphological traits except for number of branches per plant. Genotypes KM2355, LG544, and RMG1087 was found promising with stable performance across the three season; while the genotype KM2328 was identified as stable genotype under less favourable conditions. Finally, the genotypes, IPM147-1, NM159 and KM2312 were recognized as stable genotype under favourable conditions.

Keywords: Stability, mungbean, kharif, spring summer, summer

Introduction
Mungbean (*Vigna radiata* L.) is an important short-duration grain legume, well suited to small holder production under adverse climatic conditions. It is an important grain legume crop grown in India and has its origin from Indian region. Genotype × Environment (GE) interaction is most commonly used statistical analysis for the evaluation of genotypes for yield performance over multi-environments for selection of stable genotypes. Adaptability of the genotype to perform well over diverse environmental condition is a requirement for the present era (Abheysiriwardena *et al.*, 1991) [2]. Genotypes with low G×E interaction and high yield are desirable for crop breeders as well as farmers, because it indicate that the environments have less effect on the performance of genotypes and yield is greatly contributed by genetic component (Linnemann *et al.*, 1995) [3]. The objectives of the present study were to investigate the performance and consistency of forty homozygous greengram genotypes for eleven agro-morphological traits over different mungbean growing seasons of Uttar Pradesh, India using Eberhart and Russell model. Eberhart and Russell (1966) stated that a desirable cultivar should have an average yield performance that is higher under favorable conditions and less fluctuating under unfavorable conditions than that of the group of cultivars when tested in many environments.

Material and Methods
Forty genotypes of greengram were evaluated in randomized block design (RBD) with three replications. Field trials were conducted during *Kharif* 2018, *spring summer* 2019 and *summer* 2020 at Research farm, C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India representing three different growing seasons of greengram. Each genotype was sown in plot with three lines planted with spacing of 30 × 10cm. All the recommended package of practices was followed for raising healthy crop in all the three seasons. Data was collected from five randomly selected plants from each genotype per replication. The data was recorded for eleven agro-morphological traits – days to 50percent flowering, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, pod length, 100-seed weight, harvest index, seed yield per plant, days to maturity and protein content. Replicated data were analyzed as individual season-wise followed by pooled analysis. Further the data were subjected to stability analysis by Eberhart and Russell (1966) model as per the standard method, using R software package *stability* (Yassen *et al.*, 2018).

Results and Discussion

Analysis of variance for Eberhart and Russell model revealed due to genotype were significant ($p< 0.05$) for most of the traits under study, except for plant height, number of branches per plant, and harvest index; indicating the presence of considerable genotypic variability among the genotypes. Combined environment and genotype × environment interaction component of variance when tested against pooled error mean sum of squares was non-significant for all the eleven traits under study. Hence, further partitioning of combined environment and genotype × environment variance into linear and non-linear components showed that environment linear was also non-significant for all the characters. Genotype × environment (linear) was significant for days to 50percent flowering, number of branches per plant and pod length; while remaining traits was non-significant. However, pooled deviation (non-linear component) when tested against pooled error was significant for days to 50percent flowering, plant height, number of branches per plant, number of pods per plant, pod length, 100-seed weight, harvest index, days to maturity and protein content; while non-significant for number of seeds per pod and seed yield per plant (Table 1). Similar works were done by Mondal *et al*. (2011) [8] and Singh *et al*., (2014) [7].

Mean performance, regression (b_i) and squared deviation (S^2d_i) for eleven agro-morphological traits are presented in the Table 2. It is interesting to note that none of the homozygous lines was stable for all the characters. Forty homozygous genotypes with higher/lower mean values than grand mean were divided into four groups based on stability parameters *viz.*, regression coefficient and squared deviation, according to the methodology followed by Mehra and Ramanujam (1979) [4] and Singh and Singh (1980) [5] (Table 3). Genotypes falling in group I have desirable mean, regression coefficient value around one with non-significant squared deviation. Under group II, genotypes with significantly less than unity regression value and non-significant squared deviation are taken, indicating suitability towards unfavourable environments. Again, the genotypes with significantly more than unity regression is also classified under group II indicating its suitability towards favourable environments. Finally, genotypes falling in group III and group IV cannot be predicted as they exhibit significant squared deviation, irrespective of the regression coefficient values.

According to the grouping (Table 3), the genotypes KM2355, RMG1087, KM2260, MH1115, KM2364 and LGG544 were found stable for most of the traits under study. Under group II (b_i<1), the genotype KM2328 is found to be stable for days to 50percent flowering, number of branches per plant and protein content, perform better under unfavourable conditions. Genotype IPM147-1 and KM2312 were found to give stable performance during unfavourable conditions for seed yield per plant (Figure 1). The genotype NM159 placed under group II (b_i>1) and is stable in favourable conditions for number of branches per plant, and pod length; while the genotype RMG1092 is stable in favourable conditions for the trait seed yield per plant. These results are in line with the reports of Raturi *et al*., (2012) [9] and Singh *et al* (2014) [7].

Considering the overall performance, genotypes KM2355, LG544, and RMG1087 was found promising with stable performance and may be used for general cultivation across the mungbean growing seasons.

Table 1: Analysis of variance for Eberhart and Russell model

Traits	df	Days to 50 percent flowering	Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Pod length	100-Seed weight	Harvest index	Seed yield per plant	Days to maturity	Protein content
Genotype	39	88.36***	8.721	0.3479	30.892*	1.717**	3.18***	0.2202*	5.30	5.4786***	80.504***	1.788***
Environment	2	2979.25***	202.814*	0.6234	178.388**	170.685***	938.48***	6.006***	3614.6***	33.213*	138.167***	59.700***
G × E	78	48.94***	54.657***	1.4064***	48.199***	2.365***	8.10***	0.448***	17.4***	2.628**	56.625***	1.543***
E + (G × E)	80	40.73	19.454	0.4623	17.151	2.191	10.45	0.1956	35.79	1.1310	19.554	0.999
Env (Linear)	1	1986.17	135.210	0.4156	118.925	113.790	625.65	4.0037	2409.74	22.1423	92.112	39.800
G × E (Linear)	39	27.10***	7.594	0.6291*	16.205	0.841	4.64***	0.1657	7.11	0.9191	21.803	0.590
Pooled Deviation	40	5.39***	28.124***	0.3008***	15.529***	0.717	0.74**	0.1295***	4.40***	0.8124	15.548***	0.428**
Pooled Error	240	2.90	3.459	0.0554	6.179	0.448	0.43	0.0655	1.16	0.5793	6.493	0.245

Table 2: Stability parameters for eleven morphological traits across environments

Genotype	Days to 50percent flowering			Plant height			Number of branches per plant		
	bi	S^2d_i	Pooled	*bi*	S^2d_i	Pooled	*bi*	S^2d_i	Pooled
KM 2241	0.5790	1.3536	32.5000	1.0742	43.3169***	34.3405	1.3487	0.5606***	3.1830
KM 2352	0.4825	0.9400	31.0000	0.8528	23.4314***	34.9313	-11.9149	0.0504	3.3517
PDM 139	0.1771	0.6090	32.8333	1.2166	16.6302*	34.7782	-9.6119	0.3095*	3.1598
PM 1125	-0.1839	3.8627	31.0833	0.6532	44.1317***	34.2735	-10.3977	0.2696*	3.1442
KM 2342	0.3139	1.6068	32.0000	0.8647	26.9728***	34.7787	-4.2044	0.4709***	3.1171
KM 2328	0.2492*	0.0832	31.8333	1.1073	3.8651	35.2148	-15.8147*	0.0018	3.3661
SML 1811	0.3860	0.6016	32.0000	1.2311	26.4186***	33.3046	-10.7597	0.2210*	3.4977
IPM 147	0.3536*	0.0818	31.4167	0.9123	16.9954*	35.4991	-10.5217	0.7298***	3.2490
IPM 147-1	0.3860	0.6016	32.5000	0.3892	12.1784	35.7282	-5.8526	0.0577	3.5038
KM 2360	0.4587	2.4287	31.7500	0.4693	12.0968	35.5884	-8.3065	0.1958	3.2400
KM 2348	0.3378	0.4606	30.7500	1.4544	20.5129*	33.4490	-6.6710	0.9381***	3.1498
IPM 02-3	0.4825	0.9400	31.0000	1.2872	27.5493***	33.9106	-8.7655	0.0781	3.2381
PUSA 1671	0.5790	1.3536	32.5000	1.2521	47.7507***	35.1130	-1.4228	0.4588***	3.0408
KM 2368	0.1448*	0.0846	30.2500	1.9195	6.5355	35.4034	-4.2386	0.0057	3.1163
KM 2362	0.2577	1.8685	29.6667	0.7933	17.1393*	33.8095	5.0134	0.5523***	2.0720

KM 2364	0.1930*	0.1504	30.5000	1.1299	34.3872***	34.4555	-2.7369	0.1050	3.4486
PM 1126	0.2895	0.3384	34.0000	1.5235	13.5309*	35.0207	2.6166	0.0009	2.7478
KM 2355	0.1521	1.3928	29.5833	1.4756	22.5574*	33.8502	-3.7056	0.1882	3.5169
MH 1142	0.6034	3.4199	29.0000	-1.8712	22.4933*	34.5463	-6.0304	0.3859***	2.4522
VBG 2	0.8420	5.7577	40.5555	3.5089	9.9659	32.7311	6.7874	0.8314***	2.9302
MH 1115	2.2054	8.5664	40.8889	1.0226	1.0063	29.8453	10.2763	0.2143	2.9674
NM 115	2.0075	5.4474	41.3333	1.8916	51.0361***	34.9063	9.0663	0.6641***	3.0119
NM 159	1.9277	1.4904	41.0000	1.8263	36.6117***	36.9858	8.7064*	0.0002	2.6656
LGG 544	0.8942	0.3707	39.4444	4.7102	2.5706	30.5986	5.0425	0.4514***	3.1241
SML 1623	1.8641*	0.1222	44.0000	2.5645	9.4543	36.1844	8.4316	0.0094	2.4222
BM 4	1.9749	10.5523	42.0000	0.7434	25.4605***	37.3830	2.2639	0.0047	2.6131
SML 1681	1.2192	18.8571*	41.6667	3.8827	11.4730	32.0678	6.8390*	0.0004	2.6585
IPM 312	1.7396	6.7046	41.2222	0.1905	24.5672***	38.2223	9.2805	0.1137	3.0688
IPM 501	1.3998	16.6989*	40.6667	-0.4874	19.9874*	32.6519	7.5248	0.0551	2.5338
IPM 512	2.0091	1.1350	42.3333	0.7238	8.0285	37.9984	4.0667	0.4492***	3.1242
PDM 11	2.2623	18.1716*	42.4445	1.1990	56.3890***	35.5076	9.6509	0.0408	2.5094
KM 2252	1.3357	52.1504***	40.5556	-1.0247	101.4012***	34.3891	11.1843	0.2875*	3.2420
KM 2260	2.1964	0.5391	44.1111	-1.5791	3.9966	35.0779	7.3566	0.2995*	2.8951
KM 2268	1.5742	1.1707	41.6667	-0.7262	0.4428	36.1293	4.9683	0.0658	2.7963
KM 2272	2.1842	5.7762	43.3334	1.3866	22.1176*	35.3179	1.8048	0.2632*	2.9166
RMG 1087	1.0376	10.8396	41.4445	-0.9437	70.4765***	35.5511	5.3334	0.0173	2.4468
KM 2310	1.0815	0.8835	43.8889	-1.8355	21.5598*	34.3581	9.2979	0.1656	2.6786
KM 2312	1.2900	3.2205	41.2222	3.9628	38.2136***	35.6934	7.6367	1.3530***	3.0593
RMG 1092	1.4324	25.0090**	44.0000	2.4362	13.0985	35.4436	9.2647	0.7814***	2.9558
KM 2320	1.2802	0.0278	39.7778	-1.1875	158.5972***	32.5300	7.1936	0.3860***	3.1678
Mean	36.8431			34.6892			2.9846		

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Genotype	100-seed weight			Harvest index			Seed yield per plant		
	bi	S^2d_i	**Pooled**	***bi***	S^2d_i	**Pooled**	***bi***	S^2d_i	**Pooled**
KM 2241	-0.0340	0.0265	2.4291	0.3280	0.5527	31.9449	0.5920	0.2140	6.2921
KM 2352	0.3155	0.5668***	2.8078	0.3813*	0.0103	35.0133	0.6088	0.0366	8.7111
PDM 139	1.0238	0.2486	2.7521	1.1431	5.8069*	35.3036	0.5673	0.0070	7.5062
PM 1125	-1.5917	0.0490	3.1715	1.4465	1.1448	32.9459	0.4850	0.0009	8.1128
KM 2342	2.2335	0.1632	2.8583	1.1122	19.4504***	33.4207	0.7296	0.0009	7.4767
KM 2328	1.0023	0.3605*	3.1534	1.2926	0.1496	35.0790	-2.7608	0.2077	8.4121
SML 1811	-1.3288	0.0043	2.5293	1.2698	0.2718	35.9263	-2.1875	0.1805	8.7473
IPM 147	-0.3851***	0.0000	2.5344	0.8966	15.3749***	35.4691	0.7803	0.0053	8.4755
IPM 147-1	2.9524	0.3960*	3.0572	0.8654	15.9233***	34.4092	-0.8694*	0.0026	7.9107
KM 2360	0.3780	0.0669	3.0582	0.8903	16.8072***	36.8407	0.6447	0.0687	8.3143
KM 2348	-0.6970	0.0510	2.8517	1.1196	15.6758***	34.5619	1.2442	2.3161*	4.5372
IPM 02-3	-0.1458*	0.0002	2.9439	1.2693	12.4538***	34.6981	1.2338	2.1718	4.8424
PUSA 1671	-1.5246	0.0095	3.2936	1.2515	13.9076***	34.4325	0.8543	0.0028	5.5607
KM 2368	1.5227	0.1565	2.9326	1.4023*	0.0139	34.1368	1.0501	2.9667*	4.8835
KM 2362	1.4756	0.2171	3.0444	0.5532	7.5349*	32.1304	1.2387	1.2149	5.0131
KM 2364	-0.1222	0.1369	3.1173	1.0573	4.2996	32.5110	1.1521	1.5456	4.8873
PM 1126	2.3751	0.6304***	3.0928	0.8408	0.3097	35.6402	0.4309	0.0223	7.6772
KM 2355	1.4263	0.2121	2.9238	0.0682	0.6693	34.3907	0.0671	0.1858	5.5227
MH 1142	0.6917	0.0081	2.2574	0.2170***	0.0000	29.8312	0.8401	0.0025	6.6536
VBG 2	2.1803***	0.0000	3.0131	0.6646	2.9282	32.9029	1.2840	1.0329	4.9936
MH 1115	2.5178	0.0102	2.9310	0.9085	1.0980	32.9973	3.1742	0.3381	5.6720
NM 115	2.8000	0.0341	3.3879	1.2409	7.1694*	33.3856	0.6290	0.1180	4.8572
NM 159	0.6261	0.2622*	3.3435	1.1362	0.0366	34.5444	2.1920	0.6563	5.7621
LGG 544	1.4645	0.0017	3.3144	1.1013	0.9528	33.7789	0.0370	0.4401	5.3453
SML 1623	0.7904	0.0031	3.1843	1.3377	0.2866	34.5255	-0.4610	2.4727*	4.9112
BM 4	0.7056	0.1661	3.0379	1.4530***	0.0004	35.3023	0.7849	1.1055	5.4618
SML 1681	0.1342	0.0029	3.2287	1.0505	1.3049	35.5238	2.0261	0.2677	6.0500
IPM 312	0.5309	0.0366	3.1896	0.9089	7.7340*	34.5317	1.7703	0.1785	5.8824
IPM 501	1.3260	0.1901	3.1697	1.1774	5.0547*	35.1738	3.1117	0.0590	5.4373
IPM 512	3.6448	0.1433	3.4596	1.3409*	0.0370	35.0678	-0.1503	1.9994	4.0500
PDM 11	0.2116	0.0064	2.9986	1.2536	0.0286	35.5427	1.7832	0.0293	5.2888
KM 2252	-0.1886	0.0322	2.8835	1.2926	0.0362	34.6007	2.2849	0.0518	7.1747
KM 2260	1.8904	0.0172	3.3727	1.3622*	0.0084	34.3947	0.3976	1.7772	4.8878
KM 2268	1.5989	0.5387***	3.0968	1.0091	1.6330	33.4546	2.2853	1.2495	5.5417
KM 2272	0.8702	0.0282	3.1833	1.3226	0.3565	34.1346	1.4453	1.0548	5.5005
RMG 1087	1.4501	0.0003	2.8399	0.8907	3.2656	34.7133	2.8860	0.1668	6.0159
KM 2310	2.7616*	0.0015	3.4584	0.6027	0.6267	34.4367	3.3396	0.0782	6.8590
KM 2312	1.3113	0.2811*	3.2896	0.8763	0.7440	32.4405	0.0478*	0.0018	4.1993

RMG 1092	3.4904	0.0507	3.1264	0.7927	1.4607	32.9211	1.8806*	0.0005	5.8099
KM 2320	0.3159	0.0693	3.0403	0.8724	10.8769***	32.7509	2.5505	8.2645***	6.7378
Mean	3.0340			34.1452			6.1494		

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Genotype	Days to maturity			Protein content		
	bi	S^2d_i	Pooled	*bi*	S^2d_i	Pooled
KM 2241	-3.3827	57.3121***	71.7563	0.3269	0.1975	21.1304
KM 2352	-1.3714	0.4210	78.2072	0.7640	0.0166	22.2651
PDM 139	-3.0294*	0.1662	74.5082	-0.4274	0.1508	20.3361
PM 1125	-2.5894	2.9254	67.7741	0.2557*	0.0006	21.3188
KM 2342	-2.1313	0.2245	74.4998	1.1803	0.0086	21.4824
KM 2328	-0.5925	0.1163	71.5714	0.6943	0.0073	21.8841
SML 1811	-1.9360	0.2755	68.5381	0.0896	0.0402	22.2559
IPM 147	-1.8263	0.3756	69.6982	1.5961	0.3618	22.6127
IPM 147-1	-1.2583	0.2289	74.7453	1.4810	0.0405	23.0820
KM 2360	-3.5438	8.4457	70.0295	1.6883	0.5370	22.1246
KM 2348	-0.8476	0.7321	72.7642	3.4167	0.7847	22.7163
IPM 02-3	-0.2401	0.4871	66.7821	1.8188	1.3675*	23.9257
PUSA 1671	-4.6311	9.4334	69.9543	1.6403	3.0220***	22.9644
KM 2368	-1.1425	17.9160	66.9340	0.1183	0.3048	21.3786
KM 2362	1.1418	3.6670	68.0998	-0.4978	0.2849	23.9098
KM 2364	-0.1207	0.4418	71.9622	1.5053	0.2330	24.0974
PM 1126	-1.2122	21.8870	74.6056	-0.1659	1.0083*	23.4896
KM 2355	-0.9580	1.0509	69.9499	-0.0976	0.1119	21.8125
MH 1142	-0.7852	0.2631	75.3537	0.1568	4.3164***	22.2950
VBG 2	4.3962	33.4874*	65.1930	1.1027	0.0041	22.7483
MH 1115	5.6205	138.0391***	60.0710	1.7169	0.1668	23.1191
NM 115	-1.6707	21.6229	64.8549	1.5896	0.0895	22.6415
NM 159	2.9229	39.6985*	60.0679	1.0828	0.2644	22.6302
LGG 544	4.8291	2.8737	64.2841	1.3698	0.0177	22.1848
SML 1623	0.0356	31.2157*	61.6077	1.3148	0.0804	22.9551
BM 4	5.2642	52.2057***	62.1173	0.3827	0.3939	22.7657
SML 1681	4.3223	4.4489	62.3871	0.2932	0.7484	22.7026
IPM 312	3.1465	1.1498	58.7203	1.0461	0.0081	22.9764
IPM 501	1.7499	17.4409	65.7259	1.2078	0.0033	22.5955
IPM 512	2.5194	55.8462***	64.0191	1.0442	0.0465	22.6995
PDM 11	4.2492	6.6062	59.3323	1.2748	0.0211	23.1732
KM 2252	1.5066	7.0300	63.7990	1.1917	0.1321	22.6514
KM 2260	3.6420	13.1404	63.5662	1.5650	0.7916	22.5496
KM 2268	2.2056	0.2737	64.9693	0.4575***	0.0001	22.7791
KM 2272	1.2778	15.2793	66.3740	0.8456	0.0637	23.0541
RMG 1087	6.7546	9.2928	60.6366	1.5422	0.6877	23.7572
KM 2310	5.8885	27.6199*	62.4711	1.9826	0.0481	22.7915
KM 2312	5.7140	0.4984	61.2078	0.6759	0.5352	22.5747
RMG 1092	1.7635	1.5696	61.9250	1.6133	0.1995	22.2934
KM 2320	4.3191	16.2267	63.5748	1.1573	0.0039	23.0335
Mean	66.8660			22.5939		

Table 3: Grouping of mungbean homozygous genotypes based on stability parameters

Traits	Group I	Group II		Group III	Group IV
		(b_i<1)	**(b_i>1)**		
Days to 50 percent flowering	KM2241, KM2352, PDM139, PM1125, KM2342, SML1811, IPM 147-1, KM2360, KM2348, IPM02-3, PUSA 1671, KM2362, PM1126, KM2355, MH1142	KM2328, IPM147, KM2368, KM2364	SML1623	SML1681, IPM501, PDM11, KM2252, RMG1092	
Plant height	KM2328, IPM 147-1, KM2360, SML1623, IPM512, KM2260, KM2268, RMG1092	-	-	KM2241, KM2352, PDM139, PM1125, KM2342, SML1811, IPM 147, KM2348, IPM 02-3, PUSA1671, KM2362, KM2364, PM1126, KM2355, MH1142, NM115, NM159, BM4, IPM312, IPM501, PDM11, KM2252, KM2272, RMG 1087, KM2310, KM2312, KM2320	
Number of branches per plant	KM2352, IPM 147-1, KM2360, IPM 02-3, KM2368, KM2264, KM2355, IPM 312	KM2328	NM159 SML1681	KM2241, PDM139, PM1125, KM2342, SML1811, IPM147, KM2348, PUSA1671, KM2362, MH1142, VBG2, NM115, LGG544,	

				IPM512, KKM2252, KM2260, KM2272, KM2312, RMG1092, KM2320
Number of pods per plant	IPM 02-3, PUSA 1671, VBG2, MH1115, NM115, SML 1623, BM4, SML1681, IPM512, PDM11, KM2252, KM2260, KM2272, KM2310, RMG1092, KM2320	-	KM2362	PM1125, KM2328, SML1811, IPM 147-1, KM2360, NM159, IPM501, KM2268, KM2312
Number of seeds per pod	KM2352, SML1811, IPM147, KM2348, KM2364, MH1115, NM159, LGG544, SML1623, BM4, SML1681, IPM501, PDM11, KM2252, KM2260, RMG1087, RMG1092, KM2320	-	-	VBG2, IPM321, IPM512, KM2268
Pod length	VBG2, NM115, LGG544, SML1623, BM4, IPM501, PDM11, KM2252, KM2260, KM2268, KM2272, RMG1087, KM2310, RMG1092, KM2320	KM2241, PUSA1671 KM2362	MH1115 NM159	IPM 02-3, KM2368, SML1681, IPM312, IPM512, KM2312
100-Seed weight	PM1125, KM2360, PUSA1671, KM2362, KM2364, NM115, LGG544, SML1623, BM4, SML1681, IPM312, IPM501, IPM512, KM2260, KM2272, RMG1092, KM2320	IPM 147, IPM 02-3	VBG2 KM2310	KM2352, KM2328, IPM 147-1, PM1126, NM159, KM2268, KM2312
Harvest index	KM2328, SML1811, PM1126, KM2355, NM159, SML1623, SML1681, PDM11, KM2252, RMG1087 and KM2310	KM2352 MH1142	KM2368, BM4, IPM512 KM2260	PDM139, KM2342, IPM147, IPM 147-1, KM2360, KM2348, IPM 02-3, PUSA1671, KM2362, NM115, IPM312, IPM501, KM2320
Seed yield per plant	KM2241, KM2352, PDM139, PM1125, KM2342, KM2328, SML1811, IPM147, KM2360, PM1126, MH1142, KM2252, KM2310	IPM 147-1 KM2312	RMG1092	KM2348, KM2368, SML1623, KM2320
Days to maturity	IPM 02-3, NM115, LGG544, SML1681, IPM312, IPM501, PDM11, KM2252, KM2260, KM2268, KM2272, RMG1087, KM2312, RMG1092, KM2320	PDM139	-	KM2241, VBG2, MH1115, NM159, SML1623, BM4, IPM512, KM2310
Protein content	IPM 147, IPM 147-1, KM2348, KM2362, KM2364, VBG2, MH1115, NM115, NM159, SML1623, BM4, SML1681, IPM312, IPM501, IPM512, PDM11, KM2252, KM2272, RMG1087, KM2310, KM2320	PM1125 KM2268	-	IPM 02-3, PUSA1671, PM1126, MH1142

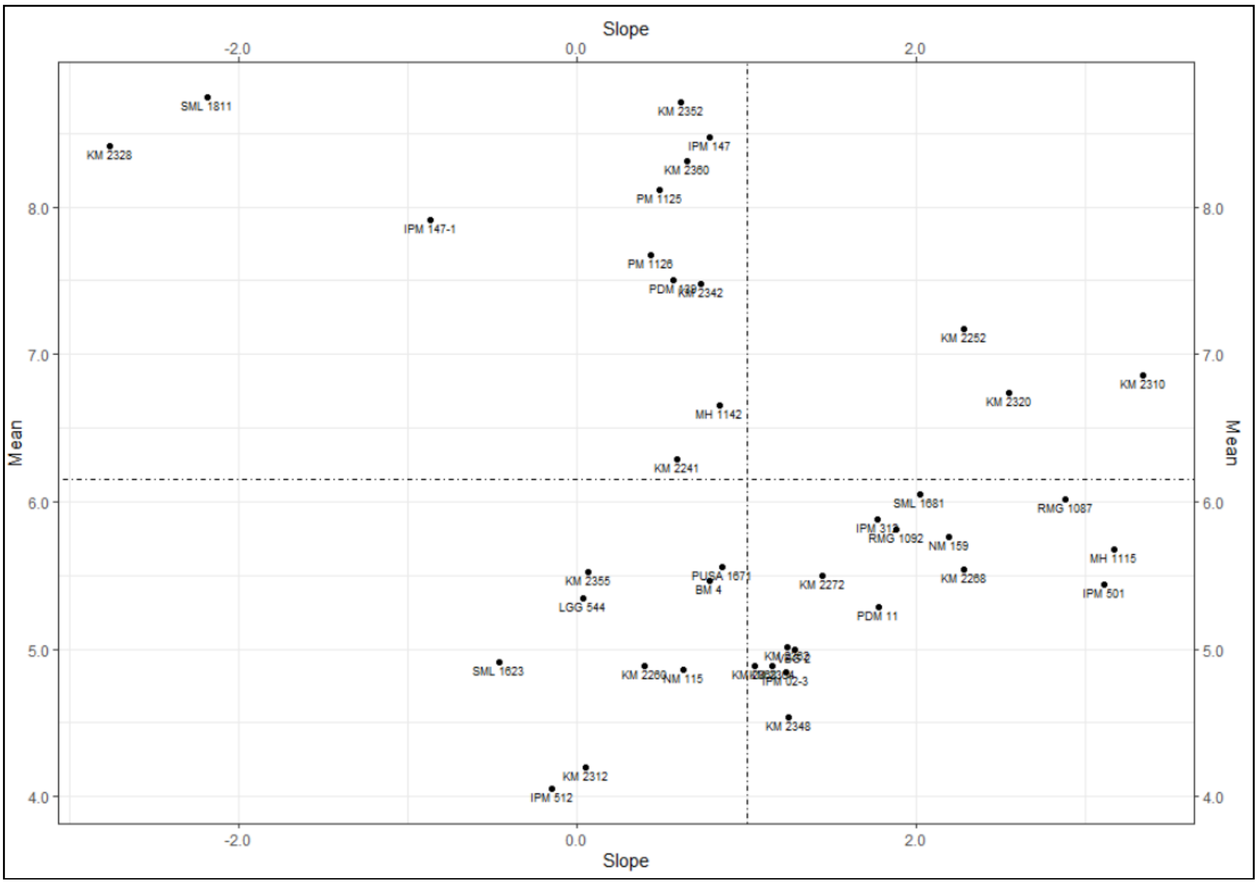

Fig 1: Regression coefficient vs. mean for seed yield per plant

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