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Trait association studies in soybean genotypes under post anthesis drought stress

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Abstract
The present study was carried out during kharif 2018 considering 30 soybean genotypes under both stress and normal condition. Analysis of variance, correlation and path coefficient analysis were studied. The analysis of variance under both stress and normal condition revealed that the mean sum of squares due to genotypes were highly significant for all traits under study. Correlation analysis revealed that seed yield per plant showed highly significant correlation with harvest index followed by number of seeds per plant, number of pods per plant, biological yield per plant, number of seeds per pod and number of pod clusters per plant under stress condition whereas under normal condition, seed yield per plant showed highest significant positive correlation with harvest index followed by biological yield per plant, number of seeds per plant, number of pod clusters per plant, number of pods per plant and 100 seed weight.
Path coefficient analysis of different yield traits under stress condition revealed that harvest index, biological yield, number of seeds per plant, days to 50% flowering recorded positive direct effect on seed yield per plant. These traits have also shown positive indirect effect via each other which indicated that simultaneous improvement of these traits and ultimately the yield can be achieved.
Whereas, path coefficient analysis of different yield traits under normal condition revealed that harvest index have shown high positive direct effect on seed yield per plant number of pod clusters per plant, days to flower initiation, biological yield per plant, number of seeds per plant, number of secondary branches per plant and 100seed weight showed positive direct effect on seed yield perplant. Days to flower initiation, number of pods clusters per plant, number of seeds per plant, biological yield and harvest index have also shown indirect effect via each other.

Keywords: Correlation, coefficient analysis, post anthesis drought stress, soybean

Introduction
Soybean [*Glycine max* (L.) Merrill], with its countless and varied uses, is an important crop at the global level. Soybean is nutritionally valuable for human and animal consumption as it contains 36.6 g of protein, 19.9 g of total fat, 30.2 g of carbohydrate, 9.3 g of dietary fiber and 15.7 mg of iron per 100 g of seeds. Besides improving the socio-economic conditions of small and marginal farmers of the country, the crop contributes 25 per cent of the total edible oil produced in the country and earns substantial amount of foreign exchange (INR 70 000 million) by exporting defatted oil cake (DOC) (Paroda, 1999; Bhatia *et al*., 2011) [18, 2]. Although, share of India in the world soybean area is 10 per cent, but its contribution is just only 4 per cent of the total world's production indicating its relatively low productivity as compared to world average (Bhatia *et al*., 2014) [3]. Due to rainfed nature, occurrence of severe drought conditions at one or the other stages of crop growth and development is the most important factor limiting soybean productivity in India (Joshi and Bhatia, 2003) [9]. Water stress is the major yield limiting factor for soybean yield enhancement under dry climate and water stress conditions Maleki *et al.* (2013) [14]. Drought stress, which usually occurs at pod filling stages, may cause significant yield losses, up to 40% in a bad year, and it deteriorates the seed quality of soybean (Manavalan *et al*., 2009) [15]. To improve soybean productivity is the need of the hour which can be achieved mainly by improving the drought tolerance.

Material and Methods
The experimental material comprised of 30 soybean genotypes procured from ICAR-IISR (Indian Institute of Soybean Research), Indore and JNKVV released varieties from Department of Plant Breeding and Genetics, JNKVV, Jabalpur.
Germplasm were raised in earthen pots at Botanical Gardenin a randomized block design at Glass House, Department of Plant Physiology, JNKVV, Jabalpur. During post flowering (7 days) and pod initiation stage (15 days), drought treatment was imposed by withholding

irrigation and shifting the pots inside the glass house. Sixteen traits including phenological and yield traits were recorded on the basis of three random competitive plants selected from each pot in each replication. The mean data of plants were subjected to genotypic correlations which were computed by following the procedure of Miller *et al.* (1958) [16] whereas path coefficient analysis was conducted according to Dewey and Lu (1959) [5].

Results and Discussion

Analysis of variance

Analysis of variance under stress condition (table no. 1) indicated that the mean sum of squares due to genotypes were highly significant for all traits under study except number of nodes per plant and number of seeds per pod which were found to be non-significant. There was low C.V. (0.29%) which belonged to days to maturity whereas, the highest C.V.(14.85) which belonged to number of primary branches per plant.

Analysis of variance under normal condition (table no. 2) indicated that the mean sum of squares due to genotypes were highly significant for all traits under study including number of nodes per plant and number of seeds per pod. Lowest C.V. belonged to days to maturity (0.31%) whereas, the highest C.V. was obtained for number of primary branches per plant (15.89%).

Table 1: Analysis of variance for yield traits in soybean genotypes under Stress condition

S.N.	Source of variation	d.f.	DFI	DFF	DM	PH at 30 days	PH at maturity	NNP	NPBP	NSBP	NPP	NPCP	NP Pods	NSP	BY	100 SW.	HI	SYP
1	Treatments	29	96.13**	60.17**	97.54**	166.10**	437.97**	12.34	5.77**	37.36**	422.46**	50.65**	1.11	2404.51**	39.00**	12.33**	87.67**	4.24**
2	Error	60	13.25	0.44	0.08	0.76	1.12	1.00	0.86	1.15	1.98	0.94	0.18	9.79	1.15	0.20	1.39	0.66
3	S.Em	-	2.06	0.37	0.16	0.49	0.60	0.56	0.52	0.61	0.80	0.55	0.07	1.77	0.61	0.25	0.66	0.14
4	CD 5%	-	4.13	0.75	0.33	0.99	1.20	1.13	1.05	1.22	1.60	1.10	0.15	3.55	1.22	0.51	1.33	0.29
5	CD 1%		5.49	1.00	0.44	1.32	1.60	1.51	1.40	1.62	2.12	1.46	0.20	4.27	1.62	0.68	1.78	0.38

Table 2: Analysis of variance for yield traits in soybean genotypes under Normal condition

S.N.	Source of variation	d.f.	DFI	DFF	DM	PH at 30 days	PH at maturity	NNP	NPBP	NSBP	NPP	NPCP	NP Pods	NSP	BY	100 SW.	HI	SYP
1	Treatments	29	68.71**	71.36**	99.4**	183.52**	659.44**	10.33**	7.80**	74.81**	1207.98**	122.47**	2.50**	3843.24**	143.62**	17.33**	117.53**	17.84**
2	Error	60	0.58	0.49	99.41	1.56	1.72	0.97	1.11	1.38	3.38	0.72	0.05	14.24	2.52	0.25	1.75	0.06
3	S.Em	-	0.43	0.40	0.17	0.70	0.74	0.56	0.59	0.66	1.04	0.48	0.13	2.14	0.90	0.28	0.75	0.14
4	CD 5%	-	0.86	0.80	0.35	1.41	1.49	1.12	1.19	1.33	2.09	0.96	0.27	4.28	1.80	0.57	1.50	0.28
5	CD 1%		1.15	1.06	0.47	1.88	1.98	1.49	1.59	1.77	2.77	1.28	0.36	5.69	2.40	0.76	2.00	0.37

Mean and Range

Under Stress condition (table no.3): Number of pods per plant ranged from AMS 59 (5.66) to 49.33 (TGX 852-3D) with mean value of 20.26. AMS 59 obtained the minimum number of seeds per plant (7.21), Whereas, TGX 852-3D had the maximum number (160.24) and the average obtained was 35.50. The average value of biological yield per plant was recorded as 18.39 ranging from 9.00 g (AMS 59) to 24.16 g (JS 21-17). 100 seed weight varied from 4.16 g (AMS 59) to 13.25 g (SQL 8) recording mean value as 8.40. Harvest Index had mean value of 16.66 ranging from 4.74 (AMS 19B) to 28.76 (TGX852-3D). The highest seed yield per plant was recorded by TGX 852-3D (5.96) and the lowest by AMS 19B (0.80 g) with mean value of 3.08 g.

Under Normal condition (table no. 4)

Number of pods per plant ranged from 14.00 (AGS 38, AMS 59 and AMS 19 B) to 102.00 (SQL 89) with mean value of 38.30. AMS 59 obtained the minimum number of seeds per plant (11.90), while SQL 89 had the maximum number (171.40). The average. Was obtained as 60.07. The average value of biological yield per plant was recorded as 25.18 g with extent of dispersion from 13.66 g (AMS 59) to 42.667 g (SQL 31). 100 seed weight varied from 4.26 g (AMS 59) to 15.71 g (SQL 8) recording mean value as 9.15. Harvest Index had mean value of 20.17 ranging from 8.54% (AMS 19B) to 33.21% (JS 21-72).Highest seed yield per plant was recorded by JS 21-72 (10.63 g) and the lowest by AMS 59 (1.33 g) with mean value of 5.27 g.

Table 3: Mean, Range and CV under Stress condition

S.N.	Traits	Mean	Range		CV (%)
			Min.	Max.	
1	DFI	39.11	25.83	50.66	9.30
2	DF50%	45.07	38.83	56.50	1.47
3	DM	99.53	89.16	109.83	0.29
4	PH at 30 days	27.32	15.16	42.50	3.20
5	PH at maturity	55.72	28.66	91.00	1.90
6	NNPP	8.57	4.00	14.00	11.65
7	NPBP	6.26	4.00	9.00	14.85
8	NSB	10.11	4.00	19.00	10.63
9	NPP	20.26	5.66	49.33	6.95
10	NPCP	7.22	2.66	16.00	13.45
11	NS/pod	1.76	1.03	3.25	7.67
12	NSP	35.50	7.21	160.24	8.81
13	BY	18.39	9.00	24.16	5.85
14	100 SW	8.40	4.16	13.25	5.40
15	HI	16.66	4.74	28.76	7.07
16	SYP	3.08	0.80	5.96	8.33

Table 4: Mean, range and CV of under Normal Condition

S. No.	Trait	Mean	Range		CV (%)
			Min.	Max.	
1	DFI	38.91	28.50	49.16	1.95
2	DF50%	44.22	37.50	55.16	1.59
3	DM	99.75	89.16	110.33	0.31
4	PH at 30 days	26.70	16.08	47.31	4.67
5	PH at maturity	53.96	29.25	81.33	2.43
6	NNPP	9.16	6.00	14.0	10.78
7	NPBP	6.63	3.00	10.33	15.89
8	NSB	12.7	6.00	24.00	9.27
9	NPP	38.30	14.00	102.00	4.80
10	NPCP	11.00	2.33	32.76	7.74
11	NS/pod	1.69	0.58	5.50	14.42
12	NSP	60.07	11.90	171.40	6.28
13	BY	25.18	13.66	42.66	6.31
14	100 SW	9.15	4.26	15.71	5.55
15	HI	20.17	8.54	33.21	6.57
16	SYP	5.27	1.33	10.63	4.70

Correlation analysis

Correlation coefficient of seed yield per plant was studied with different yield contributing traits (table no. 5). Seed yield per plant showed highly significant correlation with harvest index (0.856) followed by number of seeds per plant (0.720), number of pods per plant (0.572), biological yield per plant (0.557), number of seeds per pod (0.520) and number of pod clusters per plant (0.440) under stress condition. (Maleki *et al*. 2013, Badkul *et al*. 2014, Koraddi *et al*. 2015) [14, 1, 11], Mahbub *et al*. 2015) [13] while negatively correlated with days to maturity, number of primary branches per plant and number of secondary branches per plant.

Seed yield per plant showed highest significant positive correlation with harvest index (0.852) followed by biological yield per plant (0.777), number of seeds per plant (0.721), number of pod clusters per plant (0.650), number of pods per plant (0.644) and 100 seed weight (0.560) under normal condition. (Mishra *et al*. 2017, Ghanbari *et al*. 2018. Similar findings have been reported by Hang vu *et al*. (2019) [17, 6, 8] for total number of pods, total number of seeds and 100 seed weight, Mishra *et al*., (2017) [17]. Present findings revealed that by making selection and improvement for a particular trait simultaneous improvement in the associated trait (s) may be achieved. This suggested that these traits should be kept in mind provided the traits show high variability while selecting for improvement in seed yield.

Path coefficient analysis

Path coefficient analysis was carried out using seed yield per plant as a dependent variable. Path coefficient analysis of different yield traits under stress condition (table no. 6) on seed yield per plant revealed that harvest index (0.8438), biological yield (0.4761), number of seeds per plant (0.3132), days to 50% flowering (0.1443) depicted substantial positive direct effect on seed yield (Sirohi *et al*. 2007) [21]. Similar findings have been reported by Singh *et al*. (1983) [20], Machikowa and Laosuwan (2011) [12], Kobree and Shamsi (2011) [10], Salimi and Moradi (2012) [19], Malik *et al*. (2014), Mishra *et al*. (2017) [17]. These traits have also shown positive indirect effect via each other. It is concluded from the present study that selection for these traits could bring improvement in yield potential of future soybean genotypes.

Under normal condition Path coefficient analysis of different yield traits on seed yield per plant (table no. 7) revealed that harvest index (0.6461), number of pod clusters per plant (0.4894), days to flower initiation (0.4231), biological yield per plant (0.3087), number of seeds per plant (0.2217), number of secondary branches per plant (0.1619) and 100 seed weight (0.1285) depicted substantial positive direct effect on seed yield per plant. Similar findings have been reported by (Badkul *et al*. 2014, Chandel *et al*. 2014) [1, 4]. Days to flower initiation, number of pods clusters per plant, number of seeds per plant, biological yield and harvest index have also shown indirect effect via each other which indicated that simultaneous improvement of these traits and ultimately the yield can be achieved. It goes similar with the findings of Kobree and Shamsi (2011) [10] for number of pod per plant, indirect effect of pod/ plant on yield via the number of nodes per plant and number of seeds per plant, Salimi and Moradi (2012) [19] for numbers of seeds per plant. On the basis of correlation and path coefficient analyses it is observed that under stress and normal condition, all the economic traits have showed significant positive correlation with seed yield per plant. Plant height and phenological traits have shown negligible or negative correlation with seed yield. The study suggests that these traits should be given more emphasis while determining the breeding strategies for desirable yield improvement.

Table 5: Correlation analysis for yield traits in soybean genotypes under Stress and Normal condition

Traits	Condition	DFI	DF50%	DM	PH at 30 days	PH at maturity	NNPP	NPBP	NSBP	NPP	NPCP	NS/pod	NSPP	BY	100SW	HI	SYPP
DFI	S	1.0000	0.7048***	0.3074**	-0.0641	0.2867**	0.1737	0.1413	0.1633	0.2294*	0.1997	-0.0054	0.0851	0.3066**	-0.168	-0.0938	0.0715
	N	1.0000	0.8945***	0.4491***	-0.2107*	0.3536***	0.2273*	0.1832	0.1556	0.1593	0.0207	-0.2335*	-0.1407	0.1263	-0.2653*	-0.0245	0.0391
DF50%	S		1.0000	0.4367***	-.01966	0.3091**	0.1688	0.0682	0.0873	0.3363**	0.2878**	-0.0201	0.1108	0.4646***	-0.1034	-.0.0605	0.1682
	N		1.0000	0.5782***	-0.2902**	0.2846**	0.3154**	0.2667*	0.2070	0.2252*	0.1176	-0.1501	-0.0805	0.1465	-0.1722	0.0188	0.0500
DM	S			1.0000	-0.3071**	-0.0047	0.2515*	0.1991	0.3779***	0.1584	0.1625	-0.2749**	-0.0569	0.0688	-0.2058	-0.2032	-0.1466
	N			1.0000	-0.2271*	0.1301	0.3607***	0.0745	0.2336*	-0.0532	-0.0798	-0.2359*	-0.3116**	-0.0337	-0.2641*	-0.1893	-0.1614
PH at 30 days	S				1.0000	0.7356***	0.0162	-0.1346	0.0830	-0.0551	-0.0724	0.1502	0.1367	0.0854	-0.3135**	0.0093	0.1197
	N				1.00000	0.5371***	-0.0536	-0.0950	-0.0707	0.1136	0.0805	0.0285	0.2432*	-0.1887	-0.3994***	-0.0144	-0.0994
PH at maturity	S					1.0000	0.1739	-0.0194	0.2012	-0.0264	-0.0876	0.0537	-0.0256	0.1535	-0.3695***	-0.1353	00038
	N					1.0000	0.3888***	0.0759	0.2163*	0.0897	0.0095	-0.0950	0.0188	-0.1738	-0.5148***	-0.1092	-0.1606
NNPP	S						1.0000	0.2910**	0.2676	0.3993***	0.3972***	-0.0104	0.2284*	0.0640	-0.2870**	0.1787	0.1718
	N						1.0000	0.3521***	0.3735***	0.2374*	0.2291*	-0.3073**	-0.0872	0.1017	-0.1888	-0.0790	-0.0116
NPBP	S							1.0000	0.2696*	-0.1843	-0.1225	-0.0188	-0.2199*	-0.0767	0.1729	-0.1564	-0.1780
	N							1.0000	0.3714***	0.3800***	0.4332***	-0.1612	0.2021	0.3206**	0.0872	0.1331	0.2274*
NSBP	S								1.0000	-0.0820	0.1562	-0.2741**	-0.2520*	0.0793	-0.3000**	-0.2841**	-0.1886
	N								1.0000	0.2987**	0.2784**	-0.4164***	-0.0557	0.3437***	-0.1301	-0.2216	0.0538
NPP	S									1.0000	0.8548***	0.0575	0.7804***	0.3448***	-0.0518	0.5070***	0.5721***
	N									1.0000	0.9517***	-0.2616*	0.6886***	0.6668***	0.3413***	0.4335***	0.6448***
NPCP	S										1.0000	-0.1066	0.6039***	0.3601***	-0.1650	0.3477***	0.4409***
	N										1.0000	-0.2404*	0.6567***	0.6816***	0.3813***	0.4195***	0.6505***
NS/pod												1.0000	0.5588***	0.2205*	0.0375	0.4739***	0.5206***
												1.0000	0.3762***	-0.0550	0.1645	0.1803	0.0792
NSPP	S												1.0000	0.3292*	-0.0463	0.6424***	0.7204***
	N												1.0000	05405***	0.3876***	0.6253***	0.7212
BY	S													1.0000	0.0350	0.0826	0.5573***
	N													1.0000	0.5441***	0.3766***	0.7774***
100SW	S														1.0000	0.2318*	0.1648
	N														1.0000	0.4066***	0.5603***
HI	S															1.0000	0.8564***
	N															1.0000	0.8527***

Table 6: Path Coefficient Analysis for Yield Traits under Stress Condition

Traits	DFI	DF50%	DM	PH at 30 days	PH at maturity	NNPP	NPBP	NSBP	NPP	NPCP	NS/pod	NSPP	BY	100SW	HI
DFI	-0.0615	-0.0535	-0.0235	0.0043	-0.0218	-0.0178	-0.0179	-0.0128	-0.0170	-0.0168	0.0005	-0.0062	-0.0255	0.0130	0.0073
DF50%	0.1254	0.1443	0.0636	-0.0284	0.0455	0.0279	0.0165	0.0152	0.0497	0.0438	-0.0042	0.0161	0.0714	-0.0149	-0.0083
DM	-0.0211	-0.0244	-0.0552	0.0171	0.0003	-0.0158	-0.0138	-0.0218	-0.0088	-0.0093	0.0156	0.0031	-0.0040	0.0117	0.0115
PH at 30 days	-0.0056	-0.0158	-0.0249	0.0802	0.0592	0.0018	-0.0151	0.0073	-0.0047	-0.0067	0.0127	0.0110	0.0070	-0.0264	0.0007
PH at maturity	-0.0261	-0.0232	0.0003	-0.0544	-0.0737	-0.0142	0.0027	-0.0154	0.0019	0.0067	-0.0039	0.0019	-0.0120	0.0282	0.0104
NNPP	-0.0029	-0.0020	-0.0029	-0.0002	-0.0020	-0.0102	-0.0030	-0.0032	-0.0046	-0.0045	0.0002	-0.0026	-0.0008	0.0035	-0.0019
NPBP	0.0130	0.0051	0.0112	-0.0084	-0.0016	0.0134	0.0449	0.0138	-0.0106	-0.0080	-0.0018	-0.0129	-0.0031	0.0103	-0.0109
NSBP	0.0128	0.0065	0.0243	0.0056	0.0128	0.0191	0.0190	0.0616	-0.0058	0.0104	-0.0178	-0.0169	0.0048	-0.0202	-0.0192
NPP	-0.0320	-0.0400	-0.0185	0.0067	0.0029	-0.0519	0.0275	0.0108	-0.1160	-0.1016	-0.0081	-0.0912	-0.0423	0.0062	-0.0603
NPCP	-0.0460	-0.0510	-0.0282	0.0139	0.0152	-0.0748	0.0301	-0.0282	-0.1473	-0.1681	0.0161	-0.1055	-0.0637	0.0304	-0.0621
NS/pod	0.0014	0.0050	0.0481	-0.0269	-0.0091	0.0036	0.0068	0.0493	-0.0119	0.0163	-0.1706	-0.0962	-0.0414	-0.0087	-0.0858
NSPP	0.0316	0.0350	-0.0179	0.0431	-0.0083	0.0808	-0.0902	-0.0861	0.2463	0.1966	0.1766	0.3132	0.1089	-0.0139	0.2065
BY	0.1976	0.2355	0.0342	0.0414	0.0776	0.0387	-0.0324	0.0374	0.1737	0.1806	0.1155	0.1655	0.4761	-0.0002	0.0494
100 SW	0.0146	0.0072	0.0146	0.0227	0.0265	0.0238	-0.0159	0.0227	0.0037	0.0125	-0.0035	0.0031	0.0000	-0.0692	-0.0163
HI	-0.1002	-0.0487	-0.1765	0.0069	-0.1193	0.1608	-0.2049	-0.2633	0.4385	0.3117	0.4245	0.5562	0.0876	0.1994	0.8438
SYP	0.1009	0.1800	-0.1511	0.1236	0.0043	0.1853	-0.2459	-0.2127	0..5873	0.4634	0.5516	0.7387	0.5629	0.1492	0.8647

Table 7: Path Coefficient Analysis for Yield Traits under Normal Condition

Traits	DFI	DF50%	DM	PH at 30 days	PH at maturity	NNPP	NPBP	NSBP	NPP	NPCP	NS/pod	NSPP	BY	100SW	HI
DFI	0.4231	0.3825	0.1921	-0.0904	0.1518	0.1098	0.0926	0.0683	0.0679	0.0090	-0.1019	-0.0598	0.0579	-0.1201	-0.0097
DF50%	-0.2663	-0.2945	-0.1720	0.0863	-0.0855	-0.1013	-0.0912	-0.0614	-0.0676	-0.0350	0.0424	0.0227	-0.0457	0.0513	-0.0071
DM	0.0141	0.0182	0.0311	-0.0072	0.0041	0.0128	0.0025	0.0074	-0.0017	-0.0025	-0.0076	-0.0098	-0.0011	-0.0085	-0.0060
PH at 30 days	-0.0100	-0.0137	-0.0108	0.0468	0.0255	-0.0036	-0.0061	-0.0037	0.0053	0.0036	0.0013	0.0113	-0.0093	-0.0194	-0.0006
PH at maturity	-0.0277	-0.0224	-0.0101	-0.0420	-0.0771	-0.0331	-0.0053	-0.0171	-0.0070	-0.0007	0.0074	-0.0016	0.0142	0.0408	0.0086
NNPP	0.0137	0.0181	0.0217	-0.0041	0.0226	0.0527	0.0147	0.0204	0.0144	0.0132	-0.0187	-0.0052	0.0051	-0.0108	-0.0048
NPBP	-0.0226	-0.0319	-0.0084	0.0135	-0.0071	-0.0288	-0.1031	-0.0430	-0.0476	-0.0524	0.0230	-0.0251	-0.0359	-0.0091	-0.0204
NSBP	0.0261	0.0337	0.0387	-0.0127	0.0358	0.0626	0.0675	0.1619	0.0494	0.0458	-0.0704	-0.0101	0.0549	-0.0207	-0.0354
NPP	-0.0859	-0.1228	0.0290	-0.0612	-0.0488	-0.1463	-0.2470	-0.1634	-0.5354	-0.5131	0.1424	-0.3709	-0.3692	-0.1876	-0.2369
NPCP	0.0105	0.0582	-0.0400	0.0376	0.0046	0.1226	0.2488	0.1386	0.4690	0.4894	-0.1229	0.3248	0.3428	0.1913	0.2129
NS/pod	0.0061	0.0036	0.0062	-0.0007	0.0024	0.0089	0.0056	0.0109	0.0067	0.0063	-0.0251	-0.0094	0.0020	-0.0037	-0.0051
NSPP	-0.0314	-0.0171	-0.0696	0.0537	0.0045	-0.0220	0.0540	-0.0138	0.1536	0.1471	0.0830	0.2217	0.1218	0.0879	0.1430
BY	0.0422	0.0479	-0.0109	-0.0615	-0.0568	0.0296	0.1075	0.1047	0.2129	0.2162	-0.0247	0.1696	0.3087	0.1725	0.1302
100 SW	-0.0365	-0.0224	-0.0350	-0.0534	-0.0680	-0.0263	0.0113	-0.0165	0.0450	0.0503	0.0187	0.0510	0.0718	0.1285	0.0556
HI	-0.0148	0.0155	-0.1246	-0.0082	-0.0719	-0.0584	0.1281	-0.1412	0.2859	0.2811	0.1318	0.4167	0.2726	0.2795	0.6461
SYP	0.0406	0.0529	-0.1626	-0.1036	-0.1639	-0.0208	0.2798	0.0521	0.6509	0.6583	0.0786	0.7259	0.7904	0.5720	0.8705

Table 8: Seed yield, yield reduction percentage and of 30 soybean genotypes under both normal and stress condition

Genotypes	Seed Yield (g)		Yield Reduction Percentage
	Normal	Stress	
JS 20-29	5.13	4.65	9.41
JS 20-69	4.36	2.89	33.61
JS 20-98	3.46	3	13.29
JS 97-52	5.33	4.98	6.62
DAVIS	5.88	4.97	15.52
YOUNG	9.25	2.38	74.28
JS 21-17	7.26	6.5	10.50
AMS MB-518	6.72	3.38	49.65
TGX 852-3D	9.52	8.58	9.93
MACS-58	5.48	3.16	42.24
SKY/AK-403	3.16	1.79	43.47
HARDEE	6.79	3.19	53.06
JS 21-73	4.58	4.36	4.87
CAT-142	3.88	2.7	30.47
CAT-649	4.07	3.24	20.35
CAT-703	3.14	2.47	21.31
CAT-3293	4.11	3.26	20.74
CAT-2082	7.13	6.5	8.83
AGS-38	2.65	1.50	43.27
AMS-59	1.33	0.81	38.74
AMS-19B	1.37	0.8	41.60
AMS-26A	3.68	2.7	26.69
AMS-148	6.14	2.83	53.90
SQL-8	8.39	2.31	72.43
SQL-31	6.7	2.44	63.53
SQL-88	4.13	3.18	23.06
SQL-89	8.57	3.63	57.63
SQL-106	2.28	1.80	21.13
JS 21-71	2.93	2.29	21.81
JS 21-72	10.63	2.64	75.14

Conclusion
The analysis of variance under both stress and normal condition revealed that the mean sum of squares due to genotypes were highly significant for all traits under study. On the basis of correlation and path coefficient analyses it is observed that under stress conditions all the economic traits have showed significant positive correlation with seed yield per plant. Plant height and phenological traits have shown negligible or negative correlation with seed yield.

References
1. Badkul Amrita, Shrivastava AN, Bisen R, Mishra S. Genetic Variability, Association and Path Analyses in Advanced Generation Fixed Lines of Soybean Soybean Research 2014;12(1):20-27.
2. Bhatia VS, Agrawal DK, Srivastava SK. Vision 2030. Directorate of Soybean Research, Indian Council of Agricultural Research, Indore 2011, 23.
3. Bhatia VS, Jumrani K, Pandey GP. Developing Drought Tolerance in Soybean Using Physiological Approaches. Soybean Research 2014;12(1):1-19.
4. Chandel KK, Patel NB, Patel JB. Correlation coefficients and path analysis in soybean (*Glycine max* L. Merrill). AGRES-An International e-Journal 2014;3:25-31.
5. Dewey DI, Lu KH. A correlation and path-coefficient analysis of components of crested wheatgrass seed production. Agronomy Journal 1959;51:515-518.
6. Ghanbari S, Nooshkam A, Fakheri BA, Mahdinezhad N. Assessment of Yield and Yield Component of Soybean Genotypes in North of Khuzestan. Journal Crop Sci. Biotech 2018;21(5):435-441.
7. Gomez, Gomez. Analysis of covariance in agronomy and crop research. Canadian Journal of Plant Science 1984;91(4):621-641.
8. Hang Vu TT, Cham le TT, Hoa Vu D, Nguyen TT, Ngoc T. Asin journal of crop science 2019;11(2):32-39.
9. Joshi OP, Bhatia VS. Stress management in soybean. In: Singh H and Hegde D M (Eds.), Souvenir. National Seminar on Stress Management in Oilseeds for Attaining Self reliance in Oilseeds for Attaining Self Reliance in Vegetable Oils, Indian Society of Oilseeds Research, Hyderabad 2003, 13-25.
10. Kobraee S, Shamsi K, Rasekhi B. Soybean production under water deficit conditions. Annals of Biological Research 2011;2(2):423-434.
11. Koraddi S, Basavaraja GT, Immadi S, Vijaykumar AG. Correlation and Path Coefficient Analysis for Yield and its Components in Soybean [*Glycine max* (L.) Merrill]. The Bioscan 2015;10(4):2065-2067.
12. Machikowa T, Laosuwan P. Path coefficient analysis for yield of early maturing soybean. Journal Sci. Technol 2011;33:368.
13. Mahbub MD, Mostofa, Shirazy BJ. Evaluation of Genetic Diversity in Different Genotypes of Soybean (*Glycine max* (L.) Merrill) American Journal of Plant Biology 2015-2016;1(1):24-29.
14. Maleki A, Naderi A, Naseri R, Sadegh AF, Maleki R. Physiological Characterization of drought tolerance of various Brazilian soybean cultivars in the field. Plant Production Science 2013;7(2):129-137.
15. Manavalan LP, Guttikonda SK, Tran LS, Nguyen HT. Physiological and molecular approaches to improve drought resistance in soybean. Plant Cell Physiology 2009;50:1260-1276.
16. Miller PA, Williams JC, Robinson HF, Comstock RE. Estimate of genotypic covariance and covariance in upland cotton. Agronomy Journal 1958;50:26-31.
17. Mishra S, Rani A, Kumar S, Shrivastava AN. Evaluation of Soybean Genotypes under High temperature stress conditions. Bulletin of Environment, Pharmacology and Life Sciences 2017;6(5):400-406.
18. Paroda RS. Status of soybean research and development in India. In: Kauffman, H E (Ed.), Proceedings of VI World Soybean Research Conference, Chicago, IL, USA 1999, 13-23.
19. Salimi S, Moradi S. Effect The Correlation, Regression and Path Analysis in Soybean Genotypes (*Glycin Max* L.) Under Moisture and Normal Condition. International journal of Agronomy and Plant Production 2012;3(10):447-454.
20. Singh SP, Rao SK, Sharma SM. Yield components in Soybean. JNKVV Res. Journal 1983;17(1&2):46-509.
21. Sirohi SP, Malik S, Singh SP, Yadav R, Meenakshi. Genetic variability, correlations and path analysis for seed yield and its components in soybean (*Glycine Max* (L.) Merrill). Progressive Agriculture 2007;7(1/2):119-123.