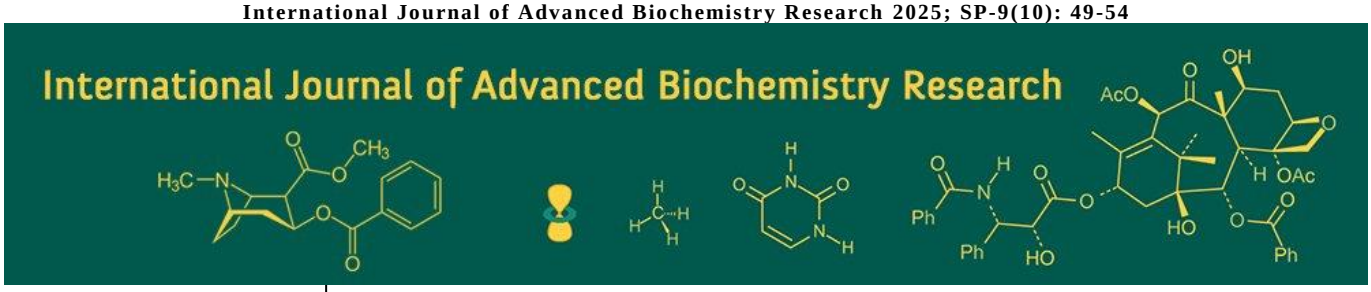

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Correlation and path studies in soybean [(Glycine max (L.) Merrill]

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Abstract
Soybean is an important oilseed crop also known as the ‘miracle bean or the golden bean’ due to its numerous industrial, nutritional, and agricultural applications. A study on correlation and path analysis among nine seed treatments of soybean variety MAUS 725 were carried out at soybean research station, Parbhani (MS) during *kharif* season 2024-2025 with three replications in RBD. The analysis of variance exhibited significant differences among treatments for all characters. In present study yield and yield contributing traits and seed quality traits of seed were positive and significantly correlated with plant height, number of branches, leaf area, number of seed per pod, number of pods per plant total dry weight, harvest index, this indicates the strong association between Plant height, branches, leaf area, dry weight, number of pods per plant, seeds per pod, and harvest index. Increase in plant height, no of pods per plant, no of seeds per pod shows increase in seed yield. Seed quality parameters were positive and significantly correlated with oil content, protein content and seed germination. The path coefficient analysis revealed that direct and indirect effects of yield contributing traits on seed yield. According to the both genotypic and phenotypic path coefficient analysis, plant height, days to 50% flowering, leaf area, no of pods per plant, no of seeds per pod, test weight, germination percentage, seed moisture had a positive direct effect on the seed yield per plant. So, choosing these traits directly can result in an increase in crop output. The significant indirect effect on seed yield per plant was exhibited by plant height, leaf area, no of pods per plant, no of seeds per pod. Negative significant indirect effects were attributed by days to 50% flowering.

Keywords: Correlation, path coefficient, direct and indirect effects, soybean (*Glycine max* L.)

Introduction
Glycine max L. sometimes known as the "miracle crop," "golden bean, " or "gold from soil," is the 20th century's wonder crop. It is a member of the genus *Glycine* L., subfamily Papilionaceae and family Leguminosae. It is supposed to have originated in China and was introduced to India in 1968 from USA (Tiwari, 2006). Soybean is primarily classified as a pulse crop but has also gained recognition as an oilseed due to its 20% cholesterol-free oil content. The seeds are highly nutritious, consisting of 40-42% protein, 26% carbohydrates, 18-25% oil, 4% minerals and 2% phospholipids. With 60% polyunsaturated fatty acids, they provide a calorific value of 452 calories per 100 grams. Soybean protein is particularly valuable because it is rich in essential amino acids, including lysine (5%), which is often lacking in many cereals. Due to its balanced amino acid profile, soybean protein is considered a complete protein. Additionally, soybeans serve as an excellent source of vitamin B-complex, thiamine, and riboflavin. The oil extracted from soybeans contains 0.5-1.0% lecithin, which is crucial for maintaining healthy human nerve tissues. Because of its high protein content, soybean is often called as the "poor man’s meat."
Soybean plays a crucial role in today's energy crisis, significantly impacting agriculture, business, and India's export sector. It contributes to 30% of the world's vegetable oil and 60% of vegetable protein supply. Packed with essential vitamins A, B, and D, along with vital minerals like calcium and iron, soybean is not just a nutritional powerhouse its outer hull is also an excellent source of dietary fibre. Beyond its oil and high-quality protein, soybean enhances soil fertility by forming a symbiotic relationship with the bacterium *Brady rhizobium japonicum*.

This process enables the plant to convert 60-100 kg of atmospheric nitrogen into 30-40 kg of soil nitrogen, enriching the soil with organic matter and boosting overall productivity.

Soybean is widely recognized for its diverse industrial applications, including its use in the production of bread, biscuits, chocolates and soap. It also serves as a key ingredient in the manufacturing of vegetable ghee, paints, varnishes, glycerine, plastic cloth, printing ink, rubber and candles. Additionally, it plays a significant role in the textile industry.

Soya protein is regarded as one of the most easily digestible vegetable proteins, bearing similarities to milk in its properties. Soybean oil has been recommended for individuals suffering from stomach ailments and diabetes in India. A recent discovery revealed that soybean oil contains 7-8% omega-3 fatty acids, a compound commonly associated with fish oil, which contributes to the reduction of coronary heart disease.

Globally, it is grown in an area of about 86.3 million acres with a production of 420.58Mt. Brazil is the leading producer, followed by the United States, Argentina, China and India (USDA, 2024) [27]. In India, it is grown in an area of about 126.90 lakh hectares, with a production of 125.817 lakh tones and productivity of 1063 kg ha^{-1} (SOPA, 2024) [25]. In Maharashtra, the crop is grown in an area of 51.36 lakh ha with 52.69 lakh tonnes of production and productivity is 1054 kg per hector (SOPA Database, 2024) [25]. In India, major soybean growing states are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh and Andhra Pradesh.

An estimated 12% of overall productivity is lost each year as a result of soybean diseases, with fungal infections alone causing damage of up to 6-8% (Bony *et al.*, 2017) [9]. In addition, the crop is afflicted by several economically significant bacterial and viral diseases. The lack of high-quality seeds at the time of sowing is one of the main obstacles to soybean production. In many regions of the world, seed viability plays a significant role in the development of crop stands and the ensuing output.

Seed coating is an effective strategy for addressing agricultural challenges and restoring degraded ecosystems, thereby contributing to enhanced food security and cost-effective ecosystem management. As a component of precision agriculture, seed coating supports high-quality seed sowing by ensuring uniform seed size particularly important for small seeds. The uniform coating of individual seeds facilitates consistent germination and allows for precision sowing using seed drills, which enhances planting accuracy. Additionally, seed coating can improve seed quality when it incorporates active ingredients. These may be physical, chemical, or biological agents such as microbial inoculants applied with the help of binders or fillers that act as carriers (Chirag, 2023) [11].

Correlation coefficient and path coefficient are the useful measures for quantifying the effect of individual trait on seed yield. Correlation gives the information about mutual association between two variables on the basis of which breeders can select superior genotypes for seed yield. Path analysis is the partial regression analysis which partitioned correlation into direct and indirect effect. Path analysis specifies the effect of independent variable via another independent variable on dependent variable. Combined study of correlation analysis with path analysis reveals the true picture of genetic association between component traits for seed yield.

Materials and Methods

The present investigation was conducted during *kharif* season 2024-2025 at the soybean research station, Parbhani using nine seed treatments of soybean variety MAUS 725.Site of experiment is located at 19.2608ºN and 76.7748ºE at an elevation of 409 meters above sea level and the soils are loamy type with clay. The material was evaluated in Randomized Block Design. The experiment comprised of 3 replications, each containing nine treatments. The data was analyzed using statistical methods, including analysis of variance (as per Panse and Sukhatme. 1967) [23] and estimation of correlation coefficients (as per Johnson *et al.* 1955) [16] and path analysis as per (Sewall Wright 1921) [28] and Dewey and Lu 1959) [12]. The source of germplasm is given in (Table 1).

Table 1: The source of germplasm is given

No of treatments	9
No of Replications	3
Spacing	45x5 cm
Plot size	2.25x5m
Date of sowing	14-07-2024

Table 2: List of treatments used in present study

T_1	Untreated seed
T_2	Rhizobium (10 g/kg of seed) + PSB (5 g/kg of seed)
T_3	Trichoderma species (4 g/kg of seed)
T_4	Imidacloprid (4 g/kg of seed)
T_5	Xelora (2 g/kg)
T_6	T_2+T_3
T_7	T_2+ T_4
T_8	T_2+ T_5
T_9	T_2+T_3+T_4

Results and Discussion

Estimates of correlation coefficient at phenotypic and genotypic levels

A. Genotypic correlation coefficient

At genotypic level the character seed yield/plant has positive and significance correlation with plant height (cm), chlorophyll content, no of pods/plant, no of seeds/pod. there has negative but significance with days to 50% flowering. plant height has positive and significance association with chlorophyll content, seed yield per plant, dry weight and negative significance correlation with days to 50% flowering. Days to 50% flowering has positive and significance association with harvest index and negative significance with plant height, chlorophyll content, no of pods/plant, seed yield/plant. no of branches/plant has positive and significance association with leaf area, chlorophyll content, harvest index, protein content, germination percentage and negatively significance with test weight. Leaf area has positive and significance association with no of branches per plant, no of pods per plant, no of seeds per pod, seed yield per plant. Chlorophyll content has positive and significance association with plant height, no of branches per plant, no of pods per plant, protein content, germination percentage and negatively significance with days to 50% flowering. no of pods per plant has positive and significance association with leaf area, chlorophyll content, no of seeds per pod, germination percentage, seed moisture,

seed yield per plant.and negatively significance with days to 50% flowering. Number of seeds per pod has positive and significance association with germination percentage, seed moisture, seed yield per plant, no of pods per plant, leaf area, and negatively significance with test weight. Plant total dry weight has positive and significance association with plant height, negatively significance with harvest index. Test weight has negative and significance association with germination percentage, seed moisture, oil content, no of branches per plant, no of seeds per pod. Harvest index has positive and significance association with germination percentage, oil content, no of branches per plant, days to 50% flowering. Protein content has positive and significance association with germination percentage, chlorophyll content, no of branches per plant. Germination percentage has positive and significance association with protein content, harvest index, no of seeds per pod, no of pods per plant, chlorophyll content, no of branches per plant there has negative but significance test weight. Seed moisture has positive and significance association with oil content, no of seeds pod^{-1}, no of pods per plant^{-1} there has negative but significance with test weight. Oil content has positive and significance correlation with harvest index, seed moisture, there has negative but significance with test weight.

Seed yield per plant showed highly significant and positive correlation with for plant height at genotypic level, similar findings concluded by Badkul *et al*. (2014) [3] and Ghodrati (2013) [13]. Nagarajan *et al.* (2015) [21] reported inter relation between seed yield and plant height. Number of pods plant^{-1} has positive and significance with seed yield plant^{-1}. Alpna *et al.* (2015) [2], Guleria *et al.* (2019) [14], Chavan *et al.* (2016) [10] and Bhartiya *et al.* (2015) [7] reported similar findings. Critical analysis of findings resulted from traits correlation indicated that selection for these characters could bring improvement in yield and yield contributing traits in maize.

B. Phenotypic correlation coefficient

Seed yield per plant has positive and significance association with plant height, chlorophyll content, no of pods per plant, no of seeds per pod, germination percentage there has negative but significance with days to 50% flowering. Plant height has positive and significance association with chlorophyll content, seed yield per plant, dry weight and negative significance association with days to 50% flowering. Days to 50% flowering negative significance with plant height (cm), seed moisture, no of pods per plant, seed yield per plant. Number of branches per plant has positive and significance association with, chlorophyll content, germination percentage. Leaf area has positive and significance association with number of seeds per pod, negative association with test weight (gm). Chlorophyll content has positive and significance association with plant height, no of branches per plant, number of seeds per pod seed yield per plant, protein content, germination percentage. Number of pods per plant has positive and significance association with plant height, no of seeds per pod, seed moisture, seed yield per plant and negatively significance with days to 50% flowering, test weight. Number of seeds per pod has positive and significance association with germination percentage, seed moisture, seed yield per plant, no of pods per plant, leaf area, chlorophyll content, protein content, oil content and negatively significance with test weight. Test weight has negative and significance association with leaf area, germination percentage, seed moisture, no of seeds per pod, no of seeds per pod. Harvest index has positive and significance association with germination percentage. Protein content has positive and significance association with germination percentage, chlorophyll content, no of seeds per pod. Germination percentage has positive and significance association with seed yield per plant, protein content, harvest index, no of seeds per pod, chlorophyll content, no of branches per plant there has negative but significance test weight. Seed moisture has positive and significance association with, no of seeds per pod, no of pods per plant there has negative but significance with test weight, days to 50% flowering. Oil content has positive and significance association with no of seeds per pod, likewise Similar findings reported by Berhanu *et al.* (2021) [6], Idhol *et al.* (2024) [15], Karyawati and Puspitaningrum (2021) [17], Kumar *et al.* (2020) [19], Bhuva *et al.* (2020) [8].

Estimates of path coefficient at phenotypic and genotypic levels

Path analysis was used to study the direct and indirect effects of yield contributing traits on seed yield, because correlation studies alone cannot provide a clear picture of these effects. The direct effect of a seed coating on seed yield indicates how reliable it is to select for that seed coating indirectly in order to increase seed yield. Direct and indirect effects of yield contributing traits with seed yield per plant were summarized in table 3.

Path coefficient analysis revealed the positive direct effect on seed yield per plant was demonstrated by plant height (0.674), days to 50% flowering (0.333), leaf area (0.377), no of pods per plant (0.361), no of seeds per pod (0.772), test weight (0.624), germination percentage (0.190), seed moisture (0.098), at genotypic level. In contrast the negative direct effect on seed yield was observed in no of branches per plant (-0.184), chlorophyll content (-0.256), dry weight (-0.200), harvest index (-0.036), protein content (-0.076), oil content (-0.064) at genotypic level.

At phenotypic level positive direct effect were sown by plant height (0.122), days to 50% flowering (0.023), no of branches per plant (0.021), leaf area (0.067), chlorophyll content (0.177), no of pods per plant (0.341), no of seeds per pod (0.426), test weight (0.465), germination percentage (0.177), seed moisture (0.189) on seed yield. Whereas, negative direct effects were exerted by dry weight (-0.176), harvest index (-0.017), protein content (-0.135), oil content (-0.130) at phenotypic level.

The significant indirect effects on seed yield per plant was exhibited by plant height (0.9153), leaf area (0.7051), no of pods per plant (1.096), no of seeds per pod (0.8675). Negative significant indirect effects were attributed by days to 50% flowering (-0.7606), at genotypic level. At the phenotypic level, plant height (0.5113), chlorophyll content (0.4256), no of pods per plant (0.6552), no of seeds per pod (0.6544), germination percentage (0.4012) shows significant indirect effects on seed yield. A negative significant indirect effect on seed yield attributed by days to 50% flowering (-0.5185), at phenotypic level. Similar findings reported by Akram *et al.* (2011) [1] and Baraskar *et al.* (2015) [4], Kumar *et al.* (2017) [18] and Rahaman *et al.* (2022) [24], Painkra *et al.* (2018) [22] and Barpanda *et al.* (2024) [5], Machado *et al.* (2017) [20] and Berhanu *et al.* (2021) [6].

Table 1: Genotypic correlation of yield, yield contributing traits, and seed quality traits of seed coating treatments in soybean

	PH	DF	NBP	LA	CC	NPP	NSP	DW	TW	HI	PC	GM	SM	OC	SYP
PH	1 **	-0.696 *	0.1285	0.183	0.926 **	0.602	0.577	0.210**	-0.086	-0.235	0.408	0.519	0.533	0.070	0.915**
DF		1 **	-0.062	-0.654	-0.796 *	-0.819**	-0.516	-0.490	0.222	0.694 *	0.261	-0.150	-0.529	0.133	-0.760 *
NBP			1 **	0.735 *	0.737 **	0.313	0.640	0.160	-0.828 **	0.795 *	0.999**	0.801 **	0.223	0.300	-0.029
LA				1 **	0.207	0.899 **	0.808 **	0.212	-0.599	0.244	0.638	0.651	0.273	0.215	0.705 *
CC					1 **	0.809 **	0.539	0.197	-0.537	0.444	0.915 **	0.943 **	0.551	0.118	0.569
NPP						1 **	0.970 **	-0.014	-0.632	-0.383	0.302	0.688 *	0.738 *	0.373	0.926 **
NSP							1 **	-0.028	-0.892 **	0.002	0.580	0.800 **	0.862 **	0.585	0.867 **
DW								1 **	0.285	-0.301**	-0.449	-0.204	0.150	-0.288	-0.030
TW									1 **	-0.372	-0.579	-0.851**	-0.981**	-0.873**	-0.531
HI										1 **	0.616	0.692 *	-0.443	0.962 **	-0.462
PC											1 **	0.976 **	-0.243	0.366	0.435
GM												1 **	0.143	0.627	0.545
SM													1 **	0.835 **	0.488
OC														1 **	-0.093
SYP															1 **

*Significant at 5% level of significance; **Significant at 1% level of significance

PH-plant height, DF-days to 50% flowering, NBP-no of branches per plant, LA-leaf area, CC-chlorophyll content, NPP-number of pods per plant, NSP-no of seeds per pod, DW-dry weight,

HI-harvest index PC-protein content, GM-germination percentage, SM-seed moisture, OC-oil content, SYP-seed yield per plant

Table 2: Phenotypic correlation of yield, yield contributing traits, and seed quality traits of seed coating treatments in soybean

	PH	DF	NBP	LA	CC	NPP	NSP	DW	TW	HI	PC	GM	SM	OC	SYP
PH	1 **	-0.534 **	0.224	-0.006	0.392 *	0.498 **	0.311	0.209	-0.018	-0.083	0.173	0.347	0.166	0.015	0.511 **
DF		1 **	0.004	-0.176	-0.215	-0.553 **	-0.320	-0.360	-0.141	0.334	-0.092	-0.071	-0.384*	0.152	-0.518 **
NBP			1 **	0.214	0.518 **	-0.108	0.111	0.195	-0.056	0.361	0.272	0.528**	-0.200	0.359	0.070
LA				1 **	0.364	0.318	0.590 **	0.090	-0.385 *	-0.102	0.202	0.200	0.010	0.148	0.289
CC					1 **	0.260	0.485 *	0.158	-0.205	0.079	0.420*	0.490**	0.039	0.300	0.425 *
NPP						1 **	0.710 **	-0.049	-0.505 **	-0.1748	0.248	0.376	0.467 *	0.0066	0.655 **
NSP							1 **	-0.036	-0.511 **	-0.099	0.386 *	0.402 *	0.477 *	0.418 *	0.654 **
DW								1 **	0.195	-0.172	-0.230	-0.218	-0.108	-0.103	-0.072
TW									1 **	-0.271	-0.216	-0.400 *	-0.443 *	-0.320	-0.108
HI										1 **	0.266	0.413 *	-0.130	0.204	-0.217
PC											1 **	0.502 **	0.035	0.057	0.251
GM												1 **	0.198	0.333	0.401 *
SM													1 **	0.300	0.374
OC														1 **	0.100
SYP															1 **

*Significant at 5% level of significance; **Significant at 1% level of significance

PH-plant height, DF-days to 50% flowering, NBP-no of branches per plant, LA-leaf area, CC-chlorophyll content, NPP-number of pods per plant, NSP-no of seeds per pod, DW-dry weight,

HI-harvest index PC-protein content, GM-germination percentage, SM-seed moisture, OC-oil content, SYP-seed yield per plant

Table. 3: Genotypic path and phenotypic path coefficient matrix direct (diagonal) and indirect effects of fourteen causal variables on seed yield per plant in nine treatments of soybean

1	PH	G	0.6743	-0.2323	-0.0237	0.0691	-0.2636	0.2180	0.4456	-0.0423	-0.0541	0.0086	-0.0314	0.0989	0.0527	-0.0046	0.9153 **
1	PH	P	0.1226	-0.0123	0.0048	-0.0005	0.0697	0.1704	0.1329	-0.0368	-0.0085	0.0015	-0.0236	0.0618	0.0315	-0.0020	0.5113 **
2	DF	G	-0.4699	0.3333	0.0116	-0.2470	0.2045	-0.2966	-0.3986	0.0983	0.1388	-0.0253	-0.0201	-0.0286	-0.0523	-0.0087	-0.7606 *
2	DF	P	-0.0656	0.0230	0.0001	-0.0119	-0.0383	-0.1889	-0.1362	0.0635	-0.0656	-0.0059	0.0126	-0.0128	-0.0727	-0.0200	-0.5185 **
3	NBP	G	0.0867	-0.0210	-0.1845	0.2776	-0.2664	0.1134	0.4947	-0.0322	-0.5167	-0.0289	-0.1075	0.1524	0.0221	-0.0195	-0.0297
3	NBP	P	0.0274	0.0001	0.0214	0.0145	0.0921	-0.0369	0.0468	-0.0345	-0.0264	-0.0064	-0.0369	0.0939	-0.0383	-0.0471	0.0704
4	LA	G	0.1235	-0.2182	-0.1357	0.3773	-0.0534	0.3254	0.6240	-0.0426	-0.3743	-0.0089	-0.0490	0.1240	0.0270	-0.0140	0.7051 *
4	LA	P	-0.0009	-0.0041	0.0046	0.0675	0.0649	0.1089	0.2513	-0.0159	-0.1795	0.0018	-0.0276	0.0357	0.0021	-0.0195	0.2893
5	CC	G	0.6920	-0.2655	-0.1914	0.0784	-0.2568	0.2929	0.4163	-0.0396	-0.3354	-0.0161	-0.0703	0.2176	0.0545	-0.0077	0.569
5	CC	P	0.0481	-0.0050	0.0111	0.0246	0.1778	0.0890	0.2065	-0.0279	-0.0954	-0.0014	-0.0570	0.0872	0.0073	-0.0393	0.4256 *
6	NPP	G	0.4061	-0.2732	-0.0578	0.3392	-0.2079	0.3619	0.7494	0.0029	-0.3948	0.0139	-0.0232	0.1310	0.0729	-0.0242	0.926 **
6	NPP	P	0.0611	-0.0127	-0.0023	0.0215	0.0463	0.3417	0.3028	0.0086	-0.2355	0.0031	-0.0337	0.0669	0.0886	-0.0009	0.6552 **
7	P	G	0.3891	-0.1721	-0.1182	0.3049	-0.1384	0.3512	0.7723	0.0056	-0.6818	-0.0001	-0.0446	0.1523	0.0852	-0.0379	0.8675 **
7	P	P	0.0383	-0.0074	0.0024	0.0399	0.0862	0.2430	0.4268	0.0063	-0.2377	0.0017	-0.0525	0.0716	0.0907	-0.0550	0.6544 **
8	DW	G	0.1422	-0.1633	-0.0296	0.0802	-0.0507	-0.0053	-0.0217	-0.2005	0.1783	0.0110	0.0345	-0.0390	0.0148	0.0186	-0.0306
8	DW	P	0.0256	-0.0083	0.0042	0.0061	0.0282	-0.0167	-0.0153	-0.1762	0.0909	0.0030	0.0313	-0.0387	-0.0205	0.0135	-0.0729
9	TW	G	-0.0585	0.0741	0.1528	-0.2264	0.1380	-0.2290	-0.8438	-0.0573	0.6240	0.0135	0.0445	-0.1620	-0.0969	0.0954	-0.5315
9	TW	P	-0.0022	-0.0033	-0.0012	-0.0260	-0.0364	-0.1729	-0.2175	-0.0344	0.4655	0.0048	0.0295	-0.0711	-0.0842	0.0419	-0.108
10	HI	G	-0.1589	0.2316	-0.1468	0.0921	-0.1141	-0.1389	0.0021	0.0604	-0.2322	-0.0363	-0.0474	0.1317	-0.0438	-0.0623	-0.4627
10	HI	P	-0.0103	0.0077	0.0077	-0.0069	0.0140	-0.0597	-0.0420	0.0305	-0.1267	-0.0176	-0.0361	0.0736	-0.0247	-0.0268	-0.2174
11	PC	G	0.2755	0.0873	-0.2582	0.2408	-0.2351	0.1095	0.4482	0.0901	-0.3617	-0.0224	-0.0768	0.1858	-0.0240	-0.0237	0.4351
11	PC	P	0.0213	-0.0021	0.0058	0.0137	0.0747	0.0849	0.1647	0.0407	-0.1009	-0.0047	-0.1358	0.0894	0.0069	-0.0076	0.2516
12	GM	G	0.3505	-0.0501	-0.1478	0.2459	-0.2937	0.2492	0.6181	0.0411	-0.5311	-0.0252	-0.0750	0.1903	0.0142	-0.0406	0.5458
12	GM	P	0.0426	-0.0017	0.0113	0.0136	0.0872	0.1286	0.1714	0.0384	-0.1862	-0.0073	-0.0683	0.1777	0.0377	-0.0437	0.4012 *
13	SM	G	0.3600	-0.1765	-0.0412	0.1031	-0.1417	0.2672	0.6662	-0.0301	-0.6122	0.0161	0.0187	0.0273	0.0988	-0.0670	0.4886
13	SM	P	0.0204	-0.0088	-0.0043	0.0007	0.0069	0.1597	0.2037	0.0190	-0.2066	0.0023	-0.0049	0.0353	0.1893	-0.0395	0.374
14	OC	G	0.0476	0.0445	-0.0555	0.0814	-0.0305	0.1350	0.4518	0.0578	-0.9194	-0.0350	-0.0281	0.1193	0.1023	-0.0647	-0.0934
14	OC	P	0.0019	0.0035	0.0077	0.0101	0.0533	0.0023	0.1791	0.0181	-0.1490	-0.0036	-0.0079	0.0594	0.0573	-0.1308	0.1008

PH-plant height, DF-days to 50% flowering, NBP-no of branches per plant, LA-leaf area, CC-chlorophyll content, NPP-number of pods per plant, NSP-no of seeds per pod, DW-dry weight,
HI-harvest index PC-protein content, GM-germination percentage, SM-seed moisture, OC-oil content, SYP-seed yield per plant

Conclusions

In present study yield and yield contributing traits and seed quality traits of seed were positive and significantly correlated with plant height, number of branches, leaf area, number of seed per pod, number of pods per plant, total dry weight, harvest index, this indicates the strong association between plant height, no of branches, leaf area, dry weight, number of pods per plant, seeds per pod, and harvest index. Increase in plant height, no of pods per plant, no of seeds per pod shows increase in seed yield. Seed quality parameters were positive and significantly correlated with oil content, protein content and seed germination.

Path analysis was used to study the direct and indirect effects of yield contributing traits on seed yield. According to the both genotypic and phenotypic path coefficient analysis, plant height, days to 50% flowering, leaf area, no of pods per plant, no of seeds per pod, test weight, germination percentage, and seed moisture had a positive direct effect on the seed yield per plant. So, choosing these traits directly can result in an increase in crop output. The significant indirect effects on seed yield per plant were exhibited by plant height, leaf area, no of pods per plant, no of seeds per pod. Negative significant indirect effects were attributed by days to 50% flowering.

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