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CORRELATION AND PATH ANALYSIS IN YARD LONG BEAN GENOTYPES FOR YIELD AND ITS ATTRIBUTING CHARACTER

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ABSTRACT

The present investigation was undertaken to evaluate correlation and path coefficient analysis among 30 genotypes of yard long bean under Randomized Block Design with two replications The study was carried out during the summer season of 2025 at the Instructional- cum-Research farm, Horticulture section of Rajarshee chhatrapati Shahu Maharaj College of Agriculture, Kolhapur. A wide range of variation were observed between all genotypes across all characters. In the present study, revealed that the pod yield per plant had a very highly significant positive correlation with number of pod per plant and highly significant positive correlation with number of seed per pod and number of pod per cluster at both genotypic and phenotypic levels. Additionally, traits such as average pod weight and vine length were positively and significantly correlated with pod yield at the genotypic level also days to first fresh pod harvest exhibited a significant negative correlation with pod yield at the genotypic level. Path analysis reviled that number of pod per plant exhibited very high direct effect on pod yield per plant followed by average pod weight, pod width reported high positive direct effect and vine length recorded moderate positive direct effect on the pod yield. The adjustment of direct and indirect effects with their respective correlations validated the role of these traits in yield improvement and selection for breeding programmes.

Key words : Yard long bean, Correlation and Path coefficient analysis, Direct effect, Indirect effect, Yield.

Introduction

Yard long bean is an economically important and nutritious vegetable belongs to fabaceae family with diploid chromosome number 2n=22. It is commonly known as vegetable cowpea, asparagus bean and Chinese long bean. Yard long bean is valued for it long tender pods, popularly known as “poor man’s meat” due to rich in protein (23-26%) other than this it also rich in vitamins A (17%) and C (31%), minerals (iron (2.5mg), calcium (72.0 mg), phosphorus (59mg), zinc (32.58 - 36.66mg), and manganese (2.92 – 3.34mg), and other micronutrients (Ano and Ubochi, 2008). Furthermore, as a fabaceae crop, it improves soil fertility by fixing atmospheric nitrogen through symbiosis with root *Rhizobium* bacteria which make it suitable for intercropping, crop rotation, and sustainable farming systems. Yard long bean can thrive hot, humid climates (20–30°C) and grows best in loam to sandy loam soils with a pH of 6.2–7.0. It is extensively cultivated in tropical and subtropical regions, particularly in Southeast Asia and southern India such as Kerala, Tamil nadu, Karnataka and Maharashtra both as a kitchen garden and a field crop. it is mainly self-pollinated due to cleistogamy, ensuring genetic stability. Enhancing productivity largely depends on exploiting genetic variability, which provides the foundation for effective selection and crop improvement. yield is a complex character governed by a variety of traits, some provide directly and the rest indirectly. Therefore, recognize the association between yield and it contributing character is vital. Correlation study helps to evaluating the degree of relation between yield and it related characters and also with in the component traits. Moreover, path coefficient analysis offers more clarity on the nature of these associations by segregating the direct and indirect effects of each traits on yield and resilence.

Materials and Methods

In summer 2025 a field trail was conducted at the instructional-cum-Research farm in the Horticulture section of Rajarshee Chhatrapati Shahu Maharaj college of agriculture, Kolhapur. The trail was conducted with 30 genotypes of yardlong bean using Randomized Block Design with two replications. The seeds were dibbled at a spacing of 2m × 1m. from each treatment 5 plant were selected for record observations on 11 characters. The data obtained on various parameters will be analyzed as per statistical method by Panse and Sukhatme (1985). For estimation of Genotypic and phenotypic correlation coefficients as suggested by Al-Jibourie *et al.* (1958) and Path coefficient analysis suggested Dewey and Lu (1959) was carried out to access the direct and indirect effect of the different traits in pod yield.

Results and Discussion

Correlation Coefficient analysis

Correlation analysis indicated that pod yield per plant had a very high significant and positive correlation with number of pods per plant (r_g = 0.619, r_p = 0.629) and high significant and positive association with number of seeds per pod (r_g = 0.545, r_p = 0.311), and number of pods per cluster (r_g = 0.409, r_p = 0.369) at both genotypic and phenotypic levels. Days to first fresh pod harvest showed a significant negative genotypic correlation (r_g = -0.353) and a non-significant negative phenotypic correlation (r_p = -0.300). Vine length at final harvest displayed a significant positive correlation at the genotypic level (r_g = 0.393) and a non-significant positive phenotypic correlation (r_p = 0.371). Average pod weight was significantly positive correlated genotypically (r_g = 0.306) and showed a non-significant positive correlation phenotypically (r_p = 0.297). Traits like pod width (r_g = 0.104, r_p = 0.057) and 100-seed weight (r_g = 0.184, r_p = 0.147) had non-significant positive correlations. Both days to flower initiation (r_g = -0.272, r_p = -0.249) and pod length (r_g = -0.045, r_p = -0.021) were negatively correlated with yield, though non-significantly. Additionally, pod width maintained a non-significant positive correlation at both levels. Similar result was line with Kalambe *et al.* (2019).

Vine length showed a high significant and positive correlation with number of seeds per pod (r_g = 0.657, r_p = 0.359) and number of pods per cluster (r_g = 0.517, r_p = 0.377) at the genotypic level, pod yield per plant was significantly positive associated with vine length (r_g = 0.393), while the phenotypic correlation (r_p = 0.371) was positive but non-significant. Vine length also displayed a significant high positive phenotypic correlation with days to first flower initiation (r_p = 0.347), while at the genotypic level, the association was positive but non-significant. Similarly, for days to first fresh pod harvest, a significant and positive phenotypic correlation was noted (r_g = 0.362), and a non-significant positive genotypic association (r_p = 0.450) was observed. The correlation of average pod weight with vine length was significant and positive at the phenotypic level (r_p = 0.325) and positive but non-

Table 1 : Details of Different yard long bean genotypes used in the experiment.

S. no.	Genotype no.	Source	S. no.	Genotype no.	Source
1	**VellayaniJyothika**	KAU, Kerala	16	**ACKYLB-16**	Karnataka
2	**ACKYLB - 2**	Kashmir	17	**Fola**	E-W Seeds
3	**Kanjikuzhy local**	Alappuzha, Kerala	18	**Rocket**	Tanindo Seeds
4	**Githika**	KAU, Kerala	19	**ACKYLB-19**	Tamilnadu
5	**Deepika**	KAU, Kerala	20	**ACKYLB-20**	Kerala
6	**lola**	KAU, Kerala	21	**Badri**	Sumashi Seeds
7	**Manjari**	KAU, Kerala	22	**Ande**	E-W Seeds
8	**Vyjayanthi**	TNAU, Tamilnadu	23	**Marry green**	E-W Seeds
9	**Karkoonthal**	Kerala	24	**Reenu**	E-W Seeds
10	**ACKYLB-10**	Tamilnadu	25	**YLB-7**	Sygenta Seeds
11	**Mitra**	KAU, Kerala	26	**ACKYLB-26**	Kerala
12	**Arka mangala**	IIHR, Bangalore	27	**NS-634**	Namdhari Seeds
13	**Harish**	NSC, Raipur	28	**ACKYLB-28**	Uttarakhand
14	**ACKYLB-14**	Kerala	29	**ACKYLB-29**	West bengal
15	**Sumanth**	Tanindo Seeds	30	**KonkanWali (Check)**	Dr.BSKKV, Dapoli

significant genotypically (r_g = 0.367). Other traits including pod length (r_g = 0.202, r_p = 0.184), 100-seed weight (rg = 0.232, r_p = 0.220), and number of pods per plant (r_g = 0.071, r_p = 0.061) showed positive but non-significant correlations at both levels. In contrast, pod width exhibited a non-significant negative correlation at both genotypic (r_g = -0.044) and phenotypic (r_p = -0.027) levels. Similar observations were reported by Pramanik *et al.* (2021). Days to flower initiation showed a highly significant positive correlation with days to first fresh pod harvest at both genotypic (r_g = 1.129) and phenotypic (r_p = 0.866) levels. Its correlation with vine length was significant and positive at the phenotypic level (r_p = 0.347), while it remained positive but non-significant genotypically (r_g = 0.429). A significant negative genotypic correlation was observed with pod width (r_g = -0.462), while the phenotypic correlation (r_p = -0.237) was negative but non-significant. For average pod weight, the correlation was significantly negative at both genotypic (r_g = -0.306) and phenotypic (r_p = -0.264) levels. Days to flower initiation also had a significant negative genotypic correlation with 100-seed weight (rg = -0.345), while the phenotypic association was negative and non-significant (r_p = -0.148). Pod yield per plant showed a negative, non-significant correlation at both genotypic (rg = -0.272) and phenotypic (r_p = -0.249) levels. Correlations with pod length (r_g = 0.053, r_p = -0.032) and number of pods per plant (rg = 0.021, r_p = -0.015) were weak, being non-significant and slightly positive at the genotypic level and negative at the phenotypic level. Number of seeds per pod was positively correlated but not significant at both genotypic (r_g = 0.178) and phenotypic (r_p = 0.122) levels. Similarly, number of pods per cluster displayed a negative, non-significant correlation at both genotypic (r_g = -0.272) and phenotypic (r_p = -0.105) levels. Nanda *et al.* (2022) also reported similar finding early.

Days to first fresh pod harvest exhibited a very highly significant positive correlation with days to flower initiation at both genotypic (r_g = 1.129) and phenotypic (r_p = 0.866) levels. Vine length showed a significant positive association at the phenotypic level (r_p = 0.362) and a non-significant positive correlation genotypically (r_g = 0.450). Pod width had a significant negative correlation at the genotypic level (r_g = -0.323) and a non-significant negative association phenotypically (r_p = -0.128). Pod length demonstrated a non-significant positive correlation at both genotypic (r_g = 0.259) and phenotypic (r_p = 0.117) levels. Pod yield per plant recorded a significant negative correlation at the genotypic level (r_g = -0.353), while it was negative and non-significant phenotypically (r_p = -0.300). Number of seeds per pod showed a non-

Table 2 : Genotypic(above) and Phenotypic (below) Diagonal correlation coefficients for pod Yield and its component characters in yard long bean.

Characters	VL	DFI	DFFPH	PL	PW	APW	NPPP	NSPP	100SW	NPPC	PYPP
VL	**1.000**	0.4296	0.4507	0.2025	-0.0444	0.3674	0.0719	0.6577***	0.2321	0.5172**	0.3939*
DFI	0.3474**	**1.000**	1.1295***	0.0537	-0.4621**	-0.3065*	0.0213	0.1789	-0.3452*	-0.2722	-0.2721
DFPH	0.3627**	0.8664***	**1.000**	0.2599	-0.3237*	-0.2509	-0.1433	0.3111	-0.2906	-0.2293	-0.3534*
PL	0.1841	-0.0320	0.1170	**1.000**	0.7346***	0.5628***	-0.5556***	0.5827***	0.5285***	0.2175	-0.0452
PW	-0.0274	-0.2371	-0.1289	0.5925***	**1.000**	0.7093***	-0.5933***	-0.0306	0.6077***	0.2624	0.1049
APW	0.3250*	-0.2649*	-0.1408	0.5132***	0.5426***	**1.000**	-0.4946***	0.3849**	0.7649***	0.3741**	0.3061*
NPPP	0.0615	-0.0150	-0.1396	-0.4981***	-0.5269***	-0.4393***	**1.000**	0.2979*	-0.4471***	0.0733	0.6193***
NSPP	0.3599**	0.1224	0.0679	0.3507**	0.1744	0.1457	0.1465	**1.000**	0.4903***	0.7167***	0.5454***
100SW	0.2219	-0.1482	-0.0859	0.3987**	0.4867***	0.6625***	-0.4266***	0.1989	**1.000**	0.1755	0.1842
NPPC	0.3776**	-0.1056	-0.0836	0.1576	0.1868	0.3181*	0.0846	0.4336***	0.1506	**1.000**	0.4097***
PYPP	0.3719	-0.2497	-0.3005	-0.0211	0.0576	0.2974	0.6299***	0.3113**	0.1478	0.3698**	**1.000**

*→ Significant at 5% level ($P \leq 0.05$), ** → Highly significant at 1% level ($P \leq 0.01$), *** → Very highly significant at 0.1% level ($P \leq 0.001$)

VL: - Vine Length, **DFI:** - Days to Flower Initiation, **DFFPH:** - Days to First Fresh Pod Harvest, **PL:** - Pod Length, **PW:** -Pod Width, **APW:** - Average Pod Weight, **NPPP:** - Number of Pod Per Plant, **NSPP:** - Number of Seed Per Pod, **100SW:** - 100 Seed weight, **NPPC:** - Number of Pod Per Cluster, **PYPP:** - Pod Yield Per Plant.

significant positive association at both levels (r_g = 0.311, r_p = 0.067). The remaining traits average pod per plant (r_g = -0.140, r_p = -0.250), number of pods per plant (r_g = -0.143, r_p = -0.139), 100-seed weight (r_g = -0.290, r_p = -0.085), and number of pods per cluster (r_g = -0.229, r_p = -0.083) all exhibited non-significant negative correlations at both genotypic and phenotypic levels. Similar result was reported by Nanda *et al.* (2022).

Pod length exhibited a very highly significant positive correlation with pod width (r_g = 0.734, r_p = 0.592) and average pod weight (r_g = 0.562, r_p = 0.513) at both genotypic and phenotypic levels. It showed a very highly significant negative correlation with number of pods per plant (r_g = -0.555, r_p = -0.498). A very high significant positive correlation was recorded with number of seeds per pod (r_g = 0.582, r_p = 0.350) and 100-seed weight (r_g = 0.528, r_p = 0.398) at both levels. The traits vine length (r_g= 0.202, rp = 0.184), days to first fresh pod harvest (rg = 0.259, r_p = 0.117), and number of pods per cluster (r_g = 0.217, r_p = 0.157) exhibited positive but non-significant correlations at both genotypic and phenotypic levels. Days to flower initiation showed a non-significant positive association at the genotypic level (r_g = 0.053) and a non-significant negative correlation at the phenotypic level (r_p = -0.032). Meanwhile, pod yield per plant demonstrated a non-significant negative correlation at both genotypic (r_g= -0.045) and phenotypic (r_p = -0.021) levels. Similar findings were also reported by Pramanik *et al*. (2021).

Pod width showed a very highly significant positive correlation with pod length (r_g = 0.735, r_p = 0.592), average pod weight (r_g = 0.709, r_p = 0.542), and 100-seed weight (r_g = 0.607, r_p = 0.486) at both genotypic and phenotypic levels. A very highly significant negative association was observed with number of pods per plant (r_g = -0.593, r_p = -0.526) at both levels. Days to flower initiation recorded a significant negative correlation at the genotypic level (r_g = -0.462) and a non-significant negative correlation at the phenotypic level (r_p = -0.237). Days to first fresh pod harvest showed a significant negative correlation genotypically (r_g = -0.323) and non-significant negative association phenotypically (r_p = -0.128). Pod yield per plant (r_g = 0.104, r_p = 0.057) and number of pods per cluster (r_g = 0.262, r_p = 0.186) exhibited positive but non-significant correlations at both levels. Number of seeds per pod showed a non-significant negative genotypic correlation (r_g = -0.030) and a non-significant positive phenotypic correlation (rp = 0.174) at both genotypically and phenotypically. Pod width itself (rg = -0.044, r_p = -0.027) had a non-significant negative association at both levels. Thangam *et al*. (2020) also

Table 3 : Direct and indirect effect of component characters on pod yield per plant (g) in yard long bean.

Characters	VL	DFI	DFFPH	PL	PW	APW	NPPP	NSPP	100SW	NPPC	PYPP
VL	**0.2052**	0.0882	0.0925	0.0416	-0.0091	0.0754	0.0147	0.1350	0.0476	0.1061	0.3939*
DFI	0.0408	**0.0950**	0.1073	0.0051	-0.0439	-0.0291	0.0020	0.0170	-0.0328	-0.0259	-0.2721
DFFPH	-0.0383	-0.0960	**-0.0850**	-0.0221	0.0275	0.0213	0.0122	-0.0264	0.0247	0.0195	-0.3534*
PL	-0.0113	-0.0030	-0.0146	**-0.0560**	-0.0411	-0.0315	0.0311	-0.0326	-0.0296	-0.0122	-0.0452
PW	-0.0208	-0.2165	-0.1517	0.3442*	**0.4685****	0.3324*	-0.2780	-0.0143	0.2847	0.1229	0.1049
APW	0.1790	-0.1493	-0.1222	0.2742	0.3455*	**0.4872****	-0.2409	0.1875	0.3726*	0.1822	0.3061*
NPPP	0.0802	0.0238	-0.1600	-0.6201***	-0.6622***	-0.5520***	**1.1162*****	0.3325*	-0.4990***	0.0819	0.6193***
NSPP	-0.0319	-0.0087	-0.0151	-0.0283	0.0015	-0.0187	-0.0145	**-0.0485**	-0.0238	-0.0348	0.5454***
100SW	0.0108	-0.0160	-0.0135	0.0245	0.0282	0.0355	-0.0208	0.0228	**0.0464**	0.0082	0.1842
NPPC	-0.0198	0.0104	0.0088	-0.0083	-0.0100	-0.0143	-0.0028	-0.0274	-0.0067	**-0.0383**	0.4097*

Residual effect = 0.2378, Diagonal or Bold figures indicates direct effect

VL: - Vine Length, **DFI:** - Days to Flower Initiation, **DFFPH:** - Days to First Fresh Pod Harvest, **PL:** - Pod Length, **PW:** -Pod Width, **APW:** - Average Pod Weight, **NPPP:** - Number of Pod Per Plant, **NSPP:** - Number of Seed Per Pod, **100SW:** - 100 Seed weight, **NPPC:** - Number of Pod Per Cluster, **PYPP:** - Pod Yield Per Plant.

reported similar findings.

Average pod weight exhibited a very highly significant positive correlation with 100-seed weight (r_g = 0.764, r_p = 0.662), pod width (r_g = 0.709, r_p = 0.542), and pod length (r_g = 0.562, r_p = 0.513) at both genotypic and phenotypic levels. A very highly significant negative association was observed with number of pods per plant (r_g = -0.494, r_p = -0.439) at both levels. Number of pods per cluster showed a highly significant positive correlation genotypically (r_g = 0.374) and a significant positive association phenotypically (r_p = 0.318). The number of seeds per pod exhibited a positive genotypic high significance (r_g = 0.384) and a non-significant positive association phenotypically (r_p = 0.145). Days to flower initiation (r_g = -0.250, r_p = -0.264) showed a significant negative correlation at both levels. Vine length had a positive non-significant genotypic association (r_g = 0.367) and a positive significant phenotypic correlation (r_p = 0.325). Pod yield per plant showed a significant positive correlation genotypically (r_g = 0.306) and a non-significant positive relation phenotypically (r_p = 0.297). Days to first fresh pod harvest recorded a non-significant negative correlation at both genotypic (r_g = -0.250) and phenotypic (r_p = -0.140) levels. Noru, R. S. R., & Beena, T. (2025) also reported similar results.

Number of pods per plant showed a very highly significant positive correlation with pod yield per plant at both genotypic (r_g = 0.619) and phenotypic (r_p = 0.629) levels. A very highly significant negative correlation was observed with pod length (r_g = -0.555, r_p = -0.498), pod width (r_g = -0.593, r_p = -0.526), average pod weight (r_g = -0.494, r_p = -0.439), and 100-seed weight (r_g = -0.447, r_p = -0.426) at both levels. Number of seeds per pod showed a significant positive genotypic association (r_g = 0.297), whereas the phenotypic correlation was positive but non-significant (r_p = 0.146).Other traits like vine length (r_g = 0.071, r_p = 0.061) and number of pods per cluster (r_g = 0.073, r_p = 0.084) exhibited a positive non-significant correlation at both levels. Days to flower initiation recorded a non-significant positive correlation at the genotypic level (r_g = 0.021) and a non-significant negative correlation phenotypically (r_p = -0.015). Similarly, days to first fresh pod harvest showed a non-significant negative association at both genotypic (r_g = -0.143) and phenotypic (r_p = -0.139) levels. Similar findings were also reported by Thangam *et al.* (2020) and Noru, R. S. R., & Beena, T. (2025) in yardlong bean. Nanda *et al.* (2022) in winged bean

Number of seeds per pod exhibited a highly significant positive correlation with pod length (r_g = 0.582, r_p = 0.350), number of pods per cluster (r_g = 0.716, r_p = 0.433), and pod yield per plant (r_g = 0.545, r_p = 0.311) at both genotypic and phenotypic levels. vine length reported very highly significant positive correlation at genotypic level (r_g = 0.657) and highly significant positive correlation at phenotypic level (r_p = 0.359), 100-seed weight showed a very highly significant positive genotypic correlation (r_g = 0.490) and a non-significant positive phenotypic association (r_p = 0.198). A similar trend was observed in average pod weight, showing a highly significant correlation (r_g = 0.384, r_p = 0.145). Number of pods per plant displayed a significant positive correlation at the genotypic level (r_g = 0.297) and positive but non-significant at the phenotypic level (r_p = 0.146). Traits such as days to flower initiation (r_g = 0.178, r_p = 0.122) and days to first fresh pod harvest (r_g = 0.311, r_p = 0.067) showed non-significant positive correlations at both levels. On the other hand, pod width had a non-significant positive phenotypic correlation (r_p = 0.174) and a non-significant negative genotypic correlation (r_g = -0.030). Similar findings were reported by Nanda *et al.* (2022).

100-seed weight showed a very highly significant positive correlation with average pod weight (r_g = 0.764, r_p = 0.663) and pod width (r_g = 0.607, r_p = 0.486) at both genotypic and phenotypic levels. pod length reported very high significant positive correlation at genotypic level (r_g = 0.528) and highly significant positive correlation at phenotypic level (r_p = 0.398) A highly significant negative correlation was observed with number of pods per plant (r_g = -0.447, r_p = -0.426) at both levels. Number of seeds per pod displayed a very highly significant positive genotypic correlation (r_g = 0.490), while at the phenotypic level, it showed a positive but non-significant association (r_p = 0.198). Other traits including vine length (r_g = 0.232, r_p = 0.221), number of pods per cluster (r_g = 0.176, r_p = 0.151), and pod yield per plant (r_g = 0.184, r_p = 0.147) exhibited non-significant positive correlations at both levels. Days to flower initiation showed a significant negative genotypic correlation (r_g = -0.345) and a non-significant negative phenotypic correlation (r_p = -0.148), while days to first fresh pod harvest (r_g = -0.291, r_p = -0.085) showed non-significant negative correlations at both levels. Gulwane *et al.* (2022) also reported similar findings.

Number of pods per cluster showed a very highly significant and positive correlation with number of seeds per pod (r_g = 0.716, r_p = 0.433) and highly significant positive correlation reported in vine length (r_g = 0.517, r_p = 0.377) at both genotypic and phenotypic levels. A very high significant positive association was also observed with pod yield per plant (r_g = 0.410) at genotypic and highly significant positive association (r_p = 0.370) at phenotypic levels. Average pod weight showed a highly significant positive correlation at the genotypic level (r_g = 0.374) and a significant positive association at the phenotypic level (r_p = 0.318). Other traits such as 100-seed weight (r_g = 0.176, r_p = 0.151), number of pods per plant (r_g = 0.073, r_p = 0.084), pod width (r_g = 0.262, r_p = 0.187), and pod length (r_g = 0.218, r_p = 0.157) recorded non-significant positive correlations at both levels. In contrast, days to flower initiation (r_g = -0.272, r_p = -0.106) and days to first fresh pod harvest (r_g = -0.229, r_p = -0.083) exhibited non-significant negative correlations with number of pods per cluster at both levels.

These results suggest that for effective improvement in pod yield of yard long bean, traits such as number of pods per plant, number of seeds per plant, and number of pod per clusters should be prioritized during selection, as simultaneous enhancement of these traits can contribute significantly to yield gains.

Path coefficient analysis

Vine length have significant and high positive correlation coefficient with pod yield per plant(r_g=0.394) while it recorded moderate positive direct effect on pod yield per plant (0.205). It exhibited low positive indirect effect to pod yield via average pod weight (0.179), negligible positive indirect effect to pod yield via number of pod per plant (0.080), days to flower initiation (0.040),100 seed weight (0.011) also indirect negligible negative effect through days to first fresh pod harvest (-0.038), number of seed per pod (-0.032), pod width (-0.021), number of pod per cluster (0.02), pod length (-0.011).

Days to first flower initiation have non-significant and moderate negative correlation coefficient with pod yield per plant (r_g = -0.272) while it recorded negligible positive direct effect to pod yield per plant (0.095). It exhibited negligible positive indirect effect through vine length (0.088), number of pod per plant (0.023), number of pod per cluster (0.010), while the following character showed non-significant and moderate negative indirect effect to pod yield per plant via, pod width (-0.217) and negligible negative indirect effect via, days to first fresh pod harvest (-0.096),100seed weight (-0.016), number of seed per pod (-0.009), pod length (-0.003). low negative indirect effect via, average pod weight (-0.149).

Days to first fresh pod harvest recorded non-significant and high negative correlation coefficient to pod yield per plant (r_g= -0.353) and it exhibited negligible negative direct effect to pod yield per plant (-0.085), however it produced low positive indirect effect through Days to flower initiation (0.107), negligible indirect through vine length (0.092), number of pod per plant (0.008). low negative indirect effect through number of pod per plant (-0.160), pod width (-0.152), average pod weight (-0.122) and negligible negative indirect effect was observed in number of seed per pod (-0.015), pod length (-0.015), 100 seed weight (-0.013).

Pod length is exhibited non-significant and negative correlation with pod yield per plant (r_g= -0.045) and negative direct effect to pod yield per plant. However pod length non-significant and high positive indirect effect via., pod width (0.344) and non-significant moderate positive indirect effect via, average pod weight (0.274) and negligible positive indirect effect via, vine length (0.0416), 100 seed weight (0.024), very negligible positive indirect relation through days to flower initiation (0.005). Reaming character were showed negligible negative indirect effect on pod yield per plant via, days first fresh pod harvest (-0.022), number of seed per pod (-0.028), number of pod per cluster (-0.008),except number of pod per plant (-0.620) showed high negative indirect effect.

Pod width had a positive non-significant correlation to pod yield per plant (r_g= 0.105) and it exhibit non-significant and high positive direct effect on pod yield per plant (0.469). Gowever pod width have high, moderate and negligible positive indirect no significant effect via, average pod weight (0.346), 100 seed weight (0.028), days to first fresh pod harvest (0.026), number of seed per pod (0.001), while reaming character showed no significant and high, negative correlation through number of pod per plant (-0.662), reaming character showed non-significant and negligible negative association to pod yield per plant via days to flower initiation(-0.043), pod length (-0.041), number of pod per cluster (-0.010), vine length (-0.009).

Average pod weight have high significant positive correlation with pod yield per plant (r_g= 0.306) and high positive no significant direct effect to pod yield per plant (0.487). while pod width (0.332) showed high positive no significant indirect effect. However, number of pod per plant showed no significant and high negative indirect effect. The character such as 100 seed weight (0.036), days to first fresh pod harvest (0.021), vine length (0.075) were recorded no significant and negligible positive indirect effect to pod yield per plant also the remaining character showed no significant and negligible negative indirect effect pod yield per plant via, pod length (-0.031), days to flower initiation (-0.029), number of seed per pod (-0.018), number of pod per cluster (-0.014). Ramandeep *et al.* (2017) also coined similar result in French bean.

Number of pod per plant exhibited high significant

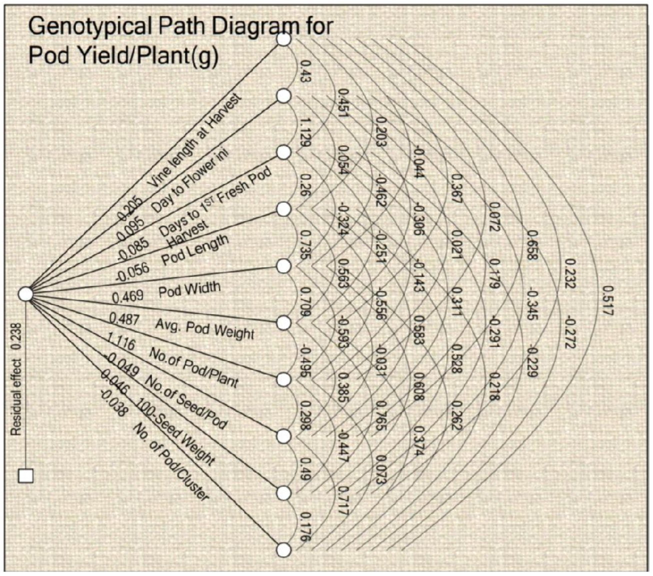

Fig. 1 : Genotypical path diagram for pod yield per plant (g) in yard long bean.

positive correlation coefficient with pod yield per plant (r_g=0.619), while it showed very high direct effect to pod yield per plant. The pod width (-0.278) and average pod weight (-0.240) showed no significant and moderate negative indirect effect. The character via, pod length (0.031), vine length (0.014), days to first fresh pod harvest (0.012) and days to flower initiation (0.002) recorded no significant and negligible positive indirect effect to pod yield per plant. The remaining characters 100 seed weight (-0.020), number seed per pod (-0.014), number of pod per cluster (-0.002) showed no significant and negligible negative indirect effect to pod yield per plant. Similar result line with Shankar *et al.* (2018) in groundnut and Ramasamy *et al*. (2021) in pegionpea.

Number of seed per pod recorded significant and high positive correlation coefficient with pod yield per plant(r_g=0.545) while it recorded negligible negative direct effect (-0.049). number of pod per plant (0.333) produced non-significant and high positive indirect effect. The character vine length (0.135) and average pod weight (0.187) showed non-significant and low positive indirect effect. The 100 seed weight (0.022) and days to flower initiation (0.017) showed no significant and negligible positive indirect effect. reaming characters such as pod length (-0.032), number of pod per cluster (-0.027), days to first fresh pod harvest (-0.026), pod width (-0.014) showed no significant and negligible negative indirect effect with pod yield per plant via number of seed per pod.

The 100 seed weight exhibited a non-significant yet positive correlation coefficient with pod yield per plant (r_g = 0.184), while showing a high positive direct effect (0.046) on pod yield. Average pod weight displayed a non-significant but high positive indirect effect (0.372), whereas pod width showed a moderate positive indirect effect (0.284). Traits such as vine length (0.047) and days to first fresh pod harvest (0.024) contributed non-significant and negligible positive indirect effects on pod yield per plant. Conversely, the number of pods per plant presented a non-significant yet high negative indirect effect (-0.499). Furthermore, days to flower initiation (-0.033), pod length (-0.029), number of seeds per pod (-0.023), and number of pods per cluster (-0.006) all demonstrated non-significant and negligible negative indirect effects on pod yield per plant via 100 seed weight. Kumar *et al*. (2024) also reported similar finding.

Number of pod per cluster had significant and high positive correlation coefficient with pod yield per plant (r_g=0.409). while it recorded non-significant negligible negative direct effect to pod yield per plant (-0.038), the characters such as average pod weight (0.182), pod width (0.123), vine length (0.106) showed non-significant and low positive indirect effect. Then the days to first fresh pod harvest (0.020),100 seed weight (0.008) showed non-significant and negligible positive indirect effect. The number of pod per plant (0.082) showed no significant and negligible positive indirect effect. Also the remaining character such as number of seed per pod (-0.034), days to flower initiation (-0.025), pod length (-0.012) showed non-significant and negligible negative indirect effect with pod yield per plant through number of pod per cluster. Manivannan *et al*. (2019) reported corresponding result in cowpea.

The consistency between the direction and strength of these direct, indirect effects and their correlation with pod yield further validates their importance for the selection for further breeding programme.

Conclusion

Correlation analysis revealed that number of pod per plant, number of seed per pod and number of pod per cluster exhibited the highest positive associations with pod yield per plant at both genotypic and phenotypic levels. Path coefficient analysis supported the correlation study that the number of pods per plant exerted the greatest direct effect on yield, while average pod weight, pod width, and vine length also contributed moderate positive direct effect on yield. Moreover, the low residual effect observed (0.238) in path analysis indicates that the traits analyzed account for most of the variability in pod yield. In combination, these results suggest that improvement in pod yield can be effectively achieved by giving focus to the number of pods per plant, seeds per pod, and pods per cluster along with supportive traits such as pod weight and vine length. reinforcing their value as key selection criteria for genetic improvement.

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