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Short Research Article

Correlation and Path Coefficient Analysis of Yield Components in Advanced Lines of Grasspea (*Lathyrus sativus* L.)

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Abstract

The present study was undertaken with eighteen advanced lines with their five parents were grown during *rabi* 2011 in Randomized Complete Block Design (RBD) with three replications in plot size of 4×0.45 m^2 at row spacing of 30 cm apart. The observations for 15 biometric characters viz., length of the first bearing node (cm), days to 50% flowering, days to maturity, number of pods $plant^{-1}$, number of seeds pod^{-1}, number of seeds $plant^{-1}$, seed yield $plant^{-1}$ (g), 100 seed weight (g), plant biomass $plant^{-1}$ (g), harvest index (%), swelling index, seed protein content (%) and ODAP content (%) at flowering, pod filling and maturity stages were recorded on five plant basis in each plot in each replication. Positive genotypic correlation was shown by harvest index, number of seeds $plant^{-1}$, plant biomass $plant^{-1}$ and number of pods $plant^{-1}$. Yield was positive and significantly correlated with seed ODAP content, biomass $plant^{-1}$, harvest index, days to maturity, number of seeds pod^{-1}, length of first bearing node and number of pods $plant^{-1}$. Seed ODAP content, biomass $plant^{-1}$, harvest index, days to maturity, number of seeds pod^{-1}, length of first bearing node and number of pods $plant^{-1}$ contributed maximum positive and direct effect on yield indicating these traits should be given emphasis while selecting high yielding cultivars. Our results indicated from the present study that traits showing strong and positive correlation with seed yield may be given priority while characters showing negative correlation should avoid during selection of superior genotypes for improving seed yield in grasspea.

1. Introduction

Grasspea (*Lathyrus sativus* L.), an annual pulse crop belonging to the family Fabaceae grows well under adverse environmental conditions and its many cultivars possess different attributes endowed with many properties that combine to make it an attractive food crop in drought-stricken, rain-fed areas where soil quality is poor and extreme environmental conditions prevail. (Palmer et al., 1989). Compared with other legumes, the grass pea is resistant to many pests including storage insects (Palmer et al., 1989). These properties make it an attraction crop for plant breeders. During last few years, intensive research work has been initiated to improve yield as well as the quality of grasspea. Grain yield in grasspea is a complex entity determined by the interplay of a number of attributes. Adequate knowledge of interrelation of factors influencing such complex characters is essential for designing an effective plant breeding programme. Studies of correlation of agronomic and morphological characters are helpful in the identification of the components of a complex character such as yield but they do not provide precise information on the relative importance of direct and indirect influences of each of the componential characters. The technique of path coefficient analysis developed by Wright (1921) has been extensively used by conventional breeders. This analysis helps to identify different components affect yield. The present paper elucidates the interrelationship of factors influencing grain yield of advanced breeding lines through correlation and path coefficient analysis.

2. Materials and Methods

Eighteen advanced lines with their five parents (listed in Table 1) were grown during *rabi* 2011 in Randomized Complete Block Design (RBD) with three replications in plot size of 4×0.45 m^2 at row spacing of 30 cm apart. The observations for 15 biometric characters viz., length of the first bearing node (cm), days to 50% flowering, days to maturity, number

Table 1: Details of the genotypes used in the study

Sl. No.	Genotype	Genera-tion	Source
1.	Mahateora	Parent	AICPIR, MUL-LARP, IGKV, Raipur
2.	Prateek	Parent	AICPIR, MUL-LARP, IGKV, Raipur
3.	Pusa 24	Parent	IARI, New Delhi
4.	Ratan	Parent	IARI, New Delhi
5.	RLS 3004	Parent	IGKV, Raipur
6.	Ratan×Mahateora	F_7	AICPIR, MUL-LARP, IGKV, Raipur
7.	Ratan×Pusa-24	F_7	AICPIR, MUL-LARP, IGKV, Raipur
8.	Prateek× RLS-3004	F_7	AICPIR, MUL-LARP, IGKV, Raipur
9.	Pusa-24×RLS-3004	F_7	AICPIR, MUL-LARP, IGKV, Raipur
10.	Ratan×RLS-3004	F_7	AICPIR, MUL-LARP, IGKV, Raipur
11.	Prateek×Pusa-24	F_7	AICPIR, MUL-LARP, IGKV, Raipur
12.	Mahateora×Ratan	F_7	AICPIR, MUL-LARP, IGKV, Raipur
13.	Ratan×Prateek	F_7	AICPIR, MUL-LARP, IGKV, Raipur
14.	Prateek×Ratan	F_6	AICPIR, MUL-LARP, IGKV, Raipur
15.	Pusa-24×Mahateora	F_6	AICPIR, MUL-LARP, IGKV, Raipur
16.	Pusa-24×Prateek	F_6	AICPIR, MUL-LARP, IGKV, Raipur
17.	Mahateora× RLS-3004	F_6	AICPIR, MUL-LARP, IGKV, Raipur
18.	Prateek× Mahateora	F_6	AICPIR, MUL-LARP, IGKV, Raipur
19.	Prateek× RLS- 3004	F_5	AICPIR, MUL-LARP, IGKV, Raipur
20.	Prateek×Ratan	F_5	AICPIR, MUL-LARP, IGKV, Raipur
21.	Ratan×Mahateora	F_5	AICPIR, MUL-LARP, IGKV, Raipur
22.	Pusa 24×Prateek	F_5	AICPIR, MUL-LARP, IGKV, Raipur
23.	RLS- 3004×Pra-teek	F_5	AICPIR, MUL-LARP, IGKV, Raipur

of pods plant^{-1}, number of seeds pod^{-1}, number of seeds plant^{-1}, seed yield plant^{-1} (g), 100 seed weight (g), plant biomass plant^{-1} (g), harvest index (%), swelling index, seed protein content (%) and ODAP content (%) at flowering, pod filling and maturity stages were recorded on five plant basis in each plot in each replication. Observations of flowering and maturity recorded on plot basis as per the descriptors for *Lathyrus* spp. (IPGRI, 2000). These observations were averaged and then subjected to statistical analysis. The genotypic correlation coefficients were estimated following the method of Singh and Chowdhury (1977). The genotypic correlation coefficients were partitioned into path coefficient using the technique outlined by Dewey and Lu (1959).

3. Results and Discussion

The different characters were analyzed for the evaluation of correlations (here genotypic correlation is mentioned). The correlation coefficients were partitioned into components of direct and indirect effects through path analysis.

3.1. Correlation analysis

The genotypic correlation coefficients between plant yield and its components are presented in Table 2. Seed yield plant^{-1} exhibited highly significant positive correlation with harvest index (0.880**, 0.749**) followed by number of seeds plant^{-1} (0.689**, 0.652**), plant biomass plant^{-1} (0.661**, 0.620**) and number of pods plant^{-1} (0.621**, 0.570**) at both the genotypic and phenotypic levels, respectively. These findings are further supported by the findings of Ali et al. (1986); Pandey et al. (2000); Larbi et al. (2010) reported for yield and attributes in grasspea.

3.2. Path coefficient analysis

The estimates of direct and indirect effects of the fourteen yield attributes on plant yield are presented in Table 3. The highest positive direct effect towards grain yield was exhibited due to seed ODAP content (1.159) followed by biomass plant^{-1} (0.655), harvest index (0.546), days to maturity (0.281), number of seeds pod^{-1} (0.175), length of first bearing node (0.123) and number of pods plant^{-1} (0.047). However, the negative direct effect on grain yield was noted due to ODAP content at pod filling stage (-1.127), followed by ODAP content at flowering stage (-0.581), days to 50% flowering (-0.311), 100 seed weight (-0.250), swelling index (-0.230), seed protein content (-0.082) and number of seeds plant^{-1} (-0.039). Hence these traits showing positive correlation may be considered

as important while planning for grasspea improvement programme. The above findings of positive direct effects on seed yield are in accordance with the findings of Pandey et al. (1996), Pandey et al. (2000); Kahalkar (2010).

Table 2: Genotypic (G) correlation for yield, its components, protein and ODAP content in grasspea

Sl. No.	Characters		Days to 50% flowering	Days to maturity	Length of first bearing node (cm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	No. of seeds plant^{-1}	Seeds yield plant^{-1} (g)	100 seed weight (g)
1.	Days to 50% flowering	G	1.000	0.659**	0.103	-0.037	-0.699**	-0.216	-0.184	-0.197
2.	Days to maturity	G		1.000	1.057**	-0.029	-0.954**	-0.190	-0.838	0.401
3.	Length of first bearing node (cm)	G			1.000	0.2.85	-0.944**	0.101	0.121	-1.125**
4.	No. of pods plant^{-1}	G				1.000	-0.017	0.898**	0.621**	-0.203
5.	No. of seeds pod^{-1}	G					1.000	0.276	0.104	-0.371
6.	No. of seeds plant^{-1}	G						1.000	0.689**	-0.166
7.	Seedsyield plant^{-1} (g)	G							1.000	-0.210
8.	100 seed weight (g)	G								1.000
9.	Plant biomass plant^{-1}	G								
10.	Harvest index (%)	G								
11.	Swelling index	G								
12.	Seed protein content %	G								
13.	ODAP at flowering stage	G								
14.	ODAP at pod filling stage	G								
15.	ODAP in seed	G								

*Significant at (p=0.05); **at (p=0.01)

Table 2: Continue...

Sl. No.	Characters		Plant biomass plant^{-1}	Harvest index (%)	Swelling index	Seed protein content %	ODAP at flowering stage	ODAP at pod filling stage	ODAP in seed
1.	Days to 50% flowering	G	-0.113	0.018	-0.168	-0.0652	0.352	-0.145	0.008
2.	Days to maturit	G	-0.323	-0.490*	-0.040	-0.495*	0.366	0.208	0.474*
3.	Length of first bearing node (cm)	G	0.719**	-0.287	0.786**	-0.163	1.051**	0.043	0.105
4.	No. of pods plant^{-1}	G	0.908**	0.248	0.060	-0.016	0.086	-0.463*	-0.574**
5.	No. of seeds pod^{-1}	G	-0.207	0.459*	0.101	-0.055	0.169	-0.612**	-0.580**
6.	No. of seeds plant^{-1}	G	0.858**	0.415*	0.086	0.024	0.176	-0.616**	-0.681**
7.	Seedsyield plant^{-1} (g)	G	0.661**	0.880**	0.002	-0.029	-0.003	-0.265	-0.262
8.	100 seed weight (g)	G	-0.237	0.243	-0.296	-0.124	-0.506	0.374	0.353
9.	Plant biomass plant^{-1}	G	1.000	0.249	0.188	0.053	0.085	-0.440*	-0.512*
10.	Harvest index (%)	G		1.000	-0.101	0.017	0.072	-0.203	0.004
11.	Swelling index	G			1.000	0.198	0.113	-0.308	-0.284
12.	Seed protein content %	G				1.000	0.027	0.083	0.087
13.	ODAP at flowering stage	G					1.000	0.237	-0.027
14.	ODAP at pod filling stage	G						1.000	0.990**
15.	ODAP in seed	G							1.000

Table 3: Genotypic (G) path coefficient showing direct and indirect effects of different characters on grain yield of grasspea

Sl. No.	Characters		Days to 50% flowering	Days to maturity	Length of first bearing node (cm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	No. of seeds plant^{-1}	100 seed weight (g)
1.	Days to 50% flowering	G	-0.311	0.185	0.013	-0..002	-0.122	0.008	0.049
2.	Days to maturity	G	-0.205	0.281	0.130	-0.001	-0.167	0.007	-0.100
3.	Length of first bearing node (cm)	G	-0.032	0.297	0.123	0.013	-0.165	-0.004	0.281
4.	No. of pods plant^{-1}	G	0.012	-0.008	0.035	0.047	-0.003	-0.035	0.051
5.	No. of seeds pod^{-1}	G	0.217	-0.268	-0.116	-0.001	0.175	-0.011	0.093
6.	No. of seeds plant^{-1}	G	0.067	-0.053	0.012	0.042	0.048	-0.039	0.042
7.	100 seed weight (g)	G	0.061	0.113	-0.138	-0.009	-0.065	0.006	-0.250
8.	Plant biomass plant-1 (g)	G	0.035	-0.091	0.088	0.042	-0.036	-0.033	0.059
9.	Harvest Index (%)	G	-0.006	-0.138	-0.035	0.012	0.080	-0.016	0.061
10.	Swelling index	G	0.052	-0.011	0.097	0.003	0.018	-0.003	0.074
11.	Seed protein content %	G	0.203	-0.139	-0.020	-0.001	-0.010	-0.001	0.031
12.	ODAP content at flowering stage	G	-0.110	0.103	0.129	0.004	0.030	-0.007	0.127
13.	ODAP content at pod filling stage	G	0.045	0.058	0.005	-0.022	-0.107	0.024	-0.094
14.	ODAP content in seed	G	-0.002	0.133	0.013	-0.027	-0.101	0.026	-0.088

*Significant at (p=0.05); **at (p=0.01)

Table 3: Continue...

Sl. No.	Characters		Plant biomass plant^{-1} (g)	Harvest index (%)	Swelling index	Seed protein content %	ODAP content at flowering stage	ODAP content at pod filling stage	ODAP content in seed	Seed yield plant^{-1} (g)
1.	Days to 50% flowering	G	-0.074	0.010	0.039	0.053	-0.205	0.163	0.009	-0.183
2.	Days to maturity	G	-0.212	-0.268	0.009	0.041	-0.213	-0.234	0.549	-0.383
3.	Length of first bearing node (cm)	G	0.471	-0.157	-.0181	0.013	-0.611	-0.049	0.122	0.2839
4.	No. of pods plant^{-1}	G	0.594	0.136	-0.014	0.001	-0.050	0.521	-0.666	0.621**
5.	No. of seeds pod^{-1}	G	-0.135	0.251	-0.023	0.005	-0.098	0.689	-0.673	0.105
6.	No. of seeds plant^{-1}	G	0.561	0.227	-0.020	-0.002	-0.102	0.694	-0.789	0.689**
7.	100 seed weight (g)	G	-0.155	-0.133	0.068	0.010	0.294	-0.421	0.409	-0.210**
8.	Plant biomass plant^{-1} (g)	G	0.655	0.136	-0.043	-0.004	-0.049	0.496	-0.594	0.661**
9.	Harvest Index (%)	G	0.163	0.546	0.023	-0.001	-0.042	0.228	0.004	0.880**
10.	Swelling index	G	0.123	-0.055	-0.230	-0.016	-0.065	0.347	-0.330	0.002
11.	Seed protein content %	G	0.034	0.010	-0.046	-0.082	-0.015	-0.094	0.100	-0.03
12.	ODAP content at flowering stage	G	0.056	0.039	-0.026	-0.002	-0.581	0.267	-0.031	-0.002
13.	ODAP content at pod filling stage	G	-0.288	-0.111	0.071	-0.007	0.138	-1.12	1.148	-0.267
14.	ODAP content in seed	G	-0.335	0.002	0.066	-0.007	0.016	-1.116	1.159	-0.261

Residual effect: 0.0500; Diagonal bold values indicate direct effect (for Genotypic Path)

4. Conclusion

Traits showing strong and positive correlation with seed yield might be given priority while characters showing negative correlation should be avoided during selection of superior genotypes for improving seed yield in grasspea.

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