Scholarly Research Journal for Interdisciplinary Studies,
Online ISSN 2278-8808, SJIF 2019 = 6.38, www.srjis.com
PEER REVIEWED & REFEREED JOURNAL, NOV-DEC, 2019, VOL- 7/55

STUDY OF DIRECT AND INDIRECT EFFECTS OF ELEVEN METRIC TRAITS CONTRIBUTING TOWARDS YIELD IN PEA (PISUM SATIVUM L.)

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Abstract

Direct and indirect effects for 11 characters in 32 strain / varieties of pea (Pisum sativum L.) were studied. Path coefficient study revealed the importance of number of pods per plant which contributed maximum direct effect for grain yield followed by number of seeds per pod, 100- grain weight, pod length, harvest index and plant height. The indirect influences through their combination were important .Plant height, 100-grain weight, pod length and harvest index extended positive direct effect on grain yield. Days to maturity, number of primary and secondary branches and days to maturity exhibited negative direct effect on grain yield.

Keywords: *Pisum sativum (L.), path- analysis, direct and indirect effects*

Introduction

Pulses occupy an indispensable place in our daily diet as a source of protein. Pulse crops also have an unique potentiality to associate symbiotically with Rhizobium spp. And fix atmospheric nitrogen. This has helped in maintaining the fertility level of soils. Pea is grown all over the world and occupies an area of about 7 million hectares, producing more than 10 million tones annually. It is grown particularly in Asia, Europe and USA. In China and USSR the grain is mostly fed to livestock, while in our country it is used for human consumption as a protein source and occupies a position of considerable value because of its importance in the agriculture economy of the country. India stands next to china and USSR in production. In India the area under pea is 544 thousand hectares with in annual production of 595 thousand tones and average productivity is 10.39 quintals per hectare .Uttar Pradesh is the largest producers in the country contributing about 345 thousand hectares in the area and 481 thousand tones in production and average productivity is 13.94 quintal/hectare. Other important pea growing states are Madhya Pradesh, Bihar, Haryana, Maharashtra and Rajasthan. Yield is a complex character, Influenced by several genetic factors interacting

with environment. Simple correlation provides information on mutual association between two variables, but it does not provide information about the cause and effect inter-relationship between yields, its components and among the components themselves. The path- co-efficient is a standard method for studying cause and effect of relationship. Moreover, path analysis provides information about contribution of different characters towards yield.

Material and Methods

In the present investigation 32 pea *(Pisum sativum*L.) genotypes were planted in a Randomized Complete Block Design with three replications. The each experimental plot consists of 6 rows of 4 m length with 30 cm distance from row to row and 10 cm from plant to plant. The observations were recorded on 10 randomly selected plants per plot for eleven characters. Wright (1921) defined the path coefficient as the ratio of the standard deviation of effect to the total standard deviation when all causes are constant, except one in question, the variability of which kept in changed .Path coefficient is simply a standardized partial regression coefficient and as such measure the direct influence of one variable upon another and permits the correlation coefficient into component of direct and indirect effects. The path coefficients were obtained by the simultaneous equation which express the basic relationship between correlation and path coefficient as suggested by Dewey and Lu (1959).

Result and Discussion

To obtain a clear understanding of the association, the genotypic correlation coefficients of grain yield with its contributing characters were portioned into direct and indirect effects through path coefficient analysis as suggested by Wright (1921).The estimates of direct and indirect effects are presented in Table 1.

The path coefficient analysis was done to determine the direct and indirect effects on grain yield via days to flowering, plant height, number of primary and secondary branches/plant, days to maturity, number of pods/plant, number of seeds/pod, pod length, 100-grain weight and harvest index. Estimation of path coefficient furnished in Table1 clearly marked that the character number of pods/plant was most significant due to contribution of maximum direct effect (0.730) on grain yield. The correlation between number of pods/plant and grain yield (0.951) was also highly significant resulting the highest contribution of direct effect. This is supported by the findings of Roy et al (2000), Singh et al.(1986) and Samaiya et al. (1990).

Days to flowering exhibited negative direct effect, while their association was negative with grain yield and the contribution of high magnitude of indirect effects through number of seeds/pod .Days to flowering had positive indirect effect with plant height, number of secondary branches, number of seeds/pod, pod length and 100-grain weight.

Plant height showed positive and significant association with grain yield (0.470) while their direct effect (0.0570 is also positive. The negative indirect effect of plant height with days to flowering, number of primary branches, number of secondary branches, days to maturity, and pod length. The maximum indirect effect of plant height with number of pods/plant were obtained.

Number of primary branches showed significant positive association with grain yield (0.657) but it direct effect (-0.128)is negative. Its indirect effects via number of pods/plant, number of seeds/pod, pod length, harvest index and 100 –grain weight were positive and high in magnitude resulting the significant positive association with grain yield.

Number of secondary branches/plant reflected negative direct effect (-0.050) on grain yield. Association between number of secondary branches and grain yield was positive (0.312). Indirect influences through days to flowering, plant height, number of pods/plant, number of seeds/pod, pod length, harvest index and 100-grain weight were positive. Rest of the characters manifested negative indirect effects for grain yield. Negative indirect effects were nullified by the powerful positive indirect effect and positive correlation

Days to maturity exhibited high negative direct effect (-0.104) on grain yield/plant and association of this character with grain yield was also negative (-0.114).Cumulative negative indirect effects through most of the characters were higher than the positive indirect influences of some characters for yield which finally contributed negative relationship. So negative direct effect may appear due to the interaction of environment which is unstable and thus the characters are not reliable for selection programme.

Number of pods/plant showed significant positive association with grain yield (0.951).IT proves its potent contribution towards grain yield and may effectively be considered for improvement in yield. It is very important to that the number of pods/plant was such a character as it contributed maximum positive direct effect (0.730) on grain yield /plant. Positive indirect influences of this character was also observed with days to flowering, plant height, days to maturity, number of seeds/pod, pod length, harvest index and 100-grain

weight. Rest of the characters showed negative indirect influences. The above results on path analysis are in accordance with those reported by Singh et al. (1985) and Gupta et al. (1986). Number of seeds/pod also had higher amount of positive direct effect (0.152) on grain yield but negative indirect effect via harvest index. Significance positive association was found between number of pods/plant, pod length and 100- grain weight.This trait has positive and significant association with grain yield (0.383). Cumulative indirect effects through most of the characters except number of primary and secondary branches/plant and days to maturity and harvest index were higher than the negative indirect influences of these characters for yield which finally contributed positive relationship. Due to good amount of direct effect and positive correlation, the characters are reliable for breeding selection programme (Paliwal et al. (1987), Irfan A Khan (1988) and Lokendra Singh et al.(2010).

Pod length has positive and significant association with grain yield (0.454) and its direct effect is also positive (0.124). The contribution of high magnitude of indirect effects through number of pods/plant, 100-grain weight and number of seeds/pod for this trait were considered for selecting suitable genotypes.

The direct effect of harvest index on grain yield was positive but positive indirect effects via days to flowering, plant height, days to maturity, number of pods/plant and 100-grain weight resulted in positive association with grain yield.

100-grain weight showed positive association with grain yield but direct effect of this character as also positive. This showed that the grain yield was directly affected by 100 grain weight. Such findings were also reported in the study of Paliwal et al.(1987), Gupta et al. (1989) ,Samaiya et al. (1990) and lokendra Singh et al. (2010).

The residual effect under path analysis was obtained 0.5639, which indicated that the important agronomic attributes effecting yield had been influenced in the present study.

Table 1: Direct and indirect effects at genotypic level of different quantitative characters on grain yield in pea

Characters	1	2	3	4	5	6	7	8	10	11	Genotypic correlation
With grain yield											
1 .Days to flowering	(-0.0029)	0.0077	-0.0018	0.0057	-0.0615	-0.0815	0.0512	0.0008	-0.0057	0.0219	-0.051

2. Plant height	0.0004	(0.0572)	-0.0076	-0.0018	-0.0091	0.1697	0.0081	-0.0041	0.0112	0.0055	0.470**
3. No. of pri. branches	0.0000	0.0033	(-0.0507)	-0.0228	-0.0174	0.2602	0.03444	0.0331	0.0007	0.0163	0.651**
4. No. of sec. branches	0.0003	0.0020	-0.576	(-0.0507)	-0.0174	0.2566	0.0192	0.0205	0.0065	0.0189	0.312
5. Days to maturity	-0.0017	0.0050	-0.0212	-0.0084	(-0.1048)	-0.0548	0.0410	0.0121	-0.0076	0.0469	-0.114
6. No. of pods/plant	0.0003	0.0133	-0.0456	-0.0178	0.0079	(0.7304)	0.0393	0.0256	0.0201	0.0009	0.951**
7. No, of seeds/pod	-0.0010	0.0030	-0.0288	-0.0064	-0.0282	0.1882	(0.1526)	0.0706	-0.0170	0.0113	0.383*
8. Pod length	-0.0000	-0.0019	-0.0340	-0.0083	0.0102	0.1496	0.0862	(0.1248)	-0.0149	0.0014	0.454**
10. Harvest index	0.0002	0.0066	-0.0009	-0.0034	0.0083	0.1524	-0.0268	-0.0193	(0.0964)	0.0087	0.123
11. 100 grain weight	-0.0004	0.0022	-0.0147	-0.0068	-0.0345	0.0045	0.0121	0.0012	0.0059	(0.1422)	0.264

Residual effect=0.5639

Note: Values in parenthesis denote direct effect

References

Roy, A. and K .Das (2000).Studies on genetic variability and path analysis in pea. Indian J. Pulse Res. 13(1):54-55.

Dewey, D. R. and Lu, K.H. (1959).A correlation and path coefficient analysis of components of crested wheat grass seed production.Agron.J.51:515-518.

Gupta, R.K. and Dahiya, B.S. (1986).Inheritance of pod yield traits in pea. Crop Improv. 13(1):45-48.

Gupta, K.R.; Lodhi, G.P. and Tomar, Y.S. (1989).Correlation and path analysis in segregating population of chickpea .Indian J. Agri. Res.23 (3); 121-124.

Irfan, A. Khan (1988).Path coefficient analysis of yield attributes in mungbean (Vigna radiata L.).Legume Res. 11(1):41-43.

Lokendra Singh, R.K. Yadav,R.P. Vyas and Jagbir Singh(2010).Character association and path analysis in pigeonpea. Current advances in Agric, Sci.2 (1):43-44.

Natarajan, K.S. and Arunmugan (1980).Correlation and path coefficient analysis in pea (Pisam sativum L.).Madras Agric J.67:387-390.

Pal,A.K. and Shivendra,S (2012).Correlation and path analysis in garden pea (Pisum sativumL.).Asian J. of Horti.7 (2):569-573.

Ranalli, P.; Candili, M.D.; Gierdano, I and Casarini, B. (1981) .Correlation and path analysis in pea (Pisum sativum L.). For processing Beitsewrift fur rflanzenzuchtung 86(1):81-86.

Singh, A.K.; and Singh, H.G. (1985).Study of direct and indirect influences of some yield, quality and physiological characters on grain yield in pea (Pisum sativumL.).Madras Agric. J. 72(42):222-225.

Singh, K.N. and Santoshi, U.S. (1986).Study of path coefficient of eleven metric traits contributing towards yield in pea (Pisum sativum L.)Crop Improv. 13(1):44-45.

12. Singh, M.N. and singh, R.B. (19880).Path analysis of certain yield traits in segregating and non-segregating generation of pea (Pisum sativum L.).Indian J. Pulse Res. 1(1):18-22.

Wright, S. (1921).Correlation and causation.J.Agric.Res.20:557-558.