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Correlation and path analysis in pea (*Pisum sativum* L.)

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Abstract
The present investigation was carried out to estimate phenotypic and genotypic correlation and path coefficient analysis were studied for various yield and its component characters in 21 different genotypes of pea during Rabi 2017-18 at Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture Latur, Vasantrao Nike Marathwada Krishi Vidyapeeth (M.S.). Correlation studies revealed that green pod yield per plant was positively and significantly associated with number of seeds per green pod and pod length. Path coefficient analysis revealed that traits like number of primary branches per plant, 50% flowering, number of clusters per plant, number of pods per cluster, number of seeds per pod and were recorded positive direct effect on green pod yield per plant. Therefore yield can be improved in pea by improving these traits.

Keywords: Pea, *Pisum sativum* L., correlation, path analysis

Introduction
Pea (*Pisum sativum* L.) belongs to family 'Leguminaceae' it grown in India as a winter vegetable in the plains of north and as a summer vegetable in the hills of India. It is one of the most important vegetable as well as pulse crop in India.

Pea is a very common nutritious vegetable grown throughout the world. It contains more proteins, carbohydrates, vitamins and minerals like calcium and phosphorus. The nutritive value of green pea (per 100 g of edible portion) is protein 6.2 g, fat 0.4 g, carbohydrate 16.9 g, iron 1.2 mg, phosphorus 102 mg, vitamin C 27 mg, vitamin B_1 0.28 mg, vitamin B_2 0.11 mg, vitamin B_3 2.8 mg. (Duke 1981, Hulse 1994) [5, 7]. It is an excellent food for human consumption taken either as a vegetable or in soup. Large production of peas is processed (canned, dehydrated or frozen) for consumption in off season. Being a proteinus vegetable it forms a valuable dish in the vegetarian diet. It ranks third in the world production amongst the grain legumes.

The inclusion of pea in crop rotation is agronomical very significant. The pea is good predecessor to other crops as it enriches the soil with the nodule bacteria which live in its root and it fixes nitrogen which becomes available to other plants.

Study of genetic variability particularly important in yield and yield contributing characters is basic to plan out future improvement programme in any crop. The correlation co-efficient gives, an idea of the nature and intensity of association between two or more quantitative characters between yield and yield contributing characters. Correlation simply measures that mutual relationship between yield and yield contributing characters. Thus, correlation helps in the selection of superior genotype from diverse genetic populations.

As there are number of factors involved in correlation studies, their indirect associations become more complex and confusing but path analysis helps to avoid this complication by measuring the direct influence of one characters on other as well as permits the partitioning of given correlation coefficients into its components of direct and indirect effects. The path coefficient analysis is an effective means of analyzing direct and causes of association and permits the critical examination of the specific that produce a given correlation. The path analysis provides information about magnitude and direction of direct and indirect effect of the yield components, which cannot provide by correlation.

Materials and Methods
An experiment was carried out at Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture Latur during the year 2017-18 to evaluate twenty one

diverse genotypes of pea. The experiment was laid out in Randomized Block Design (RBD) with two replications. Observations were recorded from five randomly selected plants of each genotype in each replication for fourteen characters *viz.*, Plant height (cm), Number of primary branches/plant, Days to first flowering, Days to 50% flowering, Days to first picking, Number of pickings, Number of clusters per plant, Number of pods per cluster, Pod length, Number of seeds per pod, Crop duration and Green pod yield per plant. For calculating, the genotypic and phenotypic correlation coefficients for all possible combination the formula suggested by Johnson *et al.* (1955) [8]. Path co-efficient analysis was calculated by the formula suggested by Dewey and Lu (1959) [3].

Results and Discussion

Correlation

Correlation coefficient of green pod yield per plant was recorded highly significant and positive with number of seeds per green pod (rg=0.707, rp=0.662) and pod length (rg=0.684, rp=0.664). Green pod yield per plant was recorded highly significant and negative correlation with plant height (rg=-0.769, rp=-0.653), number of clusters per plant (rg=-0.655, rp=-0.617), days to first picking (rg=-0.647, rp=-0.612), days to 50 per cent flowering (rg=-0.627, rp=-0.601), days to first flowering (rg=-0.607, rp=-0.554) and number of primary branches per plant (rg=-0.517, rp=-0.487) at both genotypic and phenotypic levels. These characters are responsible for increasing green pod yield per plant. Characters like days to first flowering, days to 50 per cent flowering and days to first picking were recorded negative and significant correlation with green pod yield per plant these characters showing earliness in pea crop. Similar finding reported by Diwaker *et al.*, (2018) [4], Kumar *et al*., (2015) [10], Kumawat *et al.*, (2018) [11], Basaiwala *et al.*, (2013) [1] and Gupta *et al*., (2007) [6].

Plant height

Plant height showed significant and positive correlation with number of primary branches per plant (rg=0.762, rp=0.701), days to first flowering (rg=0.568, rp=0.482), days to 50 per cent flowering (rg=0.615, rp=0.544), days to first picking (rg=0.622, rp=0.571) and number of clusters per plant (rg=0.804, rp=0.735) at both genotypic and phenotypic levels. Similar finding reported by Kumawat *et al.*, (2018) [11], Singh *et al*., (2011) [19] and Gupta *et al*., (2007) [6]. However, it showed negative but significant correlation with pod length (rg=-0.857, rp=-0.793), number of seeds per pod (rg=-0.736, rp=-0.688) and green pod yield per plant (rg=-0.769, rp=-0.653) at both genotypic and phenotypic levels. Similar finding reported by Pandey *et al.*, (2017) [14], Kumar *et al.*, (2015) [10] and Gupta *et al*., (2007) [6].

Number of primary branches per plant

Number of primary branches per plant showed significant and positive correlation with number of clusters per plant (rg=578, rp=568) at both genotypic and phenotypic level and days to first picking (rg= 0.305) positive and significant only at genotypic level. Similar finding reported by Singh *et al*., (2011) [19] and Gupta *et al*., (2007) [6]. However, it showed negative and significant genotypic and phenotypic correlation with pod length (rg=-0.674, rp=-0.664), number of seeds per pod (rg=-0.393, rp=-0.385) and green pod yield per plant (rg=-0.517, rp=-0.487) at both genotypic and phenotypic levels. Similar finding reported by Diwaker *et al.*, (2018) [4] and Rai and Dharmatti (2014) [17].

Days to first flowering

Days to first flowering showed significant and positive correlation with days to 50 per cent flowering (rg=1.026, rp=0.959), days to first picking (rg=0.929, rp=0.851), number of clusters per plant (rg=0.544, rp=0.510) and number of pods per cluster (rg=0.498, rp=0.500) at both genotypic as well as phenotypic level and crop duration (rg= 0.537) is positive and significant only at genotypic level. Similar finding reported by Kumawat *et al*. (2018) [11], Gupta *et al*., (2007) [6] and Srinivas *et al.*, (2017) [21]. However, negative but significant correlations with number of pickings (rg=-0.445, rp=-0.399), pod length (rg=-0.598, rp=-0.566), number of seeds per pod (rg=-0.716, rp=-0.682) and green pod yield per plant (rg=-0.607, rp=-0.554) at both genotypic and phenotypic levels. Similar finding reported by Kumawat *et al*., (2018) [11], Gupta *et al*., (2007) [6], Palve *et al*., (2018) [13] and Srinivas *et al*., (2017) [21].

Days to 50 per cent flowering

Days to 50 per cent flowering showed significant and positive correlation with days to first picking (rg=0.955, rp=0.877), number of clusters per plant (rg=0.586, rp=0.555) number of pods per cluster (rg=0.502, rp=0.468) and crop duration (rg=0.548, rp=0.326) at both genotypic and phenotypic levels. Similar finding reported by Rahman *et al*., (2019) [16], Pandey *et al*., (2017) [14] and Patel *et al*., (2016) [15]. However, it showed negative but significant correlations with number of pickings (rg=-0.462, rp=-0.399), pod length (rg=-0.631, rp=-0.616), number of seeds per pod (rg=-0.747, rp=-0.703) and green pod yield per plant (rg=-0.627, rp=-0.601) at both genotypic and phenotypic levels. Similar finding reported by Kumawat *et al.*, (2018) [11], Pandey *et al*., (2017) [14] and Basaiwala *et al.*, (2013) [1].

Days to first picking

Days to first picking showed significant and positive correlation with number of clusters per plant (rg=0.627, rp=0.592), number of pods per cluster (rg=0.436, rp=0.417) and crop duration (rg=0.578, rp=0.374) at both genotypic and phenotypic levels. However, it showed negative but significant correlations with pod length (rg=-0.755, rp=-0.722), number of seeds per pod (rg=-0.697, rp=-0.672) and green pod yield per plant (rg=-0.647, rp=-0.612) at both genotypic and phenotypic levels and number of pickings (rg=-0.324) negative and significant only at genotypic level. Similar finding reported by Diwaker *et al.*, (2018) [4] and Gupta *et al.*, (2007) [6].

Number of pickings

Number of pickings showed significant and positive correlation with number of seeds per pod (rg=0.420, rp=0.377) at both genotypic and phenotypic levels. Similar finding reported by Sharma *et al.*, (2012) [18]. However, it showed negative but significant correlations with number of pods per cluster (rg=-0.590, rp=-0.545) at both genotypic and phenotypic levels.

Number of clusters per plant

Number of clusters per plant showed significant and negative correlation with pod length (rg=-0.689, rp=-0.670), number of seeds per pod (rg=-0.632, rp=-0.620) and green pod yield per plant (rg=-0.655, rp=-0.617) at both genotypic and phenotypic levels. Similar finding reported by Srinivas *et al.*, (2017) [21], Patel *et al.*, (2016) [15] and Singh *et al.*, (2011) [19].

Number of pods per cluster
Number of pods per cluster showed significant and positive correlation with crop duration (rg=0.545, rp=0.364) at both genotypic and phenotypic levels.

Pod length
Pod length showed significant and positive correlation with number of seeds per pod (rg=0.751, rp=0.738) and green pod yield per plant (rg=0.684, rp=0.664) at both genotypic and phenotypic levels. Similar finding reported by Kumawat *et al.* (2018) [11], Devi *et al.,* (2017) [2] and Gupta *et al*., (2007) [6].

Number of seeds per pod
Number of seeds per pod showed significant and positive correlation with green pod yield per plant (rg=0.707, rp=0.662) at both genotypic and phenotypic levels. Similar finding reported by Kumawat *et al.,* (2018) [11] and Devi *et al*., (2017) [2]. However, it showed negative but significant correlations with crop duration (rg=-0.461) at only genotypic level.

Crop duration
Crop duration showed negative but non-significant correlation with green pod yield per plant (rg=-0.131, rp=-0.119), green pod yield per plot (rg=-0.177, rp=-0.198) and green pod yield per hectare (rg=-0.179, rp=-0.198) at both genotypic and phenotypic levels.

Path analysis
Correlation coefficients, which measure the association between any two characters, may not give a true or comprehensive picture of a rather complex situation. Path coefficient analysis provides an efficient means of measuring the direct and indirect effects of one variable through the other variables on the end product. The path coefficient analysis was carried out at genotypic level. The direct and indirect effect of various traits on green pod yield per plant is presented in Table 2.

Direct effect
The direct effect of different characters on yield estimated from the path coefficient analysis reveals that the character number of primary branches per plant (0.342) was recorded high positive direct effect on green pod yield per plant. However, days to first picking (-0.301) was recorded high negative direct effect on green pod yield per plant. Similar finding reported by Srinivas *et al.,* (2017) [21] and Diwaker *et al.,* (2018) [4].
50% flowering (0.251) was recorded moderate positive direct effect on green pod yield per plant. Similar finding reported by Basaiwala *et al.,* (2013) [1] and Diwaker *et al.,* (2018) [4].
Number of clusters per plant (0.124) and number of seeds per pod (0.136) were recorded low positive direct effect on green pod yield per plant. However, pod length (-0.152) was recorded low negative direct effect on green pod yield per plant. Similar finding reported by Pandey *et al*., (2017) [14], Sriniwas *et al.,* (2017), Kumawat *et al.* (2018) [11] and Lal *et al.,* (2018) [12].
Number of pods per cluster (0.075) was recorded positive but negligible direct effect on green pod yield per plant. However, plant height (-0.061), days to first flowering (-0.013), number of pickings (-0.094) and crop duration (-0.063) were recorded negative negligible direct effect on green pod yield per plant. Similar finding reported by Yadav *et al*., (2010) [23] Sharma *et al*., (2012) [18] Khan *et al*., (2017) [9] and Shrivastava *et al.,* (2018).

Table 1: Genotypic and phenotypic coefficients of correlation among different traits of pea

		PH	PBP	1st F	50% F	1st Pick	No Pick	Clu/Plant	Pods/Clu	PL	Seeds/pod	Crop Dur	Y/Plant
PH	rg	1.000	0.762**	0.568**	0.615**	0.622**	-0.118	0.804**	0.066	-0.857**	-0.736**	0.139	-0.769**
	rp	1.000	0.701**	0.482**	0.544**	0.571**	-0.088	0.735**	0.057	-0.793**	-0.688**	0.121	-0.653**
PBP	rg		1.000	0.187	0.219	0.305*	0.303	0.578**	-0.231	-0.674**	-0.393**	-0.243	-0.517**
	rp		1.000	0.188	0.207	0.292	0.275	0.568**	-0.221	-0.664**	-0.385*	-0.172	-0.487**
1st F	rg			1.000	1.026**	0.929**	-0.445**	0.544**	0.498**	-0.598**	-0.716**	0.537**	-0.607**
	rp			1.000	0.959**	0.851**	-0.399**	0.510**	0.500**	-0.566**	-0.682**	0.295	-0.554**
50% F	rg				1.000	0.955**	-0.462**	0.586**	0.502**	-0.631**	-0.747**	0.548**	-0.627**
	rp				1.000	0.877**	-0.399**	0.555**	0.468**	-0.616**	-0.703**	0.326*	-0.601**
1st Pick	rg					1.000	-0.324*	0.627**	0.436**	-0.755**	-0.697**	0.578**	-0.647**
	rp					1.000	-0.285	0.592**	0.417**	-0.722**	-0.672**	0.374*	-0.612**
No Pick	rg						1.000	-0.262	-0.590**	0.108	0.420**	-0.276	0.247
	rp						1.000	-0.198	-0.545**	0.116	0.377*	-0.191	0.248
Clu/Plant	rg							1.000	0.091	-0.689**	-0.632**	-0.068	-0.655**
	rp							1.000	0.087	-0.670**	-0.620**	-0.050	-0.617**
Pods/Clu	rg								1.000	-0.069	-0.304	0.545**	0.133
	rp								1.000	-0.072	-0.303	0.364*	0.106
PL	rg									1.000	0.751**	-0.248	0.684**
	rp									1.000	0.738**	-0.154	0.664**
Seeds/Pod	rg										1.000	-0.461**	0.707**
	rp										1.000	-0.275	0.662**
Crop Dur	rg											1.000	-0.131
	rp											1.000	-0.119
Y/Plant	rg												1.000
	rp												1.000

*-significant at 5% level and **-significant at 1% level PH- Plant Height, PBP-Primary branches per plant, 1st F- Days to first flowering, 50% F- Days to 50% flowering, 1st Pick- Days to first picking, No Pick- Number of pickings, Clu/Plant- Number of clusters per plant, Pods/Clu- Number of pods per cluster, PL- Pod length, Seeds/pod-Number of seeds per pod, Crop Dur- Crop duration, Y/Plot-Green pod yield per plot, Y/ha- Green pod yield per hector, Y/Plant- Green pod yield per plant, rg- Genotypic correlation, rp- Phenotypic correlation.

Table 2: Genotypic path estimates of direct and indirect effects of different traits on green pod yield per plant in pea R SQUARE = 0.9986 Residual Effect = 0.0372

	PH	PBP	1st F	50% F	1st Pick	No Pick	Clu/ Plant	Pods /Clu	PL	Seeds/ Pod	Crop Dur	Y/Plant	Partial R^2
PH	-0.061	-0.046	-0.035	-0.038	-0.038	0.007	-0.049	-0.004	0.052	0.045	-0.009	-0.769	0.047
PBP	0.261	0.342	0.064	0.075	0.104	0.104	0.198	-0.079	-0.230	-0.135	-0.083	-0.517	-0.177
1st F	-0.008	-0.003	-0.013	-0.014	-0.012	0.006	-0.007	-0.007	0.008	0.010	-0.007	-0.607	0.008
50% F	0.154	0.055	0.258	0.251	0.240	-0.116	0.147	0.126	-0.159	-0.188	0.138	-0.627	-0.157
1st Pick	-0.187	-0.092	-0.280	-0.287	-0.301	0.098	-0.189	-0.131	0.227	0.210	-0.174	-0.647	0.195
No Pick	0.011	-0.029	0.042	0.044	0.031	-0.094	0.025	0.056	-0.010	-0.040	0.026	0.247	-0.023
Clu/Plant	0.100	0.072	0.067	0.073	0.078	-0.033	0.124	0.011	-0.085	-0.078	-0.008	-0.655	-0.081
Pods/Clu	0.005	-0.017	0.037	0.038	0.033	-0.044	0.007	0.075	-0.005	-0.023	0.041	0.133	0.010
PL	0.131	0.103	0.091	0.096	0.115	-0.016	0.105	0.011	-0.152	-0.114	0.038	0.684	-0.104
Seeds/Pod	-0.100	-0.054	-0.098	-0.102	-0.095	0.057	-0.086	-0.041	0.102	0.136	-0.063	0.707	0.096
Crop Dur	-0.009	0.015	-0.034	-0.035	-0.037	0.017	0.004	-0.034	0.016	0.029	-0.063	-0.131	0.008

PH- Plant Height, PBP-Primary branches per plant, 1st F- Days to first flowering, 50% F- Days to 50%flowering, 1st Pick- Days to first picking, No Pick- Number of pickings, Clu/Plant- Number of clusters per plant, Pods/Clu- Number of pods per cluster, PL- Pod length, Seeds/pod- Number of seeds per pod, Crop Dur- Crop duration, Y/Plot-Green pod yield per plot, Y/ha- Green pod yield per hectare, Y/Plant- Green pod yield per plant.

References

1. Basaiwala P, Rastogi NK, Parikh M. Genetic variability and character association in field pea (*Pisum sativum* L.) genotypes. The. Asian. J Hort. 2013; 8(1):288-291.
2. Devi S, Kumar M, Thakur K, Bharat NK, Dogra RK, Nagar A. Variability, correlation and path analysis in pea (*Pisum Sativum* L.) genotypes under Western Himalayan conditions. Chem. Sci. Review. Letters. 2017; 6(21):555-560.
3. Dewey OR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass production. Agron. J. 1959; 57:515-518.
4. Diwaker P, Sharma MK, Soni AK, Diwaker A, Singh P. Character association and path coefficient analysis in vegetable cowpea [*Vigna unguiculata* (L.) Walp] J of Pharmacognosy. Phytochemistry. 2018; 7(1):2289-2293.
5. Duke JA. Hand book of legumes of world economic importance. Plenum Press, New York, 1981, p. 199-265.
6. Gupta AJ, Singh YV, Singh BK, Husain K. Correlation studies in garden pea (*Pisum sativum* L.). The. Hort. J 2007; 20(2):87-90.
7. Hulse JH. Nature, composition and utilization of food legumes, 1994, 77-97.
8. Johnson. Genetic advance analysis in pea (*Pisum sativum* L.). Madras. Agric. J. 1955; 6(7):387-390.
9. Khan RA, Mahmud F, Reza MA, Mahbub M, Shirazy BJ, Rahman MM. Genetic diversity, correlation and path analysis for yield and yield components of pea (*Pisum sativum* L.). World J of Agric. Sci. 2017; 13(1):11-16.
10. Kumar R, Kumar M, Dogra RK, Bharat NK. Variability and character association studies in garden pea (*Pisum sativum* var. Hortense L.). Legume Res. 2015; 38(2):164-168.
11. Kumawat PK, Singh P, Singh D, Mukherjee S, Kumawat M. Study of correlation and path analysis for green pod yield and its contributing traits in vegetable pea (*Pisum sativum* L.). Int. J Curr. Microbiol. App. Sci. 2018; 7(6):3497-3502.
12. Lal K, Kumar R, Prakash S, Kumar A, Singh Y. Genetic variability, character association and path analysis of seed yield and its contributing traits in field pea (*Pisum sativum* L. *var. arvense*). Int. J Curr. Microbiol. App. Sci. 2018; 7(6):1815-1820.
13. Palve MR, Kale VS, Bhaladhare MB, Jadhv RD. Correlation and path analysis study in F5 generation of cowpea. Int. J Curr. Microbiol. App. Sci. 2018; 6:1529-1537.
14. Pandey M, Singh VB, Yadav GC, Tyagi N, Vishen GS, Bhargav KK, Pandey P. Correlation and path coefficient analysis among different characters in genotypes of vegetable pea. Bull. Env. Pharmacol. Life. Sci. 2017; 6(11):123-130.
15. Patel UV, Parmar VK, Patel PB, Malviya AV. Correlation and path analysis study in cowpea (*Vigna unguiculata* (L.) Walp.). Int. J Sci. Env. Tech. 2016; 5(6):3897-3904.
16. Rahman AU, Katoch V, Sharma S. Studies on variability, correlation and path analysis in garden pea (*Pisum sativum* L.) for pod yield and its related traits under natural farming conditions. J Pharmacognosy. Phytochemistry. SP1, 2019, 435-438.
17. Rai PS, Dharmatti PR. Correlation and path analysis for clusterbean vegetable pod yield. The Bioscan. 2014; 9(2):811-814.
18. Sharma BB, Sharma VK. Character association and path analysis studies for yield and horticulture traits in garden pea Env. Ecology. 2012; 30(4A):1591-1598.
19. Singh A, Singh S, Babu JDP. Heritability, character association and path analysis studies in early segregating populations of field pea (*Pisum sativum* var. *Aarvense* L.). Int. J Plant. Breeding. Genetics. 2011; 5(1):86-92.
20. Singh SK, Singh VP, Srivastava S, Singh AK, Chaubey BK, Srivastava RK. Estimation of correlation coefficient among yield and attributing traits of field pea (*Pisum sativum* L.). Legume. Res. 2018; 41(1):20-26.
21. Srinivas J, Kale VS, Nagre PK. Correlation and path analysis study in cowpea [*Vigna unguiculata* (L.) Walp.] Genotypes. Int. J Curr. Microbiol. App. Sci. 2017; 6(6):3305-3313.
22. Srivastava A, Sharma A, Singh T, Kumar R. Correlation coefficient and path coefficient in field pea (*Pisum sativum* L.). Int. J Curr. Microbiol. App. Sci. 2018; 7(2):549-553.
23. Yadav P, Singh AK, Srivastava CP. Genetic variability and character association in diverse collection of Indian and exotic germplasm lines of pea (*Pisum sativum* L.). Veg. Sci. 2010; 37(1):75-77.