



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
[www.phytojournal.com](http://www.phytojournal.com)  
JPP 2020; 9(4): 65-68  
Received: 22-04-2020  
Accepted: 25-05-2020

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## Studies on correlation and path coefficient analysis and its contributing parameters in Lentil (*Lens culinaris* Medik.) genotypes

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### Abstract

The experiment on seventy four genotypes of Lentil (*Lens culinaris* Medik.) was carried out during 2015-2016 in Augmented block Design (ABD) with ten block at genetic and plant breeding farm (GPB) of Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) The seed yield per plant showed highly significant and positive correlations with the plant height (0.371), number of primary branches per plant (0.422), number of pods per plant (0.286), biological yield per plant (0.938) and harvest index, whereas significant positive correlation was observed with 100-seed weight (0.289). Path analysis identified the highest positive direct effects on seed yield per plant exerted by biological yield per plant, harvest index, number of pods per plant, 100-seed weight. However, other characters contributing substantially positive direct effects on seed yield were number of seeds per pod, days to maturity, days to 50% flowering and number of primary branches per plant.

**Keywords:** Lentil, Path analysis, correlations, Seed yield, character association

### Introduction

Pulses are the crops of national importance in India and have been grown since time immemorial. India is the largest producer and consumer of pulses in the world and also a key player with 25 per cent share in the global pulse basket from an area about 33 per cent. Pulses are grown in semiarid region of India since time immemorial. Pulses are considered as health food and offer nutritional security to millions of population suffering with protein malnutrition especially in south Asia and Africa. Some of the short duration pulses have shown great promise for crop intensification in irrigated areas. The alleviatory effect of pulses on the yield of subsequent crops have long been realized and documented in India. Total pulses were grown on an area of 25.26 m/ha with production of 16.47 m/t and productivity 652 kg/ha in 2015-16.

The area under pulse remained almost stagnant. Dry beans (*Phaseolus* beans, urd bean, mung bean etc.) contribute 31.7 per cent share in total pulse production followed by dry peas 17.7 per cent, chickpea 13.9 per cent, cowpea 7.7 per cent, broad beans 7.6 per cent, lentil 6.0 per cent and pigeonpea 5.6 per cent. Even though India has largest cultivated area of pulses in the world, but average productivity is very low, and the production is not sufficient to meet the per capita requirement. Pulses shortfall may increase to 6.8 mt by 2020-21 and the anticipated increase in per capita consumption of pulses from 9 kg/year in 2007-08 to 10.9 kg by 2020-21. The recommendation of per capita availability of pulse is 65 g/day/capita by Indian Council of Medical Research in 2008, whereas FAO/WHO recommendation of minimum requirement of 80 g/day/person. Though, the literature in respect of germplasm evaluation, correlation and path analysis studies in lentil is not meager, but these are based on testing of limited number of germplasm lines. Moreover, the results of the earlier studies on such aspects are relevant only for the material and environments involved in particular study and cannot be generalized. Therefore, a study on above aspects on the available germplasm under the environment, where it is to be exploited, is essential for successful utilization of germplasm resources for development of superior varieties. Frankel (1978) also emphasized that the evaluation of existing collections for useful characters should be done and only core collections should be retained.

### Materials and Methods

A germplasm collection of 70 varieties/strains of lentil comprising exotic as well as indigenous and four check varieties *viz.*, (NDL-1, DPL-15, IPL-81, DPL-62) constituted the experimental

materials for this study. These genotypes exhibited wide spectrum of variation for various agronomical and morphological characters which were obtained from Pulse Section Department of Genetics and Plant Breeding, Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. The used checks in experiment are well adopted varieties of the region.

The experiment was conducted to evaluate 70 germplasm lines including four checks under irrigated, normal soil condition in Augmented Design. The entire experimental field was divided into 10 blocks of equal size and each block had 11 plots. Out of 11 plots in a block, 7 plots were used for accommodating the test genotypes which were not replicated while remaining 4 were allocated to checks i.e. NDL-1, DPL-15, IPL-81, DPL-62. The four checks were randomly allocated along with the test genotypes in a block. Each plot was consisted of single row of 4 m length, following inter and intra row spacing of 25 cm and 10 cm, respectively. Recommended cultural practices were practiced to raise a good crop.

Days to maturity showed highly significant and positive correlation with days to 50% flowering (0.825).

Plant height showed non-significant and positive correlation with days to maturity (0.062) and non-significant negative correlation with days to flowering (-0.055).

Number of primary branches per plant showed non-significant and positive correlation with plant height (0.021) but highly significant negative correlation with days to maturity (-0.338) and non-significant negative correlation with days to 50% flowering (-0.192).

Number of secondary branches per plant highly significant positive correlation with number of primary branches per plant (0.349) and non-significant positive correlation with plant height (0.154) but significant negative correlation with days to maturity (-0.232).

Number of pods per plant showed highly significant and positive correlation with plant height (0.386) non-significant positive correlation with number of secondary branch per plant (0.104), days to 50% flowering (0.046) and days to maturity (0.008) but significant negative correlation with number of primary branches per plant (-0.256).

Number of seeds per pod showed significant positive correlation with number of secondary branches per plant (0.282) but non-significant positive correlation with number of pods per plant (0.166) and days to maturity (0.012). Significant and negative correlation with number of primary branches per plant (-0.244).

Biological yield per plant showed highly significant positive correlation with plant height (0.472), number of pods per plant (0.326) but non-significant and positive correlation with 100 seed weight (0.262) and 50% flowering (0.061). but non-significant and negatively correlation with number of seeds per pod (-0.078), number of secondary branches (-0.053) and days to maturity (-0.045).

Harvest index showed highly significant and positive association with primary branches per plant (0.422) and biological yield per plant (0.373) but significant positive correlation with 100 seed weight (0.262). Highly significant negative correlation with days to maturity (-0.363).

100-seed weight showed significant and positive association with number of seed per pod (0.282) while non-significant and positive correlation with number of pods per plant (0.182), significant and negative correlation with days to 50% flowering (-0.274) and days to maturity (-0.257) but non-significant negative correlation with number of primary

branch per plant (-0.131), plant height (-0.082) and number of secondary per plant (-0.014).

Seed yield per plant showed highly significant and positive association with biological yield per plant (0.938), harvest index (0.645), number of primary branches per plant (0.422), plant height (0.371) but significant and positive correlation with 100-seed weight (0.289) and number of pod per plant (0.286) whereas, it was non-significant and negatively associated with days to maturity (-0.173), number of seed per pods (-0.074) and days to 50% flowering (-0.024).

## Results and Discussion

The seed yield/plant showed positive and highly significant correlation with number of pods per plant, biological yield per plant, harvest index, number of secondary branches per plant, plant height and days to maturity whereas, 100-seed weight had positive and significant correlation with it. The grain yield/plant is negatively and non-significantly correlated with number of primary branches per plant. Thus, number of pods per plant, biological yield per plant, harvest index, number of secondary branches per plant, plant height and days to maturity emerged as closely correlated yield attributes.

Number of pods per plant showed highly significant and positive correlation with seed yield per plant, harvest index, secondary branches per plant, plant height and days to maturity. Similarly, biological yield per plant showed highly significant positive correlation with seed yield per plant, plant height and harvest index. Seeds per pod was high significant and negatively correlated with biological yield per plant while primary branches per plant and days to 50% flowering had significant and negative correlation. Harvest index showed highly significant and positive association with seed yield per plant, pods per plant, plant height, secondary branches per plant, and days to maturity and biological yield per plant. Number of secondary branches per plant expressed highly significant positive correlation with pods per plant, harvest index, seed yield per plant, plant height, days to 50% flowering, days to maturity and primary branches per plant. Plant height showed highly significant and positive association with harvest index, seed yield per plant, pods per plant, and days to maturity, secondary branches per plant and biological yield per plant. Days to maturity exhibited highly significant and positive correlation with harvest index, plant height, pods per plant, and days to 50% flowering, secondary branches per plant and seed yield per plant. 100-seed weight showed significant and positive association with seed yield per plant while non-significant and negative correlation with days to 50% flowering, days to maturity, secondary branches per plant, plant height, seeds per pod, primary branches per plant and harvest index. The occurrence of positive association at significant level of seed yield with most of its component traits and positive association between most of the yield components revealed less complex inter relationship between yield and yield components. Such situation is favourable from breeding point of view because selection for one trait may bring correlated response for improvement of other traits which are positively associated with it.

Path analysis identified biological yield per plant, pods per plant, harvest index, 100-seed weight, plant height and number of seeds per pod as highly desirable components for direct effects on seed yield; while, highly positive indirect effects on seed yield per plant was exhibited by biological yield per plant (0.5929) via pods per plant, biological yield per plant (0.4876) via plant height and followed by harvest index (0.2177) via pods per plant and harvest index (0.1663)

via 100-seed weight and (0.1493) via biological yield per plant.

The characters identified above as important direct and indirect contributors on seed yield merit due consideration in formulating selection strategy in lentil for developing high yielding varieties. The seed yield/plant showed positive and highly significant correlation with number of pods per plant, biological yield per plant, harvest index, number of secondary

branches per plant, plant height and days to maturity whereas, 100- seed weight had positive and significant correlation with it. The grain yield/plant is negatively and non-significantly correlated with number of primary branches per plant. Thus, number of pods per plant, biological yield per plant, harvest index, number of secondary branches per plant, plant height and days to maturity emerged as closely correlated yield attributes.

**Table 4.3:** Simple correlation coefficients between different characters in lentil germplasm

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches plant <sup>-1</sup>	No. of secondary branches plant <sup>-1</sup>	No. of pods plant <sup>-1</sup>	No. of seeds pod <sup>-1</sup>	100-seed weight (g)	Biological yield plant <sup>-1</sup> (g)	Harvest index (%)	Seed yield plant <sup>-1</sup> (g)
Days to 50% flowering	1.000	0.825***	-0.055	-0.192	-0.232*	0.046	-0.070	-0.274*	0.061	-0.226	-0.024
Days to maturity		1.000	0.062	-0.338**	-0.197	0.008	0.012	-0.257*	-0.045	-0.363**	-0.173
Plant height (cm)			1.000	0.021	0.154	0.386***	-0.016	-0.082	0.472***	0.064	0.371**
Number of primary branches plant <sup>-1</sup>				1.000	0.349**	-0.256*	0.244*	-0.131	0.324**	0.422***	0.422***
Number of secondary branches plant <sup>-1</sup>					1.000	0.104	0.282*	-0.014	-0.053	-0.084	-0.087
Number of pods plant <sup>-1</sup>						1.000	0.166	0.182	0.326**	0.142	0.286*
Number of seeds pod <sup>-1</sup>							1.000	0.282*	-0.078	-0.091	-0.074
100-seed weight (g)								1.000	0.216	0.262*	0.289*
Biological yield plant <sup>-1</sup> (g)									1.000	0.373**	0.938***
Harvest index (%)										1.000	0.645***
Seed yield plant <sup>-1</sup> (g)											1.000

\* Significant at 5 % probability level, \*\* Significant at 1 % probability level.

**Table 4.4:** Direct and indirect effects of different characters on seed yield per plant in lentil germplasm

Character	Days to 50% Flowering	Days to Maturity	Plant Height (cm)	Primary Branches/ Plant	Secondary Branches/ Plant	Pods/ Plant	Seeds/ Pod	100 Seed Weight (g)	Biological Yield/ Plant (g)	Harvest Index (%)	Seed Yield/ Plant (g)
Days to 50% Flowering	0.0416	0.0343	-0.0023	-0.0080	-0.0097	0.0019	-0.0029	-0.0114	0.0026	-0.0094	-0.241
Days to Maturity	-0.0335	-0.0406	-0.0025	0.0137	0.0080	-0.0003	-0.0005	0.0105	0.0019	0.0147	-0.1733
Plant Height (cm)	0.0006	-0.0007	-0.0113	-0.0002	-0.0017	-0.0044	0.0002	0.0009	-0.0053	-0.0007	0.3713
Primary Branches/ Plant	-0.0088	-0.0154	0.0010	0.0456	0.0159	-0.0117	-0.0112	-0.0060	0.0148	0.0192	0.4229
Secondary Branches/ Plant	0.0090	0.0077	-0.0060	-0.0136	-0.0388	-0.0041	-0.0110	0.0006	0.0021	0.0033	-0.0871
Pods/ Plant	-0.0007	-0.0001	-0.0055	0.0037	-0.0015	-0.0143	-0.0024	-0.0026	-0.0047	-0.0020	0.2869
Seeds/ Pod	-0.0026	0.0005	-0.0006	-0.0091	0.0105	0.0062	0.0372	0.0105	-0.0029	-0.0034	-0.0742
100 Seed Weight (g)	-0.0081	-0.0076	-0.0024	-0.0039	-0.0004	0.0054	0.0083	0.0295	0.0064	0.0077	0.2894
Biological Yield/ Plant (g)	0.0498	-0.0369	0.3809	0.2617	-0.0428	0.2633	-0.0630	0.1747	0.8065	0.3011	0.9389
Harvest Index (%)	-0.0714	-0.1144	0.0202	0.1330	-0.0267	0.0449	-0.0290	0.0828	0.1177	0.3151	0.6457

Residual effect = 0.1147

\* Significant at 5 % probability level, \*\* Significant at 1 % probability level

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