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Evaluation of Different Effective Traits on Seed Yield of Common Bean (*Phaseolus vulgaris* L.) With Path Analysis

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Abstract: In order to evaluate of different effective traits on seed yield of common bean (*Phaseolus vulgaris* L.), this experiment was carried out in Miyaneh Jahad Agriculture Research field in 2007. Regression analysis indicated that the number of pods per plant was the only effective trait on seed yield. This trait explained 83.2% of total yield variations. Path analysis showed that the maximum direct and positive effects were related to number seed per pod and harvest index. The only direct and negative effect was related to pod length.

Key words: Common bean · Yield · Yield Components · *Phaseolus vulgaris* L · Path Analysis and Regression analysis

INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is a major leguminous crop providing a good source of protein in diet and serving as a cash crop. However, the major reason for low production of common bean (*Phaseolus vulgaris* L.) in Iran is unavailability of varieties with high yield potential that are well adapted to production conditions with stability across different environments.

According to Board *et al*. [1], path coefficient is a standardized partial regression coefficient that measures the direct influence of one trait upon another and permits the separation of a correlation coefficient in to components of direct and indirect effects. In addition, it has been used to organize and present the casual relationships between predictor variables and response variables through a path diagram that is based on experimental results or on a priori grounds. Dewey and Lu, [2] described the advantage of path analysis. It permits the partitioning of the correlation coefficient in to it `s components (standardized partial regression coefficient) that measures the direct effect of a predictor variable upon it `s response variabl. The second component being the indirect effects of a predictor variable on the response variable through other predictor variable. Correlation and path coefficient have been extensively conducted in various crops e.g., for instance, Bakhash *et al*. [3], Guler *et al*. [4], Arshad *et al*. [5] on chickpea, Ihsanullah and Muhammad, [6], Quresh and Khan, [7] on wheat; Malik *et al*. [8], Ghafoor *et al*. [9] on mungbean; Johanson *et al*. [10] on soybean etc., the over all objective of such type of studies is to determine the role of various yield components in the determination of yield and to devise selection criteria for single plant selection from segregating population and also to identify parents with desirable traits for hybridization to pyramid various traits into a single genotype. Cakmakci *et al*. [11] found significant positive correlation coefficients between seed yield and biologic yield of common vetch ($r_=0.810$**), harvest index ($r_=0.423$) and pod numbers ($r_=0418$**). They reported that the direct effects of biological yield and harvest index on seed yield were greater than those of other traits. They also suggested that common vetch breeding studies should focus on biological yield, harvest index and number of seeds per plant for seed yield. The aim of this study was to determine characteristics affecting seed yield in common bean (*Phaseolus vulgaris* L.) genotypes using path analysis and stepwise multiple regression analysis in Miyaneh region, Iran.

MATERIALS AND METHODS

The experiment was conducted during the spring season of 2007 and utilized a randomized complete block design (RCBD) with 3 replications. Each line was sown in 4 rows, 4 m in length with 35 cm inter-row spacing.

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Before sowing, 40 kg ha^{-1} N and 60 kg ha^{-1} P_2O_5 as fertilizers were applied. Six diverse genotypes, collected from National Bean Research Station of Khomein, Iran (COS-16, KHOMEYN, TALASH, SAYYAD, NAZ, GOLE, DANESHKADE and DEHGAN), were grown in Research Farm of Jahad-e-Agriculture ministry of Miyaneh, Iran (Latitude 37°75′ N, Longitude 47°18′, Elevation 1733 m) in 2007.All plots were harvested for seed yield in June. Then observation of plants height (cm), pods number per plant (number), seed yield (kg ha^{-1}), seed numbers per pod (Number), pod length (cm), biological yield (kg ha^{-1}) were recorded. Harvest index (%) was calculated with equation (1):

$$HI = \frac{SY}{BY} \times 100$$

Equation (1):
HI: Harvest Index
SY: Seed Yield
BY: Biomass Yield

Stepwise multiple regression analysis was carried out using SAS statistical program. Also, the relative importance of direct and indirect effects on seed yield was determined by path analysis [12]. In path analysis, seed yield was the dependent variable and five plant characteristics were considered as independent variables.

RESULTS AND DISCUSSIONS

The result of stepwise multiple regression analysis based on seed yield as a depended variable and other traits as independent variables are shown in Table1. The only trait which entered to model is the number of pods per plant. The presence of this trait could explain 83.2% of total variations. So, it was suggested that the number of pods per plant may be the most effective factor on seed yield.

Mohammadi *et al*. [13] announced that path coefficient analysis has been widely used in crop breeding to determine the nature of relationships between grain yield and its contributing components and to identify those components with significant effects on yield for potential use as selection criteria. Table 2 displays the results of effective traits of path analysis on seed yield. Data in table 2 indicated that the highest direct and positive effect on seed yield was related to number of seeds per pod and harvest index. Sinebo [14] reported that shorter vegetative duration and higher harvest index for higher seed yield were important in barley. The only direct and negative effect on seed yield was related to pod length. For these reasons, the number of seeds per pod has the highest and the most important direct effect on seed yield variations. Also, data in Table 2 showed that the direct effect of harvest index on seed yield is 0.25 and the indirect effect of this trait via the number of seed per pod is 0.366, via number pod per plant is 0.0096, via pod length is -0.014 and via biological yield is 0.231. Probably, the positive and high correlation of harvest index with seed yield is via strong and positive effect of this trait through the number of seeds per pod, biological yield and the indirect, positive and partial effect of this trait via the number of pods per plant.

The path analysis of effective traits on seed yield showed that the number of pods per plant had indirect and positive effects via the number of seeds per pod (0.305), biological yield (0.485) and harvest index (0.15). By the way, the number of pods per plant had indirect and negative effect on seed yield through pod length (-0.0171). Also, the direct effect of the number of pods per plant on seed yield was 0.016 (Table2). In fact, increasing number pods per plant was related to the number of fertile flowers and suitable environmental conditions during flowering and pod formation which resulted in the highest amount of leaves and other green parts of plant. These green segments of plant with increasing the amount of

Table 1: stepwise regression analysis for average of dates

Model	Coefficients	Standard error	R^2	T	Prob
Number pods per plant	255/05	83/298	0/781	3/062	0/022

(Number pod per plant) 255/05+ 943/90 Y=

Table 2: The effective traits of path analysis on seed yield

		Indirect effects via					
Traits	Direct effects	Number pods per plant	Number seeds per pod	Pod length	Biological yield	Harvest index	total
Number pods per plant	0/016	-	0/305	-0/0171	0/485	0/15	0/938
Number seed per pod	0/61	0/008	-	-0/0095	-0/0485	0/15	0/71
Pod length	-0/019	0/0144	0/305	-	-0/0485	0/15	0/4019
Biological yield	0/17	0/008	0/427	-0/0114	-	0/15	0/74
Harvest index	0/25	0/0096	0/366	-0/0114	0/2231	-	0/5873

Residual effect: 0/704

food and transmitting to economical sections of plant directly increased the number of seeds per plant and the harvest index. Cousion *et al*. [15] found that harvest index was the most important factor influencing the seed yield in peas. Shrivastava *et al*. [16] also found that biological yield and harvest index were important traits affecting the seed yield. Also, data in Table 2 illustrated that the direct effect of biological yield on seed yield was 0.17, while the indirect effects of this trait via number seeds per pod was 0.427. Albayrak *et al*. [17] reported that. the indirect effect of pod length on number seeds per pod was 0.305 on common vetch which is more than the indirect effect of pod length via the number of pods per plant on seed yield (Table2). Salehi *et al*. [18] found that there were positive and significant correlations between number of seeds per pod, number of pods per plant and pod length, with grain yield. The data obtained from this study could be useful for common bean (*Phaseolus vulgaris* L.) breeders and seed producers in order to increase seed yield. Totally, they should be focused on the genotypes which have high amount of number seed per plant and harvest index.

REFERENCES

1. Board, J.E., M.S. Kang and B.G. Harville, 1997. Path analysis identify indirect selection criteria for yield of late-planted soybean. Crop Sci., 37: 879-884.
2. Dewey, D.R. and K.H. Lu, 1959. A correlation and path-coefficient analysis of components of crested wheat grass seed production. Agron. J. 51: 515-518.
3. Bakhsh, A., T. Gull, B.A. Mailk and Afsari Sharif, 1998. Comparison between F1s and their parental genotypes for the patterns of character correlation and path coefficients in chickpea (*Cicer arietinum* L.). Pak. J. Bot., 30(2): 219-219.
4. Guler, M., M.S. Adak and H. Ulkan, 2001. Determining relationships between yield and some yield components using path co-efficient analysis in chickpea (*Cicer arietinum* L.). European. J. Agron., 14: 161-166.
5. Arshad, M., A. Bakhsh, M. Bashir and A.M. Haqqani, 2002. Determining the heritability and relationship between yield and yield components in chickpea (*Cicer arietinum* L.). Pak. J. B., 34(3): 237-245.
6. Ihsanullah and Fida Muhammad, 2001. Correlation of yield and yield associated traits in spring wheat. Sarhad J. Agric., 17(1): 2001.
7. Quresh, Z. and S. Khan, 1980. Correlation studies of some factors affecting yield in wheat (*T.aestivum* L.) under rainfed conditions. Fron. J. Agric. Res., 7(2): 155-161.
8. Malik, B.A., S.A. Hussain, A.M. Haqqani and A.H. Chaudhry, 1983. Genetic variability in mungbean (*Vigna raidata*). Pak. J. Agri. Sci., 48(12): 729-735.
9. Ghafoor, A., M.A. Zahid, Z. Ahamd, M. Afzal and M. Zubair, 2000. Selecting superior mungbean lines on the basis of genetic diversity and harvest index. Pak. J. Bio. Sci., 3(8): 1270-1273.
10. Johanson, H.F. Robinson and R.E. Comstock, 1955. Estimates of genetic and environmental variability in soybeans. Agron. J., 47: 314-318.
11. Cakmakci, S., B. Aydmoglu and M. Karaca, 2003. Determining relationships among yield and yield components using correlation and path analysis is summer sown common vetch (*Vicia sativa* L.) genotypes. Pak. J. Bot., 35(3): 387-400.
12. Institute, 1998. INC SAS/STAT user guide release 7.0, Cary, NC, USA.
13. Mohammadi, S.A., B.M. Prasanna and N.N. Singh, 2003. Sequential path model for determining interrelationships among grain yield and related characters in Maize. Crop Sci., 43: 1690-1697.
14. Sinbo, W., 2002. Yield relationships of barley grown in a tropical highland environment. Crop. Sci., 42: 428-437.
15. Cousin, R., A. Massager and A. Vingere, 1985. Breeding for yield in combining peas. The Pea Crops. P.H. Hebblethwaite, M.C. Heath and T.C.K. Dawkins (Eds.). butterworths. pp: 115-129.
16. Shrivastava, M.K., R.S. Shukla and P.K. Jain, 2001. Path coefficient analysis in diverse genotype of soybean (*Glycine max* (L.) Merill).Adv. Plant Sci., 14: 47-51.
17. Albayrak, S., C.S. Sevimay and M.O. Tongel, 2003. Determination of characters regarding to seed yield using correlation and path analysis in inoculated and non-inoculated common vetch. Turkish J. Field Crop., 8(2): 76-84.
18. Salehi, M., M. Tajik and A.G. Ebadi, 2008. The Study of Relationship Between Different Traits in Common Bean (*Phaseolus vulgaris* L.) With Multivariate Statistical Methods. American Eurasian J. Agric.and Environ. Sci., 3(6): 806-809.