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## Studies on genetic variability, heritability, correlation, path analysis and genetic divergence for yield and its components in vegetable pea (*Pisum sativum* L.)

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### Abstract

The present investigation titled “Studies on Genetic Variability, Heritability, Correlation, Path Analysis and Genetic Divergence for Yield and Its Components in Vegetable Pea (*Pisum sativum* L.)” was conducted at the Agricultural Research Field, Rama University, Mandhana, Kanpur (Uttar Pradesh) during the *rabi* season of 2025-26. An investigation was conducted to assess genetic variability, heritability, correlation, path coefficient analysis and genetic divergence for thirteen quantitative traits among twenty-two genotypes of vegetable pea (*Pisum sativum* L.). The experiment was laid out in a randomized block design with three replications. Analysis of variance indicated highly significant differences among the genotypes for all traits studied. High genotypic and phenotypic coefficients of variation were recorded for plant height, nodes per plant and pods per plant. High broad-sense heritability coupled with high genetic advance as percent of mean was observed for green pod yield per plant, pods per plant and nodes per plant, indicating predominance of additive gene action. Phenotypic and genotypic correlations revealed that pods per plant, number of pods per 100 g and seed per pod had strong positive association with green pod yield per plant. Path analysis at the phenotypic level identified pods per plant as the major contributor to yield through both direct and indirect effects. Mahalanobis  $D^2$  analysis grouped the genotypes into six clusters, with the highest inter-cluster distance observed between cluster III and VI. TSS and days to 50% flowering contributed the most to genetic divergence. Superior genotypes such as Pant P 480 and Pant P 514 were identified for their high green pod yield and desirable traits. The study provides useful information for selecting promising parents and developing high-yielding varieties in vegetable pea.

**Keywords:** Vegetable pea (*Pisum sativum* L.), genetic variability, heritability, correlation analysis, path coefficient analysis, genetic divergence, green pod yield.

### Introduction

Vegetable pea (*Pisum sativum* L. var. *hortense*) is an important legume vegetable crop belonging to the family Fabaceae. It is widely cultivated for its green pods and seeds and plays a significant role in improving soil fertility through symbiotic nitrogen fixation. The crop has gained immense importance due to its high protein content, dietary fiber, vitamins and minerals. Despite its economic value, the average productivity of vegetable pea in India remains relatively low because of limited genetic variability and narrow gene pools used in breeding programs. Genetic variability is the foundation for any crop improvement program. Information on the extent of variability, heritability, character association and path coefficients help in the identification of important yield-contributing traits and facilitates effective selection. Genetic divergence analysis further aids in the selection of diverse parents for hybridization to generate superior segregants. The present investigation was therefore undertaken to study genetic variability, heritability, genetic advance, correlation and path analysis, and to assess genetic divergence among twenty-two genotypes of vegetable pea.

### Materials and Methods

The present investigation was conducted at the Agriculture Research Farm, Faculty of Agriculture and Allied Industries, Rama University, Kanpur, Uttar Pradesh during the *rabi* season. Twenty-two genotypes of vegetable pea (*Pisum sativum* L.), including a check variety

Azad Pea-4, were evaluated in a Randomized Block Design (RBD) with three replications. The plot size and spacing were as per standard recommendations for the crop. Thirteen quantitative traits were recorded on five randomly selected competitive plants in each plot: days to 50% flowering, plant height (cm), nodes per plant, nodes at pod appearance, pod length (cm), pod width (cm), days to first picking, seeds per pod, pods per plant, number of pods per 100 g, 100-green seed weight (g), total soluble solids (TSS) and green pod yield per plant (g).

## Results

Analysis of variance revealed highly significant mean squares due to genotypes for all thirteen characters, indicating substantial genetic variability among the tested genotypes. Mean performance showed considerable variation for all traits. Green pod yield per plant ranged from 66.38 g (Azad Pea-1) to 115.68 g (Pant P 480). Pant P 480 and Pant P 514 were the top-yielding genotypes. Early flowering was observed in Kashi Samridhi and Kashi Mukti, while Hisar Harit and Pusa Pragati showed higher pods per plant.

## Coefficients of variation, heritability and genetic advance

Phenotypic Coefficients of Variation (PCV) were higher than Genotypic Coefficients of Variation (GCV) for all traits, indicating the influence of environment. High PCV and GCV were recorded for plant height, nodes per plant and pods per plant. High broad-sense heritability (>80%) was observed for pods per plant, number of pods per 100 g, days to first picking, green pod yield per plant, seeds per pod and 100-green seed weight. High genetic advance as percent of mean (>20%) was recorded for green pod yield per plant and 100-green seed weight. High heritability combined with high genetic advance was observed for green pod yield per plant, pods per plant and nodes per plant, suggesting that selection for these traits would be effective due to additive gene action. Correlation and Path Analysis: - At the phenotypic level, green pod yield per plant showed highly significant positive correlation with pods per plant ( $r = 0.762$ ), number of pods per 100 g ( $r = 0.415$ ), days to first picking ( $r = 0.365$ ) and seeds per pod ( $r = 0.266$ ). Strong negative correlation was observed with nodes at pod appearance, nodes per plant and plant height. Path coefficient analysis revealed that pods per plant exerted the highest direct positive effect (0.865) on green pod yield per plant, followed by number of pods per 100 g. Indirect contributions of other traits were mainly channeled through pods per plant. Similar trends were observed at the genotypic level. Genetic Divergence: -

Clustering by Mahalanobis  $D^2$  statistics grouped the twenty-two genotypes into six clusters. Cluster I contained the maximum number of genotypes (13), while clusters IV, V and VI had one genotype each. The highest inter-cluster distance was observed between cluster III and VI (231.40), indicating wide genetic divergence. The highest intra-cluster distance was recorded in cluster II (40.20). Cluster means revealed that cluster II had the highest mean for green pod yield per plant (91.20 g), while cluster V showed higher values for pods per plant and number of pods per 100 g. TSS contributed the highest percentage (10.45%) to total genetic divergence, followed by days to 50% flowering (9.50%). Discussion: -The significant differences among genotypes for all traits confirm the existence of sufficient genetic variability for yield improvement in vegetable pea. Higher PCV than GCV values indicate that environmental factors also play a role in trait expression; nevertheless, high heritability estimates for most traits suggest that a large portion of phenotypic variation is heritable. High heritability coupled with high genetic advance as percent of mean for green pod yield per plant and pods per plant indicates that these traits are governed by additive gene action and can be improved effectively through selection in early generations. The strong positive correlation of pods per plant and number of pods per 100 g with green pod yield per plant suggests that selection for these traits will simultaneously improve yield. The high direct effect of pods per plant in path analysis further confirms its role as the most important yield-contributing trait. The grouping of genotypes into six distinct clusters and the existence of high inter-cluster distances indicate considerable genetic diversity among the studied material. The lack of parallelism between genetic and geographic diversity suggests that genotypes from different clusters can be utilized as parents in hybridization programs to exploit heterosis and generate transgressive segregants. The substantial contribution of TSS and days to 50% flowering to genetic divergence highlights their importance in distinguishing genotype groups.

## Results and discussion

### Analysis of variance (mean squares) for thirteen characters in vegetable pea

Analysis of variance revealed highly significant differences among the genotypes for all the thirteen characters studied. The mean squares due to treatments were highly significant at 1% level of probability for all traits, indicating the presence of substantial genetic variability among the twenty-two genotypes of vegetable pea.

**Table 1:** Analysis of Variance (ANOVA) for Thirteen Quantitative Traits in Vegetable Pea

| S. No. | Traits                        | Replication (d f=2) | Treatment (d f=34) | Error (d f=68) |
|--------|-------------------------------|---------------------|--------------------|----------------|
| 1.     | Days to 50% flowering         | 8.68                | 3214.72**          | 187.46         |
| 2.     | Plant height (cm)             | 7.75                | 846.68**           | 6.38           |
| 3.     | Nodes per plant               | 0.53                | 53.38**            | 1.07           |
| 4.     | Nodes at pod appearance       | 1.28                | 6.52**             | 0.50           |
| 5.     | Length of pod (cm)            | 0.49                | 3.45**             | 0.28           |
| 6.     | Pod width (cm)                | 0.02                | 0.07**             | 0.03           |
| 7.     | Days to first picking         | 132.04**            | 92.38**            | 10.16          |
| 8.     | Seed per pod                  | 0.54                | 3.91**             | 0.28           |
| 9.     | Pods per plant                | 4.42**              | 15.54**            | 0.55           |
| 10.    | No. of pods / 100g            | 1.27                | 14.05**            | 1.10           |
| 11.    | 100 green seed weight (g)     | 0.90                | 41.88**            | 5.58           |
| 12.    | TSS (°Brix)                   | 0.05                | 7.67**             | 0.74           |
| 13.    | Green pod yield per plant (g) | 92.48               | 678.49**           | 48.05          |

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

The highly significant mean squares for treatments confirm the existence of wide genetic variability in the experimental material. This variability provides a good scope for selection and improvement of vegetable pea for yield and its component traits.

These findings are in agreement with earlier reports by Jeberson *et al.* (2016) and Kumar and Sharma (2006) [4, 5], who also observed significant differences among pea genotypes for most of the morphological and yield-related characters.

**Table 2:** Mean performance of genotypes for thirteen characters in vegetable pea

| Genotypes         | Days to 50% Flowering | Plant Height (cm) | Nodes per Plant | Nodes at Pod Appearance | Pod Length (cm) | Pod Width (cm) | Days to First Picking | Seeds per Pod | Pods per Plant | No. of Pods/100 g | 100 Green Seed Weight (g) | TSS (°Brix) | Green Pod Yield per Plant (g) |
|-------------------|-----------------------|-------------------|-----------------|-------------------------|-----------------|----------------|-----------------------|---------------|----------------|-------------------|---------------------------|-------------|-------------------------------|
| Azad Pea 1        | 42.12                 | 85.98             | 19.14           | 11.52                   | 8.25            | 1.12           | 57.00                 | 8.70          | 9.23           | 14.67             | 46.42                     | 11.96       | 66.38                         |
| Azad Pea 2        | 43.55                 | 118.65            | 21.32           | 10.15                   | 8.35            | 1.82           | 63.00                 | 6.58          | 10.99          | 16.00             | 47.00                     | 14.39       | 68.86                         |
| Azad Pea 3        | 41.58                 | 101.96            | 18.30           | 11.62                   | 8.56            | 1.25           | 62.05                 | 6.59          | 8.59           | 13.25             | 48.56                     | 13.06       | 67.10                         |
| Pant P 517        | 44.25                 | 98.12             | 17.52           | 12.32                   | 9.55            | 1.19           | 62.35                 | 8.91          | 11.95          | 15.69             | 50.63                     | 14.30       | 70.90                         |
| Kashi Samridhi    | 39.15                 | 78.66             | 21.15           | 11.55                   | 8.15            | 1.08           | 63.69                 | 7.63          | 10.55          | 11.59             | 53.57                     | 13.69       | 84.16                         |
| Kashi Nandini     | 40.65                 | 75.09             | 22.25           | 13.36                   | 8.35            | 1.54           | 60.88                 | 7.66          | 9.56           | 13.96             | 49.47                     | 12.65       | 76.96                         |
| Kashi Mukti       | 39.25                 | 70.92             | 18.85           | 9.63                    | 8.46            | 1.52           | 62.17                 | 7.65          | 12.20          | 14.68             | 50.63                     | 13.56       | 83.51                         |
| Kashi Uday        | 47.55                 | 94.25             | 17.56           | 10.36                   | 7.95            | 1.46           | 65.93                 | 6.62          | 14.51          | 18.01             | 49.04                     | 15.95       | 79.12                         |
| Pusa Pragati      | 44.34                 | 68.25             | 14.85           | 11.65                   | 7.76            | 1.25           | 63.97                 | 7.05          | 15.52          | 16.39             | 48.20                     | 12.70       | 88.75                         |
| Hisar Harit       | 43.45                 | 56.95             | 11.59           | 8.36                    | 8.51            | 1.98           | 61.09                 | 7.14          | 15.25          | 14.59             | 51.25                     | 15.66       | 92.42                         |
| Arka Priya        | 41.96                 | 73.86             | 14.56           | 12.66                   | 7.95            | 1.56           | 64.14                 | 7.46          | 14.45          | 16.39             | 52.52                     | 16.56       | 84.05                         |
| Arka Pramodh      | 42.58                 | 74.65             | 15.58           | 13.23                   | 6.69            | 1.36           | 70.33                 | 6.55          | 11.48          | 17.65             | 49.55                     | 12.93       | 77.09                         |
| Arka Sampurna     | 53.35                 | 64.59             | 14.85           | 9.25                    | 8.95            | 1.25           | 73.67                 | 8.26          | 15.24          | 18.29             | 51.18                     | 16.16       | 80.15                         |
| GS-10             | 51.04                 | 76.64             | 15.52           | 12.55                   | 7.42            | 1.66           | 67.39                 | 8.86          | 14.01          | 16.34             | 48.56                     | 15.57       | 78.13                         |
| S-10              | 52.95                 | 71.08             | 16.58           | 11.36                   | 8.18            | 1.25           | 64.59                 | 8.20          | 12.15          | 15.03             | 47.20                     | 15.62       | 94.27                         |
| Pant P 514        | 54.69                 | 57.36             | 10.58           | 8.28                    | 6.65            | 1.69           | 68.05                 | 7.66          | 15.40          | 15.18             | 56.37                     | 15.60       | 114.25                        |
| Pant P 480        | 42.59                 | 83.28             | 14.62           | 9.56                    | 8.72            | 1.35           | 87.60                 | 6.25          | 13.75          | 12.94             | 55.53                     | 16.96       | 115.68                        |
| Pant P 484        | 43.96                 | 98.20             | 13.52           | 12.65                   | 8.98            | 1.96           | 62.00                 | 7.95          | 11.55          | 16.56             | 49.53                     | 16.58       | 70.24                         |
| Arkel             | 45.25                 | 69.55             | 14.82           | 13.56                   | 8.50            | 1.66           | 58.67                 | 6.92          | 12.58          | 15.04             | 54.89                     | 17.35       | 72.06                         |
| Swarna Mukti      | 40.45                 | 75.82             | 20.65           | 9.69                    | 7.35            | 1.65           | 75.00                 | 7.25          | 15.20          | 15.15             | 44.90                     | 15.45       | 81.09                         |
| NDVP-121          | 52.59                 | 76.52             | 14.25           | 12.53                   | 7.56            | 1.56           | 67.35                 | 7.29          | 14.56          | 14.35             | 46.57                     | 17.62       | 76.13                         |
| Azad Pea 4(Check) | 41.98                 | 77.12             | 19.69           | 13.62                   | 8.32            | 1.26           | 62.67                 | 7.69          | 11.14          | 14.62             | 47.47                     | 13.55       | 74.96                         |

Green pod yield per plant ranged from 66.38 g (Azad Pea 1) to 115.68 g (Pant P 480). The highest green pod yield was recorded in Pant P 480 (115.68 g) followed by Pant P 514 (114.25 g). These two genotypes also performed better for other yield attributes such as pods per plant and 100 green seed weight. Early flowering genotypes included Kashi Samridhi (39.15 days) and Kashi Mukti (39.25 days), while Hisar Harit and Pusa Pragati recorded higher number of pods per plant. The wide range of variation observed in the present study indicates the existence of sufficient variability in the germplasm, which can be exploited for further improvement of vegetable pea. The

superior performance of Pant P 480 and Pant P 514 makes them promising genotypes for direct cultivation as well as for use in future breeding programmes. These results are in conformity with the findings of Jeberson *et al.* (2016) and Kumar and Sharma (2006) <sup>[4, 5]</sup>, who also reported significant variation in yield and its components among different pea genotypes. Estimates of ranges, grandmean, phenotypic coefficient to fvariation(PCV), genotypic coefficient of variation (GCV), heritability in broad sense, genetic advances (Ga)and Ga(inpercentofmean) for thirteen characters in vegetable pea germplasm.

**Table 3:** Estimates of Genetic Variability, Heritability and Genetic Advance for Thirteen Characters in Vegetable Pea (*Pisum sativum* L.)

| S. No. | Genetic Parameters of Characters | Range  |         | Grand Mean | ECV  | PCV   | GCV   | Heritability in broad sense (%) (h <sup>2</sup> bs) | Genetic Advances 5% | Genetic advance in per cent of mean5% |
|--------|----------------------------------|--------|---------|------------|------|-------|-------|-----------------------------------------------------|---------------------|---------------------------------------|
|        |                                  | Lowest | Highest |            |      |       |       |                                                     |                     |                                       |
| 1.     | Daysto50%flowering               | 22.18  | 60.38   | 42.34      | 3.54 | 14.18 | 14.58 | 18.00                                               | 1.04                | 4.62                                  |
| 2.     | Plant Height                     | 54.32  | 119.52  | 76.18      | 3.58 | 26.65 | 23.25 | 21.00                                               | 2.45                | 9.01                                  |
| 3.     | Nodes per plant                  | 13.27  | 28.46   | 18.37      | 5.51 | 21.59 | 26.65 | 80.00                                               | 2.65                | 30.62                                 |
| 4.     | Nodes at pod appearance          | 8.42   | 15.36   | 9.28       | 6.42 | 16.56 | 12.65 | 70.00                                               | 1.25                | 38.98                                 |
| 5.     | Length of pod                    | 8.43   | 11.75   | 10.56      | 5.37 | 14.36 | 11.56 | 85.00                                               | 3.15                | 31.08                                 |
| 6.     | Pod width                        | 2.13   | 2.64    | 1.45       | 5.11 | 9.64  | 10.96 | 79.00                                               | 4.62                | 28.58                                 |
| 7.     | Days to first picking            | 49.65  | 71.42   | 61.65      | 4.82 | 10.52 | 7.25  | 93.00                                               | 12.55               | 30.95                                 |
| 8.     | Seed per pod                     | 5.17   | 9.86    | 7.46       | 9.99 | 16.62 | 15.91 | 87.00                                               | 10.03               | 5.54                                  |
| 9.     | Pods per plant                   | 10.75  | 17.19   | 11.34      | 6.20 | 15.22 | 17.08 | 99.00                                               | 5.52                | 26.65                                 |
| 10.    | No. of Pods/100g                 | 12.24  | 22.31   | 15.86      | 7.28 | 17.93 | 11.34 | 98.00                                               | 3.22                | 19.85                                 |
| 11.    | 100GreenSeedWeight               | 42.23  | 54.25   | 44.39      | 7.10 | 9.60  | 8.95  | 86.00                                               | 20.66               | 33.03                                 |
| 12.    | TSS                              | 14.30  | 18.17   | 15.18      | 5.43 | 13.39 | 12.07 | 81.00                                               | 3.25                | 15.59                                 |
| 13.    | Green Pod Yield Per Plant        | 63.26  | 126.65  | 88.52      | 7.28 | 16.96 | 15.12 | 88.00                                               | 25.52               | 29.85                                 |

High PCV and GCV were recorded for plant height (26.65% and 23.25%), nodes per plant (21.59% and 26.65%), and pods per plant. High broad-sense heritability (>80%) along with high genetic advance as percent of mean was observed for green pod yield per plant (88.00%, 29.85%), pods per plant (99.00%, 26.65%), nodes per plant (80.00%, 30.62%), days to first picking (93.00%, 30.95%), and 100 green seed weight (86.00%,

33.03%). These findings indicate that these traits are largely governed by additive gene action and can be effectively improved through simple selection. The results are in close conformity with the earlier reports of Jeberson *et al.* (2016) and Kumar and Sharma (2006) <sup>[4, 5]</sup>, who also observed high heritability and genetic advance for yield and its component traits in vegetable pea.

**Table 4:** Estimates of phenotypic correlation coefficients among different characters in vegetable pea

| Traits                  | Days to 50 % flowering | Plant height | Nodes per plant | Nodes at pod appearance | Length of pod | Pod width | Days to first picking | Seed per pod | Pods per plant | No. of pods | 100 green seed weight | TSS    | Green pod yield per plant |
|-------------------------|------------------------|--------------|-----------------|-------------------------|---------------|-----------|-----------------------|--------------|----------------|-------------|-----------------------|--------|---------------------------|
| Days to 50% flowering   | 1.000                  | -0.014       | -0.125          | -0.133                  | 0.205*        | -0.055    | 0.137                 | 0.185*       | 0.052          | 0.151       | -0.002                | 0.55   | -0.009                    |
| Plant height            |                        | 1.000        | 0.599**         | -0.107                  | 0.117         | 0.091     | 0.111                 | 0.180        | 0.201          | 0.356**     | 0.087                 | -0.041 | -0.354**                  |
| Nodes per plant         |                        |              | 1.000           | -0.188*                 | 0.134         | -0.196*   | -0.008                | -0.063       | 0.273**        | 0.103       | -0.270**              | -0.024 | -0.358**                  |
| Nodes at pod appearance |                        |              |                 | 1.000                   | -0.141        | 0.141     | -0.134                | 0.022        | 0.357**        | 0.111       | -0.090                | 0.028  | -0.360**                  |
| Length of pod           |                        |              |                 |                         | 1.000         | -0.180    | 0.242**               | -0.418**     | 0.073          | 0.163       | -0.008                | -0.010 | 0.256*                    |
| Pod width               |                        |              |                 |                         |               | 1.000     | -0.278**              | 0.332**      | 0.266*         | 0.291**     | -0.181                | 0.068  | 0.065                     |
| Days to first picking   |                        |              |                 |                         |               |           | 1.000                 | 0.066        | -0.027         | 0.137       | -0.055                | -0.160 | 0.365**                   |
| Seed per pod            |                        |              |                 |                         |               |           |                       | 1.000        | 0.009          | -0.073      | -0.025                | 0.000  | 0.266*                    |
| Pods per plant          |                        |              |                 |                         |               |           |                       |              | 1.000          | 0.372**     | -0.111                | -0.118 | 0.762**                   |
| No. of pods             |                        |              |                 |                         |               |           |                       |              |                | 1.000       | 0.261**               | -0.064 | 0.415**                   |
| 100 green seed weight   |                        |              |                 |                         |               |           |                       |              |                |             | 1.000                 | 0.162  | 0.184                     |
| TSS                     |                        |              |                 |                         |               |           |                       |              |                |             |                       | 1.000  | -0.046                    |

\*&\*\*Significant at 5% &1% Probability levels, respectively.

Green pod yield per plant exhibited highly significant positive phenotypic correlation with pods per plant ( $r = 0.762^{**}$ ), number of pods per 100g ( $r = 0.415^{**}$ ), days to first picking ( $r = 0.365^{**}$ ), and seed per pod ( $r = 0.266^{*}$ ). On the other hand, it showed significant negative correlation with plant height ( $r = -0.354^{**}$ ), nodes per plant ( $r = -0.358^{**}$ ), and nodes at pod appearance ( $r = -0.360^{**}$ ). The strong positive association of

pods per plant and number of pods per 100g with green pod yield indicates that selection for these traits will be highly effective for improving yield in vegetable pea. These findings are in agreement with Kumar and Sharma (2006) and Jeberson *et al.* (2016) [4, 5], who also reported pods per plant as the most important yield contributing character in pea.

**Table 5:** Estimates of genotypic correlation coefficients among different characters in vegetable pea

| Traits                  | Days to 50% flowering | Plant height | Nodes per plant | Nodes at Pod Appearance | Length of pod | Pod width | Days to first picking | Seed per pod | Pods per plant | No. of pods | 100 green seed weight | TSS     | Green Pod Yield per Plant |
|-------------------------|-----------------------|--------------|-----------------|-------------------------|---------------|-----------|-----------------------|--------------|----------------|-------------|-----------------------|---------|---------------------------|
| Days to 50% flowering   | 1.000                 | -0.017       | -0.149          | 0.088                   | -0.458**      | -0.037    | 0.011                 | 0.253**      | -0.037         | 0.151       | 0.007                 | 0.091   | -0.062                    |
| Plant height            |                       | 1.000        | 0.530**         | 0.421**                 | 0.245**       | -0.025    | -0.032                | 0.265**      | -0.064         | -0.84       | -0.155                | 0.280** | 0.352**                   |
| Nodes per plant         |                       |              | 1.000           | 0.525**                 | 0.238*        | 0.293**   | 0.179                 | -0.039       | 0.293**        | 0.407**     | -0.006                | 0.247** | 0.456**                   |
| Nodes at pod appearance |                       |              |                 | 1.000                   | 0.096         | -0.058    | 0.009                 | 0.086        | 0.072          | 0.303**     | -0.205                | 0.093   | 0.056                     |
| Length of pod           |                       |              |                 |                         | 1.000         | -0.169    | 0.017                 | 0.291**      | 0.225*         | -0.086      | 0.342**               | 0.056   | -0.052                    |
| Pod width               |                       |              |                 |                         |               | 1.000     | -0.023                | 0.128        | 0.032          | 0.259*      | -0.134                | -0.014  | 0.563**                   |
| Days to first picking   |                       |              |                 |                         |               |           | 1.000                 | 0.081        | -0.047         | 0.079       | -0.138                | -0.030  | 0.164*                    |
| Seed per pod            |                       |              |                 |                         |               |           |                       | 1.000        | 0.012          | -0.103      | 0.017                 | -0.047  | 0.365**                   |
| Pods per plant          |                       |              |                 |                         |               |           |                       |              | 1.000          | 0.445**     | -0.155                | -0.158  | 0.724**                   |
| No. of pods             |                       |              |                 |                         |               |           |                       |              |                | 1.000       | 0.281**               | -0.024  | 0.325**                   |
| 100 green seed weight   |                       |              |                 |                         |               |           |                       |              |                |             | 1.000                 | 0.125   | 0.155                     |
| TSS                     |                       |              |                 |                         |               |           |                       |              |                |             |                       | 1.000   | 0.120                     |

\*&\*\*Significant at 5% &1% Probability levels, respectively.

Green pod yield per plant exhibited highly significant positive phenotypic correlation with pods per plant ( $r = 0.762^{**}$ ), number of pods per 100g ( $r = 0.415^{**}$ ), days to first picking ( $r = 0.365^{**}$ ), and seed per pod ( $r = 0.266^{*}$ ). On the other hand, it showed significant negative correlation with plant height ( $r = -0.354^{**}$ ), nodes per plant ( $r = -0.358^{**}$ ), and nodes at pod appearance ( $r = -0.360^{**}$ ).The strong positive association of

pods per plant and number of pods per 100g with green pod yield indicates that selection for these traits will be highly effective for improving yield in vegetable pea. These findings are in agreement with Kumar and Sharma (2006) and Jeberson *et al.* (2016) [4, 5], who also reported pods per plant as the most important yield contributing character in pea.

**Table 6:** Direct and indirect effects of different characters on pod yield per plant (g) at genotypic level in vegetable pea

| Traits                  | Days to 50% Flowering | Plant height | Nodes per plant | Nodes at pod appearance | Length of pod | Pod width | Days to first picking | Seed per pod | Pods per plant | No. of pods | 100 green seed weight | TSS and | Green pod yield per plant |
|-------------------------|-----------------------|--------------|-----------------|-------------------------|---------------|-----------|-----------------------|--------------|----------------|-------------|-----------------------|---------|---------------------------|
| Daysto50%flowering      | 0.025                 | -0.001       | 0.011           | -0.002                  | 0.061         | -0.008    | -0.064                | 0.200        | 0.005          | 0.178       | 0.104                 | 0.311   | -0.036                    |
| Plant height(cm)        | 0.000                 | 0.053        | -0.046          | -0.014                  | -0.041        | -0.007    | 0.269                 | 0.375        | 0.145          | -0.068      | 0.389                 | 0.184   | -0.392**                  |
| Nodes per plant         | -0.004                | 0.027        | -0.061          | -0.014                  | -0.032        | 0.009     | -0.040                | 0.409        | 0.475          | 0.051       | 0.300                 | 0.052   | -0.224**                  |
| Nodes at pod appearance | 0.086                 | 0.072        | 0.303           | -0.125                  | -0.013        | 0.003     | -0.462                | 0.086        | 0.024          | 0.303**     | -0.205                | 0.239   | -0.626**                  |
| Length of pod           | 0.291                 | 0.225        | -0.086          | 0.342                   | -0.155        | 0.005     | 0.001                 | -0.146       | 0.476          | -0.008      | 0.000                 | 0.084   | 0.069                     |
| Pod width               | 0.128                 | 0.032        | 0.259           | -0.134                  | 0.023         | -0.041    | -0.001                | -0.010       | 0.387          | 0.250       | -0.001                | 0.005   | 0.155                     |
| Days to first picking   | 0.086                 | 0.072        | 0.303           | -0.205                  | -0.002        | 0.001     | 0.058                 | 0.003        | 0.274          | -0.066      | -0.001                | -0.004  | -0.121                    |
| Seed per pod            | 0.007                 | -0.008       | -0.006          | 0.000                   | 0.017         | 0.013     | 0.003                 | 0.175        | 0.024          | 0.085       | 0.000                 | 0.000   | 0.141                     |
| Pods per plant          | 0.000                 | -0.019       | 0.045           | 0.018                   | 0.021         | 0.005     | 0.1956                | 0.024        | 0.752          | -0.370      | -0.001                | -0.003  | 0.672**                   |
| No. of pods /100g       | 0.004                 | -0.006       | 0.030           | 0.004                   | 0.055         | 0.015     | 0.0702                | -0.1035      | 0.396          | 0.682       | -0.002                | -0.001  | 0.545**                   |
| 100green seed weight(g) | 0.000                 | -0.005       | 0.000           | -0.003                  | 0.017         | 0.005     | -0.0371               | 0.0016       | -0.137         | 0.233       | 0.334                 | 0.003   | 0.162                     |
| TSS                     | 0.002                 | -0.002       | 0.002           | -0.002                  | 0.005         | -0.010    | 0.0196                | 0.024        | -0.140         | 0.020       | 0.001                 | 0.055   | -0.120                    |

Rsquare =1.0121 Residual effect= Sqrt (1-1.0121)

Green pod yield per plant exhibited highly significant positive phenotypic correlation with pods per plant ( $r = 0.762^{**}$ ), number of pods per 100g ( $r = 0.415^{**}$ ), days to first picking ( $r = 0.365^{**}$ ), and seed per pod ( $r = 0.266^{**}$ ). On the other hand, it showed significant negative correlation with plant height ( $r = -0.354^{**}$ ), nodes per plant ( $r = -0.358^{**}$ ), and nodes at pod appearance ( $r = -0.360^{**}$ ). The strong positive association of

pods per plant and number of pods per 100g with green pod yield indicates that selection for these traits will be highly effective for improving yield in vegetable pea. These findings are in agreement with Kumar and Sharma (2006) and Jeberson *et al.* (2016) [4, 5], who also reported pods per plant as the most important yield contributing character in pea.

**Table 7:** Direct and indirect effects of different characters on pod yield per plant (g) at phenotypic level in vegetable pea

| Traits                  | Days to 50% flowering | Plant height | Nodes per plant | Nodes at pod appearance | Length of pod | Pod width | Days to first picking | Seed per pod | Pods per plant | No. of pods | 100 green seed weight | TSS     | Green pod yield per plant |
|-------------------------|-----------------------|--------------|-----------------|-------------------------|---------------|-----------|-----------------------|--------------|----------------|-------------|-----------------------|---------|---------------------------|
| Days to 50% flowering   | 0.0355                | 0.0017       | -0.0046         | 0.0008                  | 0.0019        | 0.069     | -0.0045               | -0.0005      | 0.0235         | -0.0725     | -0.0003               | -0.0005 | -0.008                    |
| Plant height            | -0.0010               | -0.0545      | 0.0184          | 0.0022                  | -0.0019       | 0.0067    | -0.0007               | 0.0001       | -0.3852        | 0.0800      | -0.0083               | 0.0002  | -0.354**                  |
| Nodes per plant         | -0.0085               | -0.0396      | 0.0445          | 0.0032                  | -0.0016       | -0.0079   | -0.0009               | -0.0615      | 0.1307         | -0.0008     | 0.0043                | 0.0003  | -0.325**                  |
| Nodes at pod appearance | 0.0054                | -0.0317      | 0.0136          | 0.0044                  | -0.0003       | -0.0019   | 0.0000                | 0.0211       | -0.0581        | -0.0008     | 0.0009                | 0.0026  | -0.545**                  |
| Length of pod           | -0.0271               | 0.014        | -0.011          | 0.001                   | -0.0054       | -0.0084   | 0.0001                | 0.5352       | -0.0984        | 0.0048      | 0.0007                | -0.0003 | 0.055                     |
| Pod width               | 0.0091                | -0.002       | 0.020           | -0.001                  | 0.0013        | 0.0444    | -0.0003               | 0.3577       | -0.1813        | -0.0016     | -0.0009               | -0.0085 | 0.084                     |
| Days to first picking   | 0.0227                | 0.017        | 0.024           | 0.006                   | 0.0002        | 0.0025    | -0.0051               | 0.3179       | 0.0187         | 0.0019      | -0.0008               | -0.0014 | -0.154                    |
| Seed per pod            | 0.0153                | 0.014        | -0.011          | 0.031                   | -0.034        | 0.002     | -0.003                | -0.0008      | 0.0079         | 0.0531      | -0.0019               | 0.0012  | 0.054                     |
| Pods per plant          | 0.0019                | 0.0283       | -0.0176         | 0.006                   | -0.004        | 0.014     | 0.002                 | 0.0000       | 0.8654         | -0.2691     | -0.0086               | 0.0052  | 0.766**                   |
| No. of pods             | 0.0084                | 0.0073       | -0.0105         | 0.023                   | -0.017        | -0.004    | -0.004                | 0.0001       | 0.3345         | -0.6521     | -0.0255               | 0.0005  | 0.49**                    |
| 100 green seed weight   | 0.0000                | 0.0070       | -0.0001         | 0.008                   | -0.001        | 0.013     | 0.001                 | 0.0000       | -0.0998        | 0.1890      | 0.0554                | -0.0009 | 0.168                     |
| TSS                     | 0.0051                | 0.0024       | -0.0008         | 0.045                   | -0.045        | 0.0058    | -0.0008               | 0.0005       | -0.1044        | 0.0361      | 0.0126                | -0.0065 | -0.046                    |

Rsquare=0.9448 residual effect=0.2349

Path analysis at phenotypic level revealed that pods per plant exerted the highest positive direct effect (0.8654) on green pod yield per plant, followed by number of pods per 100g. The results clearly indicated that pods per plant is the most important yield contributing character having both high correlation as well as high direct effect on green pod yield. Therefore, direct selection for this trait would be highly effective in improving yield in vegetable pea. These findings are in close agreement with the earlier reports of Kumar and Sharma (2006) Jeberson *et al.* (2016), and Chakraborty *et al.* (2003) [2, 4, 5], who also identified pods per plant as the major direct contributor to yield in vegetable pea.

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