Evaluation of yield attributes and yield in some selected crosses of F2 and F3 generations in green gram (Vigna radiata (L.) Wilczek)

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Abstract
An investigation was carried out among the progenies of five crosses of green gram (Vigna radiata L.) in F2 and F3 generations, to study the yield attributes and yield. Parameters such as number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, hundred seed weight and single plant yield were evaluated. In the present investigation, the crosses, PANT M 103 x CO GG 930 and EC 391620 x IPM 99125 registered high for most of the yield attributing characters. Further the study highlighted that high variation was observed for number of pods per plant and single plant yield in all the crosses of F2 and F3, indicating that the commencement of selection in F3, would be ideal for development of new high yielding variety.

Keywords: Yield attributes, yield, green gram, progenies, variation

Introduction
Green gram (Vigna radiate L. Wilczek) is an important pulse crop of India. In Tamil Nadu, it is cultivated on an area of about 1.90 lakh hectare with the production and productivity of 0.63 lakh tonnes and 336 kg per hectare, respectively (IIPR, 2016). In recent years, there has been a significant decline in pulse production in Tamil Nadu. In view of the above, increase in production and productivity of this crop is very crucial to meet the protein requirement especially under-nourished people depending on the vegetable protein. Seed yield is the primary objective in all field crop breeding programs. Grain yield is a complex character and is the product of many yield components. Selection for yield components has been suggested as a solution for further advance in increasing yield. Understanding the inheritance of yield components is necessary for the intelligent choice of breeding programmes for developing High -Yielding Varieties (Azizi et al., 2006) [1]. Information regarding inheritance of grain yield and its closely related components is essential to efficiently exploit the available genetic diversity in mung bean for seed yield (Khattak et al., 2004) [3]. The F2 or F3 derived lines are far from being homozygous and early generation selection relies on the assumption that the performance of a line at an early generation of selfing is predictive of its performance at homozygosity (Chahota et al., 2007) [2]. Hence, the present investigation mainly focused to determine the extent of the variability available in F2 and F3 generations of green gram and also to determine the scope of selection through heritability and genetic advance.

Materials and Methods
The experiment was conducted at Agricultural College and Research Institute, Killikulam. The F2 generation was raised during September 2017 and F3 was raised in the February 2018. Five high yielding cross combinations and parents were sown in three replications along with CO 6 variety as a standard check in Randomized Block Design. The spacing between rows was 30 cm and spacing between the individual plants was 10 cm. Observations regarding the number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, hundred seed weight and single plant yield were obtained at the time
Of harvest. Mean was computed for the parents, F2’s and F3’s in respect of all the eleven plant traits taken up for the study adopting the statistical methods suggested by Panse and Sukhatme 1964.

Results
The yield attributes and yield were presented in Table. 1

Number of primary branches per plant: The mean value for number of primary branches per plant was found to be low in AGG 10091 x CO 7 in both the generation (3.0 (F2), 3.6 (F3)). For the same trait higher mean value was obtained in the cross EC 391620 x IPM 99125 in F2 (4.8) and F3 (5.0) generation.

Number of clusters per plant: The maximum number of clusters per plant was observed in F2 generation of EC 391620 x IPM 99125 (18.0) and the minimum value was observed in EC 391620 x IPM 0214 (8.0). In F3, the maximum value was observed in the cross EC 391620 x IPM 99125 (18.0) and lower value recorded in EC 391620 x IPM 0214 (9.2).

Number of pods per cluster: Mean for number of pods per cluster ranged from 3.2 (EC 391620 x IPM 0214) to 5.6 (PANT M 103 x MH 565) in F2 and from 4.0 (EC 391620 x IPM 0214) to 6.0 (PANT M 103 x CO GG 930) in F3 generation.

Number of pods per plant: Mean value for number of pods per cluster ranged from 3.2 (EC 391620 x IPM 99125) to 3.47 g (AGG 10091 x CO 7) in F2 and from 2.62 g (EC 391620 x IPM 99125) to 3.44 g (EC 391620 x IPM 99125) in F3 generation.

Hundred seed yield: Mean value for hundred seed weight ranged from 2.51 g (EC391620 x IPM 99125) to 3.47 g (AGG 10091 x CO 7) in F2 and from 2.62 g (EC391620 x IPM 99125) to 3.44 g (EC391620 x IPM 99125) in F3.

Single plant yield: Mean value of single plant yield ranged from 15.31 g (EC391620 x IPM 0214) to 18.14 g (PANT M 103 x CO GG 930) in F2 and from 15.64 g (MH 521 x TNY Local) to 18.96 g (PANT M 103 x CO GG 930) in F3.

Table 1: Mean performance of parents in F2 and F3 generations for different yield attributes and yield

| Parents         | G  | Number of primary branches | Clusters per plant | Pods per cluster | Pods per plant | 100 seed weight | Single plant yield |
|-----------------|----|-----------------------------|--------------------|------------------|----------------|-----------------|-------------------|
| PANT M 103 (L1)| F2 | 3.20                        | 8.20               | 5.40             | 44.28          | 2.28            | 15.76             |
|                 | F3 | 2.40                        | 9.20               | 3.20             | 29.44          | 2.26            | 10.81             |
| AGG 100 91 (L4)| F2 | 3.00                        | 8.00               | 4.80             | 38.40          | 2.21            | 13.20             |
|                 | F3 | 2.80                        | 7.20               | 2.80             | 20.16          | 2.09            | 7.72              |
| EC 396120 (L5) | F2 | 3.00                        | 5.00               | 3.20             | 17.60          | 2.19            | 6.50              |
|                 | F3 | 3.40                        | 8.60               | 3.40             | 29.24          | 2.14            | 10.15             |
| CO 7 (T1)      | F2 | 2.40                        | 5.40               | 3.60             | 19.44          | 3.57            | 7.58              |
|                 | F3 | 2.68                        | 5.94               | 3.80             | 22.57          | 2.9             | 8.22              |
| IPM 99 125 (T2)| F2 | 2.60                        | 8.00               | 4.00             | 32.00          | 2.26            | 11.67             |
|                 | F3 | 2.44                        | 7.45               | 3.85             | 28.68          | 2.18            | 10.20             |
| MH 565 (T3)    | F2 | 2.00                        | 6.20               | 3.60             | 22.32          | 2.68            | 8.44              |
|                 | F3 | 2.54                        | 5.98               | 3.44             | 20.57          | 3.21            | 8.06              |
| CO GG 930 (T4)| F2 | 2.80                        | 8.00               | 4.40             | 35.20          | 2.28            | 13.53             |
|                 | F3 | 2.65                        | 7.40               | 3.25             | 24.05          | 2.14            | 9.02              |
| IPM 0214 (T8)  | F2 | 3.60                        | 6.60               | 2.40             | 15.84          | 3.01            | 6.28              |
|                 | F3 | 3.20                        | 8.20               | 3.60             | 29.52          | 2.26            | 10.24             |
| Mean           |    | 2.74                        | 7.21               | 3.67             | 26.83          | 2.48            | 9.84              |
| SE             |    | 0.10                        | 0.31               | 0.18             | 1.99           | 0.11            | 0.67              |
Table 2: Mean performance of parents in F2 and F3 generations for different characters

| Parents          | G     | Days to Flowering | Plant height | Number of primary branches | Clusters per plant | Pods per cluster | Pods per plant | Pod length | Seeds per pod | 100 seed weight | Single plant yield |
|------------------|-------|-------------------|--------------|---------------------------|--------------------|-----------------|---------------|------------|---------------|-----------------|-------------------|
| PANT M 103       | F2    | 29.00             | 34.00        | 3.20*                     | 8.20*              | 5.40           | 44.28*        | 5.94       | 7.20          | 2.28            | 15.76*            |
|                  | F3    | 28.20             | 31.90        | 2.40                      | 9.20*              | 3.20           | 29.44*        | 5.81       | 8.20          | 2.26            | 10.81*            |
| AGG 100 91       | F2    | 28.00             | 33.67        | 3.00*                     | 8.00*              | 4.80*          | 38.40*        | 4.83       | 8.50          | 2.19            | 6.50              |
|                  | F3    | 28.20             | 32.50        | 2.80                      | 7.20               | 2.80           | 20.16*        | 4.90       | 6.20          | 2.09            | 7.72              |
| EC 396120        | F2    | 28.40             | 31.60        | 3.00*                     | 5.00               | 3.20           | 17.60         | 5.22       | 6.20          | 2.19            | 6.50              |
|                  | F3    | 29.00             | 27.80        | 3.40*                     | 8.60               | 3.40           | 29.24*        | 5.91       | 6.80          | 2.14            | 10.15             |
| CO 7             | F2    | 32.20*            | 41.10*       | 2.40                      | 5.40               | 3.60           | 19.44         | 8.73*      | 10.60*        | 3.57*           | 7.55              |
|                  | F3    | 30.15*            | 38.25*       | 2.68                      | 5.94               | 3.80           | 22.57         | 7.90*      | 8.25*         | 2.98*           | 8.22              |
| IPM 99 125       | F2    | 28.40             | 36.54*       | 2.60                      | 8.00*              | 4.00*          | 32.00*        | 5.10       | 5.20          | 2.26            | 11.67*            |
|                  | F3    | 26.50             | 34.24        | 2.44                      | 7.45               | 3.85*          | 28.68         | 5.22       | 5.36          | 2.18            | 10.26             |
| MH 565           | F2    | 35.60*            | 33.94        | 2.00                      | 6.20               | 3.60*          | 22.32         | 7.32*      | 12.30*        | 2.68*           | 8.44              |
|                  | F3    | 34.80*            | 32.46        | 2.54                      | 5.98               | 3.44           | 20.57         | 6.85*      | 10.32*        | 3.21            | 8.05              |
| CO GG 930        | F2    | 28.00             | 33.20        | 2.80                      | 8.00*              | 4.40           | 35.20*        | 5.94       | 7.20          | 2.28            | 13.53*            |
|                  | F3    | 27               | 31.25        | 2.65                      | 7.40               | 3.25           | 24.05         | 6.10       | 7.90          | 2.14            | 9.02              |
| IPM 0214         | F2    | 33.80*            | 45.15*       | 3.60*                     | 6.60               | 2.40           | 15.84         | 7.76*      | 11.60*        | 3.01*           | 6.28              |
|                  | F3    | 29.80             | 32.50        | 3.20*                     | 8.20*              | 3.60           | 29.52*        | 5.81       | 5.40          | 2.26            | 10.24             |
| Mean             |       | 25.66             | 34.38        | 2.74                      | 7.21               | 3.67           | 26.83         | 6.21       | 7.78          | 2.48            | 9.84              |
| SE               |       | 0.70              | 1.04         | 0.10                      | 0.31               | 0.18           | 1.99          | 0.29       | 0.57          | 0.11            | 0.67              |

Discussion

The cross PANT M 103 x COG G 930 was found to have higher mean value for yield contributing traits viz., number of pods per cluster, pod length, seeds per pod and single plant yield in both F2 generations. Further, in F2, EC 396120 x IPM 99125 recorded high mean value for characters like plant height, number of pods per plant, number of primary branches per plant and number of clusters per plant.

Considering F3 generation, the cross EC 396120 x IPM 99125 expressed higher mean value for most of the yield related traits viz., number of primary branches per plant, number of clusters per plant, number of pods per plant, pod length and number of seeds per pod besides AGG 10091 x CO 7 exhibited higher mean value for plant height and 100 seed weight. PANT M 103 x MH 565 was found to be early in F2 as well as F3 generation because it showed lesser mean value for days to flowering. When mean was considered as an index of selection, the crosses, PANT M 103 x COG G 930 and EC 396120 x IPM 99125 registered high expression of mean and for most of the yield attributing characters. Hence selection can be attempted in segregating generation of these cross combinations. Further the study highlighted that high variability was observed for hundred seed weight and single plant yield. The breeding nature of the sergeants were investigated by their mean When mean was considered as an index of selection, the crosses, PANT M 103 x COG G 930 and EC 396120 x IPM 99125 registered high expression of mean and for most of the yield attributing characters. Hence selection can be attempted in segregating generation of these cross combinations. Further the study highlighted that high variability was observed for number of pods per plant and single plant yield in all the crosses of F2 and F3, indicating that the commencement of selection in F3, would be ideal for development of new high yielding variety.

Conclusion

In green gram, the evaluation of potential parents along with their advance generation was undertaken to conceptualize breeding strategies for yield improvement. Five crosses were evaluated along with their parents for traits viz., number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, hundred seed weight and single plant yield. The breeding nature of the sergeants were investigated by their mean When mean was considered as an index of selection, the crosses, PANT M 103 x COG G 930 and EC 396120 x IPM 99125 registered high expression of mean and for most of the yield attributing characters. Hence selection can be attempted in segregating generation of these cross combinations. Further the study highlighted that high variability was observed for number of pods per plant and single plant yield in all the crosses of F2 and F3, indicating that the commencement of selection in F3, would be ideal for development of new high yielding variety.

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