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Morpho-physiological Characterization and Yield Evaluation of Cowpea (*Vigna unguiculata* L.) Germplasm

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Abstract

The present study was conducted on morpho-physiological, biochemical and yield attributing characters of cowpea germplasm. The germplasm sown in randomized block design with two replications and observations were recorded on randomly selected five plants for twenty-nine characters. In case of quantitative parameters, germplasm PCP-1402, PCP-1111, PCP-1412, PCP-1504, DC-15 and Phule Sonali showed above average performance in all the attributes including plant height, number of branches, longer pod length, seed length, number of pods per plant, number of seeds per pod and seed yield per hectare. Among the germplasm, Phule Sonali recorded the highest (26.50%) protein content and the germplasm PCP-1502 recorded lowest (21.50) protein content. The genotype PCP-1402 recorded highest (880 kg/ha) seed yield while Phule Pandhari recorded lowest (626 kg/ha) seed yield per hectare. On the basis of different quantitative and qualitative characters it was found that the germplasm PCP-1402, PCP-1111, PCP-1412, PCP-1504, JLC-30, DC-15 and Phule Sonali were comparable and showed above average performance.

Keywords: Morpho-physiological characters, analysis of variance (ANOVA)

1. Introduction

The cowpea (*Vigna unguiculata* (L). Walp) is a significant *Kharif* crop in India among the pulses. It is a self-pollinating annual legume crop and is a member of the Leguminosae family (Mackie and Smith, 1935) ^[23]. Cowpea (*Vigna unguiculata* (L). Walp) is an annual crop that can withstand water and salt stresses and is well suited to a variety of soil types and climatic conditions (Osipitan *et al.*, 2021) ^[24]. It is a staple and versatile food legume across many African communities, where it is consumed as young leaves, immature pods and dry seeds. Also, the entire plant can be used to feed livestock (Alemu *et al.*, 2016) ^[25]. The economic value of cowpea is derived from its high nutritional value, as it contains high protein and fiber contents with low fats. Its seeds comprise 17 amino acids, some of which are essential like valine, lysine, leucine and phenylalanine.

Additionally, cowpea leaves are incredibly valuable economically and nutritionally, offering a reasonable source of protein, vitamins and many essential nutrients that could contribute to reduce human food insecurity and malnutrition (Gerrano *et al.*, 2019) ^[26]. Cowpea cultivation enhances soil characteristics in the agricultural system by compensating for the nitrogen lost by cereals plantation. This is a result of its great ability to fix nitrogen through its symbiotic root nodules, which allows it to thrive even in nutrient-poor soils (Mndzebele *et al.*, 2020) ^[27].

2. Materials and Methods

The experimental material consisted of 30 cowpea genotypes used in the study were collected from the Pulse and Oilseed Crops Research and Training Centre, MPKV, Pandharpur evaluated at the Post Graduate Institute Rahuri, during the *Kharif* season 2024. The trial was laid out in a randomized block design (RBD) with two replications. Standard cultural practices were followed throughout the growing season. The genotypes sown in three rows of each genotype of spacing 45 cm × 10 cm. The observations were recorded on five randomly selected plants from each treatment in each replication for morphological, yield contributing along with quality parameters *viz.*, Data was recorded on days to

50% flowering, days to maturity, plant height (cm), number of leaves, flower colour, leaflet shape, number of branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight, yield per hectare, protein content. The collected data were subjected to analysis of variance (ANOVA).

3. Result and discussion

Mean performance of 30 genotypes for morpho-physiological characters in cowpea: The present research work entitled “Morpho-physiological Characterization and yield evaluation of cowpea (*Vigna unguiculata* (L) Walp) germplasm” was conducted at the field of Post Graduate

Institute Farm, MPKV, Rahuri during *Kharif* 2024. Table 1. Among the germplasm, PCP-1111 recorded the tallest height (94.00 cm) and the genotype RC-101 recorded the lowest plant height (32.50 cm). The number of branches ranges from 6.50 to 11. Among the germplasm, PCP-1111 was recorded the highest (40.50) number of leaves per plant and germplasm RC-101 was recorded lowest (17.50).

Table 2. The germplasm PCP-1111 has highest leaf area 325 cm² and the Germplasm PCP-1410 recoded lowest (151.0 cm²). The germplasm PGCP-75 recorded longer pod length (16.40 cm) while the germplasm PCP-1408 and PCP-1504 has observed shorter pod length (10.50 cm) and mean of pod length was 13.22 cm.

Table 1: Mean morphological quantitative characters of cowpea Germplasm

| Sr. No. | Name of Genotype | Plant height (cm) | Number of branches Per plant | Number of leaves per plant |
|---------|--------------------|-------------------|------------------------------|----------------------------|
| 1 | PMCP-1005 | 40.50 | 9.00 | 36.00 |
| 2 | PMCP-1016 | 87.50 | 7.00 | 29.50 |
| 3 | PMCP-1018 | 35.00 | 8.50 | 28.50 |
| 4 | PCP-1111 | 94.00 | 11.00 | 40.50 |
| 5 | PCP-1131 | 84.50 | 8.50 | 25.50 |
| 6 | PCP-1402 | 75.50 | 10.50 | 32.25 |
| 7 | PCP-1405 | 45.50 | 9.50 | 35.00 |
| 8 | PCP-1408 | 92.50 | 9.00 | 38.25 |
| 9 | PCP-1410 | 42.50 | 8.00 | 27.00 |
| 10 | PCP-1412 | 78.50 | 7.00 | 34.50 |
| 11 | PCP-1502 | 35.00 | 8.50 | 32.50 |
| 12 | PCP-1504 | 37.50 | 10.00 | 25.00 |
| 13 | PCP-1506 | 43.50 | 9.50 | 26.00 |
| 14 | PCP-1507 | 38.00 | 7.50 | 26.00 |
| 15 | CPB-2201 | 57.50 | 9.00 | 27.50 |
| 16 | TC-901 | 53.50 | 7.00 | 29.50 |
| 17 | Pusa Komal | 42.50 | 7.50 | 19.50 |
| 18 | JLCP-30 | 87.50 | 8.00 | 37.00 |
| 19 | EC-343222 | 38.50 | 9.00 | 25.50 |
| 20 | VCM-8 | 35.50 | 8.50 | 29.00 |
| 21 | KBC-9 | 56.50 | 10.00 | 31.50 |
| 22 | DC-19-6 | 48.50 | 9.00 | 25.00 |
| 23 | DC-15 | 43.50 | 8.00 | 29.50 |
| 24 | PGCP-75 | 43.50 | 7.50 | 21.50 |
| 25 | TP-944 | 51.50 | 6.50 | 18.50 |
| 26 | RC-101 | 32.50 | 8.00 | 17.50 |
| 27 | Phule Pandhari (C) | 52.50 | 7.50 | 28.50 |
| 28 | Phule Vithai (C) | 49.00 | 7.50 | 30.50 |
| 29 | Phule Rakhumai (C) | 50.00 | 8.50 | 28.50 |
| 30 | Phule Sonali (C) | 42.50 | 10.00 | 27.50 |
| | Mean | 53.83 | 8.3 | 27.78 |
| | S.E.± | 2.77 | 0.56 | 1.66 |
| | C.D. at 5% | 8.01 | 1.62 | 4.79 |
| | C.V.% | 7.25 | 9.38 | 8.07 |

Table 2: Mean yield contributing quantitative characters of cowpea Germplasm

| Sr. No. | Name of Genotype | Pod Length (cm) | Seed Length (mm) | Peduncle Length (cm) |
|---------|------------------|-----------------|------------------|----------------------|
| 1 | PMCP-1005 | 12.50 | 4.50 | 23.50 |
| 2 | PMCP-1016 | 11.00 | 4.80 | 19.50 |
| 3 | PMCP-1018 | 13.75 | 4.30 | 21.50 |
| 4 | PCP-1111 | 15.50 | 6.00 | 20.00 |
| 5 | PCP-1131 | 11.00 | 4.60 | 20.00 |
| 6 | PCP-1402 | 12.75 | 4.60 | 20.50 |
| 7 | PCP-1405 | 12.00 | 5.00 | 22.00 |
| 8 | PCP-1408 | 10.50 | 4.80 | 22.50 |
| 9 | PCP-1410 | 15.00 | 5.70 | 22.00 |
| 10 | PCP-1412 | 14.50 | 4.20 | 22.00 |
| 11 | PCP-1502 | 12.00 | 4.30 | 18.50 |
| 12 | PCP-1504 | 10.50 | 4.30 | 16.00 |
| 13 | PCP-1506 | 13.75 | 3.80 | 20.50 |

| | | | | |
|----|--------------------|-------|-------|-------|
| 14 | PCP-1507 | 14.30 | 4.80 | 21.50 |
| 15 | CPB-2201 | 15.40 | 5.50 | 20.00 |
| 16 | TC-901 | 13.25 | 4.70 | 21.50 |
| 17 | Pusa Komal | 12.10 | 4.30 | 19.00 |
| 18 | JLCP-30 | 14.00 | 4.40 | 18.00 |
| 19 | EC-343222 | 13.00 | 4.50 | 20.50 |
| 20 | VCM-8 | 14.00 | 5.30 | 18.50 |
| 21 | KBC-9 | 12.75 | 5.20 | 19.50 |
| 22 | DC-19-6 | 16.00 | 4.80 | 20.00 |
| 23 | DC-15 | 14.20 | 4.90 | 20.00 |
| 24 | PGCP-75 | 16.40 | 4.40 | 19.50 |
| 25 | TP-944 | 14.00 | 4.30 | 18.50 |
| 26 | RC-101 | 11.90 | 4.50 | 19.50 |
| 27 | Phule Pandhari (C) | 13.25 | 4.20 | 18.50 |
| 28 | Phule Vithai (C) | 11.00 | 4.45 | 22.50 |
| 29 | Phule Rakhumai (C) | 12.00 | 4.05 | 20.00 |
| 30 | Phule Sonali (C) | 14.50 | 4.75 | 19.50 |
| | Mean | 13.23 | 4.66 | 21.81 |
| | S.E.± | 0.48 | 0.33 | 0.80 |
| | C.D. at 5% | 1.38 | 0.96 | 2.31 |
| | C.V.% | 5.20 | 10.18 | 5.60 |

Table 3: Yield contributing quantitative characters of cowpea Germplasm

| Sr. No. | Name of Genotype | Number of pods per plant | Number of seeds per pod | 100 seed weight (g) | Seed yield per plant (g/plant) | Seed yield per plot (kg/plot) | Seed yield per hectare (kg/ha) |
|---------|--------------------|--------------------------|-------------------------|---------------------|--------------------------------|-------------------------------|--------------------------------|
| 1 | PMCP-1005 | 13.20 | 11.20 | 11.50 | 12.20 | 0.431 | 798 |
| 2 | PMCP-1016 | 12.20 | 10.60 | 11.30 | 11.80 | 0.418 | 774 |
| 3 | PMCP-1018 | 12.00 | 10.00 | 11.60 | 10.60 | 0.400 | 741 |
| 4 | PCP-1111 | 16.00 | 11.80 | 12.25 | 12.70 | 0.445 | 824 |
| 5 | PCP-1131 | 10.00 | 10.20 | 10.50 | 10.00 | 0.381 | 705 |
| 6 | PCP-1402 | 18.40 | 12.80 | 11.70 | 13.00 | 0.475 | 880 |
| 7 | PCP-1405 | 17.60 | 11.80 | 11.75 | 12.70 | 0.472 | 874 |
| 8 | PCP-1408 | 11.00 | 10.40 | 11.90 | 10.60 | 0.401 | 742 |
| 9 | PCP-1410 | 11.40 | 10.60 | 10.70 | 11.20 | 0.403 | 747 |
| 10 | PCP-1412 | 15.00 | 11.20 | 12.00 | 12.50 | 0.435 | 805 |
| 11 | PCP-1502 | 14.60 | 10.60 | 11.50 | 12.40 | 0.439 | 812 |
| 12 | PCP-1504 | 14.80 | 12.00 | 12.50 | 12.50 | 0.440 | 815 |
| 13 | PCP-1506 | 16.00 | 11.20 | 12.17 | 12.50 | 0.446 | 825 |
| 14 | PCP-1507 | 9.20 | 10.00 | 10.75 | 9.50 | 0.361 | 669 |
| 15 | CPB-2201 | 11.60 | 12.00 | 13.25 | 11.00 | 0.401 | 743 |
| 16 | TC-901 | 9.40 | 10.40 | 10.70 | 9.50 | 0.380 | 703 |
| 17 | Pusa Komal | 12.20 | 10.60 | 11.00 | 11.20 | 0.406 | 752 |
| 18 | JLCP-30 | 12.00 | 10.40 | 11.00 | 11.00 | 0.403 | 747 |
| 19 | EC-343222 | 11.00 | 12.00 | 11.00 | 10.50 | 0.397 | 735 |
| 20 | VCM-8 | 10.40 | 10.00 | 10.50 | 10.50 | 0.391 | 724 |
| 21 | KBC-9 | 12.00 | 11.00 | 12.50 | 11.50 | 0.417 | 772 |
| 22 | DC-19-6 | 11.60 | 11.20 | 12.00 | 11.00 | 0.411 | 762 |
| 23 | DC-15 | 17.00 | 11.60 | 11.50 | 12.50 | 0.458 | 848 |
| 24 | PGCP-75 | 12.00 | 10.40 | 10.50 | 10.00 | 0.388 | 719 |
| 25 | TP-944 | 12.20 | 11.40 | 11.50 | 11.50 | 0.415 | 769 |
| 26 | RC-101 | 11.00 | 11.00 | 10.17 | 10.70 | 0.381 | 706 |
| 27 | Phule Pandhari (C) | 8.60 | 8.20 | 10.50 | 9.00 | 0.338 | 626 |
| 28 | Phule Vithai (C) | 10.60 | 9.60 | 9.50 | 10.50 | 0.396 | 733 |
| 29 | Phule Rakhumai (C) | 12.00 | 10.20 | 9.75 | 11.50 | 0.416 | 771 |
| 30 | Phule Sonali (C) | 13.20 | 11.40 | 12.50 | 12.50 | 0.425 | 787 |
| | Mean | 12.66 | 10.51 | 11.30 | 10.87 | 0.410 | 766 |
| | S.E.± | 0.65 | 0.45 | 0.50 | 0.72 | 0.03 | 41.96 |
| | C.D. at 5% | 1.88 | 1.30 | 1.46 | 2.07 | 0.08 | 121.35 |
| | C.V.% | 7.30 | 5.86 | 6.31 | 9.01 | 9.71 | 7.76 |

Table 3. The study monitored the number of pods per plant of germplasm, which ranged from 8.60 to 18.40 at the maturity stage. Among the germplasm, PCP-1402 recorded the highest number of pods per plant (18.40) and the check variety Phule Pandhari was recorded the lowest number of pods per plant (8.60). Among the germplasm, CPB-2201

was recorded the highest (13.25 g) 100 seed weight and the entry Phule Vithai (9.50 g) was recorded the lowest 100 seed weight. The genotype PCP-1402 recorded highest (880 kg/ha) yield while Phule Pandhari recorded lowest (626 kg/ha) seed yield per hectare.

Table 4. Biochemical Parameters of cowpea germplasm
Phule Sonali was recorded highest (26.50%) protein content, which was at par with most of the germplasm lines. The

entry PCP-1502 recorded lowest (21.50%) protein content and mean of all the genotypes for protein content was 24.14 per cent.

Table 4: Biochemical Parameters of cowpea germplasm

| Sr. No. | Name of Genotype | Protein content (%) | Chlorophyll Content (SPAD) |
|---------|--------------------|---------------------|----------------------------|
| 1 | PMCP-1005 | 25.00 | 41.64 |
| 2 | PMCP-1016 | 25.60 | 38.15 |
| 3 | PMCP-1018 | 24.25 | 41.60 |
| 4 | PCP-1111 | 26.00 | 43.35 |
| 5 | PCP-1131 | 22.50 | 39.30 |
| 6 | PCP-1402 | 25.00 | 39.40 |
| 7 | PCP-1405 | 25.00 | 40.20 |
| 8 | PCP-1408 | 24.50 | 47.55 |
| 9 | PCP-1410 | 24.00 | 43.00 |
| 10 | PCP-1412 | 23.00 | 45.95 |
| 11 | PCP-1502 | 21.50 | 42.50 |
| 12 | PCP-1504 | 23.50 | 44.45 |
| 13 | PCP-1506 | 22.50 | 42.75 |
| 14 | PCP-1507 | 24.00 | 39.81 |
| 15 | CPB-2201 | 24.50 | 42.15 |
| 16 | TC-901 | 25.25 | 41.45 |
| 17 | Pusa Komal | 23.50 | 42.00 |
| 18 | JLCP-30 | 23.60 | 41.95 |
| 19 | EC-343222 | 23.00 | 41.90 |
| 20 | VCM-8 | 23.75 | 41.00 |
| 21 | KBC-9 | 24.00 | 42.90 |
| 22 | DC-19-6 | 24.00 | 40.50 |
| 23 | DC-15 | 25.00 | 41.55 |
| 24 | PGCP-75 | 23.00 | 40.30 |
| 25 | TP-944 | 23.00 | 41.60 |
| 26 | RC-101 | 24.00 | 44.50 |
| 27 | Phule Pandhari (C) | 25.50 | 43.75 |
| 28 | Phule Vithai (C) | 23.50 | 40.00 |
| 29 | Phule Rakhumai (C) | 25.50 | 43.80 |
| 30 | Phule Sonali (C) | 26.50 | 47.10 |
| | Mean | 24.14 | 42.20 |
| | S.E.± | 1.23 | 1.39 |
| | C.D. at 5% | 3.57 | 4.01 |
| | C.V.% | 7.22 | 3.75 |

4. Conclusion

The present study revealed substantial morpho-physiological characterization and yield evaluation of cowpea (*Vigna unguiculata* (L) Walp) germplasm. The research work was carried out for characterization of thirty different germplasm of cowpea on morphophysiological, growth and yield contributing characters. The study recorded for seed yield per plot after harvesting. The germplasm PCP-1402 recorded highest (0.475 kg/plot) and the check variety Phule Pandhari recorded lowest (0.338 kg/plot) seed yield per plot. The seed yield per plant recorded after harvesting. The germplasm PCP-1402 recorded highest (13.00 g/plant) seed yield per plant and Phule Pandhari recorded lowest (9.00 g/plant) seed yield per plant.

Among the germplasm, Phule Sonali recorded the highest (26.50%) protein content and the germplasm PCP-1502 recorded lowest (21.50%) protein content and mean of protein content was 24.13%. The Phule Sonali was early maturing than all other germplasm while the CPB-2201 was found to be a late maturing germplasm with considerable amount of grain yield. Based on the one season of research in consideration with objectives of present research among different germplasm studied PCP-1402, PCP-1111, PCP-1405, PCP- 1412, PCP-1504 and DC-15 recorded superior

results with respect to growth, yield and yield contributing characters alongside the check variety Phule Sonali.

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