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PERFORMANCE COMPARISON OF MICROMUTANT SELECTIONS OF GREEN GRAM (*VIGNA RADIATA* L. WILCZEK) IN ADVANCED MUTATION GENERATION FOR YIELD AND PHYSIOLOGICAL ATTRIBUTES

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ABSTRACT

Performance of ten green gram micromutant selections superior in yield atleast by 20% to their parent varieties AAU 34 and AAU 39, was assessed in M_6 generation. Mutant MM_1 of cv AAU 34 gave the highest seed and biological yield, had high leaf area and relative water content of leaf at pod filling stage. The high seed yield of the mutant MM_3 was due to high harvest index combined with lower biological yield and lower leaf area. None of the AAU 39 micromutants had higher seed yield than the parent variety, possibly due to lower biological yield inspite of its wide range of variation in biological yield and leaf area.

Key words: Micromutants, green gram, yield evaluation.

Crop production ultimately depends on balanced photosynthesis, respiration, translocation, and capacity of metabolic sinks [1]. Keeping this in view, the present investigation was undertaken to define the physiological attributes for improvement of plant architecture, partitioning of dry matter, so that more of it goes for grain formation, in induced micromutant lines of two parent genotypes of green gram, AAU 34 and AAU 39.

MATERIALS AND METHODS

The experiment was carried out using 34 micromutants in M_6 generation, which were isolated after mutagenic treatments with ethyl methane sulphonate (EMS) and ^{60}Co gamma rays in single and combined doses of two base genotypes of green gram AAU 34 and AAU 39. These lines along with their base genotypes were grown in randomized block design with three replications; each plot consisted of 5 rows, 1.5 m long, with 40 x 20 cm spacing. Data on ten random plants in each replication were recorded for eight different physiological attributes (Table 1). Chlorophyll content was estimated by the method of Arnon [2].

RESULTS AND DISCUSSION

Ten out of 34 selections yielded 20% or more than their respective parents. Nine of these ten selections were significantly superior to their parent in yield (Table 1).

Table 1. Mean performances and range of selected micromutants and their parents for various physiological attributes and seed yield per plant

Micromutant or parent	Seed yield per plant (g)	Harvest index (%)	Biological yield per plant (g)	Leaf area per plant (cm^2)	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	RWC of leaf at flowering (%)	RWC of leaf at pod filling (%)	RWC of leaf at maturity (%)
MM_1	7.9	30.6	25.7	2557.7	0.86	1.45	64.7	84.1	63.2
MM_2	6.5	27.1	24.6	1714.3	0.78	1.06	68.6	85.5	72.9
MM_3	7.9	43.3	18.1	1212.0	0.72	1.12	64.3	81.5	82.6
MM_4	6.8	39.5	17.3	2486.6	1.03	1.23	67.0	82.8	81.5
MM_5	7.1	44.1	16.8	1766.5	1.13	1.46	66.1	81.5	73.8
MM_6	6.3	34.8	18.2	1825.8	0.88	1.23	68.0	90.4	89.6
MM_{11}	6.3	25.1	24.9	2710.6	0.91	1.39	69.0	75.6	74.7
MM_{12}	6.0	30.7	19.7	2395.5	0.68	1.11	70.1	75.8	78.8
MM_{13}	7.0	24.4	28.7	2621.0	0.92	1.44	78.1	72.2	80.3
MM_{15}	6.1	24.8	25.3	2286.1	0.69	1.00	69.4	80.7	79.1
Mean	6.8	32.4	21.9	2157.8	0.86	1.25	68.5	81.5	77.6
AAU 34	5.0	35.7	14.3	1179.9	0.50	0.83	64.8	92.8	76.7
AAU 39	6.9	31.6	22.2	1689.1	0.79	1.12	72.9	76.4	76.8
SE	0.6	4.8	2.9	703.2	1.83	0.22	4.66	6.66	2.41
CD	1.2	9.4	5.6	1378.3	3.58	0.42	9.12	13.05	21.73
AAU 34 mutants*	6.00-7.9	24.4-44.2	16.8-28.7	1212.0-2621.0	1.06-1.46	0.68-1.13	64.3-78.1	72.2-89.1	63.2-89.6
AAU 39 mutants**	5.4-7.4	28.9-52.6	13.9-21.5	1081.8-2729.7	0.66-1.26	0.43-0.86	63.8-87.5	77.4-99.2	74.0-85.9

*Range of superior AAU 34 micromutants.

**Range of AAU 39 micromutants (none superior to the parent).

The range of seed yield per plant in the ten promising micromutants varied from 6.0–7.9 g. Considerable variability was present for harvest index and other variables. The harvest index (30.1%) of the best yielding micromutant (MM_1) was not higher than its control (32.4%). However, the mutants MM_3 and MM_5 with much higher harvest index (43–44%) also recorded higher yields of 7.9 and 7.1 g/plant, respectively, suggesting that higher harvest index could be responsible for higher yield. High total biological yield per plant, with the exception of mutant MM_1, was not associated with high yield. Only the mutant MM_1 combined high biological yield per plant with similar harvest index as control. Thus, its high grain yield was mainly due to high total biological productivity.

The total leaf area per plant was higher in four selections than the mean of micromutants derived from AAU 34, but only MM_1 had high yield. Therefore, the total leaf area may not necessarily be related to yield. In fact, the leaf subtending the fruiting branch may be crucial. Chlorophyll a content could not be directly related to yield differences. But chlorophyll b in the mutant MM_1 was higher than in the control. Therefore, the chlorophyll content appeared to be generally adequate for plant productivity. Among the three stages when relative water content (RWC) of leaf was measured, the one at pod filling was associated with high yield. However, high RWC at this stage alone would not ensure high yield, as was observed in the mutant MM_6. The RWC at three stages showed that the genotypes with high RWC at pod filling and at maturity and unable to give high yield were obviously less efficient in the transfer of photosynthates to the seed.

With the exception of the mutant MM_{12}, the micromutants of AAU 34 were equal or better than those of AAU 39 in yield per plant, biological yield and RWC at pod filling. The poor performance of the AAU 39 micromutants was mainly due to the limitation of low biological yield. Actually none of the micromutants had biological yield equal to the parent genotype AAU 39. Since AAU 39 itself had higher yield than AAU 34, intercrossing of the AAU 34 micromutants with AAU 39 could provide an opportunity for further improvement in yield.

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