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# DRY MATTER PARTITIONING AND YIELD POTENTIAL OF SIX BLACKGRAM (*VIGNA MUNGO* L. HEPPER) GENOTYPES

**M. Motior Rahman, A. Ahad Miah* & A.F.M. Maniruzzaman***
*Pulse Research Centre, PARS, Ishurdi, Pabna, Bangladesh.*
**Bangladesh Agricultural Research Institute,*
*Joydebpur, Gazipur, Bangladesh.*

A field experiment was conducted to evaluate total dry matter (TDM) accumulation, distribution of TDM in different plant components, seed yield and yield components. Genotypes differed significantly in plant height, grain yield and mean seed size. Genotypes with higher number of pods plant$^{-1}$ produced higher yields. Leaf area index, crop growth rate and total dry matter production were positively correlated with grain yield.

## INTRODUCTION

Total dry matter accumulation is one of the factors that determines economic yield in crop species where the seed is of economic importance. The capacity and efficiency of dry matter partitioning in seeds appears to be more critical in determining final yield (Perigio *et al.*, 1989). The efficiency of dry matter partitioning toward reproductive organs is effectively governed by the cultivar and the environment the crop experiences during its growing period (Patrick, 1988). The present study was undertaken to evaluate the dry matter accumulation, its distribution pattern and the relationship with seed yield among six blackgram genotypes.

## MATERIALS AND METHODS

A field experiment was conducted on a well drained high land at the Bangladesh Agricultural Research Institute (BARI) Farm, Joydebpur during kharif 1990. Six blackgram (*Vigna mungo* L. Hepper) genotypes (MAK 1, PANT 4-26, UG 135, ISD-LOCAL, MAK 3 and B 23) were grown in a Randomized Complete Block Design (RCBD) with four replications. Seeds were sown in rows 50 cm apart on 20 August 1990, with a plot size of 6 m x 5 m. Each plot received fertilizers at the rate of 20-40-20-20-5 N, $P_2O_5$, $K_2O$, S and Zn kg ha$^{-1}$, respectively at the time of sowing. Accumulation of dry matter of different genotypes was recorded from 2 days after emergence (DAE) to maturity at an interval of five days. Ten plants were selected randomly for destructive sampling from each plot. From the sample, leaf, petiole, stem and reproductive organ were separated and dried in an oven at temperature of 80-90°C for about 72 hours and dry weights were recorded. The data on various yield attributes were recorded from 20 randomly selected plants of each plot.

## RESULTS AND DISCUSSION

**Grain yield and yield components:** The highest yield was obtained from the genotype MAK which was similar to that of the genotype ISD-LOCAL (Table 1). The genotype B 23 recorded the lowest yield (480 kg ha$^{-1}$). High yielding genotypes produced higher number of pods plant$^{-1}$ ($r$ = 0.99). Genotypes did not differ significantly in number of seeds pod-1. Seed size had no significant influence on yield. The results are in agreement with the findings of Hamid *et al.* (1990).

**Dry matter accumulation:** The rate of dry matter production was similar in all the genotypes up to 10 DAE after which it differed significantly until harvest (Fig. 1).

**Table 1. Yield and yield components of different genotypes of blackgram**

| Genotype | Plant height (cm) | TDM plant (g) | Seed yield (kg $ha^{-1}$) | Number of pods $plant^{-1}$ | Number of seeds $pod^{-1}$ | Seed size (mg) |
|---|---|---|---|---|---|---|
| MAK 1 | 24 | 8.93 | 875 | 15 | 6 | 36.8 |
| PANT 4-26 | 22 | 8.00 | 501 | 10 | 6 | 35.5 |
| UG 135 | 28 | 7.80 | 425 | 10 | 5 | 39.8 |
| ISD-LOCAL | 23 | 8.47 | 835 | 14 | 6 | 29.8 |
| MAK 3 | 26 | 8.06 | 515 | 11 | 6 | 36.2 |
| B 23 | 25 | 7.73 | 480 | 10 | 5 | 36.5 |
| LSD (0.01) | 4.41 | 0.47 | 61.50 | 3.83 | NS | 0.63 |

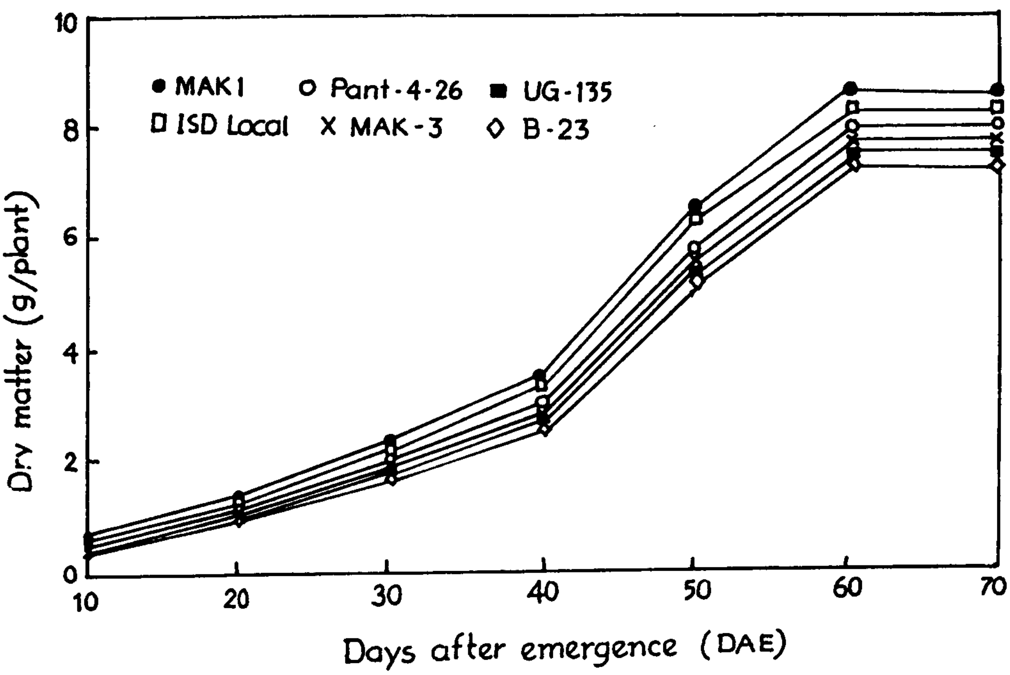


Fig. 1. Dry matter accumulation of blackgram genotypes over time (LSD value at 0.01:NS at 10-, 0.09 at 20-, 0.09 at 30-, 0.10 at 40-, 0.10 at 50, 0.14 at 60- and 0.47 at 70 DAE).

Dry matter production was very slow up to 30 DAE and there-after a sharp increase was observed up to 60 DAE after which there was no further increase in dry matter in all the genotypes. The genotypes MAK 1 and ISD-LOCAL produced significantly higher TDM and gave significantly higher grain yield (r = 0.96). Similar results were reported by Perigio *et al.* (1989).

production in reproductive organ, was also found to be positive (r = 0.82). Perigio *et al.* (1989) found similar results in mungbean. The high yielding genotypes contributed less to petiole dry matter and showed a strong negative correlation (r = -0.92) between petiole dry matter and seed yield.

**Leaf area index (LAI):** Leaf area indices were significantly different in the genotypes

**Table 2. Relative contribution of different plant components as percentage of total dry matter at vegetative and reproductive phase of blackgram genotypes**

| Genotype | Vegetative phase | | | Reproductive phase | | | |
|---|---|---|---|---|---|---|---|
| | Stem | Leaf | Petiole | Stem | Leaf | Petiole | Reproductive organ |
| MAK 1 | 26 | 61 | 13 | 14 | 37 | 11 | 38 |
| PANT 4-26 | 29 | 54 | 17 | 18 | 34 | 14 | 34 |
| UG 135 | 28 | 55 | 17 | 17 | 34 | 16 | 33 |
| ISD-LOCAL | 26 | 59 | 15 | 15 | 35 | 12 | 38 |
| MAK 3 | 27 | 57 | 16 | 16 | 34 | 13 | 37 |
| B 23 | 29 | 54 | 17 | 16 | 34 | 13 | 37 |

**Partitioning of dry matter:** During the vegetative growth phase, the leaf accounted for 54 to 61%, petiole 13 to 17% and the stem 26 to 29% of TDM accumulation (Table 2). Contribution of the photosynthetic organs (leaves and petioles) to TDM were 34-37% and 11-16%, respectively. The high yielding genotypes MAK 1 and ISD-LOCAL contributed slightly more towards photosynthetic organ during both the vegetative and reproductive phases, and thus contribution to reproductive organ, was slightly higher than that in other genotypes. There was a strong and positive correlation (r = 0.92) between yield and dry matter production in leaf while the relationship between yield and dry matter production in stem was found to be negative (r = -0.84) during both the vegetative and reproductive phases. The relationship between grain yield and dry matter

10 DAE up to maturity (Fig. 2). The highest and lowest LAI were obtained from the genotypes MAK 1 and UG 135, respectively. Maximum LAI was recorded at the pod development phase (60 DAE) in all the genotypes, after which it declined sharply. Decrease in LAI during late stage of the plant growth might be due to senescence of leaves associated with the remobilization of the stored metabolites from the leaf to the pod wall tissues. The LAI showed strong and positive correlation (r = 0.93) with grain yield.

**Crop growth rate (CGR):** During initial stages up to 20 DAE, the genotypes did not differ significantly in CGR (Fig. 3). The highest CGR obtained from the genotype MAK 1 which was statistically identical with ISD-LOCAL. The lowest CGR was recorded from the genotypes UG 134. The

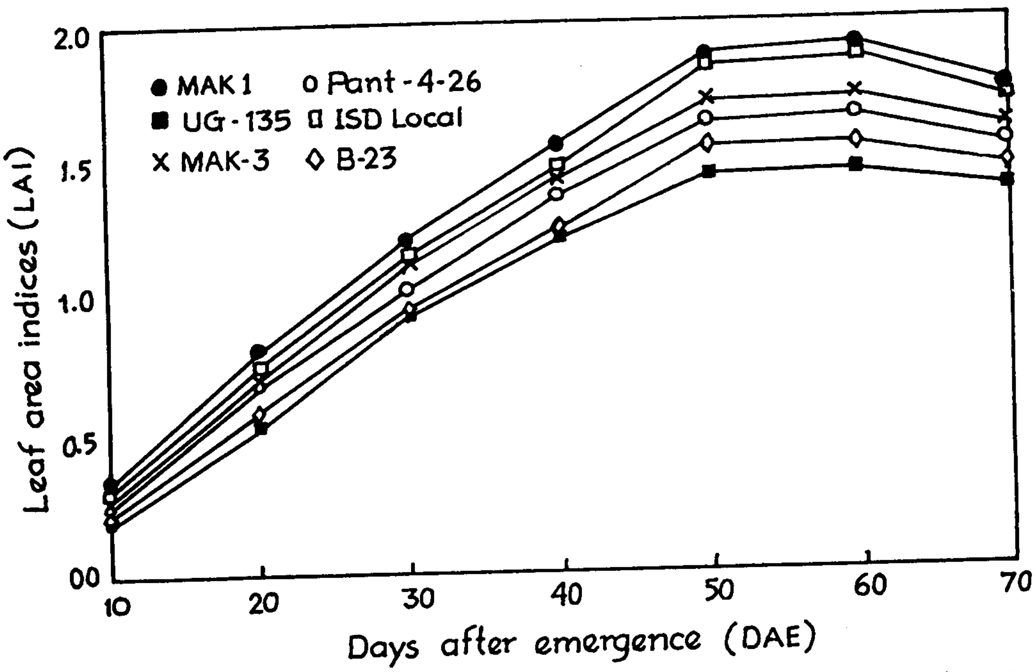


Fig. 2. Leaf area index of blackgram genotypes over time (LSD value at 0.01:NS at 10-, 0.09 at 20-, 0.07 at 30-, 0.06 at 40-, 0.07 at 50-, 0.07 at 60- and 0.16 at 70 DAE).

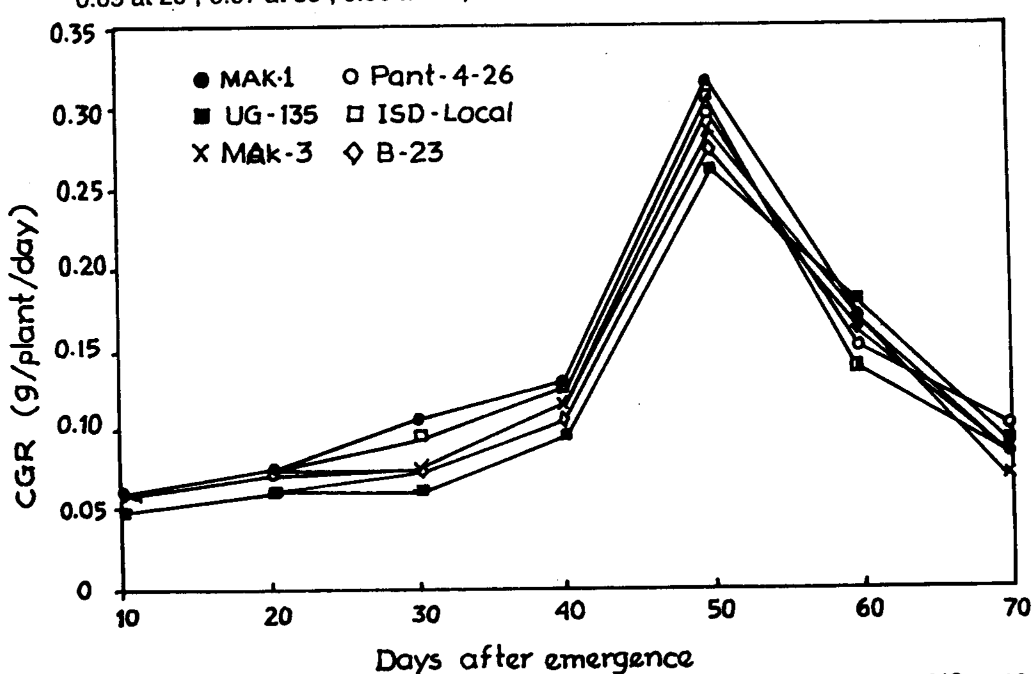


Fig. 3. Crop growth rate of blackgram genotypes over time (LSD value at 0.01:NS at 10-, NS at NS at 20-, 0.02 at 30-, 0.02 at 40-, 0.02 at 50-, 0.03 at 60- and 0.02 at 70 DAE).·AE).

maximum CGR was recorded at pod development stage (50 DAE) in all the genotypes after which it declined sharply. CGR was slow during the early vegetative phase up to 30 DAE, there after it increased sharply with the growth of plants. The CGR showed a positive and significant correlation (r = 0.90) with grain yield.

In conclusion, seed yield was mainly determined by the number of pods plant$^{-1}$ while seed size tended to compensate for reduced pod number. The results also revealed that genotypes with higher TDM due to faster crop growth rates were more efficient in partitioning more towards reproductive organs (seed) determining yield.

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