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GROWTH ATTRIBUTES ON YIELDING ABILITY IN BLACKGARM

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ABSTRACT

Twelve blackgram genotypes with an arbitrary grouping as 'high' 'medium' and 'low' yielders were studied in terms of assimilate partition. The phenotypic variability was wide. Growth in blackgram is significant between 'peak flowering' and 'harvest' phases. Yielding ability is conditioned by the twin criteria of growth attained on the 45th day and number of folds this value is increased by harvest. Accordingly, CO2 rates itself 'high' among high yielders, No.55 among 'medium' yielders and CM and T9 among 'low' yielders. Growth with the parameter of plant dry weight was phenomenal between 45 days and harvest. This velocity of growth and growth already obtained were yield determinants. This is amply demonstrated by the influence on the typical sigmoid growth curve.

The adaptability of grain legumes to ecological conditions is wide in range. Significance has to be attached to their capacity for survival in rigours of drought. They offer scope for exploitation for extensive cultivation in the tropical belt. Only a small fraction of the legumes is short day plants wheras others day neutral. They suffer badly only under water logged conditions. Except for this trait, grain legumes are eminently suited to extensive cultivation in the tropics. In their negligible demand for water supply a capacity to thrive on poor soils and a number of them being adapted to acid soils as well, eliciting basic information on physiological characteristics of the available genotypes will indeed be gainful. Chosen genotypes representing a wide genetic variability have been studied and observations presented in this contribution. Physiological characteristics will be of added utility in breeding programmes.

MATERIALS AND METHODS:

Twelve genotypes representing 'high', 'medium' and 'low' yield groups are employed in this study. The genotypes were raised at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore. Bunds were formed with a randomised block design. The soil analysed for PH 7.8; E.C. 0.65 (m.mhos/cm) and NPK status was 219, 16 and 426 Kg/ha respectively. A spacing of 15 x 20 cm was adopted. A total of five irrigations was provided at ten day intervals till flowering.

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Table 1. Plant weight (g) as Time-trend in Genotypes of Blackgram (Twenty plants)

Genotypes	Age (Days)					
	20	25	30	35	45	Harvest
High Yielders						
Co 2	4.41	7.47	21.41	37.61	96.58	737.65
Co 3	5.73	7.29	26.70	54.98	152.26	663.73
Co 4	4.94	8.82	22.18	49.43	92.81	513.43
JLU 5-1	5.42	7.01	17.49	38.83	73.35	547.20
Medium Yielders						
No.55	4.91	8.00	26.14	42.81	134.93	706.18
Krishna	5.52	9.99	19.87	53.37	163.60	951.37
BP 3	5.25	6.93	16.72	29.66	60.40	647.12
H 21	5.08	6.20	20.78	37.31	86.25	448.10
Low Yielders						
CM	4.53	5.84	15.01	29.03	70.05	415.18
T 9	4.80	6.93	18.77	33.79	79.21	394.92
338/3	4.18	5.81	17.97	32.56	94.90	266.21
KM1	5.12	7.44	16.47	32.04	101.90	302.55
CD at 5%					15.84	46.31

RESULTS AND DISCUSSION :

Growth interms of plant dry weight

Plant samples were collected at 20, 25, 30, 35 and 45 days after sowing and also at harvest stage (Table 1). The genotypes are arranged as 'high', 'medium' and 'low' yield groups, represented by four in each. They are under decreasing order in grain yield. In general, growth pattern of genotypes is by and large similar. However, marked differences among plant parts is noticeable comparing dry weight at 45th day and at harvest. The stage represented by 45th day is the peak flowering phase and commencement of pod development and the stage of harvest appear critical stage involving 'source' size in flowering, 'sink' in terms of pod yield. In high yield group, the plant dry weight shows a range of variation between 73.35 and 152.26 g on 45th day and between 513.43 and 737.65 g at harvest in four of the genotypes. But the velocity of growth differ among them. For instance Co 2 which ranks higher than Co 3 in yield eventhough on the 45th day, Co 2 shows lower value in dry weight compared to CO 3. But growth in Co 2 has been phenomenal by 7.9 fold whereas growth in Co 3 has been only of the order of 4.4 fold. In the medium yield group, No.55 and Krishna did not differ appreciably in plant dry weight on the 45th day, nor the intensity of increase by harvest stage. Nevertheless the increased pod yield in these genotypes over the two other genotypes of the group is to be ascribed to actual higher plant weight on the 45th day. The high rate of increase in plant dry weight of BP3 or H21 could hardly compensate and improve their yield potential. The low yield group shows a compensating phenomenon quite clearly. The genotype CM (crinkled mutant) and T9 present lower plant dry weight compared to the rest, 338/3 and KM1. But the increased growth rate more than compensated the low plant weight so much so, the final plant

Table 2. Leaf Production Trend with Age of Genotypes (Days) (for five plants) (Mean of Four Replicates)

Genotypes	Age (Days)					
	20	25	30	35	45	Harvest
High Yielders						
Co 2	38.5	57.5	57.8	119.5	256.3	482.3
Co 3	37.8	53.0	79.8	150.8	258.3	377.3
Co 4	36.5	55.5	87.8	130.5	208.3	322.3
JLU 5-1	39.8	45.5	75.8	109.0	181.3	324.3
Medium Yielders						
No.55	34.0	55.3	75.8	108.8	193.0	342.0
Krishna	41.8	61.5	82.0	141.8	278.8	311.0
BP 3	43.8	50.5	62.5	93.3	155.0	394.5
H 21	40.5	54.3	72.0	133.8	203.3	397.8
Low Yielders						
CM	39.3	59.0	73.3	93.3	160.0	327.5
T 9	40.3	58.0	78.5	114.5	155.3	391.3
338/3	38.0	51.8	74.0	127.8	214.5	264.3
KM1	40.8	53.5	71.3	125.0	224.5	264.8

weight increased markedly influencing the yield ranking.

While the phenomenal increase subsequent to flowering is a common feature during pod development, the events are largely conditioned by the genotypes. In plants where seed production starts, early, the plant exercises a steady state on assimilate partition between reproductive structures and the rest of the plant organs. But in other cases the bulk of new assimilates may be switched from some other organs which suffers a marked check to growth. In the present observations, there has been not only 'switching' from other organs mostly the stem but also 'current photosynthesis' during development phase. Assimilate partition and current photosynthesis in cotton as shown by Inamder *et al.*, (1925)had resulted with their onset of flowering on the 83rd day till 190th day. The dry weight had shot up by about 50 units to 80 units. In the case of blackgram, the phenomenal rise during the development phase is very much involved and the actual weight on the 45th day may as well decide the magnitude of final growth output.

Growth in terms of leaf production

Leaf production may be considered as the 'size of the assimilatory system'. The size of 'source' achieved particularly during the phase of pod development bears significace to 'flow of assimilates' to 'sink'. The ability of a genotype to produce the maximum economic yield depends on its efficient partitioning potential of the dry matter between vegetative and reproductive parts (Natarajan and Palanisamy, 1988). This has been well borne out in the case of CO 2 pertaining to 'high' yield groups and No.55 of the 'medium' group (Table 2). The poor performance of Krishna and H21 is to be ascribed to the set-back due to leaf production during post flowering phase in the former and per-flowering phase in the latter. The former suffered from early 'retarded' growth and the latter suffered from source limitation affecting 'sink'. Gifford et al (1984) opined that crop yield is linked with photsynthetic efficiency and partitioning of the photo assimilate of the economic sink. In the low yield group CM follows by T9 are in clear contrast from 338/3 and KM1 as regards intensity of leaf production.

Leaf production and productivty are not at once associated due to the complexity involving intensity of leaf production and the phase when it occurs that concerns a 'fillip' or 'set back' to yield. An added dimension is the leaf shapes and size. Three of the 'high yield group' have large leaf size ovate in shape and all the four in the low yield group are not only small in leaf size but lanceolate in shape. Thus, leaf anatomy and morphology may alter the efficiency ,even if leaf production is appreciable. Increased leaf size and thickness is suggestive of more carbondioxide assimilation by virtue of more chloroplasts and larger cell surface. This needs to be established. However, Hesketh (1963) failed to establish any correlation between net photosynthesis and thickness of lamina in nine species of grasses. In general, as a 'source sink' concept the movement of products of carbon fixation to and from each leaf changes as the plants develop is known. However as a leguminous crop, Wardlaw (1968) observes that in most dicotyledonous plants, net export commences when the leaf has reached between one-third and one half its final area. Factors that influence transport regulation is not clearly understood. Evidence is presented by Kochar and Leonard (1971) as regards *Phaseolus Vulgaris* L. the availability of assimilates at different stages of leaf expansion for export does not appear to be a decisive factor. Perhaps the differentiation of vein loading structures may determine the 'switch-over' from import to export as proposed by Gunning and Pate (1972).

In blackgram, dry matter-yield association appears to rest on the size of the assimilating system achieved at pre-flowering phase and the subsequent velocity of leaf production. An added aspect is the leaf shape besides its size.

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