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EFFECT OF SOURCE SINK MANIPULATION ON NODULATION, DRY MATTER PRODUCTION AND SEED YIELD OF BLACK GRAM

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ABSTRACT

The effect of alteration in source through defoliation or shading or the sink through deflowering on yield and associated parameters was studied on black gram cv. T9. The data indicated greater source below six node helps in better nodulation and N content, while the leaves above seventh node influence pod yield. Deflowering revealed that there was competition for assimilates between growth of nodules and developing pods. The decrease in yield under low light was due to a decrease in DMP due to poor photosynthesis. The investigation suggests existence of possible limitation of source in determining the yield of black gram.

KEY WORDS : Black gram, Source - Sink. Manipulation, Nodulation, Yield

It has been observed that partial defoliation often causes reduction in seed yield. The importance of flower production and setting needs a special emphasis as many grain legumes are prone to high flower and fruit shedding. Further, it was observed that leaf nitrogen is remobilised for seed development and thus causes a decline in photosynthesis and limit the yield of grain legumes (Minchin *et al.*, 1981). A comprehensive and critical information on the physiological basis of dry matter accumulation in relation to source - sink is limited. Thus, a detailed study was carried out on the physiological analysis of source-sink relationship in black gram.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 1987 under irrigated conditions at the Sri Venkateswara Agricultural College Farm, Tirupati, Andhra Pradesh (13 ^{0}N, 79^{0}E). The experiment was laid out in a randomised block design with four replications following recommended doses of N and P. Photosynthetic rate, chlorophyll content, leaf nitrogen, nodulation and dry matter production (DMP) of black gram (T9) were determined at 15, 30, 45 and 60 days after sowing (DAS) under normal and low light intensity conditions. Seed yield and its components were computed at maturity.

The effect of deflowering was studied by total or partial removal of flowers as and when they appeared. Flowering was first noted 30 DAS and at maturity plants had about ten nodes each. The treatments include (i) control (ii) all flowers removed (iii) flowers of sixth node and below removed and (iv) flowers of seventh node and above removed. The data on nodulation, phot osynthetic rate, DMP, chlorophyll content, leaf nitrogen and leaf area were taken at 45 and 60 DAS and yield and yield components were determined at harvest.

The source was altered using muslin cloth shades and by defoliation treatment. The muslin cloth which allows 50 per cent of sunlight was selected. The light intensity was measured with the help of Luxmeter. The defoliation treatments were initiated at 30 DAS. This included (i) control, (ii) complete defoliation, (iii) defoliation at sixth node and below and (iv) defoliation at seventh node and above. The data on nodulation, leaf area, DMP and seed yield were taken at 45 DAS and at maturity respectively.

Photosynthetic rate of the uppermost fully expanded leaves was determined and expressed as mg of CO_2 per cm^2 leaf area per day. Oven dried leaves were used for N estimation (Jackson, 1967). Chlorophyll content (Witham *et al.*, 1971) and leaf area (Waston and Watson, 1953) were determined. Nodulation was studied by determining the number and weight of nodules. The data were subjected to statistical analysis (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

The data (Table 1) indicated that nodulation was increased upto early pod filling stage and decreased later. The decrease in nodulation after

Table 1. Effect of low light intensity on photosynthetic rate, chlorophyll content, leaf nitrogen and nodulation in black gram (cv. T 9)

Characters	Days after sowing										
	15	30	45	60	Maturity	45	60	Maturity	45	60	Maturity
	Normal light					Low light			CD at 5%		
Photosynthetic rate (mg CO_2 cm^{-2} day^{-1})	38.82	74.72	50.33	29.60	14.49	27.80	17.86	11.24	8.55	5.74	3.41
Chlorophyll content (mg g^{-1} fr. wt)	1.69	2.55	2.01	1.41	0.93	2.35	1.78	1.23	0.12	0.12	0.12
Leaf nitrogen (% on dry wt. basis)	2.40	3.29	3.05	2.01	1.95	2.55	1.96	1.53	0.15	0.15	0.15
Nodule numbr per five plants	29	75	102	47	13	57	28	9	19	8	4
Nodule weight (g/five plants)	0.03	0.08	0.19	0.09	0.02	0.08	0.04	0.01	0.03	0.02	0.01

flowering may be attributed to increased demand for assimilated by the reproductive structures and also due to senescence of lower leaves which appear to be principal contributors of the energy requirement of nodules. A decline in chlorophyll content, photosynthetic rate and leaf N was also observed after 30 DAS, possibly due to the remobilisation of leaf nitrogen for pod and seed development. Similarly low light affected growth and yield components. Significant reduction in seed yield (48.6%) was partly due to decreased pod number (33.3%) and low number of seeds per pod (15.1%) under low light (Table 3). Harvest index was also reduced due to low light intensity which may be attributed to more reduction in seed yield (48.6%) than in dry matter production (42.8%). However, low light increased chlorophyll content indicating as an adoptation in plants under shade (Table 1). Similar reports were made by Cooper and Qualls (1967).

The data on deflowering (Table 2) revealed that complete deflowering increased nodule number and weight indicating in the absence of reproductive structure the source organs act as as sink. Furthermore, removal of flowers sixth node and below increased nodulation than from seventh node and above indicating the potential contribution of effective leaf area for nodule development. Deflowering increased the leaf N and chlorophyll content and delayed the leaf senescence. The leaf area was more in completely deflowered plants followed by partially deflowered and control plants. Partial deflowering reduced the seed yield due to reduction in pod number. How ever, 100 - seed weight increased by deflowering, while harvest index decreased. This supported the possibility that more assimilates were mobilised to seeds as the sink size was reduced.

Defoliation caused a reduction on nodulation and it was more when leaves from sixth node and

Table 2. Effect of defloweing on morpho-physiological characters at 45 DAS and seed yield and yield components o black gram (cv. T 9)

Treatment	Nodule number	Nodule weight (g)	TDM (g)	Leaf area (cm^2)	Chlorophyll content (mg g^{-1} fr. wt)	Leaf nitrogen (% on dry wt. basis)	Seed yield (g)	Pod number	100 seed wt. (g)	H.I (%)
Control	102	0.191	19.4	1813	2.01	3.05	12.22	69	3.528	39.4
Complete deflowering	155	0.339	16.6	1897	2.22	3.21	-	-	-	-
Deflowering at sixth node and below	135	0.29	18.6	1880	2.06	3.08	6.73	36	3.779	24.4
Deflowering at seventh node and above	116	0.247	17.9	1831	2.11	3.09	6.30	31	3.875	22.5
CD at 5%	19	0.026	0.9	29	0.12	0.15	0.43	5	0.173	1.8

* Mean of 5 plants

Table 3. Effect of defoliation on morpho-physiological characters at 45 DAS and seed yield and yield components of black gram (cv. T 9)

Treatment	Nodule number	Nodule weight (g)	TDM (g)	Leaf area (cm^2)	Seed yield (g)	Pod number	No. of seeds pod^{-1}	H.I (%)
Control	62	0.191	19.4	181.3	12.22	69	5.03	39.4
Low light	57	0.076	11.1 (42.8)	-	6.28 (48.6)	46 (33.3)	4.26 (15.1)	32.3
Complete defoliation	25	0.029	1.5	-	-	-	-	-
Deflowering at sixth node and below	47	0.078	4.5 (76.8)	373.0	4.83 (60.5)	39.0 (43.5)	3.90	34.8
Deflowering at seventh node and above	73	0.111	15.6 (19.6)	1593	7.22 (40.9)	50.0 (27.5)	4.33	32.6
CD at 5%	19	0.026	0.9	29.0	0.43	4.7	0.54	1.8

* Mean of 5 plants Figures in parentheses indicate per cent reduction over control

below removed as compared to other in which leaves of upper nodes were removed (Table 3). These results clearly demonstrated that lower leaves were the major contributors of assimilates to the roots and nodules. Further defoliation of the crop at sixth node and below reduced leaf area, DMP and ultimately the yield through lower number of seeds per pod and 100-seed weight. The yield reduction was more (60.5%) when defoliation was done at sixth node and below compared to other defoliation treatment (40.9%).

The above results suggest that retention of greater leaf area at specific positions of shoot at different growth stages is important and selection of genotypes for such a character or manipulation of leaf area retention by cultural and other management practices may probably help in enhancement of black gram yields.

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GROWTH ANALYSIS IN LINSEED

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ABSTRACT

Sowing of two genotypes of linseed (DPL-21 and KL-31) on two spacings (10 x 10 cm and 30 x 10 cm) and four levels of nitrogen (0, 40, 80 and 120 kg/ha) showed that KL-31 recorded more leaf area, LAI, LAD, AGR, CGR, total dry matter accumulation (except 30 DAS) at all crop growth stages, Grain, straw and fibre yield were also highest in this genotype. The spacing of 10 x 10 cm recorded highest LAI, LAD and CGR but at this spacing, leaf area and AGR were minimum. The maximum DMA and grain yield were seen in the case of 30 x 10 cm spacing. However, straw and fibre yield were maximum at 10 x10 cm spacing. All the growth analysis functions, dry matter accumulations at all crop growth stages and grain, straw yield were on the increase with increasing N-levels.

KEY WORDS : Linseed, Physiological Parameters, Growth Analysis Functions