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SIGNIFICANCE OF DRY MATTER PRODUCTION AND ITS PARTITIONING IN HORSEGRAM GENOTYPES

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ABSTRACT

Evaluation of 200 genotypes of horsegram for their efficiency of source and sink strength revealed that partitioning efficiency towards reproductive sink (PERS) and dry matter production at pod development stage had significant effects on grain yield. There were limitations in source in respect of low yielders and sink strength in the high yielders. Genotypes PLS 6114 and HG 23 were isolated as idotypes which possess high DMP and PERS at the time of pod formation stage coupled with better yield performance.

KEY WORDS: Dry matter production, Partitioning efficiency, Horsegram.

Horsegram is a subsidiary pulse crop grown in dry tracts of South India during late monsoon season occupying an area of 1,95,130 ha in Tamil Nadu. The yield potential of the crop under rainfed conditions is very low when compared to other pulse crops. Besides a nutritional value on par with other pulses, the crop yields considerable forage for livestock feeding. For upgrading the yield potential of the crop, a knowledge on the source-sink relationship appears necessary so as to assess the pattern of the partitioning of the assimilates which largely decides the yield potential. Hence, in the present study, genotypes of horsegram were evaluated to identify the suitable types which possess favourable dry matter partitioning between the source and the sink.

MATERIALS AND METHODS

Field experiments were conducted during the rabi season of October, 1983 at the Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore. Two hundred genotypes of horsegram were evaluated for yield and their pattern of partitioning of assimilates following a spacing of 200 x 15 cm. Randomised block design with two replications (rows) formed the experimental unit. The manuring schedule consisted of 25:50:0 of NPK (kg/ha) applied as basal dose. At the time of 50 per cent pod set (70 DAS), five plants per replication were collected for the determination of total dry matter production (DMP) and partitioning efficiency towards reproductive sink (PERS).

The dry matter was determined by drying the samples in a hot air oven at 80°C till constant weight was obtained. The PERS was calculated as given below:

$$\text{PERS} = \frac{\text{Weight of reproductive sink (g)}}{\text{Total dry matter production (g)}} \times 100$$

The grain yield on per plant basis was recorded at the time of harvest.

RESULTS AND DISCUSSION

The yield potential of each genotype of horsegram was identified based on the DMP and PERS at pod development stage. The grain yield was also taken into consideration and the genotypes were grouped into different yield categories by quadrangular method(Shanmugasundaram, 1981).The results based on these grouping are presented in Table 1.

The data revealed that the yield performance of horsegram genotypes highly varied though they were grown under similar environmental and edaphic conditions. The variation was found to be 0.96 to 14.68 g/plant. This indicated that the reproductive sink strength particularly at the time of harvest exhibited considerable elasticity.

Among the 200 genotypes, 96 were grouped as high yielders based on their high yielding performance. An average increased yield of 31.15 per cent over the mean grain yield was noticed in high yielding groups while the low yielding groups registered an average reduction of 24.58 per cent as compared to the mean value. Maximum number of genotypes (37) of the high yielders had high DMP and PERS at pod development stage and hence recorded maximum grain yield (39.02 per cent). The increase in grain yield by 39.02 per cent over the mean yield of 200 genotypes revealed the influence of high PERS and DMP and signified the importance of the activity of sink which mobilised the photo-assimilate accumulation leading distinctly to higher yields. In contrast,

Table 1. Physiological variability and grain yield of horsegram genotypes

Particulars	High yielders				Low yielders			
	Pod development stage				Pod development stage			
	Number of genotype	Mean DMP g/plant	Mean PERS %	Mean yield of grain g/plant	Number of genotype	Mean DMP g/plant	Mean PERS %	Mean yield of grain g/plant
High DMP + High PERS	37	10.98	62.94	6.84	20	10.94	65.32	3.89
Low DMP + High PERS	18	6.37	64.02	6.33	33	5.93	65.17	3.55
High DMP + Low PERS	20	11.07	51.56	6.06	19	10.17	49.59	3.60
Low DMP + Low PERS	19	6.13	48.40	6.58	34	5.67	48.18	3.41
Mean for 200 genotypes		8.30	57.34	4.92				

DMP = Dry matter production

PERS = Partitioning efficiency towards reproductive sink

large number of genotypes classified as low yielders had low DMP and PERS. Reduction in grain yield to an extent 30.69 per cent was observed in this group. This indicated that the adverse effect on yield might be due to limitation of both the source and sink strength (Stoy, 1980).

On further examination of the data (Table 2), it was observed that PERS had considerable limitation on the productivity of grains in high yielding genotypes. Reduction of PERS in high yielders led to 4.93 per cent reduction in grain yield while reduction of DMP had negligible effect on grain production (Sofied et al., 1974). In respect of low yielding groups, source had a major role in the reduction of grain yield. Increase of DMP in the

Table 2. Limitation of source and sink strength in horsegram genotypes.

Particulars	Increase/Decrease Percentage of grain yield over mean yield	Increase/Decrease in yield percentage due to		Increase/Decrease in yield percentage due to	
		High DMP	Low DMP	High PERS	Low PERS
High yielders					
High DMP + High PERS	+ 39.02	+ 31.10	+ 31.20	+ 33.84	+ 28.46
Low DMP + High PERS	+ 28.66				
High DMP + Low PERS	+ 23.17				
Low DMP + Low PERS	+ 33.74				
Low yielders					
High DMP + High PERS	- 20.94	- 23.89	- 31.30	- 26.43	- 28.76
Low DMP + High PERS	- 31.91				
High DMP + Low PERS	- 26.83				
Low DMP + Low PERS	- 30.63				

DMP = Dry matter production

PERS = Partitioning efficiency towards reproduction sink

low yielding groups may increased the grain considerably (Austin et al., 1980).

From the study, it appears that source and sink are limiting in low and high yielders respectively. The partitioning of the assimilates is identified as the main determinant of yield in horsegram. At the same time the influence of total biomass production cannot be minimised as far as productivity is concerned in this crop also (Evans and Dunstone, 1970; Donald and Hamblin, 1976).

The genotypes PLS 6114 and HG 23 were identified as ideotypes which possessed high DMP and PERS with the highest yield potential. These genotypes may be further utilised in breeding programmes for increasing grain productivity. Ten genotypes viz.,PLS 6014, 6053, 6059, 6109, 6115, 6178 (Co_1), 6190, 6263, HG 39 and HG 111 had high dry matter production with appreciable grain yield. They can be utilised as donor parents for evolving forage-cum-grain yielders.

REFERENCES

AUSTIN, R.B., BINGHAM, J., BLACKWELL, R.D. EVANS,L.T. FORD, M.A., MORGAN, C.L. and TAYLER,M. 1980. Genetic improvement in winter wheat yields since 1900 and associated physiological changes. **J. Agric. Sci.** Camb. 94: 675-689.

DONALD, C.M. and HAMBLIN, J. 1976. The biological yield and harvest index of cereals as agronomic and plant breeding crieteria. **Adv. Agron. 28:** 361-405.

EVANS, L.T. and DUNSTONE, R.L. 1970. Some physiological aspects of evoluation in wheat. **Aust. J. Biol. Sci.** 23: 725-741.

SHANMUGASUNDARAM,S. 1981. Varietal differences and genetic behavious tor the photoperiodic responses in soybean. **Bull. Inst. Trop. Agr. Kyushu.** UNI. 4: 1-61.

SOFIED, J., EVANS, L.T. and WARDLAW, J.F. 1974. The effects of temperature and light on grain filling wheat. **In:** Mechanisms of Regulation of Plant Growth (eds.) Bieleski, R.L., Ferguson, A.R. and Cress Well,M.M. Roy.Soc.Newzealand Bull. 909-915.

STOY, V. 1980. Grain filling and the properties of the sink in physiological aspects of crop productivity. Proceeding of the 15th Colloqui of the International Potash Institute held in Wageningen. The Netherlands