PHYSIOLOGICAL GENETIC PARAMETERS IN RELATION TO YIELD POTENTIAL AND STABILITY IN INDIAN MUSTARD

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Abstract :

Six genotypes of Indian mustard with variable yielding ability and stability of performance were studied for trend of early growth vigour, soluble protein content and peroxidase activity in dry seeds and young seedlings at 24 hr, 48 hr and 72 hr old stages. Two out of the three stable genotypes showed higher initial seed weight and quick gain in weight during the seedling stages. All the three stable genotypes had higher soluble protein in the dry seeds. In these genotypes, the soluble proteins were quickly utilized as shown by the sharp decline in the early stages of seed germination. The peroxidase activity was highest in high yielding genotypes but it showed inconsistent trend in early growth stages of the low stability lines. In the average stability lines, the peroxidase activity was comparatively low but remained more or less consistent in the early stages of growth vigour, higher initial soluble protein content and its quick utilization and consistency in peroxidase activity in early stages of growth seemed to be characteristic features of stable genotypes.

Introduction :

Stability of performance of a genotype is based upon the underlying mechanism of genetic homeostasis. The genetic homeostasis further depends upon the Biochemical and Physiological versatility of the genotype. In the present investigation, six genotypes, three from high yielding group and three from average yielding group were evaluated for seed yield, oil content, gain in seedling weight, soluble protein content and peroxidase activity during early germination stages. The behaviour of different genotypes in relation to their yielding ability, and stability of performance has been discussed in the present text.

Material and Methods :

Three genotypes from high yielding and average stability group and three from average yielding and high stability group were selected on the basis of field trials conducted over twelve pertinent environments. The seeds of these lines were evaluated for oil content using NMR spectroscopy. The seeds were germinated under controlled condition at constant temperature of 28°C. The seed and seedling samples were taken at dry seed stage and 24 hrs, 48 hrs and 72 hrs after soaking. The soluble protein content was worked out by using the method of Lowry, et al. (1951) and Peroxidase activity by the method of Shannon, et. al. (1966).

Results and discussion :

A summary of performance with regard to mean seed yield, oil content and stability status of the genotypes is given in table-I. A perusal of this table shows that RLM 29, RLM 198 and P 26/21 were the high yielding genotypes. However, all these genotypes have average stability of performance for seed yield. Out of these three genotypes, RLM 29 and RLM 198 had high oil content along with high stability for this trait. P 26/21 had low oil content with low stability of performance. The genotypes RLM 514, Varuna and RH 30 were the average yielder with high stability of performance. Out of these only varuna had high oil content with high stability. The other two had average oil content with average stability of performance.

The seedling behaviour of the genotypes for gain in seedling weight, pattern of soluble protein content and peroxidase activity is given in table-2. Two out of the three high yielding genotypes, namely varuna and RH 30 had higher initial seed weight and showed the highest seedling weight after 72 hours. Even the third genotype showed a higher rate of gain in seedling weight as compared to the average stability genotypes. The soluble protein content was the highest in the high stability lines and was also most quickly utilised in these lines as evidenced by the sharp decline in the early stages of seed germination. The peroxidase activity was the highest in the high yielding genotypes but showed an inconsistent trend in the early growth stages, which had comparatively lower stability. In the average yielding lines the peroxidase activity was comparatively low but remained more or less consistent in early stages of growth. These lines had high stability of performance.

The results of the present investigation indicate that higher initial seed weight, better growth vigour as evidenced by quick gain in seedling weight, higher initial soluble protein content and its quick utilization and consistency in the peroxidase activity in early stages of growth could be used as useful criteria to identify high stability genotypes. Such studies of physiological genetical parameters, therefore, could be effectively utilized in laboratory screening of desirable genotypes. It could however be noteworthy that the criteria enumerated as above are useful with regard to only the seed yield per plant. No similar trend coul be observed for oil content. It would, therefore, be worthwhile

to study the developmental stages during the grain filling period for physiological and biochemical parameters related with behaviour for oil content.

References :

Lowry, D. N. Rosenbrough, L.F. and Randall, R. 1951. Protein measurement with the folin phenol reagent. J. Biol. Chem. 193 : 265-273.

Shannon, L. Key, E. and Lew, J. 1966. Peroxidase isozymes from Horse-radish roots. I. Isolation and Physical properties. J. Biol. Chem. 241 (7442): 2166-75.

Table-1 – Field performance

Genotypes	Seed yield/plant in gms		Oil %	
	Mean	Stability	Mean	Stability
RLM 29	11.14	Average	38.50	High
RLM 198	10.75	Average	38.70	High
P 26/21	11.25	Average	33.10	Low
RLM 514	9.69	High	35.00	Average
Varuna	9.20	High	38.10	High
RH 30	9.73	High	36.60	Average

Table-2 – Seedling behaviour

Genotypes	0	24 hrs	48 hrs	72 hrs
	Weight in mg of 10 seeds/seedlings			
RLM 29	40	60	108	190
RLM 198	32	56	70	180
P 26/21	35	76	110	195
RLM 514	37	69	102	200
Varuna	63	90	124	250
RH 30	64	100	195	340
	Soluble protein percentage			
RLM 29	8.75	8.54	5.56	1.70
RLM 198	8.98	5.80	6.07	1.60
P 26/21	6.43	5.59	3.75	1.15
RLM 514	18.24	10.68	3.19	2.69
Varuna	19.06	9.17	4.00	3.45
RH 30	15.43	7.38	3.91	2.70
	Pox Activity			
RLM 29	1.36	1.14	0.56	0.71
RLM 198	1.04	1.50	0.32	0.83
P 26/21	1.59	1.00	0.48	0.51
RLM 514	0.56	0.30	0.23	0.23
Varuna	0.13	0.77	0.48	0.41
RH 30	0.51	0.37	0.35	0.56