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SEED AND SEEDLING PHYSIOLOGY OF COWPEA GENOTYPES

N. Natarajaratnam[1], T. Venkateswara Rao[2] and G. Pathmanabhan[3]

The seed and seedling physiology of ten genotypes of cowpea were studied among high and low yielders. The germination per cent, field emergence, water absorption and vigour index were positively correlated with high yielding potential of cowpea genotypes. The genotypes with low yielding potential showed negative relationship with the above parameters. The EC of seed leachates showed a negative relationship with high yielders Seed leachates contained more of sugars and free amino acids in low yielding genotypes. The EC of seed leachate and vigour index may be used as selection criteria for higher yield in the case of cowpea genotypes.

The yield variation among cowgenotypes are wide and many of the physiological parameters even at seedling stage raflect on the yield potential of the genotypes. Imbibition capacity, vigour, field emergence and drymatter content during early seedling growth directly influence the harvest index through enhanced germination and greater biomass production (Coopet and Qualls, 1968). The imbibition rates of grain legumes depend on the oxygen supply (Milthorpe and Moorby, 1974). Among the genotypes of greengram the vigour index varied considerably (Thandapani 1981). A negative relationship between electrical conductivity of the seed leachate, germination and vigour index was established by several workers (Powell and Mathews, 1979; Alikhan, 1980). In the present study, the influence of chosen seed and seedling parameters and tneir relationships among low and high yielding genotypes of cowpea were attempted.

MATERIALS AND METHODS

Ten genotypes of cowpea viz., S488, 1999 02F, Copusa 3, MS 9804, V 37, PTB 1, Copusa 2, Co 3, 522 and 534 wete chosen with varying yield potentials. For the study on the water absorption, a sample of 25 seeds in three replicates, for each variety was placed in petri plate containing water. The increase in fresh weight was recorded at the end of 4, 8, 12, 16, 20 and 24 hrs.

The per cent germination was assessed as per procedure detailed by ISTA (Anon., 1976 a). For field emergence one hundred seeds in three replicates were sown in beds and on 8th day, the seedlings were removed and the normal seedlings were counted. The vigour index was calculate by the method of Abdul-Baki and

1. Professor and Head, Department of Crop Pnysiology, TNAU, Coimbatore.

2 & 3 P.G. Student and Assistant Professor, TNAU, Coimbatore.

Anderson (1972). From a sample of 25 seedlings, the shoot / root ratio was assessed for each variety and the total drymatter produced by each variety was recorded from the plant samples drawn on 8th day. The test proposed by Presley (1958) for assessing the Electrical Conductivity of the seed leachate for 50 sseds/50 ml. water was done and the total sugar content of the seed leachate was estimated as detailed by Somogyi (1952). The free amino acid content in seed leachate was determined by the method described by Ching and Ching (1964).

RESULTS AND DISCUSSION

The water adsorption rate progressively increased with time of soaking till the final stage. After 24 hrs, the genotypes PTB 1 and V 37 recorded highest water absorption. The genotypes 522 and 534 exhibited low water absorption while Co 3 and Ms 9804 indicated moderate rates. The high yielding genotypes maintained high rates of water absorption except Ms 9804. In redgram, the protein fraction was the chief imbibing component influencing the water absorption rate (Varadarajan, 1969). Significant differences were obtained in germination percentage of high and low yielding genotypes So also, the vigour index varied among low and high yielding types. Increased vigour was observed in high yielders viz., S 488, Copusa 3 and MS 9804 (4245, 4341 and 4273) whereas in low yielders the vigour index was 3817 (Co 3), 3888 (Copusa 2) and 3890 (PTB 1) only. The increased germination rates in high yielders enhanced the yield through maintenance of optimum population. The increased vigour observed during early growth phase indicated more efficient metabolic functions, faster growth and establishment (perry, 1967). Significant negative correlation was observed between electrical conductivity of seed leachates, germination and vigour index. Electrical Conductivity of seed leachate was high in low yielder (287 mhos / cm) Copusa 2. The total sugar content and free amino acid content of the leachate were comparatively higher in all the five low yielders. The leachate of the genotype 522 (Low yielder) contained 5.75 mg total sugars with 1271 mg of free amino acid/50 seeds/ 50 ml water. It is probable that the loss of sugars and amino acids in low yielders might be due to poor integrity, disorganisation and loss of permeability of cellular membranes (Abdul Baki and Anderson, 1972). The drymatter as recorded on 8th day indicated that the high yielding genotypes of cowpea produced more drymatter as compared to the low yielding types mainly due to increased vigour. The mean value of high yielding cowpea genotype was 76.48 mg / plant while it was 53.78 mg/plant in low yielding genotypes (Table 1).

A negative correlation between the EC of seed leachate and drymatter production of the seedlings was observed. The low yielding genotypes demonstrated higher shoot / root ratio

than high yielders. Among the high yielders, only S 488 (7.45) and MS 9804 (7.43) were having wider ratios. It was evident that low yielding genotypes did not produce enough root weight corresponding to their shoot. The correlation matrix (Table 2) relating to different parameters, showed that the drymatter content was positively correlated with germination, field emergence and vigour index in cowpea genotypes, whereas the DMP wss negatively correlated with the EC of seed leachate and shoot/root ratio. The study revealed the possibility of utilising the [i] low EC of seed leachate and [ii] high vigour index as criteria for selection of superior genotypes of cowpea at seedling stage.

TABLE 1 Seed and Seedling physiology of 10 genotypes of cowpea

Genotype	Water absorption (24 hrs) (% over control)	Germination percent	Field emergence	Vigour index	DMP (mg)/ 25 seedlings	EC mhos/ cm	Total sugars mg/ 50/seeds/50ml water	Free amino acids kg/50 seed/50ml water
High yielders								
S. 488	124	97.7 (81.47)*	95.0	4245	55.5	267	4.9	933
199-02F	126	96.3 (78.91)	94·3	4187	54.9	269	4.7	928
Copusa 3	127	97.3 (80.54)	96.0	4341	57.5	263	4.5	914
MS 9804	113	97.7 (81.47)	95.1	4273	57.3	262	4.9	938
V 37	130	96.3 78.9)	94.7	4248	57.2	269	4.7	923
Mean	124	97.1 (80.19)	95.1	4259	56 5	266	4.73	928
Low yielders								
PTB 1	131	93.7 (75.46)	91.0	3890	54.3	282	5.4	1020
Copusa 2	127	94.7 (76.62)	92.3	3888	53.6	285	5.5	1110
Co 3	116	94.0 (75.82)	92.0	3817	52.8	287	5.6	1114
522	90	94.0 (75.82)	92.0	3895	54.3	283	5.8	1271
g34	71	95.7 (78.03)	94 3	3929	53.9	275	5.7	1204
Mean	107	94.4 (76.31)	92.3	3884	53.8	282	5.57	1144

* Transformed values

TABLE 2 Correlation matrix of chosen parameters in seed and seedling physiology

Parameters	Field emergence	Vigour index	EC of seed	Shoot/root ratio	Dry matter production
Germination per cent	0 8341**	0.8956**	−0.8543**	−0.1642	0 7151**
Field emergence		0.8367**	−0.8608**	−0.2760	0.7328**
Vigour index			−0.9406**	−0.3093	0.8999**
EC of seed leachates				0.3345	−0.8785**
Shoot/root ratio					0.1717

** Significant at 1 per cent level

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