International Journal of Agricultural Sciences
Volume 8 |Issue 2| June, 2012 | 505-508

RESEARCH PAPER

Assessment of accelerated ageing in pulses

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Abstract : The study was carried out to identify the pattern of seed deterioration in pulses. Based on the seed quality parameters the duration of ageing required to reach a germination percentage around 75 per cent was identified as 5 days for blackgram and 3 days for cowpea and redgram.

Key Words : Ageing, Germination percentage, Deterioration, Seed quality

View Point Article : Sujatha, K., Ramamoorthy, K. and Sivasubramaniam, K. (2012). Assessment of accelerated ageing in pulses. *Internat. J. agric. Sci.*, **8**(2): 505-508.

Article History : Received : 25.04.2012**; Revised :** 10.05.2012**; Accepted :** 04.06.2012

INTRODUCTION

In southern part of India, high RH and temperature prevails during *Rabi* season which accelerates the ageing process particularly when seeds stored in moisture pervious container like cloth bags leading to concern for vigour and viability maintenance. During storage the high RH in combination with temperature induces ageing, ultimately effecting vigour viability and productivity. Ageing is a natural irreversible phenomenon resulting in seed deterioration, which leads to loss of vigour and viability. Seeds undergo ageing immediately after physiological maturity. Various factors like seed moisture content (Roberts, 1972; Priestly, 1986 and Ahuja and Aneja, 2004 in soybean; Reusche, 1987 in peanut; Zhang *et al.*, 1993 in barley and rice; Rajasekaran, 2001 in niger), temperature and relative humidity (Khattra *et al.*, 1988 in pigeonpea; Pallavi *et al.*, 2003 in sunflower; Vanniarajan *et al.*, 2004 in black gram), oxygen pressure (Roberts and Abdalla, 1968 in micro flora and insects; Lande *et al.* , 1986 in peanut; Dewivedi, 1990 in gram) influenced ageing in seeds.

Accelerated ageing is an excellent predictor of seed storability. Seed ageing is known to cause appreciable changes in viability, producing large number of changes in qualitative and quantitative characters and can be used on large scale with simple equipment for inducing variability (Purkar, 1980; Purkar *et al.*, 1980 in peas). Ageing can also be due to alter cell membrane permeability as a consequence of lipid per oxidation leading to poly unsaturated fatty acids present in the membrane or reserve lipids, nucleic acids and proteins (Simon,1974;Saha *et al.*,1990;Beckman and Ames,1997) and works of Pammenter *et al.* (1974) and Pallavi *et al.* (2003). The knowledge on the pattern of seed deterioration is important to use its potential to judge seed vigour. With this background, studies were undertaken by employing the accelerated ageing technique to identify the pattern of seed deterioration in pulses

MATERIALS AND METHODS

Fresh seeds of (250 g each) blackgram cv. VBN 3 retained by 10/64" round perforated metal sieve, cowpea cv. CO6 retained by 12/64" round perforated metal sieve and redgram cv. APK 1 retained by 12/64" round perforated metal sieve were packed in perforated blotter paper cover and subjected to accelerated ageing in an ageing chamber maintained at 95 ± 2 per cent relative humidity and a constant temperature of 40± 1^0C (Delouche and Baskin, 1973) for a period of ten days. The seeds were shuffled daily, sampled and allowed for moisture stabilization in a desiccator containing fused calcium chloride and evaluated for the following seed quality parameters along with control. The experiment was conducted at room temperature (26 ± 1^0C) in laboratory conditions at Agricultural

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College and Research Institute, Madurai. Mean data were analyzed after Snedecor and Cochran (1961) statistically.

Germination:

Germination test in quadruplicate using 100 seeds each with four sub replicates of 25 seeds, were carried out in paper medium (ISTA, 1999) following inclined plate method (Punjabi and Basu, 1982) in a germination room maintained at a temperature of 25 ± 1^{0}C and RH 96 ± 2 per cent with diffuse light (approx. 10 h) during the day. Final count on normal seedlings was recorded on seventh day for redgram, blackgram and cowpea and percentage of germination computed.

Speed of germination:

During germination test period, observations were made daily from second to seventh day. The emergence of the seedlings with the cotyledons and plumule for blackgram, cowpea and redgram was taken as the criterion for germination.

From the mean per cent germination on each counting date, the rate of germination was calculated employing the formula suggested by Maguire (1962).

$$\text{Rate of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} + \ldots + \frac{X_n - (X_n - 1)}{Y_n}$$

where,

X_n = Percentage germination n^{th} count

Y_n = Number of days from sowing to n^{th} count

Root length:

Root length of all the normal seedlings from the germination test was measured from collar region to the root tip and the mean was expressed in cm.

Shoot length:

Shoot length of all normal seedlings from the germination test was measured from collar region to the shoot apex and the mean was expressed in cm.

Seedling dry matter production:

The normal seedlings used for growth measurements were placed in paper cover and dried under shade for 24 h and then in a hot air over maintained at 80^{0}C for 16 h and the weight was recorded using and electronic balance. The mean weight was expressed in g. 10 seedlings^{-1}.

RESULTS AND DISCUSSION

In blackgram, non-aged seeds recorded maximum germination (98%). Aged of seeds showed a reduction for all seed quality parameters. The reduction was faster after two days. At the end of eight days, the germination to 53 per cent, speed of germination declined to 8.0, root length to 10.1 cm, shoot length to 22.6 cm and dry matter production to 130 g (Table 1).

In cowpea, the initial germination of control seeds was 95 per cent. After 6 days the germination reduced to 37 per cent. The speed of germination declined from 12.0 to 8.0 per cent, root length from 18.4 to 13.2 cm, shoot length from 32.6 to 13.1 cm, dry matter production from 0.473 to 0.310g, respectively. The rate of reduction was faster when compared to blackgram (Table 2).

In redgram, at the start of the experiment, the germination was 90.0 per cent. After 6 days of ageing the speed of germination decreased from 10.2 to 7.0. For the same duration, the germination was reduced to 39.0 per cent, root length to 9.0 cm, shoot length to 11.3 cm, dry matter production to 0.402 g (Table 3). Vanitha (2005) observed a gradual decrease in germination, seedling length and dehydrogenase activity with increase in the ageing period in blackgram, sunflower and maize. Increase in electrical conductivity due to aging showed significant negative correlation with germination and vigour

Table 1 : Standardization of accelerated ageing period for blackgram cv. VBN 3

Ageing (days)	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g 10 seedlings^{-1})
Control	11.8	98.0 (84.09)	17.3	32.8	0.248
1	11.5	96.0 (62.11)	16.5	32.0	0.220
2	11.0	90.0 (71.65)	14.0	32.0	0.235
3	11.2	83.0 (65.65)	13.2	29.1	0.193
4	10.5	75.0 (59.67)	12.6	26.7	0.182
5	10.2	70.0 (56.95)	11.5	26.0	0.175
6	10.0	64.0 (53.30)	11.0	25.3	0.152
7	9.0	60.0 (50.91)	11.0	24.0	0.143
8	8.0	53.0 (45.93)	10.1	22.6	0.130
S.E.±	0.136	0.943	0.204	0.813	0.002
C.D. (P = 0.05)	0.280**	(1.948**)	0.421**	1.637**	0.005**

Figures in parentheses are arc sine transformations

** indicates significance of value at P=0.01

Table 2 : Standardization of accelerated ageing period for cowpea cv CO 6

Ageing (days)	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g 10 seedlings^{-1})
Control	12.0	95.0 (61.85)	18.4	32.6	0.473
1	11.8	80.0 (63.19)	18.0	28.2	0.451
2	11.5	72.0 (57.98)	17.3	27.4	0.428
3	11.0	65.0 (54.33)	16.1	25.2	0.378
4	10.3	55.0 (48.91)	15.6	20.4	0.343
5	10.0	43.0 (40.15)	14.3	16.2	0.332
6	8.0	37.0 (37.50)	13.2	13.1	0.310
S.E.±	0.133	0.690	0.146	0.816	0.001
C.D. (P = 0.05)	0.280**	(1.451**)	0.306**	1.657**	0.003**

Figures in parentheses are arc sine transformations
** indicates significance of value at P=0.01

Table 3 : Standardization of accelerated ageing period for redgram cv APK1

Ageing (days)	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g 10 seedlings^{-1})
Control	10.2	90.0 (71.65)	18.0	26.9	0.560
1	9.3	81.0 (64.43)	16.3	24.4	0.532
2	9.0	70.0 (56.95)	14.3	19.2	0.483
3	8.1	62.0 (46.14)	12.5	15.5	0.471
4	8.0	55.0 (43.97)	11.0	14.3	0.452
5	7.4	45.0 (42.29)	10.3	12.5	0.438
6	7.0	39.0 (38.65)	9.0	11.3	0.402
S.E.±	0.872	0.297	0.204	0.816	0.002
C.D. (P = 0.05)	1.833**	(0.625**)	0.421**	1.657**	0.004**

Figures in parentheses are arc sine transformations
** indicates significance of value at P=0.01

and could be considered as an indicator for seed viability in tomato (Ramamoorthy and Karaivaratharaju, 1989) and blackgram (Vanniarajan *et al*., 2004). The reduced activity of amylase in the aged seeds could have reduced the amount of soluble sugars available as energy substrates needed for germination thus slowing the germination process.

Based on the seed quality parameters the duration of ageing required to reach a germination percentage around 75 per cent (Indian minimum seed certification standards) was identified as 5 days for blackgram and 3 days for cowpea and redgram.

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