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Storage Potentiation of a Grass pea Seed species using Selected Plant Extracts

Chandan Kumar Pati

Assistant Professor, Department of Botany, Saldiha College (Affiliated to Bankura University), Saldiha-722 173, Bankura, West Bengal, India, E-mail: cpbotany@yahoo.co.in

ARTICLE INFO

Received: 01.10.2020

Revised: 01.01.2021

Accepted: 10.01.2021

Key words

Grass pea, *Ocimum,Aegel,* storage potentiation, accelerated ageing.

ABSTRACT

Pretreatment of grass pea (*Lathyrus sativus* L.) seeds with aqueous solutions of leaf extracts of tulsi (*Ocimum sanctum*) and bel (*Aegel marmelos*), 25g in 1000 ml distilled water of each for 2 hours and then dried back to the original dry weight of the seeds before accelerated ageing treatment (99.5% RH and 32±2^{0}C) for different durations (0 to 30 days) slowed down the rapid loss of germination and reduced the time (h) required for 50% germination (T_{50}) of seeds. The plant extracts also significantly arrested the reduction of protein, insoluble carbohydrate as well as activity of catalase enzyme of seed kernels during forced ageing period. Conversely, ageing-induced stimulation of the activity of amylase enzyme was alleviated by the seed pretreating agents. Thus, the promising effects of the experimental plant extracts on storage potentiation of the grass pea seeds are apparent in this investigation.

Introduction

Pulses constitute groups of crops of the legume family which with the help of *Rhizobium* like bacteria in their root nodules fix atmospheric nitrogen and improve the soil fertility. These crops are generally included in rotation in most of the areas in India and help to keep soil alive and productive. The pulse crop like grass pea (*Lathyrus sativus*) is considered as almost zero management crops requiring little attention for raising yield (Sundararaj and Thulasidas, 1993).

Maintenance of vigour and viability of seeds in tropical countries like India is a matter of serious concern to the crop growers because of high temperature and high relative humidity (RH) prevailing in major parts of the country almost throughout the year. These two environmental factors strongly impair seed and seedling health and cause to reduce percent seed germinability and seedling performance at a rapid rate (Basu,1994, Copeland and McDonald, 1995, Bhattacharjee, 2001, Mishra, 2006, Pati and Bhattacharjee,2013). Keeping in mind the problem of seed storing in our country, an attempt has been made in this

investigation to prolong the storage life of the grass pea seeds having viability problems using tulsi (*Ocimum sanctum*) and bel (*Aegle marmelos*) leaf extracts. Experiments of this investigation were carried out under accelerated ageing condition to obtain more or less uniform and expeditious results (Heydecker, 1972, Pati and Bhattacharjee, 2016,Pati,2019) and this mimics the natural ageing process.

Materials and Methods

After surface sterilization (0.1% $HgCl_2$ for 90 seconds) the seed sample of grass pea (*Lathyrus sativus* L.) was separately presoaked in the aqueous leaf extracts of tulsi (*Ocimum sanctum*) and bel (*Aegle marmelos*), 25g/ 1000ml each, or distilled water for 2 hours (h) and then dried back to the original dry weight of the seeds. This was repeated twice allowing maximum penetration of the chemicals present in the aqueous solution. The pretreated seed lots were taken in separate cloth bags and thus stored in a desiccator in which 99.5% relative humidity (RH) was preimposed by keeping 1.57% H_2SO_4 within it. This experimental set up was kept at 32±2^{0}C for 30 days allowing the seeds to experience forced ageing treatment and H_2SO_4 was changed at 15 day intervals to restore the desired RH within the desiccator for 30 days.

To analyse the percentage germination seeds of each treatment were transferred to separate Petri dishes containing filter paper moistened with 10ml distilled water. Germination data were recorded after 96 h of seed soaking following the International Rules for Seed Testing (ISTA, 1976). The time for 50% germination of seeds (T_{50}) was determined following the method described by Coolbear *et al.* (1984).

Protein, insoluble carbohydrate contents as well as activities of catalase and amylase enzymes were analysed from seed kernels of each sample. Quantification of insoluble carbohydrates was done following the method of McCready *et al.* (1950). Protein levels was estimated as per the methods of Lowry *et al.* (1951). Extraction and estimation of the enzyme catalase was made following the method of Snell and Snell (1971) as modified by Biswas and Choudhuri (1978). Amylase activity was estimated as per the method of Khan and Faust (1967). Assaying of these enzymes were done as per the method of Fick and Qualset, 1975.

Data were statistically analysed at the treatment and replication levels and least significant difference (LSD) values were calculated at 95% confidence limits (Panse and Sukhatme, 1967).

Results and Discussion

Data clearly revealed that pretreatment of the seed species with bel and tulsi leaf extracts significantly alleviated the accelerated ageing-induced loss of germination and reduced T_{50}

hours (Table 1), alleviated the loss of protein and insoluble carbohydrates (Table 2) as well as ageing-induced reduction of activity of catalase enzyme (Table 3) and stimulation of the activity of amylase enzyme (Table 3).

The results therefore point out that although deterioration is a common phenomenon in treated and control samples of the seed species, the catabolic processes within the treated seed samples remained somewhat subdued, thereby rendering them tolerant against unfavourable storage environment. Available reports show that during seed ageing a loss of some vital cellular components including protein, carbohydrates occurred (Abdul Baki and Anderson, 1972, Kole and Gupta, 1982). Catalase is regarded as a scavenger enzyme (Fridovich, 1976, Pati and Bhattacharjee, 2017, Ojha *et al.*,2020) and higher activity of this enzyme is indicative of higher plant vigour (Sarkar and Choudhuri, 1980). In this investigation, the plant extract-induced arrestation of rapid loss of the enzyme activity is indicative of strengthening the defense mechanism by the herbal extracts under adverse storage condition.

It can be concluded from the results of this investigation that tulsi and bel leaf extracts are effective in enhancing storage potential of grass pea seed species. Thus, invigouration property of the present seed pretreating agents seems to be apparent from the experimental results.

Table 1

Effect of seed pretreatment with leaf extracts of *Ocimum* sp. and *Aegle* sp. (25g/1000ml each) on percentage seed germination and T_{50} (time required for 50% germination) values of grass pea seeds.

Seed sample	Treatments	Percentage seed germination			T_{50} of germination		
		Days after accelerated ageing					
		0	**15**	**30**	**0**	**15**	**30**
Grass pea	Control	100	78	38	12	36	NA
	Ocimum sp.	100	84	57	12	24	72
	Aegle sp.	100	80	52	12	24	84
	LSD (P = 0.05)	NC	5.60	4.58	NC	2.50	6.05

NC: Not calculated; NA : Non attainment of 50% germination.

Table 2

Effect of seed pretreatment with leaf extracts of *Ocimum* sp. and *Aegle* sp. (25g/1000ml each) on protein (mg/g fr. wt.) and insoluble carbohydrates (mg/g fr. wt.) levels of grass pea seeds.

Seed sample	Treatments	Protein			Insoluble carbohydrates		
		Days after accelerated ageing					
		0	**15**	**30**	**0**	**15**	**30**
Grass pea	Control	32.0	22.6	11.9	23.10	18.50	10.19
	Ocimum sp.	32.2	28.2	22.0	23.17	21.82	18.02
	Aegle sp.	32.7	29.9	28.9	23.16	20.19	17.07
	LSD (P = 0.05)	NS	1.05	1.15	NS	1.01	0.08

NS : Not significant.

Table 3

Effect of seed pretreatment with leaf extracts of *Ocimum* sp. and *Aegle* sp. (25g/1000ml each) on activities of enzyme catalase (unit/h/g fr. wt.) and amylase (unit/h/g fr. wt.)) of grass pea seeds.

Seed sample	Treatments	Catalase			Amylase		
		Days after accelerated ageing					
		0	**15**	**30**	**0**	**15**	**30**
Grass pea	Control	40.4	26.2	16.9	37.1	50.0	67.8
	Ocimum sp.	40.2	32.1	27.9	37.2	40.1	51.7
	Aegle sp.	40.0	30.9	25.0	37.0	41.2	53.4
	LSD (P = 0.05)	NS	2.50	1.35	NS	3.95	4.80

NS : Not significant.

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