GERMINATION IMPROVEMENT IN PROSOPIS GLANDULOSA TORR. SEED

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ABSTRACT

Soaking in water, application of IAA, GA_3 and thiourea alone or subsequent to scarification promoted seed germination to over 90% within 6 days of incubation at 20-30°C as against 18-30 % germination after 30 days of untreated seeds. Large size seeds gave better germination. Storage upto 12 months had no significant effect on germination. The seeds germinated better at pH 5-7.

INTRODUCTION

Prosopis glandulosa Torr., a common tree in the arid/semiarid tropical plains thorn forests, is an important source of fuelwood and fodder in Pakistan, The flowers are source of nectar for honey bees. It appears that retarded seed germination affects its natural regeneration. As a very hardy species, it is desirable to study the germination requirements of its seed for reforestation/afforestation of degraded sites. No reference is available on the germination requirements of *Prosopis glandulosa* in the literature. This study was undertaken to find out methods for prompt and early germination of seed. The findings would be helpful in reforestation and afforestation programmes especially in the arid and semi-arid regions of Pakistan.

MATERIALS AND METHODS

The seed of *Prosopis glandulosa* collected in September from Attock-Nizampur area, were cleaned, extracted, dried and treated with mercuric chloride from 5 minutes and stored in polyethylene bottles at room temperature (25-30°C). Five months old stored seeds were used in the various experiments. Effects of various treatments like temperature/mechanical/chemical scarification, soaking in cold water at room temperature/warm water at 60°C/boiling water at 100°C for 1,2 and 4 hours; application of IAA, GA_3, KNO_3, Thiourea, hydrogen peroxide, nutrient solutions and sodium hypochlorite, pH, seed size, storage, alone and in combination with others on germination were determined on stored seeds. Seeds were incubated at 20°C, 25°C and 30°C. The seeds were divided into small and large sizes on visual difference. Effects of storage were determined by storing seeds for 2,4, 6, 8, 10 and 12 months and germinating them. The mean germination values for different pretreatments were based upon 5 replicates and 10 seeds per replication/treatment and the results were analyzed following Z-test.

RESULTS AND DISCUSSION

The germination percentages varied considerably due to pretreatments and temperature. The results are discussed below:

1. Effect of Different Temperatures

After 30 days the germination was 30% at 20 and 35°C. It was 18 % at 30°C. The germination initiated after 16 days at 30°C suggesting that seeds might germinate better between 20-30°C. The delayed and poor germination may be due to dormancy.

2. Effect of Soaking in Water

Soaking the seeds in cold water for 1, 2 and 4 hours gave 60-78% germination both at 25 and 30°C, while immersing seeds in warm water (at 60°C) gave 76-88% germination at 25°C. At 20°C there was no improvement. Seeds soaked for 4 hours gave higher germination percentage than those soaked for 1 and 2 hours (Table 1).

3. Effect of Mechanical and Chemical Scarification Alone and in Combination

Mechanically scarified seeds exhibited 40% germination at 20°C, 90% at 25°C and 64% at 30°C compared to poor germination of the non-treated seeds at these temperatures (Table 2). Acid scarified seeds exhibited 60-90% germination at 25°C and 30°C (Table 1). Acetone treated seeds gave 44-54% germination at 20 and 25°C and 57-74% at 30°C as compared to the control (Table 2). Seeds treated with acetone or acid subsequent to mechanical scarification gave 54-74% and 90% germination respectively showing a significant improvement over control (Table 1). Mechanical or chemical scarification alone or in combination with other treatments may facilitate the imbibition of water, emergence of seedlings, removal of waxy-coating and germination inhibitors in order to promote germination. The findings agree with others (Ilahi and Hussain, 1987 and 1988; Qaiser and Qadir, 1971; Hussain and Ilahi, 1988; Mayer and Poljkalf-Mayber, 1981).

4. Combined effect of mechanical scarification and soaking in water

The treated seeds gave 90 and 92% germination at 25 and 30°C respectively. AT 20°C, there was no effect on germination (Table 1). The combination of scarification and water soaking enhanced seed germination as compared to those treated with water alone (Table 1). This is attributable to softening of hard testa and imbibition of water.

5. Effect of IAA and GA_3 alone or with mechanical scarification

Application of IAA gave 62% germination and in combination with mechanical scarification promoted it to 72%. The GA_3 alone and in combination with scarification gave 50 and 75% germination, respectively (Table 3).

6. Effect of Thiourea alone and coupled with mechanical or chemical scarification

Seeds treated with various grades of thiourea yielded 60-66% germination at 25 and 30°C (Table 4) while chemical or mechanical scarification coupled with the application of thiourea promoted the germination to 70-94% at 25°C especially at 0.50% concentration (Table 4).

7. Effect of pH, storage and seed size

The germination was 46, 44, 38 and 24% respectively at pH 9, 7, 5 and 3 with a better seedling growth at pH 5-7 suggesting a wide habitat range. Large sized seeds exhibited healthy embryo with ample food reserve in the former case. The germination was 39, 50, 60, 70 and 50% in seeds stored for 0, 2, 4, 6 and 12 month respectively. This agrees with findings of Ilahi and Hussain (1987, 1988) and disagree with Qaisar and Qadir (1971). The viability of seeds varies with the species, storage period and conditions.

8. Least effective treatments

The application of hydrogen peroxide, sodium hypochlorite, KNO_3, nutrient solutions, boiling water alone or in combination with one-another proved least effective in promoting germination.

CONCLUSION AND RECOMMENDATION

The findings of this study suggest that *Prosopis glandulosa* seeds retains viability upto one year. Poor germination may be primarily due to hard testa and some germination inhibitors. Natural wear and tear of seed in the soil softens the testa and removes inhibitors. The presence of scarce seedlings in the vicinity of *P.glandulosa* is due to unfavourable habitat conditions resulting from deforestation and over-grazing. it is suggested that healthy seeds may be soaked in water or acid or mechanically scarified followed by the application of thiourea or hormones. The seeds may be later on sown in the soil during spring or rainy seasons amongst the thickets or *Prosopis* microhabitat and protected against grazing animals.

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Table 1.Mean germination percentage of *Prosopis* seed under different pretreatments.

Day	20°C				25°C				30°C			
	Soaking time											
	Control	1	2	4	Control	1	2	4	Control	1	2	4
					a. Cold Water (25°C) (Time in Hours)							
5	24	22	24	30	20	22	16	22	-	32	24	20
14	26	24	24	32	36	60*	72*	78*	4	76*	76*	78*
					b. Hot Water (60°C) (Time in Minutes)							
5	30	30	28	36	20	36	34	30*	-	18	16	18
14	30	44	40	50*	40	78*	76*	88*	10	44*	48*	50*
					c. Mechanical scarification + Soaking in water (H)							
5	24	-	-	-	20	10	26	38	-	30	14	16*
10	24	18	12	26	24	60*	62*	90*	-	60*	76*	92*
					d. Mechanical scarification + Acetone soaking (Min)							
5	24	46*	58*	66*	20	44*	62*	66*	-	56*	38*	70*
10	24	54*	66*	70*	24	52*	74*	74*	-	60*	60*	72*

* Significantly different at P = 0.05 from the control

Table 2. Effect of Mechanical (MS) and Chemical Scarification (CS) on the Germination and seedling growth of *Prosopis glandulosa*

	Treatment time (Minutes)														
			CS					CS					CS		
Day	Control	MS	1	2	4	Control	MS	1	2	4	Control	MD	1	2	4
						a. Acid Scarification									
4	10	28	-	-	-	6	32	4	16	6	-	-	4	26	12
6	24	30	32	22	34*	24	54*	48*	47*	54*	4	32*	60*	38	70*
10	24	40*	36	30	40*	24	90*	50*	60*	60*	18	64*	80*	60*	90*
						b. Acetone Scarification									
6	24	28	14	30	28	6	32*	-	38*	28*	-	-	22*	22*	30*
10	24	30	14	44	38	24	54*	44*	54*	42*	4	32*	46*	68*	58*
14	24	40	48*	54*	44	24	90*	46*	54*	48*	18	64*	54*	74*	70*

* Significantly different from control at P = 0.05

Table 3 Effect of IAA and GA_3 alone and subsequent to Mechanical scarification on the Germination and Early Growth of *Prosopis glandulosa* at 25°C

	Hormone Concentration (ppm)				
Day	Control	0.50	1.0	1.50	2.00
		a. IAA alone			
4	16	50*	36	44	38
6	34	62*	54*	72*	58*
8	34	66*	62*	72*	66*
		b. IAA + Mechanical Scarification			
4	16	44	34	38	40
6	34	60*	62*	68*	64*
8	34	66*	62*	70*	64*
		c. GA_3 alone			
4	16	8	10	24	18
6	34	46	46	68*	58*
8	34	50*	62*	78*	68*
		d. GA_3 + Mechanical Scarification			
4	16	30	36	40	22
6	34	58*	60*	40	48
8	34	58*	68*	64*	54

* Significant at P = 0.05 from the control.

Table 4. Effect of Thiourea alone and coupled with Mechanical and Chemical Scarification on the Germination percentage

Day	25°C					30°C				
	Thiourea Concentration (%)									
	Control	0.25	0.50	0.75	1.00	Control	0.25	0.50	0.75	1.00
				a. Thiourea alone*						
2	--	40	30	48	28	--	36	34	34	20
4	24	54	52	48	50	--	56	66	56	40
6	26	60	66	48	54	--	62	66	60	54
				b. Thiourea + Mechanical Scarification						
2	--	48	50	48	--	--	--	--	--	--
6	20	58	78	72	--	--	--	--	--	--
8	24	70	94	80	--	--	--	--	--	--
				c. Thiourea + Acid Scarification						
2	--	56	46	40	--	--	--	--	--	--
6	20	74	88	70	--	--	--	--	--	--
8	24	80	92	76	--	--	--	--	--	--

* : All values significantly differ from control at P = 0.05