

Full Length Research Paper

Standardization of seed dormancy breaking treatment in Senna (*Cassia auriculata*)

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The study conducted to standardize the seed dormancy breaking treatment in senna (*Cassia auriculata*) revealed that soaking the seeds in hot water (boiled to 100°C and removed from the flame) for 15 min and soaking with 100 ppm GA3 for 3 h had effectively improved the germination (98%), root length (7.2 cm), shoot length (9.5 cm), dry matter production (0.258 g per ten seedlings) and vigour index (1637) compared to hot water treatment for 15 min alone (89% germination) and non-scarified seeds (20% germination). The seeds scarified with concentrated sulphuric acid also showed better germination than the non scarified seeds but less than the hot water scarified seeds.

Key words: Senna, *Cassia auriculata*, seed dormancy breaking, hot water treatment.

INTRODUCTION

Cassia auriculata (Family: Fabaceae) is a fast growing profusely branched, tall, evergreen shrub, generally 1.2-3.0 m in height. The bark, known as Avaram bark or Tangeedu bark in commerce is one of the best available barks in India. The decoction of its bark is astringent and useful for sore throat, rheumatism, enemas, eye diseases, diabetes, stomach-ache and dysentery. Leaves are anthelmintic and good for ulcers, skin diseases, leprosy and herpetic eruptions. Pods are anthelmintic and used for emetic and urinary discharges. Seeds are alexipharmic and used in chronic purulent ophthalmic and conjunctivitis, cough, asthma, gout, gonorrhoea, dysentery and diabetes. Roots are astringent, alexeteric and useful in skin diseases, asthma, thirst and urinary discharge. Decoction of the roots is used as a tonic. The root shows interferon like activity against Ranikhet disease virus. Flowers are used in throat troubles, urinary disorders and as astringent. An aqueous extract of the leaves and flowers possesses hypoglycemic activity. Recently it has been reported as a potent anticancer herb.

Being a medicinally very important plant, seeds of *C. auriculata* are familiar for several research works in India. When normally sown, the seed hardly germinate beyond 1 to 2%. Seed dormancy is the most limiting factor for germination. *Cassia* spp. suffers from dormancy owing to the presence of thick seed coat that prevents water and oxygen from reaching and activating the embryo or the presence of germination-inhibitor chemical compounds and they require specific treatments for breaking dormancy.

Even though several treatments like cold and hot water soaking, acid and mechanical scarification for varying durations have been suggested by several authors (Al-Helal et al., 1989; Thomas, 1994; Revathi, 2001) for different crops, there were limited number of studies tried to overcome seed dormancy in glory lily. Soliman and Abbas (2013) reported that acid scarification for 2 min and then soaking in hot water at 100°C for 6 min was the best method for breaking dormancy of *Cassia fistula*. Al-Menaie et al. (2010) who observed that treated seeds of *C. fistula* with H₂SO₄ scarification followed

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by dropping in hot water at 50°C resulted in higher germination percentage. Hence, an attempt was made to break the hard seed coat dormancy by providing overnight water soaking, hot water soaking and acid treatment either alone or in combination with GA₃.

MATERIALS AND METHODS

The laboratory experiment was conducted during 2013 at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore to optimize the seed dormancy breaking treatment in senna. Twelve dormancy breaking treatments were imposed with a control.

For hot water soaking treatments, the seeds were soaked in boiled water (100°C) immediately after removing the water from flame for different durations. In H₂SO₄ scarification treatments, the seeds were scarified with commercial sulphuric acid for different durations. Immediately after scarification, the seeds were washed with water thoroughly. After imposing the treatments, the seeds were subjected for germination as per ISTA recommendation. The treatment details are:

- T₀ – Control
- T₁ – Scarification with H₂SO₄ for 1 min
- T₂ – Scarification with H₂SO₄ for 2 min
- T₃ – Scarification with H₂SO₄ for 3 min
- T₄ – Scarification with H₂SO₄ for 1 min + 100 ppm GA₃ for 3 h
- T₅ – Scarification with H₂SO₄ for 2 min + 100 ppm GA₃ for 3 h
- T₆ – Scarification with H₂SO₄ for 3 min + 100 ppm GA₃ for 3 h
- T₇ – Hot water treatment for 5 min
- T₈ – Hot water treatment for 10 min
- T₉ – Hot water treatment for 15 min
- T₁₀ – Hot water treatment for 5 min + 100 ppm GA₃ for 3 h
- T₁₁ – Hot water treatment for 10 min + 100 ppm GA₃ for 3 h
- T₁₂ – Hot water treatment for 15 min + 100 ppm GA₃ for 3 h

Germination (%)

Four replicates of twenty five seeds were placed in paper media adopting between paper method (Roll towel) for each stage of development and were kept under test conditions of 25±1°C and 95±2% RH maintained in a germination room illuminated with fluorescent light. After the test period of twelve days the normal seedlings were counted and the mean value was expressed as percent (ISTA, 1999).

Root and shoot length (cm)

After the germination period of 12 days, ten normal seedlings were selected at random in each of the replication and were measured for root length from the collar region to the tip of main root using measuring scale. The average of ten seedling roots was computed and expressed in centimetre. Seedlings used for measuring root length were also used for measuring shoot length (the length between collar region and tip of the primary leaf was measured and the mean was expressed in centimetre).

Dry matter production

Seedlings used for growth measurement were dried in a hot air oven maintained at 85±2°C for 24 h and cooled in a desiccator for 30 min., weighed in an electronic balance and the mean expressed as g per ten seedlings (Gupta, 1993).

Vigour index

Vigour index of seedling was calculated by adopting the method suggested by Abdul-Baki and Anderson (1973) and expressed in number.

Vigour index = Germination (per cent) × [Root length + Shoot length (cm)]

Statistical analysis

The data pertaining to the observations recorded in the laboratory were analyzed using Completely Randomized Design adopting the procedure as described by Panse and Sukhatme (1967). Whenever necessary, the suitable transformations were made before analysis. The critical difference (CD) was computed at 5% probability. Significance and non significance were denoted as * and NS, respectively.

RESULTS

In the present investigation, seed treatments imposed on senna resulted better in breaking the dormancy than the non scarified seeds. The treatment T₁₂ (Hot water for 15 min + 100 ppm GA₃ for 3 h) had recorded the maximum seed technological parameters viz., germination (98%), shoot length (9.5 cm), root length (7.2 cm), seedlings dry matter production (0.258 g per ten seedlings) and vigour index (1637). It was superior to the non scarified seeds (T₀) which recorded 20% germination, 6.2 cm as shoot length, 4.5 cm as root length, 0.105 g dry matter production per ten seedlings and 214 as vigour index. The treatment T₁₂ followed by T₁₁ in germination percentage of 95 and proved to be next best option for breaking the seed dormancy in senna. It also recorded higher vigour index of 1539 and root length of 7 cm. The treatments T₅, T₆, T₈, T₉, and T₁₀ also recorded more than 80% germination revealing that these treatments are highly favourable for removing seed dormancy. The treatment T₁ recorded 50% germination, 6.6 cm shoot length, 4.8 cm root length, 0.117 g per 10 seedlings dry matter production and 570 vigour index. The treatment T₂ recorded 56% germination, 6.8 cm shoot length, 4.9 cm root length, 0.126 g seedlings⁻¹⁰ dry matter production and 655 vigour index. The treatment T₃ recorded 61% germination, 7 cm shoot length, 5.3 cm root length, 0.131 g seedlings⁻¹⁰ dry matter production and 750 vigour index. The treatment T₄ recorded 76% germination, 7.4 cm shoot length, 5.5 cm root length, 0.135 g seedlings⁻¹⁰ dry matter production and 980 vigour index. The treatment T₅ recorded 82% germination, 7.8 cm shoot length, 6.1 cm root length, 0.149 g seedlings⁻¹⁰ dry matter production and 1140 vigour index. The treatment T₆ recorded 88% germination, 8.1 cm shoot length, 6.4 cm root length, 0.155 g seedlings⁻¹⁰ dry matter production and 1276 vigour index.

The treatment T₇ recorded 79% germination, 7.5 cm shoot length, 5.8 cm root length, 0.139 g seedlings⁻¹⁰ dry matter production and 1051 vigour index. The treatment

Table 1. Effect of different dormancy breaking treatments on physiological quality of seeds.

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g seedlings ⁻¹⁰)	Vigour index
T ₀	20	4.5	6.2	0.105	214
T ₁	50	4.8	6.6	0.117	570
T ₂	56	4.9	6.8	0.126	655
T ₃	61	5.3	7	0.131	750
T ₄	76	5.5	7.4	0.135	980
T ₅	82	6.1	7.8	0.149	1140
T ₆	88	6.4	8.1	0.155	1276
T ₇	79	5.8	7.5	0.139	1051
T ₈	85	6.3	8.1	0.152	1224
T ₉	89	6.5	8.4	0.159	1326
T ₁₀	91	6.7	8.7	0.171	1401
T ₁₁	93	7	9.2	0.188	1539
T ₁₂	98	7.2	9.5	0.258	1637
Mean	75	5.9	7.8	0.153	1059
SEd	10.7238	0.5489	0.8450	0.0300	280
CD P=0.05	22.1328	1.1329	NS	NS	578

T₈ recorded 85% germination, 8.1 cm shoot length, 6.3 cm root length, 0.152 g seedlings⁻¹⁰ dry matter production and 1224 vigour index. The treatment T₉ recorded 89% germination, 8.4 cm shoot length, 6.5 cm root length, 0.159 g seedlings⁻¹⁰ dry matter production and 1326 vigour index. The treatment T₁₀ recorded 91% germination, 8.7 cm shoot length, 6.7 cm root length, 0.171 g seedlings⁻¹⁰ dry matter production and 1401 vigour index. The treatment T₁₁ recorded 93% germination, 9.2 cm shoot length, 7 cm root length, 0.188 g seedlings⁻¹⁰ dry matter production and 1539 vigour index.

DISCUSSION

Even though all the given treatments were performed better than the non scarified seeds, the seeds of senna soaked in boiled water (100°C) for 15 min and treated with 100 ppm GA₃ recorded the highest germination of 98% accompanied with higher shoot length (7.8 cm) and root length (5.9 cm), dry matter production (0.258 g per ten seedlings) and vigour index (1637), compared to all other treatments (Table 1). The higher seed germination due to soaking in hot water might be due to the weakening of seed coat by distributing and dissolving the lignins and pectins present on epidermal layer of the seed coat, which render them impermeable to water and oxygen. The germination improvement by GA₃ treatment might be due to the activity of GA₃ as a-denovo synthesis and also helps in dormancy breaking action. The growth regulator treatments through enzymatic and hormonal mechanism stimulated metabolic processes such as sugar mobilization, protein hydrolysis, oxidation etc

(Jagadish, 1993). These results are in agreement with the findings of Kumari and Kohli (1984), Mehta and Sen (1991) and Kalavathi (1996) in *Cassia angustifolia* and Sivakumar (2005) in *Abelmoschus moschatus*.

This study clearly concluded that soaking the senna seed in boiled water (100°) for 15 min followed by 100 ppm GA₃ for 3 h had substantially improved the seed germination (98%) accompanied with longer seedlings production, dry matter production and vigour index.

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