

Effect of Seed Treatment on Germination in Sarpagandha (*Rauvolfia serpentina* Benth)

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ABSTRACT

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An experiment was carried out to know the effect of different seed treatments on seed germination in sarpagandha. The experiment was laid out in completely randomized design with seven treatments, replicated thrice. Among the different seed treatments tested, GA₃ (1000 mg L⁻¹) treatment was found to be the best, recording earliness in first and complete germination, highest values for speed of germination (1.37) and germination percentage (50 %). The GA₃ treatment resulted in 46.94 per cent reduction in number of days to complete germination, 633.93 per cent increased speed of germination and 354.55 per cent increased germination percentage over the control.

Introduction

Sarpagandha (*Rauvolfia serpentina* Benth.) is an indigenous medicinal herb of Indian continent, mentioned in ancient Indian medicinal literature, 3000 years back. Sarpagandha is having different vernacular names viz., Sarpagandha in Sanskrit, Chandrabhaga, Chandrika and Chota-Chand in Hindi, Shivanabhi balli, Sarpagandhi, Garuda paatala and Paatala gandhi in Kannada and Serpentine root, Serpentine wood and Indian snake root in English (Anon., 1956). It is used in Ayurveda, Unani, Homeopathy and Sidha systems of medicines for the treatment of high blood pressure, insomnia, cardiac diseases and a number of mental problems such as psychic disorders, mental retardation, epilepsy, agitation and

neurotic disorders, asthma, hypochondriasis, certain forms of insanity, acute stomachache and painful delivery. Juice of leaves is used as a remedy for removal of opacities of cornea. Apart from traditional use, it has been increasingly used in pharmaceutical industries.

About 30 alkaloids are known to exist in this plant. The important alkaloids are reserpine, serpentine, ajmaline, ajmalicin, rauwolfinine, recinamine and deserpidine. *Rauvolfia serpentina* continues to be an important component of traditional medicine within India, as well as the starting material for production of reserpine, with increasing demand.

Indiscriminate harvesting, loss of habitat, bio-interference, over-exploitation, *etc.* pose serious threat to its wild resources. It has been categorized as an endangered species based on the IUCN (International Union for Conservation of Nature and natural resources) Red Data Book and critically endangered in CAMP, 2001 report (Bhattarai *et al.*, 2002). Sarpagandha is banned for export except when accompanied by certificate of its cultivation. It has become necessary to develop proper agro-technology for its domestication and cultivation on scientific lines. The seed propagated crop is known to give good quality material and higher yield but, seed germination is very poor in sarpagandha. It is reported to vary from 5 to 30 per cent even when only heavy seeds (only about 10 % of normal seed lot) are chosen for sowing.

Germination of heavy seeds during May-June after soaking in water for 24 hours was 20-40 per cent. Though the seeds appear to be perfectly normal externally, the seeds exhibit very poor germination (Farooqui and Sreeramu, 2001). Hence, it is necessary to improve the seed germination, which will be of immense help for commercial cultivation of sarpagandha. With this background, the present experiment was carried out with an objective to enhance the seed germination.

Materials and Methods

The experiment was conducted at KRC College of Horticulture, Arabhavi, Gokak (Tq.) Belagavi (Dist.), Karnataka during October – December, 2015, to test the effect of different seed treatments on germination in sarpagandha. The seeds were collected from the wild stand of sarpagandha plants found in the evergreen forests of Sirsi, Uttara Kannada (Dist.), Karnataka. The fruits collected from scattered plants found in the lower storey of evergreen forests were pulped manually to

extract the seeds. Extracted seeds were washed in clean water and dried in shade. These seeds were subjected to floating test by immersing in water. The seeds which sink in water were selected for germination test. Freshly collected heavy seeds, which sink in water, were used for sowing within a week time.

The experiment comprised of seven treatments with three replications, laid out in Completely Randomized Design. The seeds were subjected to different treatments, T₁: overnight water soaking, T₂: overnight soaking of seeds in GA₃ (1000 mg l⁻¹) solution, T₃: soaking seeds in concentrated H₂SO₄ for one minute, T₄: overnight soaking of seeds in KNO₃ (1%) + HNO₃ (1%) solution, T₅: overnight soaking in cow urine (collected on the previous day), T₆: overnight soaking of seeds in cow dung slurry (cow dung : water in 1:1 ratio) and T₇ being the control (without any treatment). Hundred seeds were used for soaking in each of the treatments. The seeds after treatment were sown in protrays (of 50 wells), filled with coco peat and watered frequently based on necessity. The protrays were maintained in the indoor (ambient) condition in the laboratory.

Results and Discussion

Days to first germination

There was a significant difference among the treatments for days to first germination (Table 1). The minimum number of days taken to first germination was recorded in GA₃ (1000 mg l⁻¹) treatment (23). However, it was on par with H₂SO₄ (24.33) and cow dung slurry (26). The maximum number of days taken to first germination was recorded in control (37.67). Seed treatment with GA₃ treatment resulted in 38.94 per cent reduction in number of days take to first germination over control

Days to complete germination

Days from first germination to last germination were counted to get the days to complete germination. There was a significant difference among treatments for this parameter (Table 1). Significantly lower days to complete germination was observed in seeds treated with GA₃ (34.67) compared to rest of the treatments. The highest days to complete germination was in cow urine treatment (67.67). Comparison of means for per cent deviation revealed that, the GA₃ treatment lead to 46.94 per cent reduction in number of days to complete germination compared to control.

Speed of germination

As the high speed of germination is indication of high seed vigour, it was recorded to know the effect of seed treatments on the same. The treatments were found to differ significantly for the observed character (Table 1).

The speed of germination was significantly maximum in GA₃ treatment (1.37), followed by cow dung slurry (0.81) and KNO₃ + HNO₃ treatment (0.67). The speed of germination was significantly lower in control (0.19). The seed treatment with GA₃ increased the speed of germination by 633.93 per cent compared to control.

Germination percentage

The germinated seeds were counted and the converted into percentage. The data obtained was subjected to arc sin transformation before analysis. There was a significant difference among the treatments for germination percentage (Table 1). The significantly highest germination was recorded by GA₃ treatment (50.00 %) compared to other treatments, followed by cow dung slurry and KNO₃ + HNO₃ treatment (36.00 and 29.33 %,

respectively). The germination was minimum (11.00 %) in control. When the means of treatments were compared for per cent deviation in germination, seed treatment with GA₃ recorded 354.55 per cent increase over control.

Seed treatments have shown the variable influence on days to first germination, days to complete germination, speed of germination and germination percentage. All the seed treatments proved the early germination over control and there was a significant difference among the treatments for days to first germination.

The minimum number of days taken to first germination was in GA₃ (1000 mg l⁻¹) treatment (23 days) which was however, on par with H₂SO₄ (24.33 days), and KNO₃ + HNO₃ treatment (27 days). The delayed germination was in the control (37.67 days). Comparison of treatments means revealed that, the seeds treated with GA₃ took 38.94 per cent lower days to first germination, when compared to control. The earlier germination in GA₃ treatment might be attributed to the conversion of reserve food material into available simple sugar form by early induction of protein, α - amylase, in aleurone layer by forming m-RNA for protein (α - amylase) synthesis and inhibitory action of exogenously applied gibberellins on IBA present in seeds, leading to early germination (Bewley and Black, 1994).

Acid scarification increased the seed germination by improving seed permeability and removing the blockage of gaseous exchange, which might have improved the imbibition and respiration. This early availability of water and oxygen might have induced the early germination. Similar results have been reported by Ponkumar *et al.*, (2008) in sarpagandha, Bhuse *et al.*, (2001) and Moorthy *et al.*, (2005) in senna.

Table.1 Seed germination as influenced by seed treatment in sarpagandha

Treatment	Days to first germination		Days to complete germination		Speed of Germination		Germination (%)	
	mean	Per cent deviation*	mean	Per cent deviation*	mean	Per cent deviation*	mean	Per cent deviation*
T ₁ : Water soaking	35.33	-6.19	60.33	-7.65	0.32	+69.64	16.67 (23.85)	+51.52
T ₂ : GA ₃ (1000 mg l ⁻¹)	23.00	-38.94	34.67	-46.94	1.37	+633.93	50.00 (45.00)	+354.55
T ₃ : Conc. H ₂ SO ₄ (for 1 min.)	24.33	-35.40	54.00	-17.35	0.47	+150.00	20.00 (26.45)	+81.82
T ₄ : KNO ₃ + HNO ₃ (1% each)	27.00	-28.32	55.33	-15.31	0.67	+258.93	29.33 (32.72)	+166.67
T ₅ : Cow urine treatment	31.33	-16.81	67.67	+3.57	0.32	+69.64	17.00 (24.29)	+54.55
T ₆ : Cow dung treatment	26.00	-30.97	58.00	-11.22	0.81	+332.14	36.00 (36.85)	+227.27
T ₇ : Control	37.67	-	65.33	-	0.19	-	11.00 (19.19)	-
S.Em ±	0.83	-	1.66	-	0.02	-	0.71	-
C.D. at 1 %	3.48	-	6.98	-	0.07	-	3.00	-
CV (%)	4.89	-	5.08	-	4.99	-	4.80	-

*Per cent deviation for the pooled mean of respective treatment over control

The speed of germination was significantly higher in GA₃ treatment (1.37) followed by cow dung slurry (0.81) and KNO₃ + HNO₃ treatment (0.67) whereas, the lowest was observed in control (0.19). The seed treatment with GA₃ increased the speed of germination by 633.93 per cent compared to control. Improved speed of germination in GA₃ may be due to increased GA: ABA ratio in the seeds by exogenous application of GA₃ which could have overcome the inhibitory effect of ABA present in seeds and inhibition of mRNA synthesis which might have been accelerated by gibberellins (Bewley and Black, 1994).

There was a differential response among seed treatments for days to complete germination. The treatments were differing significantly and induced early completion of germination. The data revealed that, days to complete germination was minimum in GA₃ treatment (34.67), followed by H₂SO₄ treatment (54 days) compared to control (65.33 days). The GA₃ treatment led to 46.94 per cent reduction in number of days to complete germination over control. The early completion of germination may be attributed to enhanced early germination in GA₃ treatment due to quicker imbibitions and mobilization of reserve food in seed.

With respect to germination percentage, the maximum germination was in GA₃ treatment (50 %) which was significantly higher than rest of the treatments. The lowest germination was observed in control (11 %). Seed treatment with GA₃ recorded 354.55 per cent more germination over control. The highest percentage of germination observed in GA₃ might be due to efficient utilization of limited food reserve present in the seeds by early induction of α - amylase activity. Similar results have been reported by Bhuyar *et al.*, (2000) and Ponkumar *et al.*, (2008) in *Rauvolfia serpentina*, Bhuse *et al.*, (2001) in

senna, Mithra and Ghosh (2004) in aswagandha. Whereas, Paul, *et al.*, (2008) reported that, none of the chemical or acid seed treatments improved germination percentage significantly in sarpagandha. The germination percentages of treated *Rauvolfia tetraphylla* seeds were improved to 52.70 per cent (KNO₃) and 56.66 per cent (GA₃) as compared to 31.26 per cent in untreated seeds (Hussain and Jha, 2014).

Among the different seed treatments tested in sarpagandha, GA₃ (1000 mg L⁻¹) treatment was found to be the best, recording early germination, highest values for speed of germination, germination percentage, shoot and root length and vigour index. The GA₃ treatment resulted in 46.94 per cent reduction in number of days to complete germination, 633.93 per cent increased speed of germination, and 354.55 per cent increased germination percentage over the control.

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