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Journal of Horticulture Science and Forestry

RESEARCH ARTICLE

# Simple Method of Improved Seed Germination in *Datura metel* L.

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**Citation:** Bisht VK, Dhutraj SB, Uniyal RC, Pathak JM (2019) Simple Method of Improved Seed Germination in *Datura metel* L. J Hortic Sci For 1: 201

## Abstract

This study was carried out to improve germination of *Datura metel* through simple means. Seed were collected from the physiologically ripen fruits of healthy plants and were sterilization with 0.04% of mercuric chloride, before subjected to different pre-sowing treatments. The treatments include hot and cold water scarification for 24 h, $T_1$: 80 °C, $T_2$: 60 °C, $T_3$: 40 °C, $T_4$: 5 °C; cow urine scarification at different concentrations for 24 h, $T_5$: 100%, $T_6$: 50%, $T_7$: 25%. For control seeds were not treated. Minimum days to initiation of germination was recorded in treatment $T_4$ (9.33±0.58 days) while for control it was 20.66±2.52 days. Highest germination of 76.67% was also achieved in $T_4$ with minimum MGT and maximum germination rate. While for hot water treatment and cow urine treatment the G, MGT and GR was found comparable with control. Based on the findings of the present study, cold water treatment is recommended for obtaining higher germination.

**Keywords:** *Datura Metel*; Germination; MGT; Germination Rate

## Introduction

The downy thorn apple (*Datura metel* L.) belongs to family Solanaceae is high value medicinal plants. It is useful in tuberculosis and bronchitis and given for relieving cough and asthma. Seeds of *D. metel* have been shown to remain dormant in the soil for many months. Moreover, *Datura* spp. shows poor and irregular germination and presence of a Scopolamine (an inhibitor) is responsible it [1]. Seeds character is considered key ecological trait that influence its germination and hence the regeneration strategy [2]. It is well known fact that, the seed coat (testa) of *Datura* is permeable to water and hence the seed dormancy was apparently not due to a lack of water imbibition [3]. Brown and Bridglall [3] have also shown that the endosperm was responsible for preventing radicle emergence rather than testa and endothelium. The endosperm of seeds imposes dormancy by acting as a mechanical barrier to embryo growth [4]. There are many reports that indicated that pre-sowing seed imbibition significantly improves the seed germination in various species [5,6]. It is well understood that imbibition of seeds before sowing amplifies the germination through softening of the seed coat and exclusion of inhibitors [7].

In preliminary trial, it was observed that, the seeds of *D. metel* requires > 50 days to start germination if sown in summer season while, requires <22 days for winter season to start germination (data not published). Thus, it is assumed that, winter season is favorable for seed germination. However, the germination was very low in both the summer and winter season and indicating that some constraint are inhibiting germination. Keeping these facts in mind, the present study was carried out to explore the easy and eco-friendly pre-sowing seed treatment to improve seed germination in *D. metel.*

## Materials and Methods

Fruits were collected from a research farm of Zandu Foundation for Health Care, Ambach, Gujarat (20.40 °N latitude and 72.98 °E longitude; altitude: 15 meter above mean sea level). Seeds were removed from capsules and subjected to surface sterilization using 0.04% mercuric chloride aqueous solution ($HgCl_2$) for 20 seconds to remove any fungal infection and then were rinsed thoroughly with distilled water. There were 7 treatments each replicated thrice with 30 seeds. The experimental details are presented in Table 1. All germination test were done by sowing seeds at a depth of 1 cm in the Black coloured root trainers filled with Soil, FYM and Vermicompost in 3:2:1 ratio in shaded nursery condition in the month of November 2018 and were watered regularly (Figure 1). Experiment was monitored till the final germination was recorded. During the period of experimentation, the average maximum and minimum temperature under shade net-house condition was 25.91 °C and 22.04 °C respectively, while the average

maximum and minimum relative humidity was 63.54% and 59.94% respectively. Seed germination was evaluated at each day till final germination recorded. Time to first observed germinant (T) in days, time to maximum germination ($T_{100}$) in days and Germination percent (G) were calculated following Bisht, *et al.* [6]. Mean germination time (MGT) was calculated following Nichols and Heydecker [8] as $MGT = \Sigma(fn)/\Sigma n$; where, n is the number of newly germinated seeds on each day and *f* is the number of days after seeds were set to germinate; and germination rate (GR) was calculated following Roselle and Mayol [9] as $M_n/M_g - I_g$; where, $M_n$ is maximum number of germinants, $M_g$ is days to maximum germination and $I_g$ is days to initial germination.

| Treatments | Method | Duration |
|---|---|---|
| **Control** | Seeds were not treated | - |
| $T_1$ | Soaking of seeds in hot water (80 °C) | Left to cool gradually at room temperature for 24 h |
| $T_2$ | Soaking of seeds in hot water (60 °C) | Left to cool gradually at room temperature for 24 h |
| $T_3$ | Soaking of seeds in hot water (40 °C) | Left to cool gradually at room temperature for 24 h |
| $T_4$ | Soaking of seeds in cold water (5 °C) | Left for 24h at room temperature |
| $T_5$ | Soaking of seeds in Cow urine (100%) | 24 h at room temperature |
| $T_6$ | Soaking of seeds in Cow urine (50%) | 24 h at room temperature |
| $T_7$ | Soaking of seeds in Cow urine (25%) | 24 h at room temperature |

**Table 1:** Details of the different treatments applied to examine seed germination in *D. metel*


**Figure 1: A:** Seed germination; **B:** Seedlings; **C:** Mature plant of *D. metel*

## Results and Discussion

In our preliminary trial it was observed that, the seeds of *D. metel* requires > 50 days to start germination in summer season, while in present study, days require for initiation of germination in control is 20.66±2.52 days, which is reduced by ~55% in $T_4$ (9.33±0.58 days), and 45-50% for other treatments (10.33±0.58 to 11.33±0.58 days). Results of the germination study are presented in Figure 2. Highest germination of 76.67±8.82% was achieved in $T_4$ followed by 61.11±10.72% in $T_2$, 56.56±3.85% in $T_1$ and minimum of 40.00±11.55% in $T_5$. For control it was 44.33±5.77%. Germination of seeds with different treatments reveals significant improvement as compared to control except for $T_5$ and $T_7$ ($P < 0.05$). The highest G, GR, T and $T_{100}$ and lowest MGT was achieved in $T_4$. While for other treatment, the G, MGT and GR was found comparable with control. Time to initiate germination (T), time to maximum germination ($T_{100}$) and Mean Germination time (MGT) of seeds with different treatments reveals significant decrease in time as compared to control for all the treatments ($P < 0.05$) (Figure 3).

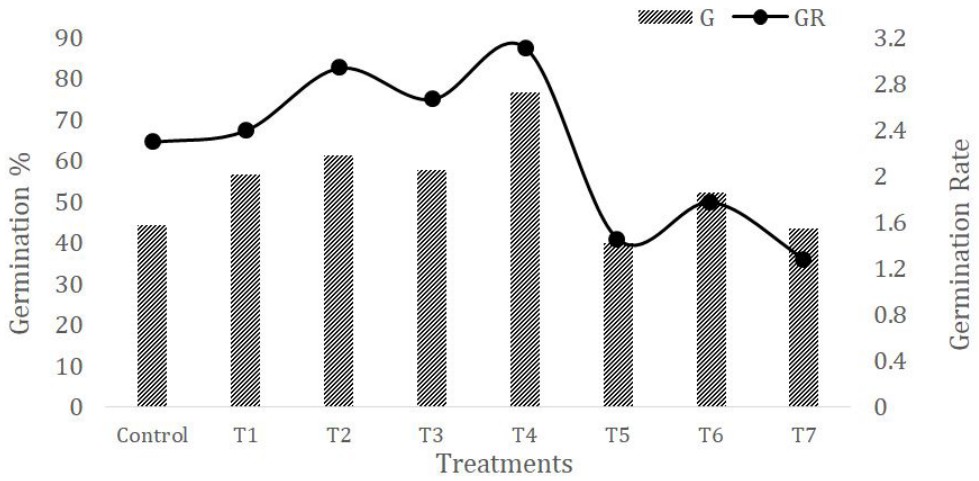


**Figure 2:** Effect of pre sowing treatments on time Germination % (G; Bars) and germination rate (GR; lines) for seeds of *D. metel*

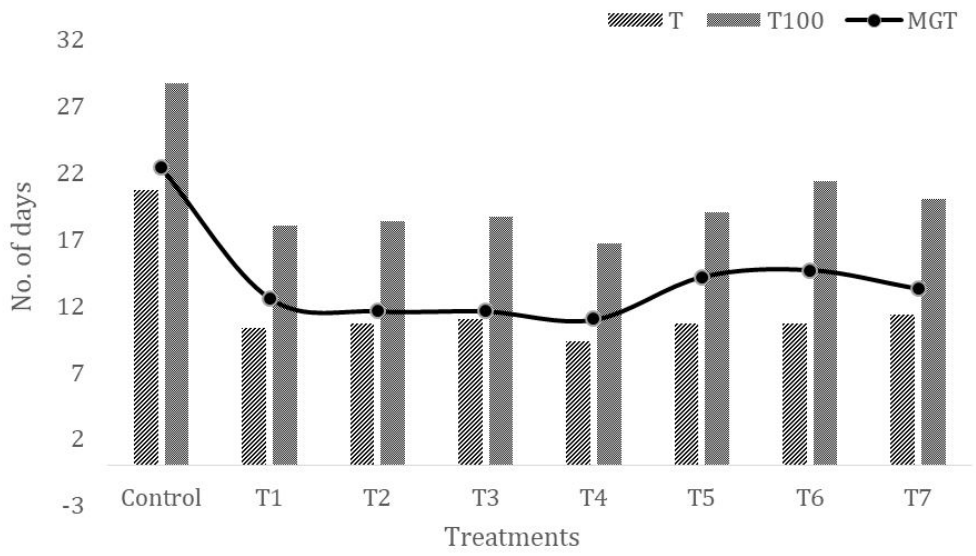


**Figure 3:** Effect of pre sowing treatments on time to first observed germinant (T) and time to maximum germinant ($T_{100}$) (bars) and mean germination time (MGT; lines) for seeds of *D. metel*

It was observed that, hot water treatment ($T_1$, $T_2$ and $T_3$) also improve the germination but was comparable to control. Stoll [10] reported that heat treatment of Cowpea at 65 °C for 5 m did not significantly alter germination percentage. Likewise, the germination does not improved by bio-scarification (soaking of seeds in different concentrations of cow urine; treatment $T_5$, $T_6$ and $T_7$) and hence, not found to be suitable for improving seed germination in *D. metel*.

It is reported that, the seeds of *Datura* sp. requires 10 days to incubate when the testa was removed [3]. Here in present study, we have achieved this without removing testa from seed for all the treatments. This indicated that, pre-sowing seed imbibition and lower soil temperature reduces the germination time and thus, there is no need to remove testa from the seeds to expedite germination. Moreover, the germination in *Datura* was reported to indifferent to light and dark [11] and seeds incubated in the dark showed higher germination [3]. In present study, the seeds were shown in black coloured root trainers and the comparably higher germination obtained also support the facts that *Datura* seeds requires dark conditions for better germination.

It is observed in our earlier study that, the seeds of *D. metel* showed average germination of < 45% during the summer months (data not published). However in present study carried out in winter showed 40.00 to 76.67% germination for different treatments. Higher germination with reduced MGT in most of the treatments in present study may be attributed to the fact that the seeds dormancy in *D. metel* was reduced during winter and induced during summer, thus, showed adaptive characteristics typical for a summer annual species. Thus, have limited range of environmental conditions for germination and indicated that seeds are conditionally dormant. This type of physiological dormancy (embryo dormancy) need special treatment to resume metabolic activity and required cold temperature application of less than 7 °C to break dormancy [12]. A similar result has been reported for *Solanum nigrum* [13]. Induction of seasonal dormancy in *D. metel* mainly occurred during summer after seeds had experienced high temperature in soil. Taab [14] also reported that high soil temperature induced dormancy in *Solanum nigrum* and *S. physalifolium*.

The reduced time to initiate germination (T) and to achieve maximum germination ($T_{100}$) in present study indicated that, the seeds may need low temperature to facilitate germination, which in natural conditions is achieved during winter. Highest germination with reduced MGT and highest GR in cold water treatment ($T_4$) also support the theory that the seeds of *D. metel* require low temperature to resume metabolic activity which initiate germination. This phenomenon of *Datura* seeds to germinate quickly in winters may seems to be adaptive characteristic as it gives low risk to seedlings establishment and warmer environment for its vegetative growth, flowering and fruiting. In colder regions it may achieve naturally during winters, but for South Gujarat region, where temperature does not drops down to chilling effect, pre-sowing treatment of seeds with cold water treatment is recommended for better germination.

## Disclosure of Potential Conflict of Interest

The authors declare that they have no conflict of interest.

## Research involving human participation and/or animals

This article does not contain any studies with human participants or animals performed by any of the authors.

## References

1. Mallick GK, Sasmal B (1997) Effect of EMS on germination of Datura seeds. Phytobreedon 13: 46-8.

2. Bisht VK, Kuniyal CP, Negi JS, Bhandari AK, Bhatt VP (2016) Variation in the seed germination in Sapindus mukorossi in relation to tree age dependent seed vigour. Natl Acad Sci Lett 39: 379-82.

3. Brown NAC, Bridglall SS (1987) Preliminary studies of seed dormancy in Datura stramonium. S Afr J Bot 53: 107-9.

4. Ikuma H, Thimann KV (1963) The role of seed coats in germination of photosensitive lettuce seeds. Plant Cell Physiol 4: 169-85.

5. Bhatt A, Rawal RS, Dhar U (2005) Germination improvement in Swertia angustifolia: a high value medicinal plant of Himalaya. Curr Sci 89: 1008-12.

6. Bisht VK, Negi JS, Bhandari AK, Bhatt VP, Kandari LS (2017) Effect of pre-sowing treatment on seed germination behaviour of Hedychium spicatum Buch.-Ham ex Smith. Proc Natl Acad Sci India Sect B: Biol Sci 87: 53-8.

7. Hartmann HT, Kester DE (1979) Plant propagation: principles and practices, (4th Edition) Prentice Hall of India Ltd., New Delhi.

8. Nichols MA, Heydecker W (1968) Two approaches to the study of germination data. Proc Int Seed Test Assoc 33: 531-40.

9. Rossello JA, Mayol M (2002) Seed germination and reproductive features of Lysimachia minoricensis (Primulaceae), a wild-extinct plant. Ann Bot 89: 559-62.

10. Stoll G (2000) Natural Crop protection in the Tropical Letting Information Come to Life. (2nd Edition) Margraf Verlag PP. 387.

11. Kinzel W (1926) Frost und licht, neue tabellen. Eugen Ulmer, Stuttgart.

12. Bradford KJ, Chen F, Cooley MB (1999) Gene expression prior to radicle emergence in imbibed tomato seeds. In: Black M, Bradford KJ, Vazquez-Ramos J (eds.) Seed Biology advances and Applications. Proceedings of the sixth International Workshop on Seeds, Merida, México.

13. Baskin CC, Milberg P, Andersson L, Baskin JM (2001) Seed dormancy-breaking and germination requirements of Drosera anglica, an insectivorous species of the North Hemisphere. Acta Oecologica 22: 1-8.

14. Taab A (2009) Seed dormancy and germination in Solanum nigrum and S. physalifolium as influenced by temperature conditions. Swedish University of Agricultural Sciences, Uppsala.