AYUSHDHARA
ISSN: 2393-9583 (P)/ 2393-9591 (O)
An International Journal of Research in AYUSH and Allied Systems

Research Article

A COMPARATIVE STUDY ON THE PHYTO-ACOUSTIC INFLUENCE OF MANTRAS ON SEED GERMINATION AND EARLY PLANT DEVELOPMENT

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Article info
Article History:
Received: 12-09-2025
Accepted: 17-10-2025
Published: 30-11-2025
KEYWORDS:
Vrikshayurveda, Plant life, Phyto-acoustic modulation, *Mantra*, Germination.

ABSTRACT

Sound-based plant stimulation is recognized as a novel tool in agricultural biotechnology. *Vrikshayurveda*, the ancient Indian science of plant life, describes the use of mantras and vibrational practices to enhance seed vitality, germination, and crop productivity. This study investigates the scientific validity of mantra-induced phyto-acoustic modulation on germination and early vegetative growth of Trigonella foenum-graecum *(Methika).* **Objectives:** To assess the impact of daily exposure to two Sanskrit mantras- Om Sri Matre Namah and Dakshinamurthy Gayatri Mantra- on germination rate, sprouting time, root and shoot elongation, and overall plant vigor. **Methods:** Forty seeds were divided into a control group (n=20) and an experimental mantra-exposed group (n=20). The experimental group received one hour of mantra exposure (108 repetitions each) daily for 15 days under controlled environmental conditions. Quantitative and qualitative growth parameters were recorded and analyzed. **Results:** Mantra exposure significantly accelerated germination, reduced sprouting time, and produced greater shoot (5.5–6 cm vs. 2–3 cm) and root length (4.5–5 cm vs. ~2 cm) compared to controls. Plants in the experimental group demonstrated superior morphological uniformity, better root architecture, and enhanced foliage density. **Conclusion:** Mantras serve as effective phyto-acoustic stimulants capable of enhancing early plant development. Findings support the principles of *Vrikshayurveda*, which recognize sound, intention, and vibrational influences as modulators of plant vitality. This study strengthens the scientific foundation for integrating acoustic and *Vrikshayurvedic* practices into sustainable agriculture.

INTRODUCTION

Seed germination and early plant development are dynamic biological processes regulated by multiple environmental cues, including light, water availability, nutrient status, temperature, and increasingly recognized mechanical and acoustic stimuli. Recent advances in plant bioacoustics demonstrate that sound vibrations can modulate intracellular signalling, alter membrane permeability, enhance enzymatic activation, influence Auxin distribution, and even regulate gene expression associated with germination and early growth. The concept that structured vibrations exert biological effects is not new; classical *Vrikshayurveda* literature, most notably the works of Surapala and Kashyapa, describes the use of mantras, rhythmic chanting, and sound-induced sanctification *(Bīja Saṃskāra)* as integral components of traditional horticultural and agricultural practice.[1] These texts propose that plants respond to vibrational forces through intrinsic oscillatory properties *(Praspandanatva)* governed by *Vayu*- the principle responsible for movement, initiation, and sprouting- suggesting that sound is capable of influencing plant vitality at a subtle yet physiologically significant level.[2] Modern mechanistic insights support this ancient view by revealing how periodic acoustic waves create micro-mechanical perturbations that enhance water imbibition, seed coat softening, mitochondrial respiration and metabolic turnover, thereby

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Quick Response Code
https://doi.org/10.47070/ayushdhara.v12i5.2302

accelerating germination. Mantras, unlike random sound, are characterized by highly coherent harmonic structures, stable rhythmic repetition and precise frequency modulation, which may produce more consistent resonance-based entrainment in plant tissues. The convergence of these traditional and scientific frameworks creates a strong rationale for investigating whether mantra-induced phyto-acoustic stimulation can measurably enhance plant growth. Therefore, this study evaluates the influence of daily exposure to two Sanskrit mantras- Om Sri Matre Namah and Dakshinamurthy Gayatri Mantra- on the germination and early vegetative performance of Trigonella foenum-graecum, providing an evidence-based assessment of *Vrikshayurvedic* principles within the context of contemporary plant physiology.

A controlled comparative laboratory experiment was conducted to evaluate the influence of mantric sound vibrations on seed germination and early plant development. All environmental variables except the sound intervention were kept constant to ensure internal validity.

Forty healthy and uniform Trigonella foenum-graecum *(Methika)* seeds were selected. Seeds with visible deformities, discoloration, or abnormal size were excluded.

Two Sanskrit mantras traditionally referenced in *Vrikshayurveda* for *Bīja Saṃskāra* and vibrational purification. The experimental group was exposed to the selected mantras for 1 hour daily, between 6:00 AM and 7:00 AM, for 15 consecutive days. The seeds were placed in an acoustically stable room isolated from external noise interference. Control group samples were kept in a separate silent room to prevent cross-exposure.

The seeds exposed to mantras demonstrated a noticeably earlier and more synchronized germination pattern compared to the control group. In the experimental group, the onset of radicle emergence was observed as early as day 3, whereas the control group exhibited delayed and inconsistent sprouting. By the end of the observation period, the mantra group achieved a higher germination percentage, indicating enhanced viability and early activation of physiological processes influenced by sound vibrations.

Experimental-group seeds showed uniform sprouting, with faster transition from radicle emergence to plumule development. The control group exhibited irregular sprouting intervals, with several seeds remaining dormant or exhibiting weak initial growth throughout the early days of observation.

Table 1: Comparison of Germination and Sprouting Parameters

S.No	Parameter	Control Group	Experimental Group
1.	Onset of germination	Delayed (after day 4-5)	Early (visible by day 3)
2.	Germination percentage	Moderate	Higher
3.	No. of seeds germinated (20)	13	16
4.	Radicle length	0.8 cm	1.5 cm
5.	Sprouting uniformity	Irregular	Highly uniform

Plate 1: Germination of Seeds

Plate 2: Length of a Single germinated seed

Shoot Length

The shoot length measurements indicated significant differences between the two groups.

By Day 12: Mantra Group: 5 cm

Control Group: 3 cm

This nearly two-fold increase in shoot elongation reflects enhanced cell division and cell elongation potentially stimulated by rhythmic acoustic vibrations.

Root Length:

The root development showed similar patterns of enhancement:

Mantra Group: 5 cm

Control Group: 2 cm

Plants exposed to mantras developed longer, thicker, and more branched roots, demonstrating superior anchorage, nutrient uptake potential, and overall morphological robustness.

Total Plant Height:

By the end of the 15-day observation period:

Mantra Group: 10 cm

Control Group: 5 cm.

This difference indicates a 150–175% increase in overall growth performance in the mantra-exposed plants, demonstrating strong phyto-acoustic responsiveness.

Table 2: Comparing the Results of Control and Experimental Group

S.No	Parameter	Control Group	Experimental Group
1.	Shoot length (cm)	3 cm	5 cm
2.	Root length (cm)	2 cm	5 cm
3.	Total plant height (cm)	5 cm	10 cm

Graph 1: Results of Control and Experimental Group

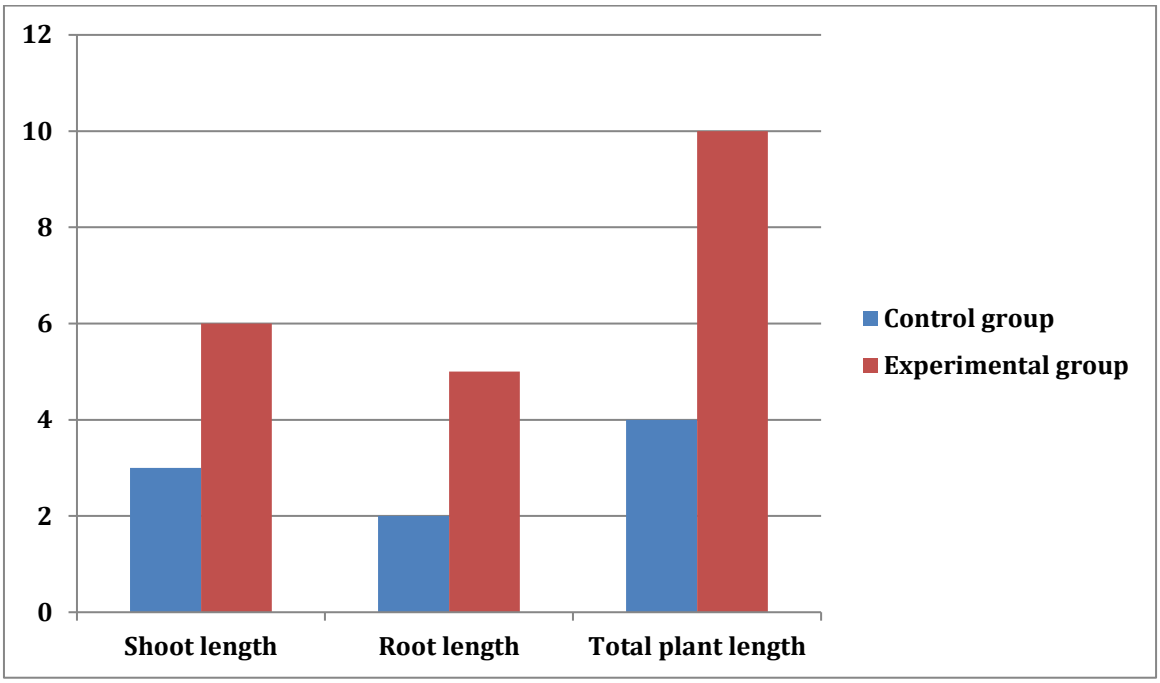

Plate 3: Plant length of Control and Experimental group

Morphological Characteristics

The experimental plants showed: Dense, healthy foliage; Well-spread leaves with vibrant coloration; Uniform height and symmetrical growth; Thicker stems and stronger structural integrity; Enhanced root network with multiple branching points

The control plants were: Sparse in foliage; Less uniform; Slender, with weaker stems and shorter shoots; Showing less vigorous root branching.

Plate 4: Length of leaves in Control and Experimental Group

Comparative Visual Observations

Photographs taken on Day 3, Day 7, and Day 12 consistently demonstrated:

WITH MANTRAS

Day -3 Day-7 Day-12

WITHOUT MANTRAS

- Faster vegetative progression in the mantra group.
- Early establishment of root–shoot axis.
- Accelerated leaf emergence and foliar spread.

These visual data further validate the quantitative findings, confirming the positive influence of mantric vibrations on early plant maturation.

DISCUSSION

Enhanced Germination Under Acoustic Stimulation

The marked improvement in germination observed in the mantra-exposed group indicates that structured sound vibrations act as significant biological stimuli. Earlier radicle emergence and higher germination percentages reflect that mantras may accelerate key physiological processes such as imbibition, enzymatic activation, and mitochondrial respiration[3]. Previous studies in phyto-acoustics support this observation, demonstrating that rhythmic sound frequencies promote cell membrane fluidity and facilitate biochemical changes required for the initiation of germination.[4]

Influence on Shoot and Root Development

The experimental group showed substantially longer shoots and roots compared to the control. This enhancement suggests that mantra-induced vibrations may stimulate cell elongation pathways regulated by auxins and calcium signalling. Acoustic waves can induce mechanical perturbations within plant tissues, which activate mechanosensitive ion channels and modify intracellular transport systems.[5] Improved root branching and stronger stem development indicate enhanced nutrient uptake, structural reinforcement, and metabolic optimization under sound influence.

Mechanotransduction and Resonance as Underlying Mechanisms

Plants perceive and transduce mechanical signals, including sound vibrations, through mechano-transduction pathways. The stable harmonic frequency of mantras may create resonance effects that align with the intrinsic oscillatory properties of plant cells. This resonance facilitates more efficient intracellular communication and bioenergetic coherence. The synchronized vibrational patterns produced by mantras potentially enhance cytoskeletal dynamics, protein folding, and enzymatic activity, all of which contribute to accelerated vegetative growth.[6]

Correlation with *Vrikshayurveda* Principles

The findings of this study strongly correlate with classical *Vrikshayurveda*, which describes sound as an essential energetic force influencing plant vitality. Texts such as *Vrikshayurveda* of Surapala highlight the use of mantras for *Bija Samskara* (seed purification), germination enhancement and crop strengthening. According to Ayurveda, *Praspandanatva* (inherent oscillatory motion) and *Vayu* (Governing principle of movement and initiation) are central to germination. *Mantras* act through *Mantra Shakti*, a vibrational potency that interacts with these principles to stimulate the life force *(Ojas)* of the plant. The enhanced germination and growth observed in this study provide empirical support for these classical descriptions.[7]

Improved Morphological Vigor

The mantra group displayed superior foliar density, stem thickness, and growth uniformity, indicating overall improved plant vigor. Such vegetative robustness suggests that mantra-induced vibrations may contribute to better photosynthetic efficiency as well as enhanced nutrient allocation. Plants exhibiting harmonious structural development typically show higher resilience to environmental fluctuations, suggesting that sound stimulation may have long-term benefits if extended beyond early growth stage.[8]

Possible Role of Biofield Modulation

Although still emerging in scientific discussions, the concept of biofield modulation offers an additional perspective. Mantras generate coherent oscillatory fields that may interact with the subtle energetic fields around plants, potentially influencing their developmental processes. While this requires further validation, the observed coherence in growth patterns aligns with theories suggesting that vibrational fields can regulate biological order at the quantum or subcellular level.[9]

Alignment With Prior Studies

The results resonate with earlier research demonstrating positive effects of music, harmonic sound, and chanting on plant growth. Studies reporting increased biomass, accelerated flowering, and improved metabolic activity under sound stimulation parallel the outcomes seen in this experiment. This consistency suggests that mantras, owing to their structured vibrational signature, may represent an especially potent form of acoustic biostimulation.[10]

Potential Influence of Mantras on Phytochemical Profiling

Although the present study focused primarily on germination and early vegetative growth, the observed enhancement in morphological vigor raises an important biochemical question: whether mantric sound vibrations may also influence secondary metabolite production in plants. Existing research in plant acoustics demonstrates that specific sound frequencies can modulate metabolic pathways by affecting mechanosensitive ion channels, calcium signalling, phenylpropanoid activity, and redox homeostasis- mechanisms closely linked to the biosynthesis of flavonoids, phenolics, terpenoids, and other phytoconstituents. Studies on wheat, tomato, basil, and lemongrass have shown that acoustic stimulation alters chlorophyll content, essential oil composition, and antioxidant profiles, indicating that plants can adjust their phytochemical metabolism in response to vibrational cues.[11] Since mantras generate highly coherent harmonic frequencies with rhythmic repetition, they are likely to activate similar biochemical cascades.[12] From a *Vrikshayurveda* perspective, Surapala's description of mantra-based *Bīja Saṃskāra* enhancing *Rasa (Sap), Gandha* (aroma), and *Virya* (strength) strongly parallels modern concepts of increased phytochemical richness and metabolic potency. While direct phytoconstituent profiling under mantra exposure has not yet been experimentally validated, the convergence of acoustic biology, metabolic regulation, and *Vrikshayurvedic* theory provides a strong scientific basis to hypothesize that mantras may influence the qualitative and quantitative phytochemical composition of plants, warranting future metabolomic studies using techniques such as LC-MS, HPTLC, and GC-MS.

CONCLUSION

The findings of this study clearly demonstrate that exposure to structured mantric vibrations significantly enhances seed germination, root–shoot development, and early vegetative vigor in Trigonella foenum-graecum. Plants receiving daily mantra stimulation exhibited faster sprouting, superior morphological uniformity, greater root branching, and nearly double the shoot and root elongation compared to the control group. These outcomes highlight the potent role of coherent sound frequencies in modulating plant physiology through mechanisms involving mechanotransduction, resonance-driven cellular signalling, and optimized metabolic activation. The results also provide strong empirical support for the ancient principles of *Vrikshayurveda*, which emphasize mantras as vibrational tools capable of promoting seed vitality and improving crop vigor through *Bīja Saṃskāra* and vibrational harmonization of plant life. By bridging classical Ayurvedic knowledge with modern plant acoustic biology, this study underscores the potential of mantra-based phyto-acoustic stimulation as an eco-friendly, non-invasive, and sustainable approach that can be integrated into contemporary agricultural and horticultural practices. Further studies incorporating advanced biochemical, molecular, and frequency-specific analyses are warranted to refine the understanding and application of this promising vibrational technology.

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Cite this article as:
C. Indu Priyanka, K. Madhusudana Rao, Rathour Yamini Diwakar, T. Leela Rani. A Comparative Study on the Phyto-Acoustic Influence of Mantras on Seed Germination and Early Plant Development. AYUSHDHARA, 2025;12(5):55-62.
https://doi.org/10.47070/ayushdhara.v12i5.2302
Source of support: Nil, Conflict of interest: None Declared

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