
**ISSN Print:** 2664-844X
**ISSN Online:** 2664-8458
NAAS Rating (2026): 4.97
IJAFS 2026; 8(7): 362-367
www.agriculturaljournals.com
Received: 23-04-2026
Accepted: 28-05-2026

**Chena G Panchal**
Assistant Research Scientist, Department of Soil Science and Agriculture Chemistry, Gujarat Natural Farming Science University, Halol, Gujarat, India

**Krupali B Ramanuj**
Assistant Research Scientist, Department of Agriculture Microbiology, Gujarat Natural Farming Science University, Halol, Gujarat, India

**Gopal D Vadodariya**
Associate Professor, College of Natural Farming, Gujarat Natural Farming Science University, Halol

**Alpesh A Bhimani**
Assistant Research Scientist, Department of Agriculture Microbiology, Gujarat Natural Farming Science University, Halol, Gujarat, India

**Vaishali Patel**
Laboratory Technician, Department of Agriculture Microbiology, Gujarat Natural Farming Science University, Halol, Gujarat, India

**Dr. CK Timbadiya**
Vice Chancellor, Gujarat Natural Farming Science University, Halol, Gujarat, India

**Corresponding Author:**
**Chena G Panchal**
Assistant Research Scientist, Department of Soil Science and Agriculture Chemistry, Gujarat Natural Farming Science University, Halol, Gujarat, India

# Comparative effects of natural farming concoctions on seed germination and early seedling growth of groundnut (*Arachis hypogaea* L.)

**Chena G Panchal, Krupali B Ramanuj, Gopal D Vadodariya, Alpesh A Bhimani, Vaishali Patel and CK Timbadiya**

**DOI:** https://www.doi.org/10.33545/2664844X.2026.v8.i7e.1700

**Abstract**
A pot study trial was carried out at the laboratory facility at Gujarat Natural Farming Science University, Halol. The aim of the study was to evaluate the effect of *Jeevamrit* and clusterbean powder-based formulation on seedling germination of *Arachis hypogea* (L.). Pot study setup was prepared and groundnuts were sown in three different treatment pots namely Natural soil, *Jeevamrit*+natural soil and Clusterbean Raw Powder Based Formulation. Parameters recorded were Germination percentage, Seed Vigour Index, Root length and Shoot length. Among the treatments, *Jeevamrit* + Natural Soil recorded the highest germination percentage (80%), seed vigour index (2712), root length (22 cm) and shoot length (17 cm). The Natural Soil treatment recorded intermediate values with 72% germination, seed vigour index of 2160, root length of 16 cm and shoot length of 15 cm. The lowest performance was observed in the Clusterbean Raw Powder Based Formulation, which recorded 60% germination, seed vigour index of 1364, root length of 6 cm and shoot length of 12 cm. These findings suggest that *Jeevamrit* application created more favourable conditions for early seed germination and seedling establishment than the other treatments. The consistent superiority of *Jeevamrit* across all measured parameters indicates its positive influence on early crop growth and development. For better growth performance of groundnut it is recommended to apply *Jeevamrit* at every irrigation.

**Keywords:** Groundnut, *Jeevamrit*, Clusterbean formulation, germination, seed vigour

## 1. Introduction
Groundnut (*Arachis hypogaea* L.), commonly referred to as peanut, earthnut, monkey nut, or goober, is an important annual leguminous crop cultivated worldwide. Its seeds are rich in essential nutrients, including vitamin E, niacin, folate, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine, and potassium, making them a valuable component of human diets. Groundnut kernels are consumed in various forms such as raw, roasted, or boiled, while the extracted oil is widely used for cooking and food preparation. In addition to its role as a food crop, groundnut serves as livestock feed through the use of seeds, oil cake, green fodder, and straw. The crop also contributes to several industrial applications, particularly through the utilization of oil cakes and organic fertilizers. Since seeds are the primary means of crop propagation and account for the production of nearly 90% of agricultural crops globally, maintaining seed quality is essential for achieving vigorous plant growth and higher yields. However, seed quality is often compromised by fungal contamination, and studies have indicated that approximately one-quarter of the world's crop production is affected by mould and fungal infestation [1]. As a leguminous crop, groundnut contributes significantly to soil health by fixing atmospheric nitrogen through symbiotic microorganisms, thereby enhancing soil fertility and supporting sustainable agricultural production. This natural nitrogen fixation reduces the dependence on synthetic fertilizers and promotes environmentally friendly farming practices. Among all agricultural inputs, seed is considered the most fundamental component and has a decisive influence on crop establishment, growth, and productivity, including in groundnut cultivation. The use of high-quality seed, combined with appropriate management practices and inputs such as fertilizers, irrigation, and farm machinery, is essential for achieving higher yields and improved crop performance. Consequently, seed quality remains a critical factor in determining the overall productivity

and profitability of agricultural systems [2]. Seed represents one of the most expensive and critical inputs in groundnut production, making its quality a major determinant of crop success. The use of inferior or low-vigour seeds often results in reduced germination, uneven plant emergence, and poor crop establishment, ultimately affecting yield potential. Studies have shown that nearly 30% of seeds planted in the field either fail to germinate or are unable to develop into healthy and productive plants [3]. Therefore, ensuring the availability and use of high-quality seed is essential for achieving uniform crop stands, improved productivity, and greater economic returns in groundnut cultivation.

## 2. Materials and Methods

### 2.1 Area of study and seed collection

The experiment was carried out in pots at Laboratory located in Gujarat Natural Farming Science University, Halol, Gujarat. The Groundnuts were procured from research farm at the GNFSU.

### 2.2 Experimental details

Seeds were sown in three different treatment pots as shown in table 1. Twenty-five seeds were used per treatment with three replications in a Completely Randomized Design (CRD). Regular irrigation was provided. *Jeevamrit* was prepared using 10kg fresh cow dung, 10L cow urine, 2kg jaggery, 2kg pulse flour, 100g healthy soil, 180L water and stored in drum and kept for fermentation upto 5 days under shade with mixing it twice daily in clockwise direction with use of wooden stick. Clusterbean based powder formulation was prepared using 10kg cluster bean powder, 200g jaggery, 100g honey, 100L water and fermented for 24h after which 100L water was again added and fermented for 10 days with mixing it twice daily in clockwise direction with use of wooden stick.

### 2.3 Observations recorded

The following parameters were recorded for seeds:

*Germination percentage*

Germination percentage was calculated by following formula:

Germination (%) = Number of seed germinated/total number of seed sown x 100

### 2.4 Seedling Growth Parameters

**Seed Vigour Index**

Seed Vigour Index was calculated by measuring the germination percentage and the physical growth (length or weight) of the seedlings by following formula:

SVI= Germination (%) x mean seedling length (cm)

**Root length**

Root length was measured at the end of the germination period by uprooting selected seedlings and recording the distance from the collar region to the tip of the taproot. The mean value was expressed in centimetres.

**Shoot length**

Shoot length was measured from the collar region to the apical tip of randomly selected seedlings at the end of the observation period, and the mean value was recorded in centimetres.

**3. Statistical analysis:** Data were analyzed using Completely Randomized Design (CRD) procedures, and treatment means were compared using standard statistical methods.

## 4. Results and Discussion

### 4.1 Effect of Different Treatments on Germination and Seedling Growth Parameters

The effect of different treatments on germination percentage, seed vigour index, root length and shoot length at 0-10 DAS is presented in Table 1. The results clearly indicated that all growth parameters were influenced by the applied treatments during the early seedling stage.

Among the treatments, *Jeevamrit* + Natural Soil recorded the highest germination percentage (80%), seed vigour index (2712), root length (22 cm) and shoot length (17 cm). The Natural Soil treatment recorded intermediate values with 72% germination, seed vigour index of 2160, root length of 16 cm and shoot length of 15 cm. The lowest performance was observed in the Clusterbean Raw Powder Based Formulation, which recorded 60% germination, seed vigour index of 1364, root length of 6 cm and shoot length of 12 cm (Table 1).

These findings suggest that *Jeevamrit* application created more favourable conditions for early seed germination and seedling establishment than the other treatments. The consistent superiority of *Jeevamrit* across all measured parameters indicates its positive influence on early crop growth and development.

### 4.2 Germination Percentage

Germination percentage is one of the most important indicators of seed quality and successful crop establishment. The germination performance of different treatments is illustrated in Figure 4.1. The highest germination percentage was observed in *Jeevamrit* + Natural Soil (80%), followed by Natural Soil (72%), while the lowest germination was recorded in the Clusterbean Raw Powder Based Formulation (60%). The comparative analysis showed that *Jeevamrit* treatment increased germination by 33.33% over the Clusterbean formulation and by 11.11% over Natural Soil (Table 4.2 and Table 4.3). Mean germination percentage for different varieties of groundnut were found to be 49.33%, 68.45% and 76.89% as observed on $7^{th}$,$14^{th}$ and $24^{th}$ days after sowing by Likhitha *et al.* [4]. Thenuja *et al.* [5] reported 85% germination without the dosages of gamma radiation. Ankaiah *et al.* [6] observed germination (%) to be highest in groundnut variety Kadiri 6 of 80.2%, followed by JL-24 (79.4%) and Narayani (78%) varieties.

The improved germination observed under *Jeevamrit* treatment may be associated with the availability of beneficial microorganisms and naturally occurring growth-promoting substances that create favourable conditions for seed imbibition and seed emergence. Better germination during the initial growth stage ensures uniform crop establishment and provides a strong foundation for subsequent plant growth.

### 4.3 Seed Vigour Index

Seed vigour index is a comprehensive indicator that reflects both germination performance and seedling growth. The variation in seed vigour among treatments is presented in Figure 4.2. The highest seed vigour index was recorded in *Jeevamrit* + Natural Soil (2712), followed by Natural Soil (2160) and Clusterbean Raw Powder Based Formulation (1364). Compared with the Clusterbean formulation,

*Jeevamrit* treatment increased seed vigour by 98.83%, whereas Natural Soil improved seed vigour by 58.36% (Table 2). Furthermore, *Jeevamrit* recorded 25.56% higher seed vigour than Natural Soil (Table 3). Chandanasree *et al.* [7] reported that amongst 10 different varieties of groundnut tested highest seedling vigour of 2110 was found in Kadiri-6 variety. Rathod [8] observed seed vigour of groundnut Cv. TLG-45 ranged from 150-600 in treatments of varied dosages of leaf extract of *Polyalthia longifolia* (Sonner) Thw. Ramanadane *et al.* [9] noted that seed vigour index of 12 different types of storage treatments of groundnut ranged from 1208 to 3679. Vigour index of 762.85 was found by Aparna *et al.* [10].

The higher seed vigour observed under *Jeevamrit* treatment indicates stronger seedling establishment and better physiological activity during the initial growth period. Vigorous seedlings generally possess greater capacity for nutrient uptake, better adaptability to environmental conditions and improved growth potential. The results therefore demonstrate the significant role of *Jeevamrit* in promoting healthy and vigorous seedlings during the first ten days after sowing.

### 4.4 Root Length

Root growth plays a vital role in water absorption, nutrient uptake and overall plant establishment. The effect of treatments on root length is presented in Figure 4.3. Among all treatments, *Jeevamrit* + Natural Soil recorded the maximum root length of 22 cm, followed by Natural Soil (16 cm). The shortest root length was observed in the Clusterbean Raw Powder Based Formulation (6 cm). The percentage improvement analysis revealed that *Jeevamrit* treatment increased root length by 266.67% compared to the Clusterbean formulation (Table 4.2 and Figure 4.5). Natural Soil also improved root length by 166.67% over the Clusterbean treatment. In addition, *Jeevamrit* produced 37.50% greater root growth than Natural Soil (Table 4.3). 9.11±0.91 cm root length was seen in experiment carried out by Neelamegam and Sutha [11]. Satu and Ahmad [12] observed root length of 5.70±0.10 cm in groundnut. 9.9 cm root length observed by Parthasarathi *et al.* [13] during study of allelopathic effect of leaf extract of *Parthenium hysterophorus* L.

Among all the growth parameters evaluated in the present study, root length exhibited the highest percentage improvement. This indicates that root development was the most responsive parameter to *Jeevamrit* application. A stronger root system enables seedlings to access water and nutrients more efficiently, thereby improving overall plant growth and resilience during the early stages of development.

### 4.5 Shoot Length

The effect of different treatments on shoot length is shown in Figure 4.4. The maximum shoot length was recorded under *Jeevamrit* + Natural Soil (17 cm), followed by Natural Soil (15 cm), while the minimum shoot length was observed in the Clusterbean Raw Powder Based Formulation (12 cm). The comparative analysis indicated that *Jeevamrit* treatment increased shoot length by 41.67% compared to the Clusterbean formulation and by 13.33% compared to Natural Soil (Table 4.2 and Table 4.3). Rahmah *et al.* [14] observed lowest size of shoot length in groundnut genotype, S 19-3 to be 12.22 cm whereas highest of 18.65 cm was found in DODR genotype during a study of Bambara groundnut genotypes for drought tolerance at germination stage. Nirmal *et al.* [15] reported shoot length under normal conditions of *Arachis hypogaea* L. was found to be 18.553±1.52 cm. Chinnasamy *et al.* [16] noted that shoot length decreased with increase in storage period (1-10 months) from 15.4 cm to 10.2 cm.

Enhanced shoot growth under *Jeevamrit* treatment may be associated with improved nutrient availability and increased microbial activity in the root zone, which supports rapid seedling development. Better shoot growth during the early stage contributes to greater leaf area development and increased photosynthetic efficiency in later growth stages.

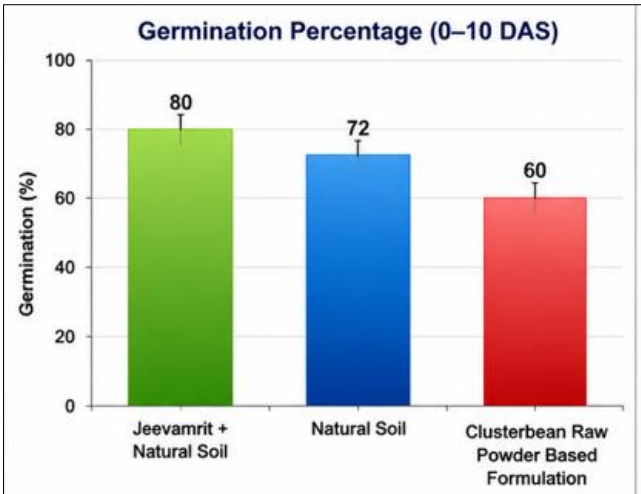


**Figure 4.1.** Effect of different treatments on germination percentage at 0–10 DAS.

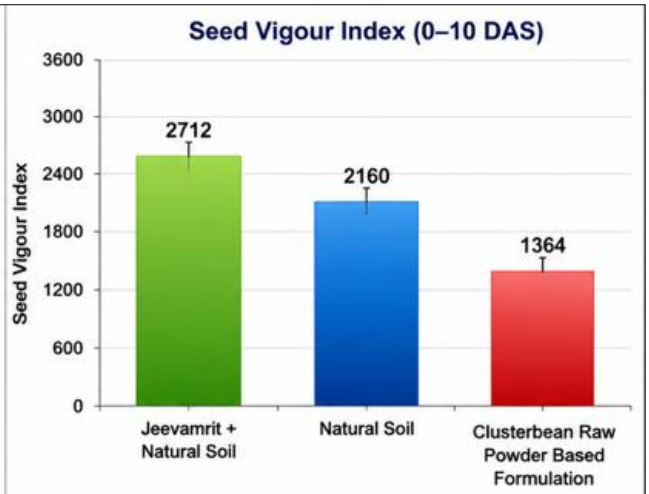


**Figure 4.2.** Effect of different treatments on seed vigour index at 0–10 DAS.

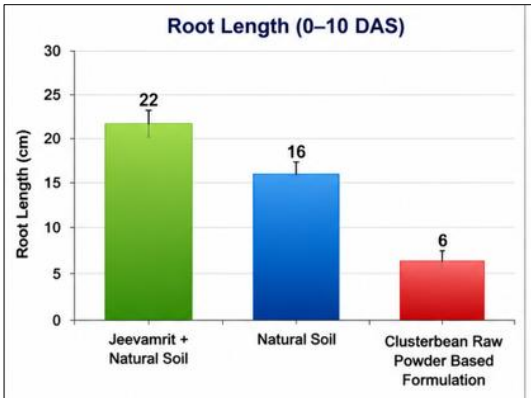


**Figure 4.3.** Effect of different treatments on root length at 0–10 DAS.

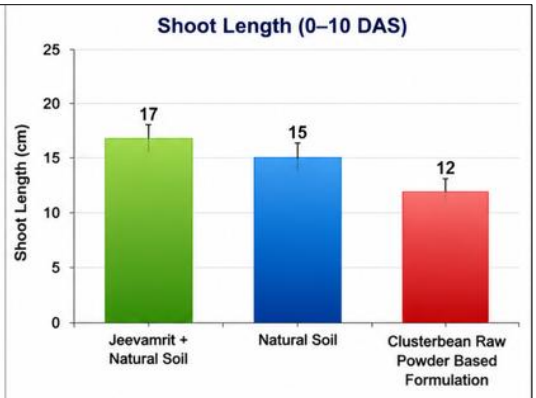


**Figure 4.4.** Effect of different treatments on shoot length at 0–10 DAS.

### 4.6 Comparative Performance of Treatments

The overall comparative performance of different treatments is presented in Figure 4.5 and Figure 4.6.

The percentage improvement analysis (Figure 4.5) clearly demonstrated the superiority of *Jeevamrit* + Natural Soil over the Clusterbean Raw Powder Based Formulation. The treatment increased:

- Germination percentage by 33.33%
- Seed vigour index by 98.83%
- Root length by 266.67%
- Shoot length by 41.67%

Among these parameters, root length showed the highest improvement, followed by seed vigour index.

Similarly, the Relative Performance Index (RPI) presented in Figure 4.6 further confirmed the superior performance of *Jeevamrit* treatment. When the Clusterbean Raw Powder Based Formulation was considered as the baseline (100), *Jeevamrit* recorded RPI values of 133 for germination, 199 for seed vigour, 367 for root length and 142 for shoot length. Natural Soil also outperformed the Clusterbean formulation, but its performance remained lower than that of *Jeevamrit* across all parameters.

The RPI analysis clearly indicates that *Jeevamrit* treatment consistently maintained superior performance in terms of seed germination, seedling vigour and growth characteristics during the first ten days after sowing.

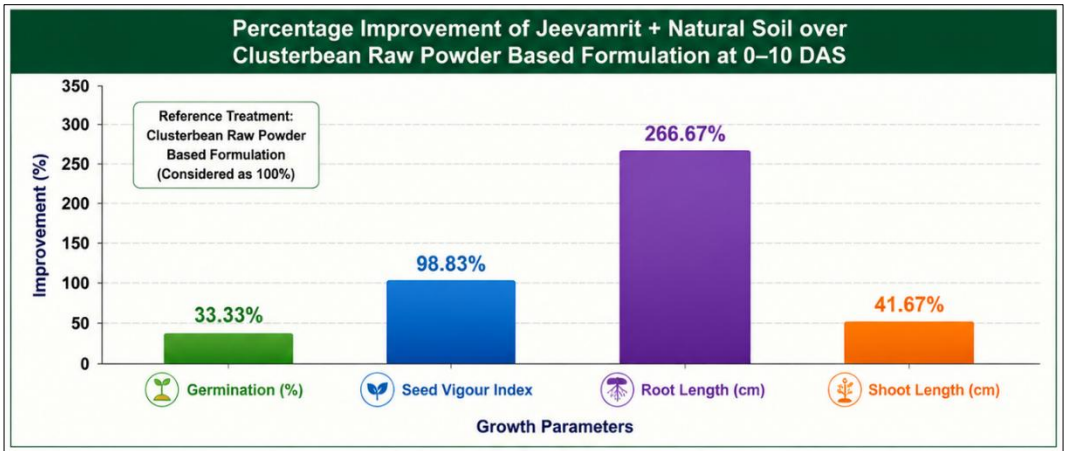


**Figure 4.5.** Percentage improvement of Jeevamrit + Natural Soil over Clusterbean Raw Powder Based Formulation for different growth parameters at 0–10 DAS.

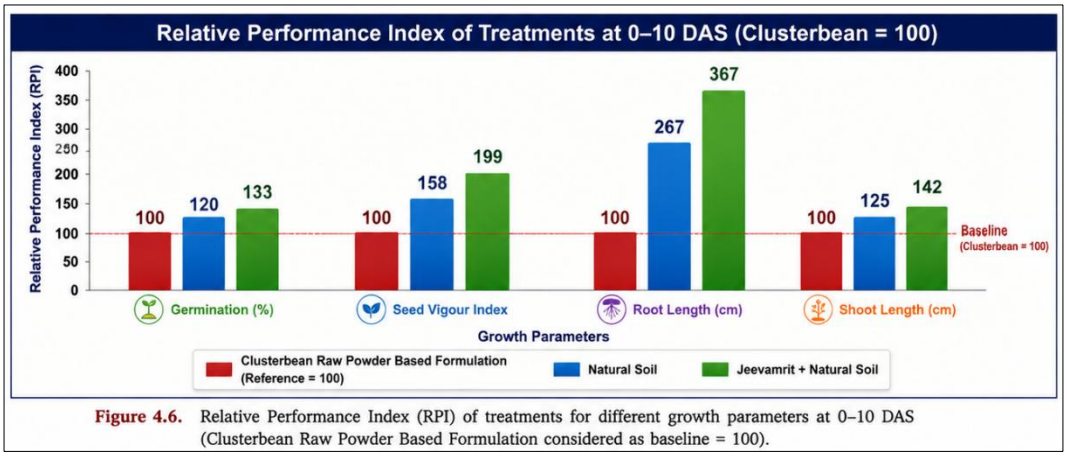


**Figure 4.6.** Relative Performance Index (RPI) of treatments for different growth parameters at 0–10 DAS (Clusterbean Raw Powder Based Formulation considered as baseline = 100).

**Table 1:** Comparative Effect of Jeevamrit, Natural Soil and Clusterbean Raw Powder Based Formulation on Germination and Seedling Growth Parameters at 10 Days After Sowing (DAS)

| Treatment | Germination% | Seed Vigour | Root Length(cm) | Shoot Length(cm) |
|---|---|---|---|---|
| *Jeevamrit*+ Natural Soil | 80 | 2712 | 22 | 17 |
| Natural Soil | 72 | 2160 | 16 | 15 |
| Clusterbean Raw Powder Based Formulation | 60 | 1364 | 6 | 12 |

**Table 2:** Percentage Improvement of Different Growth Parameters Relative to Clusterbean Raw Powder Based Formulation at 0-10 DAS

| Parameter | Clusterbean | Jeevamrit | Improvement (%) |
|---|---|---|---|
| Germination (%) | 60 | 80 | 33.33 |
| Seed Vigour Index | 1364 | 2712 | 98.83 |
| Root Length (cm) | 6 | 22 | 266.67 |
| Shoot Length (cm) | 12 | 17 | 41.67 |

**Table 3:** Percentage Improvement of Jeevamrit + Natural Soil over Natural Soil at 0-10 DAS

| Parameter | Natural Soil | *Jeevamrit* | Improvement (%) |
|---|---|---|---|
| Germination (%) | 72 | 80 | 11.11 |
| Seed Vigour Index | 2160 | 2712 | 25.56 |
| Root Length (cm) | 16 | 22 | 37.50 |
| Shoot Length (cm) | 15 | 17 | 13.33 |

## Conclusion

The findings of the present study demonstrate that *Jeevamrit* + Natural Soil was the most effective treatment for promoting early seedling growth during the 0-10 DAS period. The treatment consistently produced the highest values for germination percentage, seed vigour index, root length and shoot length. The most remarkable response was observed in root development, where *Jeevamrit* increased root length by 266.67% over the Clusterbean Raw Powder Based Formulation. Seed vigour also improved substantially, showing a 98.83% increase. These improvements indicate stronger seedling establishment, enhanced nutrient uptake capacity and better growth potential during the early stages of crop development. Overall, the results suggest that *Jeevamrit* application significantly improved seedling performance and early plant growth compared with both Natural Soil and Clusterbean Raw Powder Based Formulation. The treatment proved particularly effective in enhancing root development and seed vigour, which are critical factors for successful crop establishment and future plant productivity.

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