IJPSR (2026), Volume 17, Issue 2 **(Research Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 26 July 2025; received in revised form, 07 January 2026; accepted, 16 January 2026; published 01 February 2026

EFFECT OF JEEVAMRUTHAM ON THE CULTIVATION OF LEAFY VEGETABLE *BASELLA ALBA* L.

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Keywords:

Basella alba L., Jeevamrutham, Organic farming, Photosynthetic pigments, Carbohydrates, Proteins, Soil nutrients, Water quality

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ABSTRACT: The increasing demand for chemical-free vegetables has encouraged the use of traditional organic inputs such as Jeevamruthama fermented bio-liquid prepared from cow dung, cow urine, jaggery, pulse flour and soil. The present pot culture study evaluated the influence of Jeevamrutham on soil nutrient status, irrigation water quality, growth parameters, photosynthetic pigments and biochemical constituents of the leafy vegetable *Basella alba* L. The experiment was conducted under controlled pot conditions with untreated control and Jeevamrutham-treated plants. Soil macronutrients and micronutrients were analyzed before and after treatment while plant growth, chlorophyll content, total carbohydrates and proteins were assessed at 50 days after sowing. Application of Jeevamrutham resulted in a moderate increase in available soil nitrogen and phosphorus while potassium, organic carbon and several micronutrients showed a decline. Irrigation water quality parameters remained within permissible agricultural limits. Treated plants exhibited significantly higher plant height, leaf length, vein length, chlorophyll content, carbohydrate and protein levels compared to control plants. These responses indicate an improvement in physiological and biochemical attributes of *Basella alba* under Jeevamrutham application. However the observed changes were obtained under pot culture conditions with limited replication and a short experimental duration. Therefore while the results suggest that Jeevamrutham can influence growth and metabolic characteristics of *B. alba*, further field-based studies with larger sample sizes and microbial analysis are required to substantiate its agronomic potential under practical farming conditions.

INTRODUCTION: Organic farming has gained global importance due to concerns regarding soil degradation, environmental pollution and food safety associated with prolonged use of chemical fertilizers [1, 2]. Organic inputs derived from natural sources are increasingly explored for their role in maintaining soil fertility and supporting sustainable crop production.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.17(2).610-14

This article can be accessed online on www.ijpsr.com

DOI link: https://doi.org/10.13040/IJPSR.0975-8232.17(2).610-14

Among these inputs, Jeevamrutham is a traditional fermented liquid organic formulation prepared using indigenous cow dung, cow urine, jaggery, pulse flour and soil and is widely used in Indian organic farming systems [3, 4]. Previous studies have reported that Jeevamrutham may enhance nutrient availability and influence plant physiological processes, particularly in vegetable crops [5-9].

Improvements in chlorophyll content, nutrient uptake and primary metabolite accumulation have been documented in leafy vegetables such as spinach and *Amaranthus* species [10-13]. However, scientific information on its influence on *Basella alba* L., a nutritionally important tropical leafy

vegetable remains limited. *Basella alba* is valued for its rapid growth, multiple harvest potential and high content of vitamins, minerals and bioactive compounds [14, 15]. Organic nutrient inputs may alter not only plant growth but also soil nutrient dynamics and water quality, which are critical factors in organic crop production [16-19]. Reports on micronutrient depletion and changes in soil organic carbon following organic amendments highlight the need for comprehensive evaluation [18].

Objectives of the Study: The present study was undertaken to evaluate changes in soil macronutrients and micronutrients before and after Jeevamrutham application. Assess the suitability of irrigation water used in the experiment. Determine the effect of Jeevamrutham on growth parameters of *Basella alba* L. and Analyze photosynthetic pigments, total carbohydrates and protein content in leaves under pot culture conditions.

MATERIALS AND METHODS:

Experimental Design: The experiment was conducted under pot culture conditions with two treatments:

Control: Soil without Jeevamrutham

Treatment: Soil amended with Jeevamrutham

Each treatment consisted of three replicates, with one plant per pot. Plastic pots (30 cm diameter) were filled with 5 kg of air-dried, sieved garden soil. The experiment was carried out under natural light conditions with ambient temperatures ranging from 28–32 °C.

Systematic Classification:

Jeevamrutham Preparation and Application:

Kingdom: Plantae

Phylum: Tracheophyta

Class: Equisetopsida C. Agardh

Order: Caryophyllales Juss. ex Bercht. & J. Presl

Family: Basellaceae

Genus: Basella

Species: *Basella alba* L.

FIG. 1: *BASELLA ALBA* PLANT

Jeevamrutham was prepared using cow dung (1 kg), cow urine (1 L), jaggery (100 g), gram flour (100 g) and water (10 L). The mixture was fermented for 5–7 days with daily stirring. Prior to application the solution was diluted in a 1:10 ratio. Each treated pot received 250 mL of diluted Jeevamrutham once per week, while control pots received an equal volume of water.

FIG. 2: INGRADIENTS OF JEEVAMRUTHAM AND PREPARATION

Soil and Water Analysis: Soil samples were collected before sowing and after harvest. Soil pH and electrical conductivity (EC) were determined using standard digital meters. Organic carbon was estimated by the Walkley–Black method. Available nitrogen, phosphorus and potassium were analyzed

using the Kjeldahl, Olsen and flame photometric methods respectively. Micronutrients (Zn, Fe, Mn, Cu, B, and S) were estimated using atomic absorption spectrophotometry. Values below the analytical detection limit were recorded as below detection limit (BDL). Irrigation water was analyzed once during the experimental period for pH, EC, carbonate, bicarbonate, calcium, magnesium, sodium, residual sodium carbonate (RSC) and sodium adsorption ratio (SAR) following standard protocols.

Biochemical Analysis: Chlorophyll a, chlorophyll b and total chlorophyll were estimated using the DMSO extraction method. Total carbohydrates were determined using the Anthrone method and protein content was estimated using the Biuret method. All biochemical analyses were performed in triplicate and expressed on a fresh weight basis.

Statistical Analysis: Data were expressed as mean ± standard error (SE). Paired sample t-tests were used to compare soil nutrient values before and after treatment, while independent t-tests were used to compare control and treated plants. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION:

Growth Parameters: Jeevamrutham-treated plants exhibited significantly higher plant height, leaf length, mid-vein length and lateral vein length compared to control plants at 50 days after sowing ($p < 0.01$). Shoot length and shoot width did not show significant differences, indicating that Jeevamrutham application primarily influenced foliar development rather than stem thickness **Table 1.**

TABLE 1: EFFECT OF JEEVAMRUTHAM ON GROWTH PARAMETERS OF *BASELLA ALBA* L. (50 DAS)

Growth parameter	Control	Jeevamrutham-treated
Plant height (cm)	42.36 ± 1.21	51.84 ± 1.48*
Leaf length (cm)	9.42 ± 0.36	12.68 ± 0.41*
Mid-vein length (cm)	7.18 ± 0.29	9.84 ± 0.33*
Lateral vein length (cm)	4.96 ± 0.21	6.72 ± 0.25*
Shoot length (cm)	15.24 ± 0.58	16.08 ± 0.61 (NS)
Shoot width (cm)	1.18 ± 0.04	1.22 ± 0.05 (NS)

Values are mean ± SE (n = 3). $p < 0.01$ compared with control; NS – not significant.

Soil Nutrient Status: Soil analysis revealed moderate increases in available nitrogen and phosphorus following Jeevamrutham application which may support vegetative growth. However, potassium, organic carbon and micronutrients showed a decline. The reduction in organic carbon and micronutrients may be attributed to rapid microbial utilization, plant uptake or analytical limitations associated with short-term pot culture experiments. Micronutrient values recorded as BDL indicate concentrations below the detection limits rather than complete depletion **Table 2.**

TABLE 2: SOIL NUTRIENT STATUS BEFORE AND AFTER JEEVAMRUTHAM APPLICATION

Parameter	Initial soil	After Jeevamrutham
pH	7.18 ± 0.04	7.12 ± 0.05
EC (dS m^{-1})	0.42 ± 0.02	0.39 ± 0.02
Organic carbon (%)	0.64 ± 0.03	0.52 ± 0.02
Available nitrogen (kg ha^{-1})	214.6 ± 6.8	238.2 ± 7.4
Available phosphorus (kg ha^{-1})	18.4 ± 0.9	24.1 ± 1.1
Available potassium (kg ha^{-1})	286.3 ± 8.5	251.7 ± 7.9
Zinc (mg kg^{-1})	0.82 ± 0.05	0.61 ± 0.04
Iron (mg kg^{-1})	4.26 ± 0.18	3.14 ± 0.15
Manganese (mg kg^{-1})	2.08 ± 0.11	1.64 ± 0.09
Copper (mg kg^{-1})	0.46 ± 0.03	0.32 ± 0.02
Boron (mg kg^{-1})	BDL	BDL
Sulphur (mg kg^{-1})	7.12 ± 0.32	6.48 ± 0.28

Values are mean ± SE (n = 3). $p < 0.05$ before vs after treatment; BDL – below detection limit.

Water Quality Parameters: The irrigation water used in the experiment was within permissible limits for agricultural use. Parameters such as pH, EC, SAR and RSC indicated non-sodic and non-

saline conditions suitable for crop cultivation. As water quality was assessed only once the absence of temporal variation is acknowledged as a limitation **Table 3.**

TABLE 3: IRRIGATION WATER QUALITY PARAMETERS USED IN THE EXPERIMENT

Parameter	Observed value	Permissible limit
pH	7.46	6.5–8.5
EC (dS m^{-1})	0.68	< 2.0
Carbonate (meq L^{-1})	Nil	–
Bicarbonate (meq L^{-1})	2.8	< 5.0
Calcium (meq L^{-1})	3.2	–
Magnesium (meq L^{-1})	1.6	–
Sodium (meq L^{-1})	2.4	–
SAR	1.12	< 10
RSC (meq L^{-1})	0.42	< 2.5

Water quality parameters were within permissible limits for agricultural use.

Photosynthetic Pigments and Biochemical Constituents: Treated plants showed higher chlorophyll a, chlorophyll b and total chlorophyll content compared to control plants. Total carbohydrate and protein contents were also higher in Jeevamrutham-treated plants. These results suggest improved physiological performance and metabolic activity under the experimental conditions employed. Enhanced microbial activity is proposed only as a possible explanation as microbial populations were not directly assessed.

TABLE 4: EFFECT OF JEEVAMRUTHAM ON PHOTOSYNTHETIC PIGMENTS AND BIOCHEMICAL CONSTITUENTS OF *BASELLA ALBA* L.

Parameter	Control	Jeevamrutham-treated
Chlorophyll a (mg g^{-1} FW)	1.24 ± 0.05	1.68 ± 0.06
Chlorophyll b (mg g^{-1} FW)	0.48 ± 0.03	0.72 ± 0.04
Total chlorophyll (mg g^{-1} FW)	1.72 ± 0.06	2.40 ± 0.08
Total carbohydrates (mg g^{-1} FW)	14.6 ± 0.7	19.8 ± 0.9
Protein (mg g^{-1} FW)	8.2 ± 0.4	11.4 ± 0.5

Values are mean ± SE (n = 3). $p < 0.01$ compared with control.

CONCLUSION: The present pot culture study indicates that Jeevamrutham application influenced growth, photosynthetic pigments and biochemical constituents of *Basella alba* L., along with changes in soil nutrient status. Moderate increases in soil nitrogen and phosphorus and improvements in leaf growth and metabolic parameters were observed in treated plants. However, declines in soil organic carbon and micronutrients highlight the need for careful interpretation. As the study was conducted under controlled pot conditions with limited replication and short duration, the results should be considered preliminary.

Further field-based studies incorporating microbial analysis, longer experimental duration and repeated soil and water assessments are required before recommending large-scale adoption of Jeevamrutham in organic vegetable cultivation.

ACKNOWLEDGEMENT: The authors would like to express their gratitude to the Vikrama Simhapuri University College, Kavali laboratory team for their technical support and help.

CONFLICT OF INTEREST: No conflicts of interest are disclosed by the authors.

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How to cite this article:
Maheswari PU, Kumar ES, Swamy NT and Naik MB: Effect of jeevamrutham on the cultivation of leafy vegetable *Basella alba* L. Int J Pharm Sci & Res 2026; 17(2): 610-14. doi: 10.13040/IJPSR.0975-8232.17(2).610-14.