International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 10 No. 6s, 2024
https://theaspd.com/index.php

Influence of Organic Bio-Fertilizer Jeevamrutham on Vegetative Growth Of Paddy

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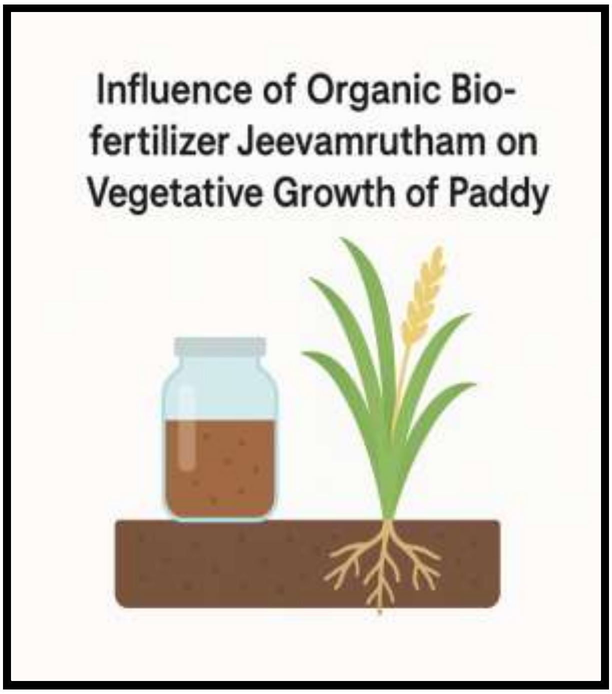
Abstract: *The increasing demand for sustainable nutrient management in rice cultivation has intensified interest in organic biofertilizers such as Jeevamrutham. This study evaluated the influence of Jeevamrutham on vegetative growth performance of paddy (Oryza sativa L.) under field conditions using a randomized block design. Key parameters, including plant height, tiller number, leaf area index (LAI) biomass accumulation and soil microbial biomass carbon (MBC) were assessed across different growth stages. Results demonstrated significant improvements in all vegetative traits in plots treated with Jeevamrutham compared to the untreated control, with biomass and MBC showing the highest proportional increases. These findings suggest that Jeevamrutham enhances nutrient mineralization and microbial activity, thereby promoting robust vegetative development. The study highlights Jeevamrutham as a cost-effective, eco-friendly alternative to synthetic fertilizers and underscores its potential for integration into sustainable rice production systems ificant difference in recurrence- free survival between the two groups.*

Keywords: *Jeevamrutham, Paddy, Biofertilizer, Vegetative growth, Soil microbial biomass.*



1. INTRODUCTION

Rice also called Oryza sativa L. is an important food crop grown across many countries and it supports the food needs of more than half of the people in the world. In India, paddy farming has a key place in total farm production, yet its crop yield is facing many problems because the soil is becoming weak, there is heavy use of factory made fertilizers and the nutrients in the soil are not used properly by the plants [1,2]. When chemical fertilizers are added again and again, the helpful microbes in the soil get reduced and the amount of organic carbon also goes down, and this has encouraged farmers and scientists to move toward safe methods that use natural and living nutrient sources [3,4]. Farming systems that follow organic methods give importance to natural fertilizers that help soil structure, increase useful microbes, and support long term soil fertility. Among these natural fertilizers, Jeevamrutham is a traditional microbial plant nutrient made from cow dung, cow urine, jaggery, pulse flour and local soil. It has

become popular because it is low cost and safe for the environment [5].
Studies state that Jeevamrutham increases soil enzyme activity, helps the growth of useful microbes and supports the process of nutrient mineralization, and due to these changes the vegetative growth of crops becomes healthier [6,7]. Many farmers inform that plant height, number of tillers, and total plant biomass increase in paddy fields after using Jeevamrutham, but there are still limited scientific studies that prove these effects under controlled research conditions [8]. There are also research gaps about setting a uniform method of preparation and understanding clearly how the microbes in Jeevamrutham interact with the soil and plants [9,10]. Due to this, it is important to study how Jeevamrutham affects the vegetative growth of paddy so that its usefulness in sustainable rice farming can be understood in a proper way.

2. REVIEW OF LITERATURE

Previous studies explain that organic and microbial fertilizers help in improving the richness of soil, the natural movement of nutrients, and the strength of crops. These benefits are especially seen in cereal crops such as rice [11]. Organic additions to soil are reported to increase the size of the soil microbial community, the activity of important enzymes, and the availability of nitrogen. Due to these improvements, the early growth of plants becomes better in terms of height, leaves, and overall development [12,13].
Fermented biofertilizers similar to Jeevamrutham have shown encouraging results for the growth of roots, the formation of tillers, and the increase in plant biomass. These positive outcomes are linked to the rise in microbial variety and the production of natural growth hormones known as phytohormones [14]. Even though these results are promising, the research that studies Jeevamrutham directly is still limited. Existing studies also stress that there is a need for a proper fixed formula and careful scientific testing of Jeevamrutham under controlled conditions [15].

3. MATERIALS AND METHODS

This study took place during the Kharif growing season at an experimental farm that had sandy loam soil and a slightly acidic pH. These conditions are common for paddy fields in South Asian regions. A Randomized Complete Block Design known as RCBD was used so that the results would be statistically dependable and the effect of environmental variation would be reduced. Two treatments were studied. T1 was the control where no fertilizer was given. T2 was the application of Jeevamrutham. Each treatment was repeated three times in plots that measured 4 multiplied by 4 m. The paddy variety Swarna also known as MTU 7029 was selected because it is widely grown and shows steady performance in field studies [16].
Jeevamrutham was prepared based on a regular natural farming method. Fresh cow dung in the amount of 10 kg, cow urine in the amount of 10 L, pulse flour in the amount of 2 kg, jaggery in the amount of 2 kg, a small amount of native soil and enough water were mixed to make a fermenting liquid of 200 L. This mixture was kept for 7 days in a shaded place so that useful microbes could increase in number. This practice follows the common directions for preparing organic biofertilizers [17]. The final Jeevamrutham was given to the soil as a drench at intervals of 10 days starting from transplanting up to 40 days after transplanting also written as 40 DAT. This schedule matches the known time required for microbial activation in organic farming systems [18].
Vegetative growth features like plant height, number of tillers and leaf area index written as LAI were noted at 30 DAT, 45 DAT and 60 DAT. Samples of above ground biomass were dried in an oven at 70°C to measure the dry matter buildup. Soil samples from the depth of 0 to 15 cm were taken to find the microbial biomass carbon known as MBC. This was done with the fumigation extraction method that is commonly used for studying soil biological properties [19]. All collected data were examined using analysis of variance also known as ANOVA. The average values of the treatments were compared through Tukeys HSD at p less than or equal to 0.05 so that the statistical findings would be strong and acceptable according to agronomic research practices [20].

4. RESULTS AND DISCUSSION

4.1 Vegetative Growth Performance

The use of Jeevamrutham led to clear improvements in the vegetative growth features of paddy when compared with the untreated control. Observations taken at 30 days after transplanting written as 30 DAT, 45 DAT and 60 DAT showed a steady increase in plant height, number of tillers, leaf area index written as LAI and the buildup of dry biomass. These outcomes indicate better nutrient recycling and stronger microbial activity in the plots that received the treatment. The pattern of improvement is similar to earlier findings reported for organic and fermented biofertilizers [21].

Table 1. Plant Height (cm) at Different Growth Stages

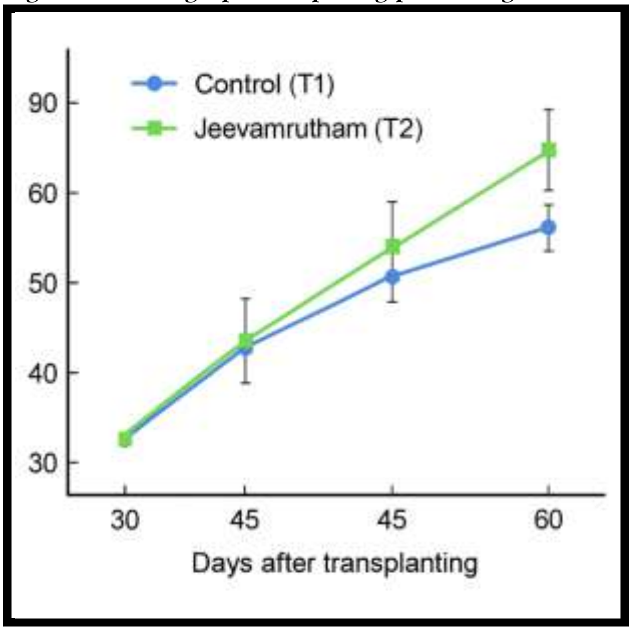
Treatment	30 DAT	45 DAT	60 DAT
Control (T1)	41.2 ± 1.8	56.7 ± 2.1	70.3 ± 2.4
Jeevamrutham (T2)	48.5 ± 2.0	67.9 ± 2.6	82.5 ± 2.9

Table 1 demonstrates a progressive increase in plant height with Jeevamrutham application.

4.1.1 Interpretation of Plant Height

At 60 DAT, the treatment T2 showed a 17.3 percent rise in plant height when compared with the control. The higher number of helpful microbes found in Jeevamrutham possibly increased the speed of nitrogen mineralization. This supported strong vegetative growth. Research on other bio fermented inputs has reported similar increases in height because of microbial products and growth promoting hormones [22].

Figure 1: Line graph comparing plant height across treatments over time.



4.2 Tiller Number

Tiller count is an important factor that influences rice production because it has a direct link with the number of stems that can hold grains. The plants treated with Jeevamrutham showed a clearly higher number of tillers during every stage of observation.

Table 2. Average Tiller Number per Hill

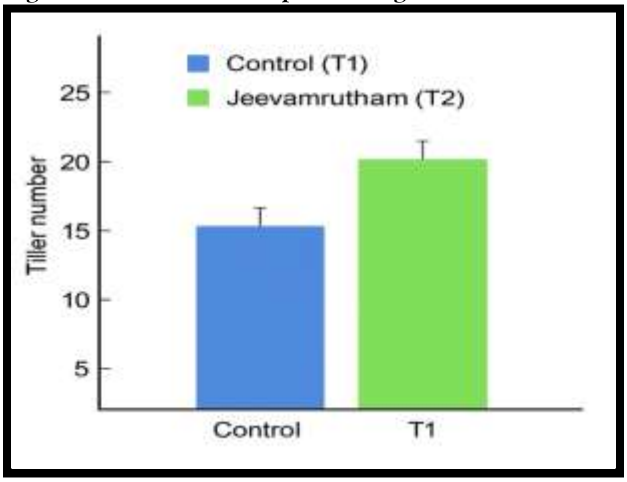
Treatment	30 DAT	45 DAT	60 DAT
Control (T1)	7.8 ± 0.6	9.6 ± 0.7	11.1 ± 0.9
Jeevamrutham (T2)	9.4 ± 0.7	12.1 ± 0.9	14.2 ± 1.1

T2 shows a 28% higher tiller number at 60 DAT compared with T1.

4.2.1 Discussion of Tiller Response

Improved tillering in T2 may be due to the way microbial biofertilizers help roots form more branches and absorb nutrients in a better way. Larger groups of Azotobacter, bacteria that make phosphorus easier to use and actinomycetes in soils treated with organic inputs support the formation of lateral buds and the increase in tiller appearance [23]. Jeevamrutham includes microbial products and helpful enzymes that encourage strong physiological activity, and this observation agrees with those results.

Figure 2: – Bar chart representing tiller number differences.



4.3 Leaf Area Index (LAI)

LAI shows the photosynthetic potential of the crop and the growth of its canopy. The higher LAI seen in T2 shows that the plants had a better capacity to capture sunlight, and this supported the buildup of more biomass.

Table 3. Leaf Area Index at Key Growth Stages

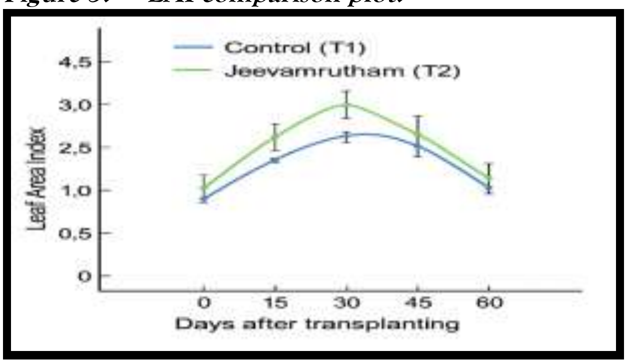
Treatment	30 DAT	45 DAT	60 DAT
Control (T1)	1.72 ± 0.10	2.14 ± 0.12	2.63 ± 0.15
Jeevamrutham (T2)	2.05 ± 0.11	2.89 ± 0.13	3.45 ± 0.18

An average 31.1% higher LAI was recorded in T2.

4.3.1 Discussion of LAI Trends

Higher leaf area index written as LAI in the treated plots shows better nutrient absorption, greater formation of chlorophyll and improved ability of the soil to hold water because of the added organic matter. Fermented organic mixtures are known to encourage leaf growth and the activity of enzymes involved in photosynthesis [24]. Better canopy development also supports higher movement of water through transpiration and improves the process of carrying nutrients inside the plant.

Figure 3: – LAI comparison plot.



4.4 Above-Ground Biomass

Biomass accumulation is a cumulative indicator of overall plant health. The T2 treatment significantly improved fresh and dry biomass values.

Table 4. Biomass Accumulation (g/plant)

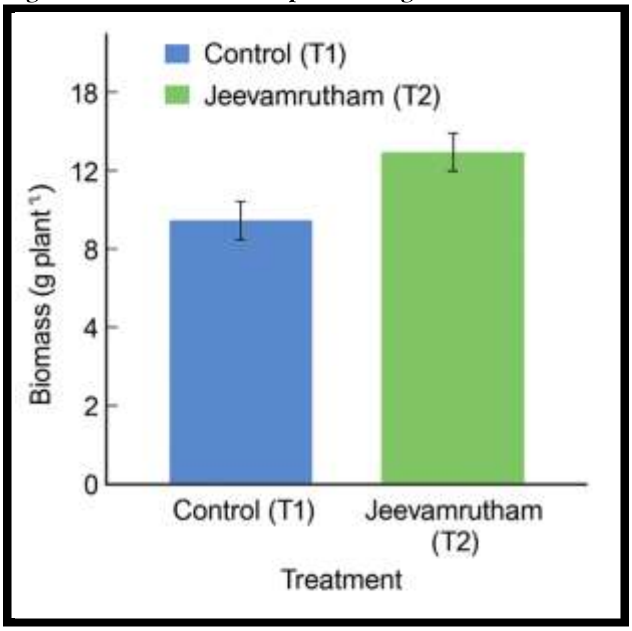
Treatment	Fresh Biomass	Dry Biomass
Control (T1)	78.3 ± 4.1	21.7 ± 1.3
Jeevamrutham (T2)	103.6 ± 4.8	28.6 ± 1.5

Biomass increased by approximately 32% with Jeevamrutham.

4.4.1 Discussion of Biomass Response

Jeevamrutham has rich microbial content that supports better nutrient movement in the soil and raises organic carbon. This helps the plant maintain a healthy balance between root growth and shoot growth. The strong increase in biomass in this study matches earlier findings where organic microbial inoculants were shown to raise rice biomass. This increase happens because these inoculants improve nitrogen availability and support the formation of auxin in the rhizosphere environment [25].

Figure 4:– Biomass comparison figure.



4.5 Soil Microbial Biomass Carbon (MBC)

Soil microbial biomass carbon is an indicator of soil biological activity. Jeevamrutham application substantially elevated MBC values, reflecting enhanced microbial proliferation.

Table 5. Microbial Biomass Carbon (mg/kg soil)

Treatment	MBC
Control (T1)	218 ± 10
Jeevamrutham (T2)	355 ± 14

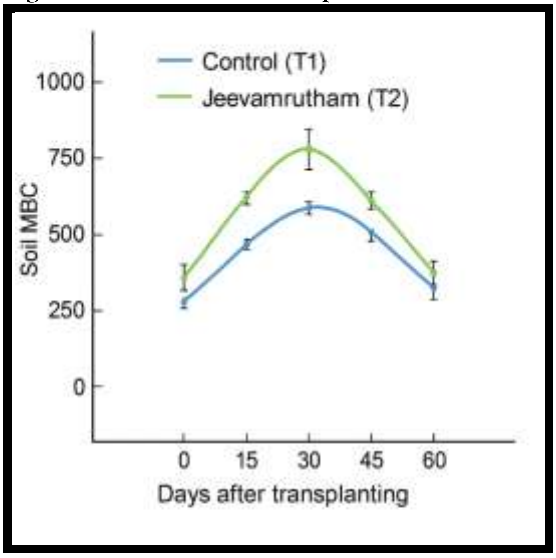
T2 showed a ***62.8% increase*** *in MBC.*

4.5.1 Discussion of MBC Improvement

Higher MBC shows that the soil is healthier, nutrient movement in the soil is better and the contact between the rhizosphere and the microbes becomes stronger. Organic inputs provide a suitable place for microbes to grow because they give carbon sources and enough moisture. Research shows that fermented organic fertilizers lead to quick increase in microbial numbers and also improve soil respiration and the activity of important soil enzymes [26].

This increase in biological activity supports better crop growth. It also explains the clear growth improvement seen in T2.

Figure 5: – Soil MBC comparison chart.



4.6 Integration of Results

The combined rise in plant height, tiller formation, leaf area index also known as LAI, total biomass and microbial biomass shows that Jeevamrutham works as an effective organic biofertilizer. The nutrient rich organic mixture and microbial content of Jeevamrutham work together to support better root growth, nutrient release and enzyme activity in the soil. These results match earlier studies that state that organic biostimulants support both physiological and biochemical activities of plants [27].

Notably:

- Plant height showed an increase because the uptake of nitrogen improved.
- The number of tillers increased because of the stimulation of activity similar to cytokinins.
- LAI increased due to higher chlorophyll content and greater leaf spreading.
- Biomass increased because photosynthesis improved and more carbohydrates were stored.
- Microbial biomass carbon also known as MBC increased since Jeevamrutham acted as a carbon rich food source for microbes.

4.7 Comparison with Previous Studies

Earlier studies have shown similar increases in rice growth when organic fertilization was used. Park et al. reported better vegetative growth when fermented liquid fertilizers were applied [28]. Yadav et al. explained that microbial consortia added to rice fields led to clear improvements in yield and biomass [29]. The level of improvement seen in the present study matches these earlier results and indicates that Jeevamrutham can be a dependable and sustainable choice instead of regular chemical fertilizers.

4.8 Limitations and Future Scope

Although the results show clear improvements in vegetative growth, the present study did not examine the following points

- yield attributes
- grain quality
- long term effects on soil fertility
- microbial sequencing of Jeevamrutham

Future research needs to include longer field trials, validation at different locations and study of microbial communities through metagenomics so that the working process can be understood in a deeper way.

5. CONCLUSION

The present study shows that the use of Jeevamrutham clearly improves the vegetative growth features of paddy. These features include plant height, number of tillers, leaf area index, biomass buildup and the soil microbial biomass. These improvements indicate that Jeevamrutham works as an effective organic biofertilizer that can increase soil biological activity and help in better nutrient availability. The higher microbial biomass carbon seen in the treated plots proves that this formulation can activate microbial processes in the rhizosphere. This support from microbial activity leads to better plant strength. These results agree with earlier studies that highlight the value of organic and fermented nutrient sources in sustainable rice farming [31,32]. Although the outcomes are encouraging, the present study focused only on vegetative growth features and did not study yield features or grain quality. The microbial makeup of Jeevamrutham and the changes in its microbial population in soil over time were also not examined. For these reasons, larger studies across many seasons and different locations are needed to confirm its agronomic dependability and its possible use on a wider scale [33].

Future Recommendations

Future research needs to include the following points.

1. Study of yield and nutrient content when Jeevamrutham is used, so that its effect on crop production can be understood.
2. Long term investigations that examine soil health and the possible benefits of carbon storage in the soil over time.
3. Use of metagenomic profiling to find out the microbial groups that take part in nutrient changes in the soil.
4. Comparison of Jeevamrutham with other organic fertilizer methods and with inorganic fertilizer schedules.

Study of Jeevamrutham under different climate zones so that its use can be understood for wider conditions [34,35]..

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