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INFLUENCE OF FOLIAR APPLICATION OF GROWTH STIMULANTS AND MICRONUTRIENTS ON NUTRIENT STATUS, PEST AND DISEASE INCIDENCE AND ECONOMICS IN INDIAN PENNYWORT (*CENTELLA ASIATICA* L.)

Arya Sivadas[1], Ravi C. S.[2]*, Bhoomika H. R.[3], Naveen N. E.[3] and Girish R.[4]

[1]Department of PSMAC, College of Horticulture, Mudigere-577132, Karnataka, India

[2]Department of PSMAC, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

[3]ICAR-Krishi Vigyan Kendra, Brahmavara, Udupi – 576213, Karnataka, India

[4]ICAR-KVK, Shivamogga – 577204, Karnataka, India

*Corresponding Author E-mail: *ravics@uahs.edu.in*

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ABSTRACT

A field experiment was conducted at College of Horticulture, Mudigere during 2023 -24 to study the effect of foliar application of growth stimulants and micronutrients on nutrient status, pest and disease incidence and economics in Indian pennywort. The experiment was laid out in Randomized Complete Block Design with twelve treatments and three replications. The nutrient analysis among different treatments studied revealed that, the treatment T_{10} : Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1% showed a higher iron (85.69 mg/100g) and zinc (77.08 mg/100g) content followed by T_6 which received Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1% (73.80 and 73.03 mg/100g, respectively) and the lowest was recorded in T_{12}: Control (13.33 and 19.11 mg/100g, respectively). The lower available N (227 kg/ha), P (14.00 kg/ha), K (85.33 kg/ha), Fe (10.08 mg/kg) and Zn (0.38 mg/kg) in soil after harvest were recorded in T10. While maximum values of available N, P and K (266.67, 26.00 and 116.00 kg/ha, respectively), Fe (23.15 mg/kg) and Zn (0.90 mg/kg) were recorded in T12 (control). The incidence of pests was not above the economic threshold level and no significant differences were found among treatments for *sclerotium* wilt and *Ceracospora* leaf spot disease during the cropping period. The economics analysis clearly indicated that treatment T10: Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1% had a higher net return (□ 3,17,706.4 ha^{-1}) with B:C ratio of 2.53:1.

Keywords **:** pest, nutrient, disease, potassium humate, Indian pennywort, economics

Introduction

Traditional medicine using medicinal plants dates back 4000-5000 years. Today, 170 countries and 80% of the global population rely on herbal remedies providing natural alternatives to synthetic drugs and inspiring modern pharmaceuticals. *Centella asiatica* L. also known as Gotu kola or Indian pennywort is a perennial herb used in traditional Indian medicine for centuries. It treats various ailments including high blood pressure, rheumatism, fever, nervous disorders and memory enhancement earning it the reputation as a "brain food". It rejuvenates nerves and brain cells, increases intelligence and concentration and has anti-depressant and neuroprotective effects with additional cosmetic uses to boost collagen and firm skin. Indian pennywort possesses numerous health benefits including anti-leprotic, viral, bacterial, anxiety, stress, tumour and diabetic properties as well as antimicrobial, anti-inflammatory and anti-proliferative effects. It also exhibits antioxidant, anti-fungal, anti-protozoal, cardiovascular, antiulcer, and anti-cancer properties protecting against liver toxicity and diabetic complications. Its therapeutic properties make it a popular ingredient in skincare, haircare and culinary products offering a range of health and beauty benefits (Roy *et al.*, 2017).

Centella asiatica a highly valued medicinal herb has an increasing demand in pharmaceutical and cosmetic industries exacerbates the need for sustainable and eco-friendly cultivation practices. Conventional chemical pesticides and fungicides pose environmental health risks. Panchagavya contains a rich composition of nutrients, growth hormones and beneficial microorganisms that collectively contributes to enhanced nutrient uptake, root development and photosynthetic activity ultimately resulting in better yield, quality and nutritional content in crops. Jeevamrutha is an organic growth stimulant made from a mixture of cow dung, cow urine, jaggery and gram flour fermented to create a nutrient rich microbial culture. Potassium humate is an effective natural material containing potassium and humic substances which enhances nutrient uptake and activate photosynthesis. Micronutrients like zinc and iron are essential element for plant growth and also acts as a metal component of various enzymes, as a functional and structural component (Said-Al Ahl and Omer, 2009). This study investigates the efficacy of growth stimulants and micronutrients in enhancing nutrient status, pest and disease incidence and economics.

Materials and Methods

Study site: The experiment was carried out at experimental block of the Department of Plantation, Spices, Medicinal and Aromatic crops, College of Horticulture, Mudigere which is situated in the Western Ghats and represents the hilly zone (Zone-9) of Karnataka at an altitude of 982 m above mean sea level at 13° 25' North latitude and 75° 25' East longitude. The experimental site consisting of medium sandy loam soil with acidic pH ranging from 4.8 to 5.00. The area received a total annual rainfall of 1372.5 mm during experimental period of the year 2023-24. The average annual minimum and maximum temperature ranged from 18.15 to 29.44°C. The average annual minimum and maximum relative humidity ranged from 71.54 to 88.31 per cent.

Planting material and treatments: The experimental field was brought to fine tilth by repeated ploughing and clod crushing. The plots measuring 1.5 m × 1.2 m were made as per the layout plan leaving a space of 0.5 m between replications and 0.5 m between plots. The well grown stolons were planted at a spacing of 30 × 30 cm in the raised beds under 50% shade net condition. The experiment was laid out in Randomized Complete Block Design with twelve treatments *viz.,*T_1: Jeevamrutha @ 3%, T_2: Panchagavya @ 3%, T_3: Pottassium humate @ 1%, T_4: $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%, T_5: $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%, T_6: Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%, T_7: Jeevamrutha @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%, T_8: Panchagavya @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%, T_9: Panchagavya @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%, T_{10}: Pottassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%, T_{11}: Pottassium humate @ 1% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2% and T_{12}: Control and three replications.

Spray schedule: 2 sprays at 60 and 90 days after transplanting**.**

Plant nutrient analysis: The plant nutrient status of each treatment was analysed by inductively coupled plasma-Optical Emission Spectrometer (ICP-OES), Agilent Technologies 5800Series at 150 days after transplanting.

Soil nutrient status

The effect of foliar application of growth stimulants and micronutrients on soil nutrient status after harvest of *Centella asiatica* were recorded.

Soil pH: Soil pH was measured using pH meter (Jackson, 1958).

Electrical conductivity (EC) (dSm^{-1}): Soil electrical conductivity (EC) was measured using EC Bridge (Jackson, 1958).

Organic carbon (%): Soil organic carbon content was determined by Walkley and Black wet titration method (Walkley and Black, 1934).

Available nitrogen (kg ha^{-1}): The available nitrogen content in the soil was determined by alkaline potassium permanganate method (Subbiah and Asija, 1956).

Available phosphorus (kg ha^{-1}): The available phosphorus content in the soil was determined by Bray and Kurtz method (Bray and Kurtz, 1947).

Available potassium (kg ha^{-1}): The available potassium content in the soil was determined by neutral normal ammonium acetate extract using flame photometer (Jackson, 1958).

Available zinc (kg ha^{-1}): The available zinc content in the soil was determined by DTPA soil test using an atomic absorption spectrophotometer (Lindsay and Norvell, 1978).

Available iron (kg ha^{-1}): The available iron content in the soil was determined by DTPA soil test using an atomic absorption spectrophotometer (Lindsay and Norvell, 1978).

Pest and disease incidence: An observation of the incidence of pest and disease was carried out at College of Horticulture, Mudigere from February 2024 to June 2024 under 50 per cent shade. Observations were made for pest incidence in *Centella asiatica* L. once in fortnight interval. The insects that occurred were collected using a sweep net and killed, then stored in ethyl alcohol (70%). Later, the specimens were identified up to species level. Similarly for disease incidence in *Centella asiatica* L., the crop was monitored at fortnightly interval by recording the expression of disease or damage symptoms to assess disease incidence. The proportion of infected plants per plot was calculated and expressed as percentage of disease incidence as mentioned below 0 to 4 damage scale (Noor *et al.,* 2015).

Scale	Symptom of damage
0	No symptoms
1	0 - 25 % of plants with disease symptoms
2	25 - 50 % of plants with disease symptoms
3	50 - 75 % of plants with disease symptoms
4	> 75% of plants with disease symptoms

Economic analysis: The economics of mandukaparni sprayed with growth stimulants and micronutrients was worked out based on input costs, returns and profit earned by the sale of *Centella asiatica* L. dried herbage by taking into account of the existing price of inputs and price of the produce at domestic markets.

Cost of cultivation (Rs./ ha): The cost incurred from planting to the harvest of the crop was worked out.

Gross returns (Rs. / ha): The yield was computed per ha and the total income was worked out at the prevailing market rate.

Net returns (Rs. / ha): Net returns were obtained by subtracting the gross returns from cost of cultivation.

Net returns (Rs. / ha) = Gross returns (Rs. / ha) – Cost of cultivation (Rs. / ha)

Benefit cost ratio: The benefit cost ratio (BCR) was worked out by using the formula given below.

$$Benefit : Cost\ ratio = \frac{Net\ income\ (ha^{-1})}{Cost\ of\ cultivation\ (ha^{-1})}$$

Results and Discussion

Effect of foliar application of growth stimulants and micronutrients on plant nutrient status

Iron: The iron content varied significantly among the different treatments and the data pertaining to iron content is presented in Table 1. Among the different treatments examined, the treatment T_{10} : Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1% exhibited the maximum iron content (85.69 mg/100g) followed by T_6 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1% (73.80 mg/100g) while, the minimum iron content was in T_{12} (13.33 mg/100g).

Zinc: A significant variation was noticed for zinc content (Table 1). Among the different treatments, the treatment T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%) exhibited the significantly maximum zinc content (77.08 mg/100g) followed by T_6 (73.03). While, zinc content was found minimum in T_{12} (19.11 mg/100g).

The application of humic acid appeared to have positive effect on micronutrient uptake as humic acid increases leaf area, plant biomass and enhances the photosynthesis which increases the permeability of plant tissue, thereby increasing the leaf nutrient content. The findings are in accordance with the results obtained by Talebi and Jabbarzadeh (2018) in china rose. Additionally, humic substances react with the cell membrane structures and interact as a carrier of nutrients which leads to enhanced nutrient uptake. These outcomes are in accordance with the results obtained by Turkmen *et al.* (2005) in pepper plants who indicated that humic substances may improve nutrient uptake.

Effect of foliar application of growth stimulants and micronutrients on soil nutrient status

The results on effect of foliar application of growth stimulants and micronutrients on available nitrogen, phosphorus, potassium, iron and zinc content in soil after harvest of *Centella asiatica* are tabulated in Table 2.

Available nitrogen: It was found that the availability of nitrogen was varied from 266.67 kg ha^{-1} to 227.00 kg ha^{-1} at harvest. The maximum nitrogen availability (266.67 kg ha^{-1}) was recorded with T_{12} (Control). The initial available nitrogen in soil was 270.00 kg ha^{-1}. The lowest available nitrogen (227.00 kg ha^{-1}) was observed in T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%).

Available phosphorus: After harvest the highest available phosphorus content (26.00 kg/ha) in soil was noticed in treatment T_{12} (Control). The initial available phosphorus content in soil was 29.00 kg ha^{-1}. The lowest available phosphorus content of 14.00 kg/ha was observed in T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%).

Available potassium: The data presented in Table 2 revealed that the treatments T_{12} (Control) recorded significantly highest potassium (116.00 kg ha^{-1}) in soil over rest of the treatments. The initial soil available potassium was 140.02 kg ha^{-1}. The lowest available potassium (85.33 kg ha^{-1}) was observed in treatment T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%).

Available iron: There was a significant difference between treatments with respect to iron content of the soil after harvest of crop (Table 2). However, highest iron content (23.15 mg/kg) was found in T_{12} (Control) followed by T_2 (Panchagavya @ 3%) (21.98 mg/kg). The iron content (10.08 mg/kg) was found to be lowest in T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%).

Available zinc: There was a significant difference between treatments with respect to zinc content of the soil after harvest of crop (Table 2). However, higher zinc content (0.90 mg/kg) was found in T_{12} (Control) and which was observed to be *on par* with T_2 (Panchagavya @ 3%) (0.88 mg/kg). The lowest zinc content (0.38 mg/kg) was noticed in T_{10} (Potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1%).

The foliar application of potassium humate enhances the plants ability to absorb nutrients more efficiently. This enhanced the growth and biomass production which will lead to a lower concentration of nutrients in soil, whereas in control plants do not exhibit same level of growth or nutrient uptake. Even though the soil nutrients remain stable, the plants may not be utilizing nutrients effectively as compared to other treatments which resulted in higher nutrient concentration in control. Similar results were obtained by Gajjela and Chatterjee (2019) in bitter gourd.

Effect of foliar application of growth stimulants and micronutrients on incidence of pest and disease

The **i**ncidence of pest and disease was monitored regularly at fortnightly interval in experimental plot from February to June 2024 as listed in the Table 3 and 4. A total of 5 species of insects (Table 3) and two diseases were associated with mandukaparni crop during experimental period. These insects belong to 4 different families and 3 different orders.

Insect pests

Defoliators: The pest cabbage looper (*Trichoplusia Ni)* larva was observed feeding on leaves creating holes and severe defoliation was observed later. Leaf eating caterpillar (*Spodoptera litura fabricius*) was found damaging plants by nibbling at the ground level in few patches. Later instar larva completely defoliated plants. Grasshopper (*Omocestus viridulus*) nymphs and adults found feeding on the leaves with characteristic damage symptoms of irregular defoliation of leaves.

Sucking pests: Mirid bug (*Halticus minutus*) was observed causing a pin hole tinge mark on leaves and suck sap from the leaves. Severe infestation on plants was observed by white patches on the leaves. Similarly, white fly (*Bemisia tabaci*) was observed on plants during late vegetative stage. Severe infestation was observed with wilting and drying of plants and secretion of honey dew leading to black sooty mould fungus on leaves.

Similar results of defoliators and sucking pests were observed by Girish *et al.* (2018) and Nanditha (2022) under shade net conditions.

Disease incidence

During the study period, two diseases were noticed in the experimental plot *viz., Sclerotium* wilt and *Cercospora* leaf spot as presented in the Table 4.

Sclerotium wilt: Sclerotium wilt was observed at crop maturity stage. Fungal mycelia on crop debris or sclerotia serve as primary inoculum. The symptoms of the disease include that infected tissues or plant parts have white and fluffy fungal mycelia on the surface, which often spreads the soil surrounding the plant. Subsequently disease development results in rotted stolons, leaves and roots and eventual death of the plant. The study revealed that non-significant difference was found among different treatments for *Sclerotium* wilt.

Cercospora leaf spot: Foliar disease *Cercospora* leaf spot caused by fungal pathogen *Cercospora centellae* caused considerable damage to plants. Symptoms of the disease includes minute circular to semi-circular light brown spots which gradually occupied the entire leaf lamina, spots were dark brown surrounded by brown zone, leaves turn yellow and defoliated prematurely. In some cases, entire leaf lamina was covered by numerous spots. The study revealed that non-significant difference was found among different treatments for *Sclerotium* wilt.

Effect of growth stimulants and micronutrients on economics

The cost economics of *Centella asiatica* as influenced by foliar application of growth stimulants and micronutrients are represented in the Table 5. The treatment T_9 with Panchagavya @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2% registered higher cost of cultivation (Rs. 1,42,147 ha^{-1}) followed by T_7 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2% (Rs. 138981 ha^{-1}). Least cost of cultivation was found in T_{12} : Control (Rs. 86,210 ha^{-1}). Highest gross return was obtained by the T_{10} with potassium humate @ 1% + $ZnSO_4$@ 0.1% + $FeSO_4$ @ 0.1% (Rs. 4,43,200 ha^{-1}), followed by T_6 with Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1% treatment (Rs. 3,29,600 ha^{-1}). The lowest gross return was obtained in T_{12} : Control (Rs. 1,44000 ha^{-1}). Among the different treatments studied, the treatment T_{10} had higher net returns (Rs. 3,17,706 ha^{-1}) followed by T_6 (Rs. 2,02,052 ha^{-1}) over control (Rs. 7,073 ha^{-1}) . The highest benefit cost ratio (2.53) was recorded in the treatment T_{10} (Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%) and which was followed by T_4 (1.59) and T_6 (1.58). The lowest benefit cost ratio (0.08) was observed in T_{12} (Control). Significant increase in the fresh and dry herbage yield of *Centella asiatica* might be due to the combined application of potassium humate along with zinc sulphate and iron sulphate which gave the maximum cost benefit ratio. The foliar application of humic acid was economical compared to other treatments. These results are partially supported by Lokesh *et al.* (2018) in coriander and Prabhu *et al.*(2010) on mint who also obtained best results in terms of yield and economic return.

Table 1 : Effect of foliar application of growth stimulants and micronutrients on plant nutrient status of *Centella asiatica* L.

Treatments	Iron (mg/100g)	Zinc (mg/100g)
T_1 : Jeevamrutha @ 3%	28.69	35.26
T_2 : Panchagavya @ 3%	25.94	20.77
T_3 : Potassium humate @ 1%	38.05	43.58
T_4 : $ZnSO_4$ @ 0.1% + FeSO4 @ 0.1%	32.28	34.45
T_5 : $ZnSO_4$ @ 0.2% + FeSO4 @ 0.2%	30.73	32.83
T_6 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	73.80	73.03
T_7 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	56.05	61.27
T_8 : Panchagavya @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	47.52	55.21
T_9 : Panchagavya @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	36.23	49.57
T_{10} : Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	85.69	77.08
T_{11} : Potassium humate @ 1%+ $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	66.11	71.35
T_{12} : Control (RDF)	13.33	19.11
S. Em ±	0.72	0.53
CD @ 5%	2.10	1.56

Table 2 : Effect of foliar application of growth stimulants and micronutrients on soil nutrient status after harvest of *Centella asiatica* L.

Treatments	Available nitrogen (kg/ha)	Available phosphorus (kg/ha)	Available potassium (kg/ha)	Available iron (mg/kg)	Available zinc (mg/kg)
T_1 : Jeevamrutha @ 3%	261.00	23.00	104.00	18.67	0.83
T_2 : Panchagavya @ 3%	262.00	25.67	113.00	21.98	0.88
T_3 : Potassium humate @ 1%	255.67	22.33	100.33	17.85	0.81
T_4 : $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	241.00	21.67	97.00	16.85	0.82
T_5 : $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	253.00	23.00	114.00	16.94	0.83
T_6 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	230.67	16.33	88.00	11.89	0.57
T_7 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	236.33	18.67	91.00	13.26	0.70
T_8 : Panchagavya @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	241.67	17.33	93.00	14.07	0.66
T_9 : Panchagavya @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	246.67	21.00	96.00	17.04	0.71
T_{10} : Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	227.00	14.00	85.33	10.08	0.38
T_{11} : Potassium humate @ 1%+ $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	234.00	18.67	90.67	12.92	0.74
T_{12} : Control (RDF)	266.67	26.00	116.00	23.15	0.90
S. Em ±	1.12	0.78	0.66	0.35	0.04
CD @ 5%	3.28	2.3	1.94	1.02	0.12

Table 3 : Succession of insect pests observed on *Centella asiatica* under shade net condition.

Sl.No.	Crop stage	Pest	Scientific name	Family and order
1	Peak growth stage	Cabbage semilooper	*Trichoplusia Ni*	Noctuidae : lepidoptera
		Leaf eating caterpillar	*Spodoptera litura*	
		Grass hopper	*Omocestus viridulus*	Gomphocerinae : Acrididae
2		White fly	*Bemesia tabaci*	Pseudococcidae: Hemiptera
		Jumping plant bug (Sucking bug)	*Halticus minutus*	Miridae : Hemiptera

Table 4 : Effect of growth stimulants and micronutrients on disease incidence

Treatments	Mean score (0-4) scale	
	Sclerotium wilt	***Cercospora* leaf spot**
T_1	0.33 (0.91)	0.00 (0.71)
T_2	0.00 (0.71)	0.00 (0.71)
T_3	0.00 (0.71)	0.33 (0.91)
T_4	0.33 (0.91)	0.67 (1.08)
T_5	0.33 (0.91)	0.33 (0.91)
T_6	0.00 (0.71)	0.00 (0.71)
T_7	0.33 (0.91)	0.33 (0.91)
T_8	0.00 (0.71)	0.00 (0.71)
T_9	0.00 (0.71)	0.00 (0.71)
T_{10}	0.33 (0.91)	0.33 (0.91)
T_{11}	0.00 (0.71)	0.00 (0.71)
T_{12}	1.00 (1.22)	0.67 (1.08)
S.Em±	0.22	0.20
CD @ 5%	0.64	0.58
	NS	**NS**

Note: Figures in the paratheses are square root ($\sqrt{x}$ + 0.5) transformed values.

Table 5 : Effect of growth stimulants and micronutrients on economics

Treatment details	Cost of cultivation	Gross income (Rs./ha)	Net income (Rs./ha)	Benefit : Cost ratio
T_1 : Jeevamrutha @ 3%	116094	211200	95106	0.82
T_2 : Panchagavya @ 3%	119261	166400	47139	0.40
T_3 : Potassium humate @ 1%	114040	222400	108360	0.95
T_4 : $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	97714	252800	155086	1.59
T_5 : $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	109147	212800	103653	0.95
T_6 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	127548	329600	202052	1.58
T_7 : Jeevamrutha @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	138981	220800	81819	0.59
T_8 : Panchagavya @ 3% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	130714	262400	131685	1.01
T_9 : Panchagavya @ 3% + $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	142147	238400	96253	0.68
T_{10} : Potassium humate @ 1% + $ZnSO_4$ @ 0.1% + $FeSO_4$ @ 0.1%	125494	443200	317706	2.53
T_{11} : Potassium humate @ 1%+ $ZnSO_4$ @ 0.2% + $FeSO_4$ @ 0.2%	136927	275200	138273	1.01
T_{12} : Control (RDF)	86260	144000	7073	0.08

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