

## **Evaluation of Poornima Kit: Biofertilizer Efficacy testing using paddy as model crop**



**Department of Agricultural Microbiology  
IndiraGandhKrishiVishwavidyalaya,Raipur(C.G.)**

**SUBMITTED TO:  
Siesto Green**

## **Executive summary:**

The conceptual idea of the Poornima Kit (as provided by Siesto Green) was to rejuvenate soil and enhance the microbial activity in crop rhizosphere in organic aura. The aim of the trial was to evaluate the performance of product alone and in combination with inorganic fertilizers & organic manures. It was also an objective to find out the best compatibility of the product (Poornima Kit) with particular organic manure which can enhance the crop productivity & soil health as well. Further objective of this trial was to know that could it replace the 50% inorganic fertilizer or it will self-sufficient to equate the yield with 100% RDF. The outcome of trial gives significant treatment effect on overall growth, yield parameters and yield of the crop with application of synthetic fertilizer @ 80:40:30 NPK per hectare, followed by individual application of “ Poornima Kit” which also found at par with the top performing synthetic fertilizer application at recommended dose of synthetic fertilizer. The performance of Poornima Kit with 50% dose of synthetic fertilizer is also well appreciable as it was third in order in most of the studied parameters.

## **Introduction:**

A bio-capsule is a novel method of storing and delivering agriculturally important microbes through capsules. It's a novel patented bio-capsule technology developed by ICAR-Indian Institute of Spices Research, Kozhikode, Kerala and being used as effective fertilizer for organic farming. The technology involves encapsulation of the microorganisms of interest in a gelatin capsule for delivery to the agricultural crops for the enhanced soil nutrient solubilization, growth and yield. The recently patented product is used for cultivation of spices, vegetable and other crops. This technique can be used for delivering all kinds of agriculturally important microorganisms, viz., N fixers, nutrient solubilizers / mobilizers, Plant Growth Promoting Rhizobacteria (PGPR), *Trichoderma*, *Burkholderia*, etc. The effectiveness of bio-capsules can vary based on factors such as soil type, climate, and specific product formulations.

Looking to the above facts a study was conducted to evaluate the efficacy of such bio-product (Poornima Kit) on the performance of paddy during Kharif 2023. This trial was also conducted to find the possibility of utilizing Poornima Kit alone and in combination with organic

manures and chemical fertilizers for maximization of paddy yield. The test was also performed to know the impact of such microbial cum bio product with other organic materials on physico-chemical, chemical and biological properties of soil.

### **Objectives:**

1. Effects of Poornima Kit on the growth and development of rice, yield attributing characters and yield.
2. Effect of bio-inputs (Poornima Kit) on microbial activity in the soil during each phase of rice cultivation.
3. Compatibility of bio-input with synthetic fertilizers with respect to crop growth and soil health.
4. Assess the impact of Poornima Kit on residual soil nutrient content after rice harvest.

### **Technical Program of Work**

The field experiment was conducted during the kharif season of 2022-23 at instructional cum research farm College of Agriculture IGKV Raipur (C.G.) The field trial consisting of bio-capsule (Poornima kit), vermicompost, bio-slurry, synthetic fertilizer (NPK), water soluble synthetic fertilizer (NPK) .

### **Experimental details: -**

Season	Kharif 2023
Crop	Paddy
Variety	Protezin
Soil type	<i>Vertisol (kanhar soil)</i>
Establishment	Transplanting
Plot size	7 x 3 square meter
Spacing	10 x 20cm
Design	Randomized block Design
Replication	3
Treatment	10
RDF	N: P: K @ 80:40:30 kg/ha <sup>-1</sup>

## TREATMENT DETAILS: -

Treatment No.	Treatment details
	1 <sup>st</sup> Dose (before sowing)
T1	No application
T 2	Poornima Kit
T 3	Bio-slurry
T 4	Poornima Kit +bio-slurry
T 5	Vermicompost
T 6	Poornima Kit + vermicompost
T 7	Synthetic fertilizer (NPK)@RDF
T 8	Poornima Kit+ 50% synthetic fertilizer (NPK)@RDF
T 9	Water soluble synthetic fertilizer (NPK)@20:20:20
T 10	Poornima Kit+50% water soluble synthetic fertilizer (NPK)@20:20:20

- \* Components of Poornimacycle Kit – NPK consortia, zinc solubilizing bacteria, Humigrow (humic acid) PGP/PGR, Cropforce PGP/PGR and mycorrhiza.
- \* The rate of application of different components of Poornima cycle Kit was as follows:
  - \* (i) NPK consortia: 2 capsule per acre
  - \* (ii) Zinc solubilizing bacteria : 1capsule per acre
  - \* (iii) Humigrow :120g per acre
  - \* (iv) Cropforce : 120g per acre
  - \* (v) Mycorrhiza : 100g per acre

### The application rate of organic manure and fertilizers was as follows:

- (i) Vermicompost : 1.5 ton per hectare
- (ii) Bio slurry : 40 liter per hectare
- (iii) Water soluble fertilizers (20:20:20::N:P:K) : 2.5kg per hectare
- (iv) Synthetic fertilizer :80:40:30 N:P:K per hectare

### Observations recorded –

#### A. Plant: -

1. Plant Height (cm) at 30,60,90 days after transplanting.
2. No. of tillers 60,90 days after transplanting.
3. No. Panicles at 60,90 days after transplanting

4. Dry weight of shoot(g)
5. Seed weight of plant(g)
6. Test weight (g)
7. Grain yield ( $\text{q ha}^{-1}$ ) per plot
8. Straw yield ( $\text{q ha}^{-1}$ ) per plot

**B. Soil:-**

1. pH Acidity
2. Organic Matter
3. Microbial Population
4. Residual NPK content in soil

**C. Plant -**

1. NPK content in grain & straw
2. NPK uptake by crop at harvesting





**Plate-1: General view of field and nursery preparation for sowing of paddy**





**Paddy nursery ready for transplanting**



**Transplanting of paddy seedlings  
Plate: 2**





**Plate-3: View of experimental field after transplanting**



## **Results:**

### **(1) Study of plant growth parameters as influenced by application of Poornima Kit:**

#### **(i) Plant height: -**

The plant growth of paddy was recorded in three different stages of the crop which was tabulated in Table-1 and presented in Plate-5. The data recorded at 30, 60, 90 days after transplanting (DAT) were found significant over control due to application of different treatments.

The height of paddy at 30 DAT increased significantly over control due to application of synthetic fertilizer applied at recommended dose (80:40:30 NPK)(T7) and use of Poornima kit with 50% RDF(T8). However, remaining treatments were found at par and non-significant over control. The treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) had recorded the maximum height of 59.67 cm, followed by the treatment T8 (Poornima Kit + Synthetic fertilizer@50% RDF) with a mean height of 59.18 cm recorded.

At 60 DAT, three treatments significantly increased the plant height over control i.e. treatment T2, T7 & T8. The treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) had increased the height of the plant maximum (90.51cm), followed by treatment T2 (Poornima Kit) with mean height of 88.90cm. The treatment T8 was third in order and recorded a plant height of 88.82 cm. The remaining treatments were also found at par with treatment T7 except treatment No. T4 (Poornima Kit with Bio slurry) and control.

At 90 DAT, two treatments performed significantly better over control with respect to plant growth. The treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) produced the maximum height (93.44cm), followed by treatment T8 (Poornima Kit + Synthetic fertilizer@50% RDF) which had shown 92.54cm height, followed by treatment T2 (Poornima Kit) with mean height of 90.47cm.

**Table-1.Effect of Poornima Kit on height of paddy grown in *vertisol* under Chhattisgarh plain**

Treatment No.	Treatment Details	Height(cm)		
		30DAT	60DAT	90DAT
<b>T1</b>	Control(No Fertilizer)	52.82	81.65	84.21
<b>T2</b>	Poornima Kit	55.39	88.90	90.47
<b>T3</b>	Bio-slurry	55.57	85.28	87.86
<b>T4</b>	Poornima Kit +Bio-slurry	55.81	85.67	88.28
<b>T5</b>	Vermicompost	56.54	86.57	88.84
<b>T6</b>	Poornima Kit + Vermicompost	53.38	83.39	85.37
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	59.67	90.51	93.44
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	59.18	88.82	92.54
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	54.65	87.80	90.08
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	53.72	85.10	86.73
<b>C.D.(0.05)</b>		<b>4.35</b>	<b>6.68</b>	<b>8.30</b>





**Plate-5: Plant height measurement**

## **(ii) Variation in tiller number of paddy due to application of Poornima Kit:-**

The number of tillers was influenced by Poornima Kit at different growth stages of Plant development, notably at 60 & 90 days after transplanting (DAT) (Table-2).

The result revealed that single treatment i.e. Poornima Kit with 50% Synthetic fertilizer found effective to increase the number of tillers of crop over control significantly. The result clearly indicated that at 60 DAT the application of Poornima Kit with 50 % dose of Synthetic fertilizer produced maximum number of tillers (4.67/plant), followed by treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) with tiller number of 4.57/plant. Although treatment T7 was at par with control.

At 90 DAT two treatments were found significantly superior over control to increase the tiller numbers per plant. Maximum number of tillers (5.07/plant) was recorded both in inorganic treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) and partially inorganic treatment T8 (Poornima Kit + Synthetic fertilizer@50% RDF). The remaining treatments were found at par with control.

## **(iii) Number of panicles:-**

The number of panicles was influenced by different treatments as recorded in 60 & 90 days after transplanting (DAT) (Table-3).

The result revealed that at 60DAT single treatment found effective to increase the number of tillers significantly over control i.e. Poornima Kit with 50% Synthetic fertilizer. In this stage maximum number of panicles (4.67/plant) was produced by treatment T8, followed by treatment T7 which produced 4.57 panicles per plant.



**Table -2. Effect of Poornima Kit on number of Tillers of paddy grown in  
Vertisol under Chhattisgarh plain**

Treatment No.	Treatment Details	Number of Tillers/plant	
		60 DAT	90 DAT
<b>T1</b>	Control (NoFertilizer)	3.93	4.23
<b>T2</b>	Poornima Kit	4.40	4.50
<b>T3</b>	Bio-slurry	4.07	4.90
<b>T4</b>	Poornima Kit + Bio-slurry	4.03	4.20
<b>T5</b>	Vermicompost	4.07	4.27
<b>T6</b>	Poornima Kit + Vermicompost	4.03	4.17
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	4.57	5.07
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	4.67	5.07
<b>T9</b>	Water soluble synthetic fertilizer (NPK) @20:20:20	3.93	5.20
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	4.36	4.40
<b>C.D.(0.05)</b>		<b>0.68</b>	<b>0.69</b>

**Table -3. Effect of Poornima Kit on number of Panicles of paddy grown in *Vertisol* under Chhattisgarh plain**

<b>Treatment No.</b>	<b>Treatment Details</b>	<b>Number of Panicles/plant</b>
		<b>60 DAT</b>
<b>T1</b>	Control (NoFertilizer)	3.73
<b>T2</b>	Poornima Kit	3.83
<b>T3</b>	Bio-slurry	4.07
<b>T4</b>	Poornima Kit + Bio-slurry	3.80
<b>T5</b>	Vermicompost	4.03
<b>T6</b>	Poornima Kit + Vermicompost	3.97
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	4.57
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50%RDF	4.67
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	3.93
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	4.20
<b>C.D.(0.05)</b>		<b>0.47</b>





**Performance of experimental paddy at 30 DAT**



**Performance of experimental paddy at 60 DAT**



**Performance of experimental paddy at 90 DAT**

**Plate-6**

## **(2) Study of crop yield attributing parameters:**

### **(i) Changes in shoot dry weight of paddy due to application of Poornima Kit:-**

The shoot dry weight of paddy is a good indicator of plant growth which also determines the crop yield. In this study the shoot dry matter of paddy was quantified at harvest stages (Table-4). In this stage most of the treatments showed significant increase in shoot weight over control except two treatments T5 (Vermicompost) and T6 (Poornima Kit + Vermicompost) which found inferior to others and non-significant to control. Maximum plant shoot dry weight (8.17 g/plant) was attributed with treatment T7 (Synthetic fertilizer @ 80:40:30 NPK), followed by treatment T2 (Poornima Kit which produced 7.87g dry mass of shoot per plant which was at par with treatment T7.

### **(ii) Effect of Poornima Kit on grain weight of paddy:-**

The seed weight paddy was recorded at harvest (Table-5). This shows the productivity of crop per plant basis. The data showed all the treatments increased the seed weight per plant significantly over control except four treatments i.e. treatment T4 (Poornima Kit + Bio-slurry). Treatment T5 (Vermicompost) and Treatment T6 (Poornima Kit + Vermicompost). Maximum seed yield per plant (3.73 g) was recorded in treatment T7 (Synthetic fertilizer @ 80:40:30 NPK), followed by use of Poornima Kit (T2) which produced 3.53g seed per plant. Both the treatments were found at par with each other.

**Table -4. Effect of Poornima Kit on shoot dry weight and seed weight biomass of paddy grown in *Vertisol* under Chhattisgarh plain**

<b>Treatment No.</b>	<b>Treatment Details</b>	<b>Dry Shoot Weight</b>	<b>Seed Weight</b>
		<b>(gm/plant)</b>	<b>(gm/plant)</b>
<b>T1</b>	Control (No Fertilizer)	5.63	3.00
<b>T2</b>	Poornima Kit	7.87	3.53
<b>T3</b>	Bio-slurry	6.50	3.27
<b>T4</b>	Poornima Kit + Bio-slurry	6.80	3.33
<b>T5</b>	Vermicompost	5.90	3.27
<b>T6</b>	Poornima Kit + Vermicompost	6.30	3.27
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	8.17	3.73
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50%RDF	7.40	3.43
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	6.87	3.40
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	7.07	3.40
<b>C.D.(0.05)</b>		<b>0.76</b>	<b>0.36</b>



### **(3)Study of crop yield parameters:-**

#### **(ii)Crop yield:-**

The crop yield study was conducted after harvest of crop. Different parameters related to crop yield was measured (Table-7) to justify the efficacy of Poornima Kit applied alone to crop or in combination with chemical fertilizers and organic manures. The grain and straw yield per plot were measured and further converted the quantity of yield to quintal per hectare on the basis of plot wise data.

The seed weight of paddy was recorded at harvest (Table-5). This shows the productivity of crop per plant basis. The data showed all the treatments increased the seed weight per plant over control. Maximum seed yield per plant (41.54q/ha) was recorded in treatment T7 (Synthetic fertilizer @ 80:40:30 NPK), followed by application of Poornima Kit as T2 which produced 40.30q/ha grain yield. The treatment T8 (Poornima Kit + synthetic fertilizer@50%) was third in order and also performed good yield of 38.83q/ha. Similarly in case of straw yield all the treatments were found effective to produce significantly higher straw yield over control. Highest straw yield was produced by treatment T7 (Synthetic fertilizer @ 80:40:30 NPK) with mean straw yield of 60.13q/ha, followed by treatment T8 (Poornima Kit +Synthetic fertilizer@50% RDF) which produced 55.03q/ha straw yield. The yield of Poornima Kit in treatment T2 was third in order which produced 54.81q/ha yield.

**Table -5.Effect of Poornima Kit on yield parameters of paddy grown in *Vertisol* under Chhattisgarh plain**

Treatment (no.)	Treatment details	Grain yield		Straw yield	
		kg/plot	q/ha	kg/plot	q/ha
<b>T1</b>	Control(No Fertilizer)	3.93	18.71	5.1	24.29
<b>T2</b>	Poornima Kit	8.46	40.29	11.51	54.81
<b>T3</b>	Bio-slurry	7.84	37.33	10.51	50.05
<b>T4</b>	Poornima Kit+Bio-slurry	7.80	37.14	10.44	49.71
<b>T5</b>	Vermicompost	7.10	33.81	9.75	46.43
<b>T6</b>	Poornima Kit + Vermicompost	7.67	36.52	10.07	47.95
<b>T7</b>	Synthetic Fertilizers (N:P:K)	8.72	41.52	12.63	60.14
<b>T8</b>	Poornima Kit + Synthetic fertilizer (NPK) 50%	8.16	38.86	11.56	55.05
<b>T9</b>	Water soluble synthetic fertilizer (NPK)	7.89	37.57	11.17	53.19
<b>T10</b>	Poornima Kit + water soluble synthetic fertilizer (NPK) 50%	7.91	37.67	11.02	52.48
<b>C.D.(0.05)</b>		<b>0.99</b>	<b>4.75</b>	<b>1.95</b>	<b>5.23</b>





**Crop performance at maturity**



**Harvesting of crop**

**Plate:7**



**(4) Variation in test weight of paddy grains due to application of Poornima Kit alone and in combination with chemical fertilizers &/or organic manures:-**

Important yield attributing character of paddy like test weight was studied after harvest of crop (Table-6). The test weight of paddy grains was significantly affected by application of inorganic fertilizers/organic manures alone and in combination with Poornima Kit. Highest test weight was recorded in treatment T7 (Synthetic fertilizer with recommended dose i.e. 80:40:30 NPK), with a mean value of 26.57g, followed by application of Poornima Kit alone in treatment T2 with a test weight of 26.23g which was at par with T7 (Synthetic fertilizer with recommended dose i.e. 80:40:30 NPK). The maximum value was found at par with all the treatments except control (No application). The minimum value of test weight (except control) was observed in case of vermicompost treatment (T5) with a value of 25.13g.

**(5) Nutrient content in paddy as influenced by Poornima Kit and other inorganic & organic treatments:-**

**(i) NPK content in grain:**

Nutrient content in paddy at harvest of crop is presented in Table- 7. The nitrogen content in grain was significantly affected by application of different treatments. Maximum nitrogen content in grain (1.25%) was attributed to the treatment T7 (Synthetic fertilizer in recommended dose i.e. 80:40:30 NPK), followed by treatment T2 (Poornima Kit) in which 1.20% nitrogen was quantified in paddy grains. Treatment No. T2, T8, T9 & T10 were found at par with treatment T7. Except control, minimum nitrogen content in grain (0.96%) was found in treatment T5 (Vermicompost).

In case of Phosphorus content treatment No. T2, T4, T7, T8 & T10 have shown significantly higher content of P in grain over control. Highest phosphorus content was associated with treatment T2 (Poornima Kit), with mean P value of 0.591%, followed by treatment T4 (Poornima Kit with bio slurry) which had shown an accumulation of 0.542% P in grain. The treatment T4 & T8 were found at par with treatment T2. The potassium content in grain varied among treatments which found significantly higher over control. The highest K content in grain was associated with treatment T8 with mean value of 0.32%, followed by treatment T7 (0.30%). Excluding control, the minimum value of K in grain was found in treatment No. T5 (Vermicompost).

**Table -6.Effect of Poornima Kit on grain test weight of paddy grown in *Vertiso* /under Chhattisgarh plain**

<b>Treatment No.</b>	<b>Treatment Details</b>	<b>Test Weight</b>
		<b>(g)</b>
<b>T1</b>	Control (No Fertilizer)	18.27
<b>T2</b>	Poornima Kit	26.23
<b>T3</b>	Bio-slurry	25.60
<b>T4</b>	Poornima Kit + Bio-slurry	25.50
<b>T5</b>	Vermicompost	25.13
<b>T6</b>	Poornima Kit + Vermicompost	25.37
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	26.57
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50%RDF	25.77
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	25.73
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	25.63
<b>C.D.(0.05)</b>		<b>2.04</b>

**Table -7.Effect of Poornima Kit on nutrient content in grain and straw of paddy grown in *Vertisol* under Chhattisgarh plain**

Treatment No.	Treatment Details	Nutrient content (%) (At harvest)					
		N		P		K	
		Grain	Straw	Grain	Straw	Grain	Straw
<b>T1</b>	Control (No Fertilizer)	0.75	0.59	0.416	0.129	0.2	1.13
<b>T2</b>	Poornima Kit	1.2	0.69	0.591	0.133	0.29	1.77
<b>T3</b>	Bio-slurry	0.97	0.62	0.453	0.13	0.25	1.45
<b>T4</b>	Poornima Kit + Bio-slurry	1.11	0.67	0.542	0.132	0.26	1.6
<b>T5</b>	Vermicompost	0.96	0.6	0.431	0.128	0.24	1.45
<b>T6</b>	Poornima Kit + Vermicompost	1.09	0.65	0.453	0.128	0.26	1.54
<b>T7</b>	Synthetic Fertilizers (NPK)@RDF	1.25	0.71	0.521	0.133	0.3	1.65
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	1.18	0.69	0.539	0.134	0.32	1.7
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	1.15	0.69	0.457	0.132	0.29	1.49
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	1.18	0.67	0.484	0.132	0.29	1.62
<b>CD(0.05 )</b>		<b>0.11</b>	<b>0.06</b>	<b>0.052</b>	<b>0.013</b>	<b>0.03</b>	<b>0.19</b>



**(ii) NPK content in straw:**

NPK content in straw at harvest of paddy is present in Table-7. The nitrogen content in paddy straw significantly varied among treatments. Treatment No. T2, T4, T7, T8, T9, T10 increased the nitrogen content in straw significantly over control. The treatment T7 (Synthetic fertilizer in recommended dose i.e. 80:40:30 NPK) exhibited the highest nitrogen accumulation (0.71%) in straw, followed by treatment T2, T8 & T9 which accumulated equal amount of nitrogen (0.69%) in straw. The treatment T5 found inferior to accumulate minimum quantity of N in straw (0.60%), excluding control

The phosphorus content in straw did not differ among treatments significantly. However, highest content of phosphorus was associated with treatment T8 (Poornima Kit + synthetic fertilizer@50%RDF) and minimum in treatment T5(Vermicompost) & T6 (Poornima Kit + Vermicompost).

The paddy straw normally contains high quantity of potassium. In the present experiment potassium quantity in straw increased significantly due to application of different treatments and found significantly higher over control. The highest accumulation of potassium in straw (1.77%) was observed in treatment T2 (Poornima Kit), followed by treatment T8(Poornima Kit + synthetic fertilizer@50%RDF) where 1.70% potassium was quantified in straw. Minimum quantity of potassium (1.45%) was found in treatment T5(Vermicompost) & T3(Bio slurry), excluding control.

**(6) Variation in nutrient uptake by paddy due to application of Poornima Kit alone and in combination with inorganic fertilizers & organic manures:-**

**(i) Uptake by grain:**

The uptake of three major nutrients by paddy was influenced by different inorganic and organic treatments & their combination, which is presented in Table-8. The result revealed that uptake of N, P & K by grain was significantly affected by different treatments. The highest uptake of nitrogen and potassium by paddy grain was attributed with the treatment T7 where synthetic fertilizers were applied at recommended dose. In case of N-uptake highest uptake of 51.90 kg/ha was found in treatment T7, followed by treatment T2 (Poornima Kit) with mean uptake of 48.34 kg/ha and at par with treatment T7.

In case of P-uptake highest uptake of P (23.81 kg/ha) by paddy grain was attributed with treatment T2 (Poornima Kit), followed by treatment T7 (21.63kg). The treatment T7 & T8 were found at par with treatment T2 (Poornima Kit).

In case of K-uptake highest uptake was shown by treatment T7 (synthetic fertilizer with recommended dose i.e. 80:40:30 NPK) with mean value of 12.46kg/ha, followed by treatment T8(Poornima Kit + synthetic fertilizer@50% RDF) with mean value of 12.43kg/ha. Use of Poornima Kit (T2) alone was third in order which has shown 11.68kg K uptake by grain. Treatment T8 & T2 were found at par with T7.

**Table -8.Effect of Poornima Kit on nutrient uptake by grain and straw of paddy grown in *Vertisol* under Chhattisgarh plain**

Treatment No.	Treatment Details	Nutrient Uptake (kg/ha)					
		N		P		K	
		Grain	Straw	Grain	Straw	Grain	Straw
<b>T1</b>	Control (No Fertilizer)	14.04	14.33	7.79	3.13	3.74	27.44
<b>T2</b>	Poornima Kit	48.34	37.82	23.81	7.29	11.68	97.01
<b>T3</b>	Bio-slurry	36.21	31.03	16.91	6.51	9.33	72.57
<b>T4</b>	Poornima Kit + Bio-slurry	41.23	33.31	20.13	6.56	9.66	79.54
<b>T5</b>	Vermicompost	32.46	27.86	14.57	5.94	8.11	67.32
<b>T6</b>	Poornima Kit + Vermicompost	39.81	31.17	16.55	6.14	9.50	73.85
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	51.90	42.70	21.63	8.00	12.46	99.24
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	45.85	37.98	20.94	7.38	12.43	93.58
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	43.21	36.70	17.17	7.02	10.90	79.25
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	44.45	35.16	18.23	6.93	10.92	85.01
<b>CD(0.05 )</b>		<b>4.46</b>	<b>3.61</b>	<b>2.01</b>	<b>0.71</b>	<b>1.03</b>	<b>8.56</b>



## **(ii) Uptake by straw:**

The uptake of NPK by paddy straw is presented in Table- 8. The N-uptake by straw was found significantly higher in all the treatments over control. Highest N-uptake of 42.70kg/ha was associated with treatment T7 (synthetic fertilizer with recommended dose i.e. 80:40:30 NPK), followed by treatment T8 (Poornima Kit + synthetic fertilizer@50% RDF) where 37.98 kg nitrogen was absorbed by paddy straw. Treatment T2 (Poornima Kit) was third in order. The only treatment T8 was found par with treatment T-7.

In case of P-uptake all treatments have shown positive impact on uptake of phosphorus by paddy straw. Maximum uptake (8.00kg/ha) was associated with treatment T7 (synthetic fertilizer with recommended dose i.e. 80:40:30 NPK), followed by treatment T8 (Poornima Kit + synthetic fertilizer@50% RDF) which have 7.38 kg P uptake/ha. The Treatment T2 with Poornima Kit was third in order (7.29kg/ha) and found at par with treatment T7 & T8.

In case of K-uptake all nine treatments have found superior over control with respect to absorption of potassium by straw. The treatments T7 (synthetic fertilizer with recommended dose i.e. 80:40:30 NPK) found best for maximum uptake (99.24kg/ha), followed by treatment T2 (Poornima Kit) which accumulated 97.01kg K/ha and found at par with treatment T7. Treatment T8 also found at par with treatment T7.

## **(7) Soil properties as influenced by application of Poornima Kit alone or in combination with inorganic fertilizers & organic manures**

### **(i) Soil pH:**

The changes in soil reaction (pH) were studied in three different stages of crop (30, 60 DAT & at post-harvest)(Table-9). In all three stages a non-significant variation was observed among treatments. No definite trend in increase or decrease of pH was noticed due to application of treatments. However, a little increase in soil pH was found in most of the cases due to application of treatments in comparison to control.

### **(ii) Soil organic matter:**

The soil organic carbon was estimated at different growth stages of paddy crop which was presented in Table-10 & Plate-9.

The data revealed that at 30 DAT all the organic treatments significantly increased the soil organic carbon in comparison to control. In this stage of crop growth maximum soil organic carbon was accumulated by treatment T4 (Poornima Kit + Bio-slurry) with mean value of 0.56%, followed by treatment T3 (Bio-slurry) with carbon content of 0.56%.

At 60 DAT comparatively higher organic matters accumulation in soil was observed in comparison to 30 DAT. In this stage all the organic treatments and treatments with inorganic & organic combinations significantly increased the soil organic matter content significantly over control. Highest accumulation of soil organic carbon was attributed to treatment T2 (Poornima Kit) which has an accumulation of 0.59% organic carbon in soil, followed by treatment T3 (Bio-slurry) with an accumulation of 0.58% C and found at par with treatment T2. At 90 DAT all the treatments exhibited significant increase in soil organic carbon over control except the treatments containing water soluble synthetic fertilizer alone or in combination with Poornima Kit. Maximum amount soil organic carbon accumulation was noticed in treatment treatment T4 (Poornima Kit + Bio-slurry), followed by treatment T2 (Poornima Kit) which was at par with treatment T4. The treatments contained 0.57% and 0.56% organic carbon, respectively.

In above study it can be concluded that bio-slurry alone or in combination with Poornima Kit or Poornima Kit alone found effective to increase the soil organic carbon content.

**Table -9.Effect of Poornima Kit on soil pH of paddy grown *Vertisol* under Chhattisgarh plain**

Treatment No.	Treatment Details	pH		
		30DAT	60DAT	At harvest
<b>T1</b>	Control (No Fertilizer)	7.47	7.47	7.43
<b>T2</b>	Poornima Kit	7.50	7.57	7.47
<b>T3</b>	Bio-slurry	7.57	7.53	7.63
<b>T4</b>	Poornima Kit + Bio-slurry	7.50	7.50	7.57
<b>T5</b>	Vermicompost	7.50	7.53	7.43
<b>T6</b>	Poornima Kit + Vermicompost	7.50	7.47	7.50
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	7.50	7.57	7.40
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50%RDF	7.53	7.50	7.63
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	7.53	7.67	7.60
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	7.57	7.57	7.57
<b>C.D.(0.05)</b>		<b>NS</b>	<b>NS</b>	<b>NS</b>

**Table -10.Effect of Poornima Kit on soil organic carbon content of paddy grown *Vertisol* under Chhattisgarh plain**

Treatment No.	Treatment Details	Soil Organic Carbon (%)		
		30DAT	60DAT	At harvest
<b>T1</b>	Control (No Fertilizer)	0.43	0.48	0.46
<b>T2</b>	Poornima Kit	0.52	0.59	0.56
<b>T3</b>	Bio-slurry	0.56	0.58	0.55
<b>T4</b>	Poornima Kit + Bio-slurry	0.59	0.54	0.57
<b>T5</b>	Vermicompost	0.53	0.56	0.50
<b>T6</b>	Poornima Kit + Vermicompost	0.54	0.54	0.53
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	0.54	0.52	0.53
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	0.43	0.55	0.53
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	0.51	0.51	0.50
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	0.47	0.54	0.49
<b>C.D.(0.05)</b>		<b>0.07</b>	<b>0.04</b>	<b>0.04</b>





**Plate 9:-Determination of organic carbon content of soil**

**(8)Variation in residual nutrient content in soil due to application of Poornima Kit alone and in combination with organic manures & synthetic fertilizers:-**

The residual nitrogen, phosphorus and potassium content in soil were determined at harvest of crop which is presented in Table-11. The values shown that there was a non-significant variation was found among residual nitrogen & potassium quantity due to application of different treatments. However, phosphorus content varied significantly among treatments. All the three major nutrients found in maximum quantity in soil due to application of Poornima Kit with vermicompost (T6). In case of N, the treatment T8(Poornima Kit +Synthetic fertilizer@50% RDF), was next in order, where as in case of P & K the treatment T5 (Vermicompost) was second in order.

The overall picture shown that use of Poornima Kit with vermicompost is an effective combination to increase the residual nutrient content in soil.

**Table -11.Effect of Poornima Kit on residual soil nutrient content of paddy grown  
Vertisol under Chhattisgarh plain**

Treatment No.	Treatment details	Residual soil nutrient content (kg/ha)								
		N			P			K		
		30DAT	60DAT	At harvest	30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
<b>T1</b>	Control (NoFertilizer)	242.52	242.52	225.79	18.91	18.55	17.39	465.70	450.02	431.98
<b>T2</b>	Poornima Kit	246.70	255.06	238.34	21.39	22.46	20.37	476.22	465.55	446.32
<b>T3</b>	Bio-slurry	242.52	246.70	229.97	22.46	22.37	19.54	471.52	460.51	437.73
<b>T4</b>	Poornima Kit + Bio-slurry	246.70	250.88	234.15	23.84	24.37	19.95	474.58	465.21	450.80
<b>T5</b>	Vermicompost	250.88	255.06	242.52	23.18	23.21	21.48	473.72	467.04	459.39
<b>T6</b>	Poornima Kit + Vermicompost	250.88	259.24	250.88	23.66	23.75	21.63	478.58	470.25	463.90
<b>T7</b>	Synthetic Fertilizers (NPK) @RDF	271.79	267.61	234.15	21.75	22.22	19.33	476.11	466.85	438.85
<b>T8</b>	Poornima Kit + Synthetic Fertilizers (NPK) @50% RDF	255.06	259.24	242.52	22.04	22.49	20.07	480.22	472.30	449.46
<b>T9</b>	Water soluble synthetic fertilizer (NPK)@20:20:20	246.70	250.88	229.97	21.33	21.60	19.00	466.82	448.26	429.33
<b>T10</b>	Poornima Kit + Water soluble synthetic fertilizer (NPK) @50% of 20:20:20	255.06	255.06	238.34	21.54	22.43	19.71	472.08	453.75	435.90
<b>CD (0.5)</b>		<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>1.70</b>	<b>1.77</b>	<b>1.82</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

### **(9)Variation in microbial growth in paddy rhizosphere due to application of Poornima Kit alone and in combination with organic manures and synthetic fertilizers**

A study on the growth of bacteria, fungi and actinomycetes in paddy rhizosphere was performed at 30, 60 DAT and at harvest (Table- 12, Plate- 8). The population of bacteria increased significantly in almost treatments over control at 30, 60 DAT and at harvest. However, at 30 DAT, the treatment No.T7 (Synthetic fertilizer @ 80:40:30 NPK) found ineffective to increase the bacterial population over control. At harvest also, treatment No. T7 (Synthetic fertilizer @ 80:40:30 NPK) did not promote the bacterial population in all the stages. The application of vermicompost (T5) found most significant to increase the bacterial population, followed by use of Poornima Kit with vermicompost (T6) at 30 DAT. In case of 60 DAT & harvest the Poornima Kit with vermicompost (T6) was found most significant to increase the bacterial population, followed by use of vermicompost (T5). The treatment T4 & T5 were found at par with treatment T6 in respective growth stages.

Similar to bacteria, fungal population was affected significantly in above three stages of crop. In 30 DAT & at harvest all the treatments were found effective to increase the fungal population in paddy rhizosphere over control but at 60 DAT treatment No. T7 (Synthetic fertilizer @ 80:40:30 NPK), T8 (Poornima Kit +Synthetic fertilizer@50% RDF), T9 (Water soluble synthetic fertilizer (NPK)) &T10 (Poornima Kit + water soluble synthetic fertilizer (NPK) 50%) were not promoted the fungal growth significantly over control. At 60 DAT and at harvest treatment Poornima Kit with vermicompost (T6) increased the fungal population maximum, followed by use of vermicompost (T5) which was at par with T6.

Actinomycetes population was also affected by different treatments. Except few treatments all were significantly increased the actinomycetes population in rhizosphere soil over control. At 30 DAT the treatment T7 & T8 were found ineffective, whereas at harvest stage the only treatment T7 was found ineffective. At all the stages the treatment of vermicompost (T5) was found most effective to enhance the growth of actinomycetes, followed by use of Poornima Kit with vermicompost. However, at harvest the Poornima Kit with bio-slurry was second in order to increase the actinomycetes population. It is worthwhile to note that the Poornima Kit with vermicompost at 30 DAT & 60 DAT & Poornima Kit with bio-slurry at harvest were found at par with treatment of vermicompost.

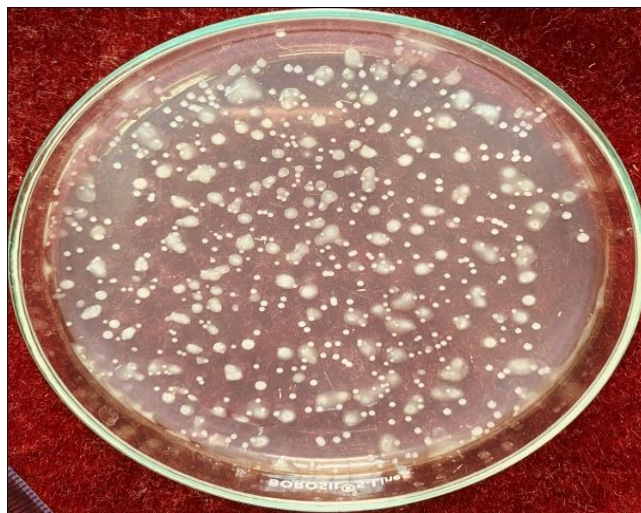


**Table -12.Effect of Poornima Kit on Microbial Population in paddy grown in Vertisol under Chhattisgarh plain**

Treat ment No.	Treatment details	Microbial Population (cfu/gm soil)								
		Bacteria(x10 <sup>7</sup> )			Fungi (x10 <sup>4</sup> )			Actinomycetes(x10 <sup>6</sup> )		
		30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
<b>T1</b>	<b>No application</b>	44.33	47.33	40.33	14.33	16.33	10.33	32.7	38.00	35.67
<b>T2</b>	<b>Poornima kit</b>	52.67	60.67	48.33	17.33	20.67	15.00	43.33	50.33	52.00
<b>T3</b>	<b>Bio-slurry</b>	53.67	61.67	51.67	18.67	22.67	16.00	45.67	50.33	52.67
<b>T4</b>	<b>Poornima kit + bio-slurry</b>	57.67	60.00	50.00	21.33	23.00	17.33	49.33	54.67	54.00
<b>T5</b>	<b>Vermicompost</b>	61.00	64.33	53.00	21.67	23.33	17.33	56.67	58.67	55.33
<b>T6</b>	<b>Poornima kit + vermicompost</b>	58.67	65.67	53.67	20.67	24.00	18.67	55.33	55.00	53.00
<b>T7</b>	<b>Synthetic fertilizers (n:p:k)</b>	47.33	55.33	42.33	15.67	15.67	11.67	35.00	46.33	40.00
<b>T8</b>	<b>Poornima kit + synthetic fertilizer (NPK) 50%</b>	49.33	57.61	46.67	16.00	17.33	13.67	37.67	47.00	44.33
<b>T9</b>	<b>Water soluble synthetic fertilizer (NPK)</b>	50.33	56.33	45.67	16.33	17.00	13.00	37.33	45.00	43.67
<b>T10</b>	<b>Poornima kit + water soluble synthetic fertilizer (NPK) 50%</b>	51.67	59.67	47.33	16.67	18.33	14.33	38.00	48.3	46.00
<b>C.D.(0.5)</b>		<b>5.54</b>	<b>5.43</b>	<b>4.76</b>	<b>1.65</b>	<b>2.20</b>	<b>1.53</b>	<b>3.94</b>	<b>5.42</b>	<b>5.09</b>



**Actinomycetes colony**



**Bacterial colony**



**Fungal colony**

**Plate 8: Microbial population study of experimental field soil**

## Conclusion:

The study titled "Evaluation of Poornima Kit: Biofertilizer, Efficacy Testing Using Paddy as a Model Crop" draws conclusions suggesting that the application of the Poornima Kit presents a viable alternative for partially replacing synthetic (chemical) fertilizers. The study encompassed various treatments, combining the Poornima Kit with (i) synthetic fertilizers at 100% and 50% recommended doses, and (ii) different organic manures. The findings are as follows:

- When used alone, the Poornima Kit was at par in enhancing crop growth, yield attributing parameters like number of tillers, dry shoot weight, seed weight and overall crop yield compared to the application of synthetic fertilizer at 100% recommended dose.
- The Poornima Kit when used with synthetic fertilizer at 50% was at par in producing the maximum height compared to the application of synthetic fertilizer at 100% recommended dose.
- When used alone, the Poornima Kit was at par in enhancing nutrient content in grain and straw of paddy compared to the application of synthetic fertilizer at 100% recommended dose.
- The combination of the Poornima Kit with bio-slurry exhibited better compatibility compared to its combination with vermicompost. This combination resulted in improved nutrient uptake, yield, and other parameters.
- The application of the Poornima Kit with bio-slurry and when Poornima Kit is used alone led to an increase in soil organic carbon, surpassing other organic and inorganic treatments.
- The utilization of the Poornima Kit with vermicompost demonstrated the most significant increase in bacterial and fungal population in the soil during the most active stage of crop growth (60 days after transplanting). However, the highest population of actinomycetes populations was observed with the application of vermicompost at the same growth stage. Vermicompost performed optimally when used along with the Poornima Kit which was comparable to vermicompost application.
- The response of the Poornima Kit when combined with 50% synthetic fertilizer was superior to its combination with 50% water-soluble synthetic fertilizer.

Dr. Anup Kumar Singh  
Sr. Scientist

Dr. Ravindra Soni  
Scientist

Prof. & Head  
Department of Agricultural Microbiology  
Indira Gandhi Krishi Vishwavidyalaya, Raipur  
Chhattisgarh

Director of Research Services  
Indira Gandhi Krishi Vishwavidyalaya, Raipur  
Chhattisgarh