**Impact of Liquid Biofertilizers on Nutrition of Finger Millet and Residual Soil Fertility Status**

 **ABSTRACT**

A randomized block design experiment with 11 treatments and 3 replications was conducted during Kharif 2020 to investigate the impact of liquid biofertilizers on finger millet (*Eleusine coracana* L.) growth and yield. The study used RAU-8 variety, sown on July 28, 2020, with a recommended fertilizer dose of 40:20:20 NPK kg/ha. Results showed that combining 100% RDF with liquid biofertilizer seed treatment and soil application significantly enhanced soil nutrient availability, dehydrogenase activity, and crop productivity, comparable to RDF alone. that integrating 100% recommended dose of fertilizers (RDF) with liquid biofertilizers significantly enhanced soil nutrient availability, with notable increases in nitrogen (185.25 kg/ha), phosphorus (19.21 kg/ha), and potassium (132.78 kg/ha) levels under the application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure applied in furrows), which was found to be at par with treatment T10- RDF (40:20:20, N:P:K Kg ha -1) and lower available nitrogen (121.52 kg ha -1 kgha-1), phosphorus (10.40 kg ha -1) and potassium (84.78 kg ha -1 ) in soil were estimated with T11 -(control) has observed that the greatest post-harvest availability of total N, P2O5, and K2O from finger millet has demonstrated a noticeably higher nutritional availability.

***Keywords:*** liquid biofertilizer, Finger Millet, Microorganisms, Soil Fertility Status

**Introduction**

Ragi, also known as finger millet [*Eleusine coracana* (L.) Gaertn.], is a staple crop in the Southern region and is a great diet for diabetics. Among the small millets, it takes up the most cultivated area. The grains are high in protein and carbohydrates, and they are also high in calcium and iron. It produces 1.98 million tons and has a productivity of 1661 kg ha-1 on 1.19 million hectares of land in India (Sakamma *et al*., 2018). The states of Tamil Nadu, Andra Pradesh, Orissa, Jharkhand, Maharashtra, and Uttaranchal are the next greatest producers of finger millet in India, after Karnataka. When compared to other grains, millets have special qualities. compared to main grains like rice, wheat, and maize, these may grow well in arid and irregular weather, tolerate relatively poor soils, and require relatively fewer external inputs. Millets are a staple grain that can be used as food or fodder and has excellent nutritional value. Furthermore, millets are ecologically beneficial (Brahmachari *et al*. 2018), allow for mutually beneficial intercropping with other important crops (Maitra *et al*. 2000), and sequester carbon, increasing the opportunities for CO2 abatement. Their rich varietal diversity also contributes to enhanced agro-biodiversity. Cultivating hardy and environmentally sound millets could be a smart solution for maximum output with food and nutritional security in the context of climate change and global warming. India is the world's biggest producer of several types of millet.

Products called biofertilizers, which include living microorganisms, are used in agriculture to increase soil quality and agricultural output by fixing nitrogen, absorbing phosphorus, and mobilizing nutrients. Although the potential of biofertilizers to increase crop productivity has been thoroughly investigated and validated in recent years, the technology has not yet gained widespread adoption. The majority of Indian manufacturers are now using coal, lignite, and charcoal as carriers in their carrier-based inoculants. However, because the process of producing carrier-based inoculants is labour-intensive and time-consuming, involving transportation, mining, drying, milling, screening, sterilizing, and pH correction, the cost is considerable. several problems with carrier-based inoculants were resolved by liquid inoculant compositions. One-of-a-kind combinations of live cells of certain microorganisms in a nutritive medium, including cell-protectant substances, are known as liquid inoculants. Cell viability is increased by inoculant compositions including cell-protecting substances both during storage and following seed or soil application.

**Material and method**

**Experiment site**

The previously mentioned TCA, Dholi (Muzaffarpur), is situated on the southern bank of the Burhi Gandak at an elevation of 58 meters above sea level. Its coordinates are 25.590 North latitude and 85.350 East longitude. The humid sub-tropical climate zone is greatly impacted by the monsoon.

**Observation:**

**Collection of plant sample**

Five plant was plucked at random from every plots adjacent to the border row. in grain and straw samples. Uprooting was done with care, using a khurpi to dig around the plant and remove the adhering sand without serious injury to root that topsoil was derived from plant roots including rootlets were cleaned with an underwater jet, and the grain sample had been baked in a drying oven to dry at 78°c and crushed to 40 mesh size.

**Nitrogen content and uptake**

The micro Kjeldahl method was used to determine the nitrogen content of finely ground (40 mesh) plant components in grains and straw following digestion in concentrated H2SO4. Nitrogen uptake by grains and straw was calculated using the following formula:

$$Nitrogen uptake by grain (kg ha^{-1}) = Grain yield (kg ha^{-1}) × Nitrogen content (\%) × 10^{-2}$$

$$Nitrogen uptake by straw (kg ha^{-1}) =straw yield (kg ha^{-1}) × Nitrogen content (\%) × 10^{-2} $$

**Phosphorus content and uptake**

The molybdovanadate phosphoric acid yellow color method was used to assess the amount of phosphorus in finger millets, grain, and straw following crop harvesting, following digestion in tri-acid (Page, 1982). To determine the P absorption by grains and straw, the following formula was utilized:

$$Phosphorus uptake by grain (kg ha^{-1}) = Grain yield (kg ha^{-1}) × Phosphorus content (\%) ×10^{-2}$$

$$Phosphorus uptake by straw (kg ha^{-1}) = straw yield (kg ha^{-1}) × Phosphorus content (\%) ×10^{-2}$$

**Potassium content and uptake**

After tri-acid digestion, the potassium concentration in finger millets plants, seed and straw had assessed by using Flame photometric technique (Jackson, 1967), while K absorption through wheat crops, grain and straw were calculated from the following.

$Potassium uptake by grain \left(kg ha^{-1}\right)= Grain yield \left(kg ha^{-1}\right)× Potassium content (\%) ×10^{-2}$

$$Potassium uptake by straw \left(kg ha^{-1}\right)= straw yield \left(kg ha^{-1}\right)× Potassium content (\%) ×10^{-2}$$

**Soil reaction (pH) & electrical conductivity (EC)**

The pH as well as EC of the soils was measured doing it with a pH metre and a conductivity bridge in a (1:2.5) soil-water ratio.

**Organic carbon (%)**

When soil's organic carbon contained were calculated using the “Walkley and Blacks technique (1934) as stated by Jackson (1973)” and represented as a percentage.

**Available N, P and K as initial soil status**

**Available N2 (kg ha-1)**

The “alkaline permanganate method” (Subbiah and Asijas, 1956) was used to determine the amount of available nitrogen.

**Available P205 (kg ha-1)**

Total accessible phosphorus has been calculated using the technique given by Olsen and Watanable (1965).

**Available K20** $(kg ha^{-1}) $

Total accessible K content of soil was separated to use a ‘neutral normal ammonium acetate solution (pH-7.0) and soil extract was prepared in a 1:5 ratio. whereas, K has been measured in an extracted using a flame photometer was reported in Jackson (1973) and the results were adjusted to kg/ha.

**Results and Discussion.**

**Nitrogen content (%) in grain and straw**

Interestingly, the results revealed a positive correlation between liquid biofertilizer application had a substantial impact on the nitrogen content of finger millet grain, according to an analysis of mean data on the subject (Table 2). The highest nitrogen concentration (1.20%) in grain was recorded by treatment T1 application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance, which was statistically equivalent to T6 (1.12%) but significantly better than T3 (1.17%) and T4 (1.16%). Nonetheless, it was roughly comparable to T2 (1.09 %). Grain with T11 (control) had the lowest nitrogen concentration (0.95%) and average data on nitrogen content in straw (%), different treatments had a substantial impact on the amount of nitrogen in the straw (%), which was modified by liquid biofertilizer T1 had the highest nitrogen content (0.66%) in straw, which was substantially higher than T3 (0.64%) and T4 (0.64%), which were statistically comparable to T6 (0.62%). T11 (control) had the lowest nitrogen content (0.42%) in straw. respectively after crop harvest under different seed treatment with liquid biofertilizer treatment in the experimental plot. This conclusion is backed by Bekere *et al* (1954) work.

**Phosphorus content (%) in grain and straw**

A review of average data on the amount of phosphorus in finger millet grain showed that the amount of phosphorus in the grain was significantly affected by liquid biofertilizer (Table 2). The highest phosphorus content (0.36%) was recorded by treatment T1 application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance. which was noticeably higher than that of T3 (0.35%) and T4 (0.35%) in grain. T5 (0.34%) was roughly equal to T6 (0.35%) and T10 (0.35%) With T11 (control), the lowest phosphorus concentration (0.29%) was detected in the grain and Data on the amount of phosphorus in finger millet straw showed that the amount of phosphorus in the straw, which was altered by different treatments, was significantly impacted by the use of liquid biofertilizers. Straw with the highest phosphorus concentration (0.09%) was found to be substantially better than T6 (0.08%), T3 (0.09%), and T4 (0.092%). Nonetheless, it was roughly comparable to T10 (0.08 %) while T11 (control) had the lowest phosphorus concentration in straw (0.04%).

**Potassium content (%) in grain and straw**

Liquid biofertilizer had a substantial impact on potassium content, according to an analysis of mean data about potassium content (%) in finger millets (Table 2). The highest potassium concentration (0.41%) in grain was recorded by treatment T1 Application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance, which was noticeably higher than that of T3 (0.40%) and T4 (0.40%). Grain with a minimum potassium level of 0.29% was recorded using T11 (control) and an analysis of the average data about the percentage of potassium in straw showed that different treatments had a substantial impact on the percentage of potassium in straw, The lowest potassium level in grain (0.92%) was recorded with T11 (control), whereas the highest potassium content (1.25%) in straw was noted with T4, which was about similar with T6 (1.20%) but significantly superior than T3 (1.23%) and T4 (1.24%). the study of S.R. Olsen (1954) provided support for this finding.

**Nitrogen uptake by grain and straw (kg ha-1)**

The maximum Grain and Straw uptake of nitrogen was significantly impacted by liquid biofertilizers (kg ha-1). Treatment T1 application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance had the maximum nitrogen uptake by grain (28.43 kg ha-1) and (31.97 kg ha-1) by straw which was noticeably better than T3 (27.00 kg ha-1) by grain and (30.15 kg ha-1) by straw along with T4 (24.94 kg ha-1 seed, 28.46 kg ha-1 straw) seed and straw T11 (control) had the lowest nitrogen uptake by grain (8.95 kg ha-1) along with nitrogen uptake by straw (8.83 kg ha-1). This conclusion has been assisted more by finding with Pallavi *et al.* (2016).

**Phosphorus uptake by grain and straw (kg ha-1)**

The maximum phosphorus uptake by grain (8.51 kg ha-1) and straw (9.95 kg ha-1) was recorded under T1 treatment application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance, however, it was at par with T3 by grain (8.25 kg ha-1) along with straw (9.28 kg ha-1) was done T4 (7.68 kg ha-1)by seed and phosphorus uptake by straw (7.63 kg ha-1). The minimum phosphorus uptake by grain (2.73 kg ha-1) and straw (2.63 kg ha-1) was registered under T11 ­(control), it was noticed by (table 3.) the present findings are similar to the finding of Koushik and Singh (2008).

**Potassium uptake by grain and straw (kg ha-1)**

The maximum potassium uptake by grain (9.71kg ha-1) and straw (60.68 kg ha-1) was recorded under T1 treatment application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance, however, it was at par with T3 treatment. The minimum potassium uptake by grain (2.75 kg ha-1) and straw (18.27 kg ha-1) was found under T11 -­(control). Similar observation was recorded by Korla *et al.* (2019).

**Physical and chemical characteristics of soil after harvest**

After a thorough examination of mean data on PH, EC (dsm-1) and organic carbon (%) it was found that liquid biofertilizers had a non-significant impact on post-harvest soil as compared to initial soil parameters. However, which acts as a medium for EC and OC, hence EC and OC of the post-harvest soil are higher than initial soil parameters. The outcome was explained and represented in (Table 1 and 5), Similarly, findings were also reported by Meena *et al* (2015).

An appraisal of data revealed that available NPK (kg ha-1) content in the soil after harvest of finger millet were significantly affected by varying treatments. The maximum nitrogen content (185.25 kg ha-1) and phosphorus (19.21kg ha-1) and potassium content (132.78 kg ha-1) in soil was observed with T1 -100%RDF+seed treatment with liquid biofertilizer (5 ml kg-1 seed) followed by soil application of liquid biofertilizer (2.5 lit., mix with 500 kg/ha FYM and apply in-furrow and the minimum nitrogen content in soil was observed under T11 -(control) (Table 5). Finger millets are utilized for metabolic activity as they are a nutrient-dense cereal crop. The available NPK in the finger millets crop in this study was significantly impacted by liquid biofertilizers, according to post-harvest soil analysis. This can be because the fertilizer was administered in the field at the recommended standard dosage. because the crop's nutrient intake and the soil's nutrient condition after harvest are inversely correlated. So, NPK status in the post- harvest soil was lower in the plot which had higher absorption of NPK by crop. When compared to administering the proper fertilizer doses separately, the increases in available NPK in post-harvest soil were not statistically significant. *Azotobacter's* N2 fixation and *PSB's* microbial P solubilization might be the cause of this. This result is quite comparable to those of Thind *et al*. (2007) and *Singh et al*. (2009).

**Conclusion**

The integrated treatment of 100% RDF and liquid biofertilizers resulted in maximum NPK content, uptake, grain and straw yield were observed with T1 Application of 100% recommended dose of fertilizers (RDF) in conjunction with liquid biofertilizer treatment, comprising seed inoculation (5 ml/kg seed) and subsequent soil application (2.5 L mixed with 500 kg farmyard manure), significantly enhanced crop performance. this study revealed that integrating 100% recommended dose of fertilizers (RDF) with liquid biofertilizer application significantly enhanced finger millet's grain and straw yield, as well as NPK content. The combined treatment of seed treatment with liquid biofertilizer and soil application outperformed the control and was comparable to RDF alone. These findings suggest that liquid biofertilizers can be a valuable supplement to chemical fertilizers, promoting sustainable agriculture practices.

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**Reference**

Bekere W and Hailemariam A (2012). Influences of Inoculation Methods and Phosphorus levels on Nitrogen Fixation Attributes and Yield of Soybean (Glycine max L.). At Haru, Western Ethiopia. *American Journal of Plant Nutrition and Fertilization Technology***. 2**(2): 45-55.

Brahmachari, K, Sarkar, S, Santra D.K. and Maitra, S. 2018. Millet for food and nutritional security in drought prone and red laterite region of eastern India. *International Journal of Plant and Soil Science*, **26**(6): 01-07.

Jackson ML.Soil Chemical Analysis.Prentice Hallof India Pvt. Ltd., New Delhi, 1973, 485.

Korla Aditya Chowdary and Bikas Chandra Patrap (2019) Effect of Micronutrient Application with Different Sources of NPK on Growth and Yield of Finger Millet Crop in Red Laterite Zone *journal of Agricultural Science and Technology B***9** (2019) 403-416 doi: 10.17265/2161-6264/2019.06.004

Koushic, N. and Singha Roy, A. K.(2008). Residual effect of vermicompost, chemical fertilizer and biofertilizer in wheat on succeeding fodder cowpea. *Annals of Agriculture Research*, *New Series,* **29** (1, 2, 3, & 4):73-77.

Maitra, S, Ghosh, D.C., Sounda, G. Jana, P.K. and Roy, D.K. 2000. Productivity, competition and economics of intercropping legumes in finger millet (*Eleusine coracana*) at different fertility levels. *Indian Journal of Agricultural Sciences*, **70**(12): 824-828.

Meena, V.S, Maurya, B.R., Verma, J.P, Aeron, A., Kumar, A, Kim, K., Bajpai, V.K. 2015b. Potassium solubilizing rhizobacteria (KSR): Isolation, identification, and K-release dynamics from waste mica. *Ecol. Eng.***81**, 340-347.

Pallavi, Ch, Joseph, B., Aariff Khan, M.A. and Hemalatha, S. 2016a. Effect of integrated nutrient management on nutrient uptake, soil available nutrients and productivity of rainfed finger millet, *International Journal of Science, Environment,* **5**(5): 2798-2813.

Sakamma, S, Umesha, K.B, Girish, M.R., Ravi, C.S, Satishkumar, M. and VeerabhadrappaBellundagi. 2018. Finger Millet (*Eleusine coracana* L. Gaertn.) Production System: Status, Potential, Constraints and Implications for Improving Small Farmer’s Welfare. *Journal of Agricultural Science*: 10(1).

Subbiah GV, Asija GL. Arapid procedure for the estimation of available nitrogen in soil. *Curr. Sci.* 1956; 25:258-260.

Singh, F., Kumar, R. and Pal, S**.** (2008). Integrated nutrient management in ricewheat cropping system for sustainable productivity. *Journal of the IndianSociety of Soil Science,* **56 (**2): 205-208.

**Table 1: Chemical soil characteristic (0-20cm)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No** | **Particulars** | **Valueobtained** | **Method adopted** | **References** |
| 1 | EC (dSm-1 at 25oC) | 0.34 | Conductivitybridge | (Jackson,1973) |
| 2 | pH (1:2.5 watersuspension ratio) | 8.33 | Glass electrode pH meter | (Jackson,1973) |
| 3 | O C (%) | 0.44 | Walkleyandblack method | (Walkley and Black,1934) |
| 4 | Available N2 (kg ha-1) | 169.40 | Alkalinepermanganate method | (Subbaih and Asija,1956) |
| 5 | Available P2O5 (kg ha-1) | 15.95 | Olsen’s method and Watanable | (Olsen and watanabe,1965) |
| 6 | Available K2O (kg ha-1) | 126.40 | Flame photometer method | (Jackson,1973) |

**Table 2: Liquid biofertilizer's reaction and application method on NPK content in grain and straw of Finger millet.**

| **Treatment No.** | **Treatment** | **Grain (%)** | **Straw (%)** |
| --- | --- | --- | --- |
| N | P | K | N | P | K |
| T1 | 100%RDF+ seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid  | 1.20 | 0.36 | 0.41 | 0.66 | 0.09 | 1.25 |
| T2 | 100%RDF +seed treatment with biofertilizers in liquid | 1.09 | 0.35 | 0.38 | 0.59 | 0.09 | 1.18 |
| T3 | 100%RDF+ soil application with biofertilizers in liquid  | 1.17 | 0.35 | 0.40 | 0.64 | 0.09 | 1.23 |
| T4 | 85%RDF+ seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 1.16 | 0.35 | 0.40 | 0.64 | 0.09 | 1.24 |
| T5 | 85%RDF + seed treatment with biofertilizers in liquid  | 1.06 | 0.34 | 0.38 | 0.56 | 0.08 | 1.19 |
| T6 | 85%RDF + soil application with biofertilizers in liquid  | 1.12 | 0.35 | 0.39 | 0.62 | 0.09 | 1.20 |
| T7 | 70%RDF+ seed treatment with biofertilizers in liquid followed by soil application of liquid biofertilizer | 1.03 | 0.34 | 0.37 | 0.53 | 0.07 | 1.16 |
| T8 | 70%RDF + seed treatment with biofertilizers in liquid  | 1.00 | 0.34 | 0.37 | 0.52 | 0.07 | 1.14 |
| T9 | 70%RDF + soil application with liquid biofertilizer  | 1.02 | 0.34 | 0.37 | 0.53 | 0.07 | 1.15 |
| T10 | RDF (40:20:20,N:P2O5:K2O Kg ha ‑1 ) | 1.08 | 0.35 | 0.38 | 0.58 | 0.08 | 1.17 |
| T11 | Control | 0.95 | 0.29 | 0.29 | 0.42 | 0.04 | 0.92 |
|  | S.Em.± | 0.034 | 0.004 | 0.005 | 0.02 | 0.003 | 0.015 |
|  |  CD (P=0.05)  | 0.101 | 0.013 | 0.015 | 0.055 | 0.010 | 0.044 |

Seed treatment = (Bio- NPK biofertilizers in liquid@ 5ml/kg seed)

Soil application = liquid biofertilizer(bio-NPK @ 2.5 lit.) mixed with 500 Kg ha-1 FYM applied in furrow

**Table 3: Liquid biofertilizer's reaction and application method on NPK and uptake by grain and straw of Finger millet.**

| **Treatment No.** | **Treatment detail** | **Grain (kg ha-1)** | **Straw (kg ha-1)** |
| --- | --- | --- | --- |
| **N** | **P** | **K** | **N** | **P** | **K** |
| T1 | 100%RDF+seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 28.43 | 8.51 | 9.71 | 31.97 | 9.95 | 60.68 |
| T2 | 100%RDF +seed treatment with biofertilizers in liquid | 21.17 | 6.81 | 7.50 | 22.67 | 7.42 | 45.41 |
| T3 | 100%RDF+ soil application with biofertilizers in liquid  | 27.00 | 8.25 | 9.41 | 30.15 | 9.28 | 57.78 |
| T4 | 85%RDF+ seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 24.94 | 7.68 | 8.75 | 28.46 | 8.35 | 54.82 |
| T5 | 85%RDF + seed treatment with biofertilizers in liquid  | 19.38 | 6.34 | 7.06 | 20.41 | 6.39 | 43.47 |
| T6 | 85%RDF + soil application with biofertilizers in liquid  | 23.54 | 7.37 | 8.25 | 26.37 | 7.80 | 51.06 |
| T7 | 70%RDF+ seed treatment with biofertilizers in liquid followed by soil application of liquid biofertilizer | 17.35 | 5.83 | 6.39 | 18.72 | 5.88 | 40.87 |
| T8 | 70%RDF + seed treatment with biofertilizers in liquid  | 14.25 | 4.91 | 5.31 | 15.89 | 4.93 | 34.74 |
| T9 | 70%RDF + soil application with biofertilizers in liquid  | 15.54 | 5.27 | 5.71 | 17.08 | 5.34 | 37.02 |
| T10 | RDF (40:20:20,N:P2O5:K2O Kg ha ‑1 ) | 20.51 | 6.65 | 7.25 | 22.13 | 7.16 | 44.57 |
| T11 | Control | 8.95 | 2.73 | 2.75 | 8.83 | 2.63 | 19.27 |
|  | S.Em.± | 1.56 | 0.32 | 0.41 | 1.24 | 0.34 | 2.21 |
|  |  CD (P=0.05)  | 4.63 | 0.97 | 1.22 | 3.70 | 1.02 | 6.56 |

Seed treatment = (Bio- NPK biofertilizers in liquid@ 5ml/kg seed)

Soil application = liquid biofertilizer(bio-NPK @ 2.5 lit.) mixed with 500 Kg ha-1 FYM applied in furrow

**Table 4 : Response of biofertilizers in liquid and their mode of application on Post harvest soil physic-chemical properties of Finger millet.**

| **Treatment No.** | **Treatment detail** | **EC (dsm-1)** | **pH** | **Organic Carbon (%)** |
| --- | --- | --- | --- | --- |
| T1 | 100%RDF+seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 0.36 | 8.31 | 0.45 |
| T2 | 100%RDF +seed treatment with biofertilizers in liquid | 0.37 | 8.33 | 0.44 |
| T3 | 100%RDF+ soil application with biofertilizers in liquid  | 0.36 | 8.31 | 0.45 |
| T4 | 85%RDF+ seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 0.36 | 8.31 | 0.45 |
| T5 | 85%RDF + seed treatment with biofertilizers in liquid  | 0.37 | 8.33 | 0.44 |
| T6 | 85%RDF + soil application with biofertilizers in liquid  | 0.36 | 8.31 | 0.46 |
| T7 | 70%RDF+ seed treatment with biofertilizers in liquid followed by soil application of liquid biofertilizer | 0.35 | 8.3 | 0.46 |
| T8 | 70%RDF + seed treatment with biofertilizers in liquid  | 0.36 | 8.33 | 0.44 |
| T9 | 70%RDF + soil application with biofertilizers in liquid  | 0.35 | 8.3 | 0.47 |
| T10 | RDF (40:20:20,N:P2O5:K2O Kg ha ‑1 ) | 0.37 | 8.33 | 0.44 |
| T11 | Control | 0.34 | 8.31 | 0.45 |
|  | S.Em.± | 0.006 | 0.123 | 0.007 |
|  |  CD (P=0.05)  | NS | NS | NS |

Seed treatment = (Bio- NPK biofertilizers in liquid@ 5ml/kg seed)

Soil application = liquid biofertilizer(bio-NPK @ 2.5 lit.) mixed with 500 Kg ha-1 FYM applied in furrow

**Table 5: Response of biofertilizers in liquid and their mode of application on post-harvest soil of Finger millet.**

| **Treatment No.** | **Treatment** | **N (kg ha-1)** | **P2O5 (kg ha-1)** | **K2O (kg ha-1)** |
| --- | --- | --- | --- | --- |
| T1 | 100%RDF+seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 185.25 | 19.21 | 132.85 |
| T2 | 100%RDF +seed treatment with biofertilizers in liquid | 184.94 | 18.75 | 132.35 |
| T3 | 100%RDF+ soil application with biofertilizers in liquid  | 182.93 | 18.30 | 131.68 |
| T4 | 85%RDF+ seed treatment with biofertilizers in liquid followed by soil application of biofertilizers in liquid | 170.15 | 15.75 | 127.87 |
| T5 | 85%RDF + seed treatment with biofertilizers in liquid  | 176.18 | 15.27 | 128.05 |
| T6 | 85%RDF + soil application with biofertilizers in liquid  | 172.15 | 16.08 | 118.83 |
| T7 | 70%RDF+ seed treatment with biofertilizers in liquid followed by soil application of liquid biofertilizer | 150.42 | 14.23 | 119.90 |
| T8 | 70%RDF + seed treatment with biofertilizers in liquid  | 155.55 | 15.01 | 119.75 |
| T9 | 70%RDF + soil application with biofertilizers in liquid  | 153.43 | 14.54 | 132.30 |
| T10 | RDF (40:20:20,N:P2O5:K2O Kg ha ‑1 ) | 181.92 | 18.06 | 132.78 |
| T11 | Control | 121.52 | 10.40 | 84.78 |
|  | S.Em.± | 6.07 | 1.08 | 1.38 |
|  |  CD (P=0.05)  | 17.92 | 3.21 | 4.12 |
|  |  |  |  |  |

Seed treatment = (Bio- NPK biofertilizers in liquid@ 5ml/kg seed)

Soil application = liquid biofertilizer(bio-NPK @ 2.5 lit.) mixed with 500 Kg ha-1 FYM applied in furrow