# RESPONSE OF LIQUID BIOFERTILIZER AND THEIR MODE OF APPLICATION ON DEHYDROGENASE ACTIVITY AND ECONOMICSOFDIFFERENT TREATMENTS ON FINGER MILLET (ELEUSINE CORACANA L.)

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**Abstract**
Field research was carried out during the Kharif seasonin2020 in a randomized block design with three replications involving eleven treatments to determine the effect of liquid biofertilizer on the growth and yield of ragi. The factors considered forthe study comprised different liquid biofertilizer practices. A common recommended fertilizer dose of 40N: 20 P2O5: 20 K2OKg ha-1 was used. The maximum dehydrogenaseactivity (g TPF g-1 dry soil 24 h-1), gross return (89824 ha-1), net return (62859 ha-1) and Benefit-Cost ratio (2.33) were gained under T1-100% RDF + Seed treatment with liquid biofertilizer (5 ml kg-1 Seed), followed by soil application of liquid biofertilizer (2.5-liter mix with 500kg/ha Farm Yard Manure applied in-furrow), under finger millet. The minimum gross return (36203 ₹ ha-1), net return (14703 ₹ ha-1), and Benefit: Cost ratio (0.68) was obtained under T11-(control) under finger millet crop.

**Keywords:** Finger Millet, Economics and Liquid Biofertilizer.

## Introduction

Finger millet is also called ragi or mandua in India. It is important minor millet in India, used as a staple food in many southern states and hilly regions of India. It is grown for grains as well as for fodder, but never cultivated exclusively as fodder/ forage crop. Fresh green plants or dry Stover is highly palatable by cattle.

It is known as Nutri –grain, due to its low fat (1.1%), high protein (9.2%), minerals (2.3%) (Mainly iron, phosphorus and calcium) andvitamins A and B, besides 76% carbohydrates. It has high nutritional value due to its methionine-rich protein, which is not found in rice, maize and sorghum. The germinating grains are malted and fed to lactating mothers, pregnant women and as wearing food for children. It is recommended for diabetic patients.

These grains are consumed in various preparations like ragi balls, rotis, dosa cakes, puddings and biscuits, or even as popped grains in India. It is also used to make fermented beer in Africa.

Finger millet is known for its high adaptability to varying elevations, drought tolerance and high seasonal flexibility –therefore included in most dryland cropping systems. Finger millet has been a source of sustainability in rural areas, due to its multifaceted benefits – in terms of stabilized income and nutritional importance.

In India, finger millet is grown on 1.14 million hectares, yielding 1.69 million tonnes (MT) and average productivity of 1483 kg ha-1. Bihar has 4.21 lakh hectare of finger millet planted, with a yearly yield of 4.19 lakh tonnes and productivity of 944 kg per hectare.(Department of Agriculture and Cooperation, 2014). Compared to several other treatments, its 150 percent customized fertilizer dose administration resulted in a significantly greater yield of grain and straw (3279 & 4510 kg per ha, respectively). However, it was on par with the application of 100 and 125 percent customized fertilizer doses. The use of a customized fertilizer dose resulted in 125 percent greater net returns and now a better B: C ratio occurred Anil Kumar et al. (2003) found that the study of gross return and net return increased with increasing Farm Yard Manure and diazotroph inoculation. According to the data obtained the highest net return or B: C ratio included Rs. 18,800 and 1.74 using 15 t / ha of farmyard manure combined with inoculated Azotobacter chroococcum (MSX-9), trailed by Rs. 18,657 and 1.74 with the similar amount of further Farm Yard Manure found by Gupta and Aggarwal (2008).

The foxtail millet reacted to the different nutrient levels. As a result of the current research, it has been determined that a balanced nutrient dose (up to 6 tonnes FYM per ha + 60:30:20 kg NPK per ha) has been an effective yet recommended application that increases grain yield, as well as monetary returns, found Ojha et al. (2018) and Singh et al.,(2008)revealed that application of Farm Yard Manure at 7.5 tonnes per hectare + 50 percent RDN + biofertilizers (Azotobacter+ PSB) yielded the highest net returns (Rs.22722) but also B:C ratio (1.95) within the wheat crop, compared to the control, which yielded Rs.16360 net returns as well as 1.64 B: C ratio during wheat plant.Ullasaet al.,(2017)experimented andreported toapply a prescribed dose of Farm Yard Manure (7.5 tonnes per ha) together with 100 % N equivalent Vermicompost (4 tonnes per hectare) was noted to be superior to further organic nutrient management strategies in terms of finger millet growth and production, however, applying 125 percent N equivalent vermicompost alone (5 t ha-1) yields a better return on investment per rupee invested.

**Material and method**

**Experiment site**

The aforementioned TCA, Dholi (Muzaffarpur), is located on the Burhi Gandak's southern bank, at an elevation of 58 meters above sea level; it is located at 25.590 North latitude & 85.350 East longitudes. The monsoon has a tremendous impact on the humid subtropical climate zone.

Observation

**Dehydrogenase activity**

Dehydrogenase enzyme activity from post-harvest soils was analyzed as reducing 2, 3, 5-triphenyl tetrazolium chloride (TTC) and triphenyl formazan (TPF) that used Cassidaet. al, colorimetricmethod (1964).

$$\boldsymbol{Dehydrogenase activity \mu g TPF g^{-1} soil hr^{-1} = \frac{(Sample - Blank)\ X25}{Weight of soil X24}}$$

**Economics**

**Cost of cultivation**

Based on the inputs used and their current costs, the cost of finger millet production under various establishment treatment procedures was determined. Simultaneously, the gross return was estimated using current grain and straw yields and prices. Finally, applying the following formula, the net return (₹ ha-1) and benefit-cost ratio with every treatment were calculated.

**Gross return**

Crops provide responsible for the total monetary worth of such economic product (grain) than (straw). It is expressed as ₹ ha-1 and is determined by averaging the total yield (primary and by-product) even by current market rates ₹ q-1

$$Grossreturn(₹ha^{-1}) = Grainyield(kgha^{-1})XMarketprice(₹kg^{-1}) + Strawyield(kgha^{-1})XMarketprice(₹kg^{-1})$$

**Net profit**

The net profit was computed by subtracting the gross return from the cost of cultivation.

$$\boldsymbol{Net\ return}\ (₹\boldsymbol{ha^{-1}}) = \boldsymbol{Gross\ return}\ (₹\boldsymbol{ha^{-1}}) - \boldsymbol{Cost\ of\ cultivation}(₹\boldsymbol{ha^{-1}})$$

**Benefit: Cost ratio**

The benefit: cost ratio was measured as the proportion of net return to cultivation price using the given equations:

$$\boldsymbol{Benefit - Costratio} = \frac{\boldsymbol{netreturn}₹\boldsymbol{ha^{-1}}}{\boldsymbol{Thetotalreturnofcultuvation}₹\boldsymbol{ha^{-1}}}$$

**Results and Discussion**

The maximum nutrient content in dehydrogenase activity (μg TPFg$^{-1}$ dry soil 24h$^{-1}$) in soil was observed with $T_1$ (100% RDF + seed treatment with liquid biofertilizer (5 ml kg$^{-1}$ seed), trailed by soil application of liquid biofertilizer (2.5 lit, mix with 500 kg/ha FYM, and apply in-furrow (132.10 $\mu$gTPFg$^{-1}$ dry soil 24h$^{-1}$) and the minimum nutrient content in dehydrogenise activity ($\mu$gTPFg$^{-1}$ dry soil 24h$^{-1}$**)** in soil was observed with $T_{11}$- (control) (78.60 $\mu$gTPFg$^{-1}$ dry soil 24h$^{-1}$). Biofertilizers (Azotobacter + PSB) increased the diversity and activity of microbes in the soil,increased microbe diversity and action and enhanced dehydrogenase activity.This finding is in close conformity with Singh and Dhar (2011).

The highest cost of cultivation (26965₹ ha$^{-1}$), gross return (89824 ₹ ha$^{-1}$), net return (62859 ₹ ha$^{-1}$), and Benefit:Cost ratio (2.33) were fetched under $T_1$ – 100 % RDF + seed treatment with liquid biofertilizer (5 ml kg$^{-1}$ seed) trailed by soil application of liquid biofertilizer (2.5 lit. mix with 500Kg/kg Farm Yard Manure applied in-furrow. Which was statistically at par with $T_3$- 100%RDF+ soil application with liquid biofertilizer and $T_4$-85%RDF+seed treatment with liquid biofertilizer (5 ml kg$^{-1}$ seed) trailed by soil application of liquid biofertilizer (2.5 lit., mix with 500 kg/ha Farm Yard Manure and apply in-furrow, under finger millet. The minimum cost of cultivation (21500 ₹ ha$^{-1}$), gross return (36203 ₹ ha$^{-1}$), net return (14703 ₹ ha$^{-1}$), and B: C ratio (0.68) were obtained under $T_{11}$- (control). It may be because of the cheap input costs and the good response to biofertilizers in finger millet described in Singh *et al.* (2008) and Kumar *et al.,* (2009)

The application of Farm Yard Manure @ 7.5 tonnes per hectare + 50% RDN + biofertilizer (*Azotobacter* + PSB) is effective and cost-effective intended for achieving maximum and long-term wheat yield. This finding is consistent with Behera *et al.,* (2007) The highest benefit-cost ratio was 3.19 with 75 percent net profit, compared to 3.17 with 100 percent net profit alone when averaged over all the treatments of soil application biofertilizers of 250 ml acre$^{-1}$ with 75 percent net profit. Any number more than two is regarded as safe because the farmer receives ₹ 2.00 for each rupee invested, as reported by (Rathor *et at.,* 2018).

**Conclusion**

The highest charge of cultivation (26965₹ ha$^{-1}$), gross return (89824 ₹ ha$^{-1}$), net return (62859 ₹ ha$^{-1}$), and Benefit:Cost ratio (2.33%) was registered under $T_1$ -100%RDF+Seed treatment with the liquid biofertilizer (5 ml kg$^{-1}$ seed) trailed by soil application of liquid biofertilizer (2.5 lit., blended with 500 kg/ha Farm yard Manure apply in-furrow and the minimum cost of cultivation (21500 ₹ ha$^{-1}$), gross return (36203 ₹ ha$^{-1}$), net return (14703 ₹ ha$^{-1}$) and B:C ratio (0.68%) was registered under $T_{11}$ -control.

**References**

Anil Kumar B. H., Gowda K. T., and Sudhir K. (2003) Growth, yield and nutrient uptake as influenced by integrated nutrient management in dryland finger millet. Mysore Journal.Agriculture.Science., 37(1): 24-28.

Behera, U.K., Sharma, A. R. and Pandey, H.N. (2007) Sustaining productivity of wheat-soybean cropping system through integrated nutrient management practices on the vertisols of central India. Plant and Soil, 297: 185-199.

Pallavi, B., Joseph, M.A. Khan, A., and Hemalatha, S. (2016) Effect of integrated nutrient management on nutrient uptake,soil available nutrients and productivity of finger millets International Journal of Science, Environment ISSN 2278-3687 (O) and Technology, 5(5):2798 – 2813.

Department of Agriculture and Cooperation. State of Indian Agriculture (2013–2014) Ministry of Agriculture, Government of India: New Delhi, India, 2014.

Gupta, T. C., and Aggarwal, S. K. (2008) Performance of wheat (Triticumaestivivum) to the incorporation of organic manure and bioinoculants.Archives of Agronomy and Soil Science, 54 (6): 615-627.

Ojha, E., Adhikari, B. B., &Katuwal, Y. (2018) Nutrient management trial on foxtail millet at Sundarbazar, Lamjung. Journal of the Institute of Agriculture and Animal Science, 35(1):89-94.

Rathore, V. S., Singh, P., &Gautam, R. C. (2006) Productivity and water-use efficiency of rainfedpearlmillet (Pennisetumglaucum) as influenced by planting patterns and integrated nutrient management. Indian Journal of Agronomy, 51(1): 46-48.

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

Singh, R., Singh, B. and Patidar, M.(2008) Effect of preceding crops and nutrient management on productivity of wheat (Triticumaestivum) based cropping system in the arid region. Indian Journal of Agronomy, 53 (4): 267-272.

Ullasa, M. Y., Pradeep, S., Shrikantha, C. D., &Sridhara, S. (2017) Effect of different organic nutrient management practices on growth, yield and economics of finger millet, Eleusinecoracana (L) Gaertn. International Journal of Farm Sciences, 7(2):10-14.

**Table 1 : Response of liquid biofertilizer and their mode of application on dehydrogenase activity on the soil of Finger millet.**

| Treatment No. | Treatment | Dehydrogenase activity (µgTPFg$^{-1}$ dry soil 24h$^{-1}$) |
|---|---|---|
| $T_1$ | 100%RDF+seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 132.10 |
| $T_2$ | 100%RDF +seed treatment with liquid biofertilizer | 126.83 |
| $T_3$ | 100%RDF+ soil application with liquid biofertilizer | 130.60 |
| $T_4$ | 85%RDF+ seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 129.13 |
| $T_5$ | 85%RDF + seed treatment with liquid biofertilizer | 118.30 |
| $T_6$ | 85%RDF + soil application with liquid biofertilizer | 124.60 |
| $T_7$ | 70%RDF+ seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 108.63 |
| $T_8$ | 70%RDF + seed treatment with liquid biofertilizer | 105.70 |
| $T_9$ | 70%RDF + soil application with liquid biofertilizer | 107.20 |
| $T_{10}$ | RDF (40:20:20, N:$P_2O_5$:$K_2O$ Kg ha $^{-1}$ ) | 119.80 |
| $T_{11}$ | Control | 78.60 |
| | S.Em.± | 1.66 |
| | CD (P=0.05) | 4.93 |

Seed treatment = (Bio- NPK liquid biofertilizer @ 5ml/kg seed)
Soil application = liquid biofertilizer (bio-NPK @ 2.5 lit.) mixed with 500 Kg ha$^{-1}$ FYM applied in furrow

**Table 2: Response of liquid biofertilizer and their mode of application on the cost of cultivation and benefit-cost ratio of Finger millet.**

| Treatment No. | Treatment detail | Cost of Cultivation (₹ $ha^{-1}$) | Gross Return (₹ $ha^{-1}$) | Net Return (₹ $ha^{-1}$) | B:C ratio |
|---|---|---|---|---|---|
| $T_1$ | 100%RDF+seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 26965 | 89824 | 62859 | 2.33 |
| $T_2$ | 100%RDF +seed treatment with liquid biofertilizer | 24098 | 73536 | 49438 | 2.05 |
| $T_3$ | 100%RDF+ soil application with liquid biofertilizer | 26593 | 87710 | 61117 | 2.30 |
| $T_4$ | 85%RDF+ seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 26685 | 81789 | 55104 | 2.07 |
| $T_5$ | 85%RDF + seed treatment with liquid biofertilizer | 23808 | 69221 | 45413 | 1.91 |
| $T_6$ | 85%RDF + soil application with liquid biofertilizer | 26313 | 79574 | 53261 | 2.02 |
| $T_7$ | 70%RDF+ seed treatment with liquid biofertilizer followed by soil application of liquid biofertilizer | 26402 | 64366 | 37964 | 1.44 |
| $T_8$ | 70%RDF + seed treatment with liquid biofertilizer | 24025 | 54665 | 30640 | 1.28 |
| $T_9$ | 70%RDF + soil application with liquid biofertilizer | 26030 | 58383 | 32353 | 1.24 |
| $T_{10}$ | RDF (40:20:20, $N:P_2O_5:K_2O$ Kg $ha^{-1}$) | 23726 | 72188 | 48462 | 2.04 |
| $T_{11}$ | Control | 21500 | 36203 | 14703 | 0.68 |
| | S.Em.± | | 3188 | 3188 | 0.093 |
| | CD (P=0.05) | | 9470 | 9470 | 0.277 |

Seed treatment = (Bio- NPK liquid biofertilizer @ 5ml/kg seed)
Soil application = liquid biofertilizer (bio-NPK @ 2.5 lit.) mixed with 500 Kg $ha^{-1}$ FYM applied in furrow