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Nutrient dynamics in foxtail millet – *Melia dubia* based agroforestry system under organic production system

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ABSTRACT

Investigation on Nutrient dynamics in foxtail millet- Melia dubia agroforestry system under organic production system was conducted for two years (2018-19 and 2019-20) at the University of Agricultural Sciences, Raichur, Karnataka, India. There were eleven treatments with three replications, laid out in a completely randomized block design. In pooled data, nitrogen, phosphorus, and potassium uptake by foxtail millet at harvest were significantly higher in sole foxtail millet with recommended organic nutrient management practices without tree components (45.67, 12.77 and 55.90 kg ha^{-1}, respectively) when compared with all the treatments with tree association. No organic manurial treatment recorded significantly lower nitrogen, phosphorous and potassium uptake (10.55, 4.95, and 22.18 kg ha^{-1}, respectively) at harvest of the crop. While, with tree association in agroforestry system, available soil nitrogen, phosphorus and potassium were significantly higher by application of FYM + poultry manure + panchagavya alternated with vermiwash spray (242.80, 27.60 and 311.52 kg ha^{-1}, respectively) followed by application of FYM + poultry manure + vermiwash spray (235.17, 24.93 and 288.61 kg ha^{-1}, respectively) which in turn showed significant superiority over no organic manurial treatment, application of FYM and FYM + vermiwash spray.

Keywords: *pooled data, nitrogen, phosphorus, and potassium uptake by foxtail millet at harvest were significantly higher in sole foxtail millet*

1.0 Introduction

To meet the rising population demand for food and timber wood, there is intense pressure on cultivable land and existing forests. The escalating demand of food, fodder and timber wood can be attained either by increasing the farm area or the productivity. Since the former option has limited scope, the only economic and viable option left out for enhancing the productivity of agricultural field is with the integration of trees in agroforestry systems [1]. In order to meet the requirement, particularly for wood and tree derived produce, the fast growing species in the present context are playing major role to increase the productivity. On the other hand, the increasing concentration of carbon in the atmosphere is also creating difficulty to the biological entities in the form of climate change which needs to be minimized, where fast growing trees are playing crucial role in carbon sequestration [2]. In this context, agroforestry, a concept developed in recent decades, but traditionally practiced in Indian sub-continent and elsewhere as a low cost input farming system, will be of much help to combat the situation.

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Farming systems that incorporate perennial trees and shrubs have the advantage of producing fuel wood, timber, fodder, fruit and other products along with annual crops. In addition, they decrease the farmers' exposure to seasonal, environmental variations and over the long term, maintain and improve soil health. There are many tree species which are found to be suitable for agroforestry system but recently *Melia dubia* gaining more importance and most preferred [3].

Trees influence the soil properties and in turn on growth and yield of plants in agroforestry systems. Tree species return a sufficient amount of nutrients through litter fall. The percentage return varies with species, site and plant age. Much attention has been given in recent years to the effect of growing tree species on soil properties. Selective absorption of nutrients by different tree species and their capacity to return to soil bring about changes in soil properties. Trees affect soil properties through several pathways [4-5]. Trees alter inputs to the soil system by increasing capture of wet fall and dry fall and by adding to soil N via N_2 fixation. They affect the morphology and chemical conditions of the soil as a result of the characteristics of above and below ground litter inputs. The chemical and physical nature of leaf, bark, branches and roots alter decomposition and nutrient availability via controls on soil water and the soil fauna involved in litter breakdown. Extensive lateral root systems scavenge soil nutrients and redistribute them beneath tree canopies. In general, trees represent both conduits through which nutrients cycle and sites for the accumulation of nutrients within a landscape With this background, a field study was conducted to know the nutrient dynamics in agroforestry system.

2.0 Material and Methods

Study site

The experiment on "Nutrient dynamics in foxtail millet – *Melia dubia* based agroforestry system under organic production system" was conducted for two years(2018-19 and 2019-20) on farmer's field at Santhekallur village of Raichur district which represents Northern Dry Zone of Karnataka (Zone 3).

Experimental design

There were eleven treatments with three replications, laid out in completely randomized block design. The treatments consisted of the application of no organic manure (control), FYM equivalent to 100 per cent RDN, FYM (50%) + Vermicompost (50 %) and FYM (50 %) + Poultry manure (50 %) equivalent to 100 per cent RDN alone and in combination with foliar spray of 3.0 per cent panchagavya and 5.0 per cent vermiwash at 30 and 45 DAS and foliar spray of 3.0 per cent panchagavya at 30 DAS alternated with 5.0 per cent vermiwash at 45 DAS.

Nutrient analysis for uptake of nutrients

Plant samples collected at harvest were grounded in Willey mill to pass through 40 mm mesh sieve. The ground material was collected in butter paper bags and later used for chemical analysis. Nitrogen, phosphorus and potassium were estimated by following standard procedures [6]. Based on the nutrient content of plants and dry matter production, the uptake of nitrogen, phosphorus and potassium were worked out.

The dry soil samples were powdered using pestle and mortar and passed through 0.2 mm sieve. A known weight of finely powdered sample was treated with excess but known volume of standard $K_2Cr_2O_7$ and concentrated H_2SO_4. The unused $K_2Cr_2O_7$ was quantified by back titration with standard ferrous ammonium sulphate (FAS) using diphenylamine as an indicator[6].

Nutrient uptake for N, P and K was calculated by the formula as mentioned below.

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient concentration (\%) x Biomass (kg ha}^{-1})}{100}$$

Soil nutrient analysis

Available nitrogen

The available nitrogen was determined by the alkaline potassium permanganate method [7]. A known weight of soil was treated with excess amount of potassium permanganate with 25 per cent NaOH solution. The liberated ammonia was trapped in boric acid mixed indicator solution and determined by titration against standard H_2SO_4. The available nitrogen content of the soil was calculated by following the formula.

$$\text{Available N} = \frac{\text{TV x N of } H_2SO_4 \text{ x } 0.014 \text{ x } 10^{\circ} \text{ x } 2.24}{\text{Weight of soil sample (g)}}$$

Available phosphorus

Available phosphorus in soil was extracted by Olsen's extractant 0.5 M $NaHCO_3$ and phosphorus was determined by the stannous chloride molybdophosphoric blue colour method [7]. The blue color was developed by chloromolybdic acid and the intensity of blue colour was determined at 660 nm. The available phosphorus content of the soil was calculated by following formula.

$$\text{Available } P_2O_5 = \frac{\text{Graph ppm x Vol. of extract x Volume made x 2.24 x 2.29 x } 10^{\circ}}{P_2O_5 \text{ (kg ha}^{-1}) \text{ } 10^6 \text{ x Aliquot taken x Weight of soil sample}}$$

Available potassium

Available potassium was extracted with neutral normal ammonium acetate solution and was determined using flame photometer. The available potassium content of the soil was calculated by following formula.

$$\text{Available } K_2O \text{ (kg ha}^{-1}) = \frac{\text{PPM x Volume of extract x Volume made x 1.20 x 2.24 x } 10^{\circ}}{10^6 \text{ x Weight of soil sample x Aliquot taken}}$$

Soil pH and Electric conductivity

The soil pH was determined in 1:2.5 soil: water suspension using digital pH meter with glass electrode. The electrical conductivity of soil was determined using clear extract of soil: water suspension using a conductivity bridge[6].

Soil carbon

The dry soil samples were powdered using a pestle and mortar and passed through 0.2 mm sieve. A known weight of finely powdered sample was treated with an excess but known volume of standard $K_2Cr_2O_7$ and concentrated H_2SO_4. The unused $K_2Cr_2O_7$ was quantified by back titration with standard ferrous ammonium sulphate (FAS) using diphenylamine as an indicator [6].

Statistical data analysis

The observations recorded in this study was analyzed statistically for test of significance following the Fisher's method of analysis of variance (ANOVA) as outlined by [8]. The level of significance on 'F' test was tested at 5 per cent. The results have been discussed based on critical difference at P = 0.05.

3.0 Results and Discussion

3.1 Uptake of nutrients: The data pertaining to uptake of nutrients was presented in Table 1.

3.1.1 Nitrogen uptake (Kg ha^{-1})

Different treatments in *Melia dubia* based agroforestry system exerted significant variation in uptake of nitrogen (N) by foxtail millet in both years and in pooled data. In pooled data, sole foxtail millet without tree component with the recommended organic nutrient schedule recorded significantly higher nitrogen uptake (45.67 kg ha^{-1}) when compared with all other treatments in agroforestry system except FYM + poultry manure + panchagavya alternated with vermiwash spray (40.92 kg ha^{-1}) which in turn showed its significant superiority over all the treatments except FYM + vermicompost + panchagavya alternated with vermiwash spray (38.47 kg ha^{-1}) and FYM + poultry manure + panchagavya spray (38.42 kg ha^{-1}), FYM + poultry manure (37.55 kg ha^{-1}) and FYM + poultry manure + vermiwash (36.27 kg ha^{-1}). No organic manurial treatment recorded significantly lower nitrogen uptake when compared with all the treatments (10.55 kg ha^{-1}). Effects due to other treatments were intermediary. Nitrogen plays important role in augmenting the productivity and sustainability [9].

3.1.2 Uptake of phosphorus (Kg ha^{-1})

In pooled data, phosphorus uptake by foxtail millet was significantly superior with sole foxtail millet with recommended organic nutrient practice without tree association (12.77 kg ha^{-1}) when compared to all other treatments with tree association (4.95 to 8.92 kg ha^{-1}).

Among the treatments in agroforestry system, FYM + poultry manure + panchagavya alternated with vermiwash spray recorded significantly higher phosphorus uptake (8.92 kg ha^{1}) compared to all the treatments except FYM + poultry manure + panchagavya spray (8.73 kg ha^{-1}), FYM + poultry manure + vermiwash spray (8.58 kg ha^{-1}), FYM + vermicompost+ panchagavya alternated with vermiwash spray (8.42 kg ha^{-1}) and FYM + poultry manure (8.25 kg ha^{-1}). No organic manurial treatment recorded significantly lower phosphorus uptake (4.95 kg ha^{-1}) compared to all the treatments.

3.1.3 Potassium uptake (Kg ha^{-1})

In pooled data, significantly higher uptake of potassium by the crop was noticed with the treatments of sole foxtail millet with recommended organic nutrient schedule without tree component (55.90 kg ha^{-1}) over all the treatments in tree association except treatment FYM + poultry manure + panchagavya alternated with vermiwash spray (44.17 kg ha^{-1}) during 2019. In agroforestry system, during 2019 and in pooled data, significantly higher potassium uptake was observed with application of FYM + poultry manure + panchagavya alternated with vermiwash spray (47.07 kg ha^{-1} and 44.17 kg ha^{-1}, respectively) when compared with potassium uptake in treatments with no organic manurial application (19.33 kg ha^{-1} and 22.18 kg ha^{-1}, respectively), FYM (27.87 kg ha^{-1} and 26.60 kg ha^{-1}, respectively), FYM + vermicompost (33.20 kg ha^{-1} and 32.40 kg ha^{-1}, respectively), FYM + vermicompost + panchagavya spray (31.60 kg ha^{-1} and 32.07 kg ha^{-1}, respectively). During 2018, application of FYM + vermicompost + panchagavya alternated with vermiwash spray resulted in significantly higher potassium uptake (43.50 kg ha^{-1}) when compared to all other treatments except treatment FYM + poultry manure + panchagavya alternated with vermiwash spray (41.27 kg ha^{-1}). During both the years, lower uptake of potassium was recorded with no organic manurial treatment.

In the present study, among organic manurial treatments with association of *Melia dubia* species, uptake of nitrogen, phosphorous and potassium at harvest was higher with FYM + poultry manure + panchagavya alternated with vermiwash, FYM + vermicompost + panchagavya alterated with vermiwash, FYM + poultry manure + panchagavya, FYM+vermiwash+panchagavya, FYM+ vermicompost+ panchagavya, when compared to other organic manurial treatments (T_2, T_3 and T_4) and no organic manurial treatment (T_1) in pooled data. It might be due to higher grain yield besides higher availability of soil nutrients in these treatments.

Increased availability of nutrients were also due to the buildup of soil micro-flora resulting in increased bacteria, fungi, actinomycetes, P-solubilizer and N fixer population in the soil which inturn resulted in faster decomposition of applied organic manures and caused in release of nutrients to unavailable form to available form. These results are in conformity with the findings [10]. In agroforestry system, a significant increase in uptake of NPK than control was mainly due to following organic nutrient management practices. Similar finding were also reported by [11] in finger millet and foxtail millet with *Melia azedaracha* due to application of poultry manure, [12] in pearl millet with *Melia dubia* due to application of 75% RDN through poultry manure + pongamia green leaf manure @ 10 t ha^{-1} and [13] in garden pea with *Grewia optiva* due to use of 120 per cent of the recommended doses of nitrogen through vermicompost and poultry manure.

3.2 Soil properties

Information pertaining to soil properties is furnished in the Table 2.

3.2.1 Influence on pH

The soil pH did not vary significantly due to different treatments in *Melia dubia* based agroforestry system during both years and in pooled data, however, there was least reduction in pH due to different organic nutrient management practices in the agroforestry system, which was ranged from 7.57 to 7.60 in pooled data. Reduction in soil pH in agroforestry system was attributed to release of organic acids by tree litter and applied organic inputs. Similar results were also observed by [14-19].

3.2.2 Influence on Electric conductivity

Different treatments did not exert significant variation in electric conductivity of soil with and without tree component. However, least increase in EC due to organic nutrient management treatments in agroforestry system and in sole foxtail millet without tree component was seen when compared with no organic manurial treatment in both the years of study and in pooled data. Similar results were also observed by [18] reported that increase in EC among the agroforestry system compared to initial values. [20] observed that higher doses of organic manures (vermicompost and FYM) were more effective in increasing EC when compared to no organic manure application in vegetables intercropped with *Melia composita* and without tree interface.

3.2.3 Organic carbon (%)

Organic carbon content of soil did not vary significantly due to different treatments with and without tree association. Maximum organic carbon was observed with FYM + poultry manure **+** panchagavya alternated with vermiwash spray (0.46 %) and FYM + vermicompost + panchagavya alternated with vermiwash spray (0.46 %). No organic manurial treatment recorded lowest organic carbon content of soil (0.42 %) when compared with all the treatments. Similar results were also reported by [20,11,12].

3.3 Soil available nutrients

Information pertaining to soil available nutrients is furnished in the Table 2.

3.3. 1 Nitrogen (Kg ha^{-1})

Soil available nitrogen differed significantly due to different treatments in *Melia dubia* with tree association during both the years and in pooled data. In pooled data, significantly higher available soil nitrogen was recorded with the FYM + poultry manure **+** panchagavya alternated with vermiwash spray (242.80 kg ha^{-1}) over all other treatments except FYM + poultry manure + vermiwash spray (235.17 kg ha^{-1}) which was found to be superior over rest of the treatments except FYM + poultry manure (233.50 kg ha^{-1}), FYM + vermicompost + panchagavya alternated with vermiwash spray (232.37 kg ha^{-1}) and FYM + poultry manure + panchagavya spray (232.25 kg ha^{-1}) which in turn they were comparable with each other. The treatment with no organic manures application showed significantly lower available soil nitrogen (198.53 kg ha^{-1}) and was found on par with FYM + vermicompost + vermiwash (205.38 kg ha^{-1}) and also sole foxtail millet with recommended nutrient practice without tree component (203.34 kg ha^{-1}). Significantly higher soil available nitrogen in organic manurial treatments (T_5 to T_{10}) may be attributed to rapid mineralisation of organic manures by higher microbial activity, which provided readily available nutrients to plants.

3.3.2 Phosphorous (Kg ha^{-1})

Among organic manurial treatments with tree association, in pooled data, significantly higher soil phosphorus was influenced by FYM + poultry manure + panchagavya alternated with vermiwash spray (27.60 kg ha^{-1}) when compared with no organic manurial treatment (8.55 kg ha^{-1}), FYM (20.84 kg ha^{-1}), FYM + vermicompost + panchagavya spray (22.05 kg ha^{-1}), FYM + vermicompost + vermiwash spray (23.52 kg ha^{-1}) and FYM + vermicompost(23.69 kg ha^{-1}). The soil phosphorus in sole foxtail millet with the recommended nutrient schedule without tree component was found to be lower than all other treatments, while no organic manurial treatment in tree association resulted in significantly lower available phosphorous (8.55 kg ha^{-1}).

3.3.3 Potassium (Kg ha^{-1})

In *Melia dubia* based agroforestry system, among organic nutrient management treatments, application of FYM + poultry manure + panchagavya alternated with vermiwash spray showed its significant superiority in higher soil potassium (311.52 kg ha^{-1}) when compared to all other treatments in pooled data. Potassium availability in soil after harvest of crop was found to be significantly lower in sole foxtail millet with recommended organic nutrient sources without tree component than all other treatments. No organic manurial treatment recorded significantly lower available potassium in soil (187.21 kg ha^{-1}). Other treatments were intermediary in their effect on available potassium in the soil. Similar trend was followed during 2018 and 2019.

Significant increase in soil available NPK due to organic manurial treatments (T_5 to T_{10}) in agroforestry system was mainly attributed to the significant increase in soil beneficial micro- organisms and enzyme activities like phosphatase and dehydrogenase. The significant increase in the availability of potassium may be ascribed to the higher mineralization of K_2O by microflora in soil solution in case of combined application of organic manures and panchagavya and/or vermiwash. The increase in potassium might be due to release of potassium from mineral bound K or native K.

4. Conclusion

In the foxtail millet – *Melia dubia* based agroforestry system, application of vermicompost (50 % RDF) and poultry manure (50 % RDF) and foliar spray of panchagavya (3 %) alternated with vermiwash (5 %) recorded significantly higher uptake of NPK and soil available NPK. Organic nutrients significantly influenced the nutrient status in both plants and soil.

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Discloser statement

No potential conflict of interest was reported by the authors.

Table 1. Uptake of nitrogen, phosphorous and potassium in foxtail millet as influenced by organic nutrient management practices in Melia dubia based agroforestry system

Treatments	Uptake of nutrients (Kg ha^{-1})								
	Nitrogen			Phosphorus			Potassium		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	9.60	11.50	10.55	4.83	5.07	4.95	25.03	19.33	22.18
T_2	26.93	27.57	27.25	6.63	6.93	6.78	25.33	27.87	26.60
T_3	32.37	37.90	35.13	7.13	7.23	7.18	31.60	33.20	32.40
T_4	34.30	40.80	37.55	8.27	8.23	8.25	32.77	34.90	33.83
T_5	30.73	36.07	33.40	6.57	6.97	6.77	31.80	36.87	34.33
T_6	35.47	41.37	38.42	8.43	9.03	8.73	32.50	39.00	35.75
T_7	31.97	37.03	34.50	7.63	7.70	7.67	32.53	31.60	32.07
T_8	33.53	39.00	36.27	8.33	8.83	8.58	37.60	35.23	36.42
T_9	34.73	42.20	38.47	8.07	8.77	8.42	42.80	36.43	39.62
T_{10}	36.40	45.43	40.92	8.77	9.07	8.92	41.27	47.07	44.17
T_{11}	40.33	51.00	45.67	12.10	13.43	12.77	54.93	56.87	55.90
S.Em ±	1.29	2.30	1.71	0.29	0.36	0.28	1.86	4.39	2.82
C. D. at 5%	3.80	6.77	5.04	0.86	1.05	0.82	5.50	12.95	8.32

T_1: No organic manure (Control)
T_2:FYM equivalent to 100 % RDN
T_3: FYM (50%) + Vermicompost (50%) equivalent to 100 % RDN
T_4:FYM (50%) + Poultry manure (50%) equivalent to 100 % RDN
T_5: T_3 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_6:T_4 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_7:T_3 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_8:T_4 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_9:T_3 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{10}:T_4 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{11}: Sole foxtail millet without tree component

Table 2. Soil pH, EC and organic carbon in foxtail millet cultivation as influenced by organic nutrient management practices in Melia dubia based agroforestry system

Treatments	Soil pH			Electric conductivity (dS m^{-1})			Organic carbon (%)		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	7.61	7.61	7.61	0.24	0.25	0.25	0.42	0.43	0.42
T_2	7.60	7.60	7.60	0.24	0.26	0.25	0.43	0.44	0.43
T_3	7.59	7.58	7.59	0.24	0.26	0.25	0.43	0.44	0.44
T_4	7.58	7.56	7.57	0.25	0.26	0.25	0.44	0.45	0.44
T_5	7.60	7.59	7.60	0.26	0.25	0.25	0.43	0.44	0.44
T_6	7.59	7.55	7.57	0.25	0.25	0.25	0.45	0.46	0.45
T_7	7.60	7.59	7.59	0.24	0.25	0.25	0.43	0.44	0.44
T_8	7.59	7.57	7.58	0.25	0.25	0.25	0.45	0.46	0.45
T_9	7.59	7.59	7.59	0.25	0.26	0.25	0.45	0.46	0.46
T_{10}	7.58	7.57	7.58	0.26	0.27	0.26	0.45	0.46	0.46
T_{11}	7.60	7.62	7.61	0.26	0.27	0.26	0.44	0.45	0.45
S.Em ±	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C. D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

T_1: No organic manure (Control)
T_2:FYM equivalent to 100 % RDN
T_3: FYM (50%) + Vermicompost (50%) equivalent to 100 % RDN
T_4:FYM (50%) + Poultry manure (50%) equivalent to 100 % RDN
T_5: T_3 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_6:T_4 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_7:T_3 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_8:T_4 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_9:T_3 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{10}:T_4 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{11}: Sole foxtail millet without tree component

Table 3. Soil available nutrients in foxtail millet cultivation as influenced by organic nutrient management practices in Melia dubia based agroforestry system

Treatments	Soil available nutrients (Kg ha^{-1})								
	Nitrogen			Phosphorous			Potassium		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	206.33	190.73	198.53	11.23	5.87	8.55	192.19	182.23	187.21
T_2	212.27	203.63	207.95	20.30	21.38	20.84	272.32	277.77	275.04
T_3	214.13	212.13	213.13	22.33	25.05	23.69	278.66	284.23	281.45
T_4	238.90	228.10	233.50	24.07	25.73	24.90	283.40	289.07	286.23
T_5	218.47	207.67	213.07	21.37	22.74	22.05	277.03	282.57	279.80
T_6	232.93	231.57	232.25	24.40	26.91	25.65	282.78	288.43	285.61
T_7	208.90	201.87	205.38	22.23	24.80	23.52	283.30	288.97	286.13
T_8	239.67	230.67	235.17	25.30	24.57	24.93	285.75	291.47	288.61
T_9	238.47	226.27	232.37	23.80	25.80	24.80	283.01	288.67	285.84
T_{10}	241.17	244.43	242.80	26.57	28.63	27.60	308.43	314.60	311.52
T_{11}	208.45	198.24	203.34	15.77	18.25	17.01	225.45	245.36	235.40
S.Em ±	02.42	03.81	02.78	01.30	01.50	01.21	03.61	03.44	03.47
C. D. at 5%	07.14	11.24	08.19	03.83	04.44	03.58	10.61	10.15	10.24

DAS: Days after sowing
T_1: No organic manure (Control)
T_2:FYM equivalent to 100 % RDN
T_3: FYM (50%) + Vermicompost (50%) equivalent to 100 % RDN
T_4:FYM (50%) + Poultry manure (50%) equivalent to 100 % RDN
T_5: T_3 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_6:T_4 + Foliar spray of Panchagavya @ 3 % at 30 and 45 DAS
T_7:T_3 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_8:T_4 + Foliar spray of Vermiwash @ 5 % at 30 and 45 DAS
T_9:T_3 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{10}:T_4 + Foliar spray of Panchagavya @ 3 % at 30 DAS and Vermiwash @ 5 % at 45 DAS
T_{11}: Sole foxtail millet without tree component

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