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# Effect of Organic Nutrient Sources as Soil and Foliar Application on Growth and Yield of Barnyard Millet

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## ABSTRACT

To evaluate the effect of integrated organic nutrient sources on growth and yield of barnyard millet, the field experiment was conducted in the Farmer's Field at Anaikkudam Village, Udaiyarpalayam Taluk, Ariyalur District, Tamil Nadu. The experimental design was randomized block design with eight treatments replicated thrice. The treatments of the study were T<sub>1</sub>: Control, T<sub>2</sub>: 100% RDF, T<sub>3</sub>: CPC @ 10 t ha<sup>-1</sup> + BMP @ 1.0 t ha<sup>-1</sup> + PG (3%), T<sub>4</sub>: CPC @ 10 t ha<sup>-1</sup> + PG (3%), T<sub>5</sub>: CPC @ 10 t ha<sup>-1</sup> + BMP @ 1.0 t ha<sup>-1</sup>, T<sub>6</sub>: T<sub>3</sub> + Liquid Bio-fertilizer (1%), T<sub>7</sub>: T<sub>4</sub> + Liquid Bio-fertilizer (1%), T<sub>8</sub>: T<sub>5</sub> + Liquid bio-fertilizer (1%). The results revealed that application of 100% RDF (T<sub>2</sub>) recorded significantly the highest grain yield and straw yield of 2172 and 4518 kg ha<sup>-1</sup>, respectively in barnyard millet. The next best was found to be with CPC + BMP + PG + LBF (T<sub>6</sub>) (grain yield - 1923 kg ha<sup>-1</sup> and straw yield - 4071 kg ha<sup>-1</sup>).

**Key words:** Coirpith compost, Bonemeal, Panchagavya, Liquid bio-fertilizer, Barnyard millet

Recycling is the process to change waste into new products. The key component of modern waste reduction is reduce-reuse-recycling. The millets are the principal sources of energy, protein, vitamins and minerals for millions of poorest people. In recent years, there is a huge awareness among people about health, nutritive value of millets. The area under barnyard millet in India is about 1.95 lakh hectares and production of 1.67 million tonnes [1]. The organic farming is a dynamic and benefits in terms of soil fertility, soil health and sustainable productivity. Coir pith is a by-product of coir industry, constitutes about 70% of coconut husk. About 7.5 million tonnes of coir pith are produced per annum in India. It facilitates water retention in soil and slow release of nutrients. Bone meal is a mixture of ground animal bones, slaughter house wastes. It is an organic fertilizer rich in 12-16% of P and an excellent source of Ca. Panchagavya is an organic formulation with a blend of five products obtained from cow i.e., milk, ghee, curd, dung and urine [2]. The liquid bio-fertilizers are suspension containing desired micro-organisms, easy to use, handling and storage [3].

## MATERIALS AND METHODS

The field experiment was conducted to study the impact of integrated organic nutrient sources on growth, yield attributes and yield of barnyard millet in the farmer's field at Anaikkudam Village, Udaiyarpalayam Taluk, Ariyalur District of Tamil Nadu. The weather at Anaikkudam village is moderately warm with hot summer months. The experimental design adopted in the field experiment was randomized block design with eight treatments replicated thrice. The eight treatments were T<sub>1</sub>: Control, T<sub>2</sub>: 100% RDF, T<sub>3</sub>: CPC + BMP + PG, T<sub>4</sub>: CPC + PG, T<sub>5</sub>: CPC + BMP, T<sub>6</sub>– T<sub>3</sub>+ LBF, T<sub>7</sub> – T<sub>4</sub>+ LBF and T<sub>8</sub> – T<sub>5</sub>+ LBF. The growth, yield attributes and yield of barnyard millet were measured and recorded. The recommended dose of fertilizers 40: 30: 50 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> were adopted and incorporated. Nitrogen applied in two splits viz., first half as basal and remaining half at 30 days after planting. The entire dose of P and K were applied basally. The required quantities of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were supplied through urea, super phosphate and muriate of potash, respectively. As per the treatment schedule, different organic nutrient sources viz., coir pith compost, bone meal, Panchagavya were given. Liquid bio-fertilizers were also supplied as foliar spray @ 1% on 30 and 60 DAS. The growth, yield attributes and yield of barnyard millet were measured with different treatments.

## RESULTS AND DISCUSSION

*Plant height (cm)*

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The effect of different combinations of organic sources viz., CPC, BMP, PG and LBF on plant height at different growth stages of barnyard millet (30, 60 DAS and at harvest stage) (Table 1). The plant height was increased progressively with increase in age of crop.

#### 30 DAS

Application of 100% RDF recorded significantly highest plant height of 55.27 cm. It was followed by 51.35 cm was registered with T<sub>6</sub>: CPC + BMP + PG + LBF. However, the lowest plant height (34.10 cm) was recorded

in control treatment (T<sub>1</sub>) which received no organic and inorganic nutrients.

#### 60 DAS

The plant height was significantly high in T<sub>2</sub>: 100% RDF (138.68 cm). The application of CPC+BMP+PK+LBF (T<sub>6</sub>), CPC+PK+LBF (T<sub>7</sub>) and T<sub>8</sub>: CPC+PK+LBF recorded the plant height of 121.52, 84.75 and 107.29 cm, respectively. Among the different treatments tried, the treatments T<sub>8</sub>&T<sub>3</sub>, T<sub>5</sub>&T<sub>7</sub>, were on par. However, the lowest plant height of 59.34 cm was found to be with control.

Table 1 Plant height (cm) and yield attributes of barnyard millet cv. CO2 as influenced by coir pith compost, bone meal powder, Panchagavya and liquid bio-fertilizer

Treatments	Plant height (cm)			Yield attributes				
	30 DAS	60 DAS	At harvest	No. of productive tillers plant <sup>-1</sup>	No. of ear heads plant <sup>-1</sup>	Ear head length (cm)	Ear head weight (g)	1000 grain weight (g)
T <sub>1</sub> : Control	34.10	59.34	72.25	1.92	2.81	9.17	10.29	2.89
T <sub>2</sub> : 100% RDF	55.27	138.68	149.47	6.95	4.43	18.39	18.64	3.37
T <sub>3</sub> : CPC + BMP + PG	47.35	101.17	109.85	4.63	3.71	14.03	14.42	3.16
T <sub>4</sub> : CPC + PG	38.52	71.97	82.51	2.73	3.06	10.65	11.55	2.96
T <sub>5</sub> : CPC + BMP	43.26	86.43	96.43	3.64	3.40	12.40	12.97	3.11
T <sub>6</sub> : T <sub>3</sub> + LBF	51.35	121.52	125.71	5.63	4.13	15.83	15.89	3.28
T <sub>7</sub> : T <sub>4</sub> + LBF	42.29	84.75	94.17	3.59	3.35	12.19	12.93	3.06
T <sub>8</sub> : T <sub>5</sub> + LBF	47.72	107.29	112.30	4.69	3.83	14.26	14.50	3.20
S. Ed.	1.21	4.32	4.71	0.36	0.09	0.45	0.36	0.78
CD (P = 0.05)	2.42	8.64	9.42	0.73	0.19	0.97	0.77	NS

#### At harvest

The highest plant height of 149.47 cm followed by 125.71 cm was recorded with application of 100% RDF (T<sub>2</sub>), CPC + BMP + PK + LBF (T<sub>6</sub>) at harvest stage, respectively. The lowest plant height (72.25 cm) was recorded in control (T<sub>1</sub>). The treatment T<sub>7</sub>: CPC + PG + LBF and T<sub>8</sub>: CPC + BMP + LBF registered the plant height of 94.17 and 112.30 cm, respectively. The treatments T<sub>8</sub> and T<sub>3</sub>, T<sub>5</sub> and T<sub>7</sub> were on par. This might be due to the synergistic and cumulative effect of macro nutrients from inorganic fertilizers [4]. Application of coir pith compost, bone meal powder, Panchagavya and liquid bio-fertilizer (T<sub>6</sub>) recorded the second-best plant height of 51.35, 121.52 and 125.71cm, respectively on 30, 60 DAS and at harvest stage, respectively. The observation on plant height at different stages of growth indicated that there were significant influences of various treatments on plant height [5].

#### Yield attributes

The number of productive tillers plant<sup>-1</sup>, number of ear heads plant<sup>-1</sup>, ear head weight, ear head length and 1000 grain weight were significantly influenced with the application of different combinations of organic nutrient sources viz., coir pith compost, bone meal powder, Panchagavya and liquid bio-fertilizer (Table 1).

#### Number of productive tillers plant<sup>-1</sup>

Among the different treatments, application of 100% RDF (T<sub>2</sub>) registered significantly highest number productive tillers plant<sup>-1</sup> (6.95) of barnyard millet. This was followed by application of CPC + BMP + PG + LBF (T<sub>6</sub>) registered the number of productive tillers of 5.63. The treatments T<sub>8</sub> and T<sub>3</sub> recorded the number of productive tillers of 4.69 and 4.63, respectively. The treatment T<sub>8</sub> was on par with T<sub>3</sub>. The lowest number of productive tillers plant<sup>-1</sup> (1.92) was recorded in control (T<sub>1</sub>).

#### Number of ear head plant<sup>-1</sup>

The effect of different treatments on number of ear heads plant<sup>-1</sup> was significant. The highest number of ear heads plant<sup>-1</sup> of 4.43 was found to be with 100% RDF (T<sub>2</sub>). The treatments T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> recorded the number of ear heads plant<sup>-1</sup> of 3.71, 3.06 and 3.40, respectively. However, the lowest number of ear heads plant<sup>-1</sup>(2.81) noticed in control (T<sub>1</sub>).

#### Ear head length (cm)

The highest and the lowest ear head length of 18.39 and 9.17 cm were recorded in T<sub>2</sub>: 100% RDF and in T<sub>1</sub>: control, respectively. Application of CPC + BMP + PG (T<sub>3</sub>), CPC + PG (T<sub>4</sub>) and CPC + BMP (T<sub>5</sub>) recorded the ear head length of 14.03, 10.65 and 12.40 cm, respectively. The treatment T<sub>3</sub> (14.03 cm) was on par with T<sub>8</sub>: CPC + BMP + LBF registered the ear head length of 14.26 cm.

#### Ear head weight (g)

The highest ear head weight of 18.64 g was noticed in the treatment (T<sub>2</sub>) received 100 % RDF. The treatment T<sub>6</sub>: CPC + BMP + PG + LBF and T<sub>7</sub>: CPC + PG + LBF registered the ear head weight of 15.89, 12.93 g, respectively. Application of CPC + BMP + LBF (T<sub>8</sub>) and CPC + BMP + PK (T<sub>3</sub>) registered the ear head weight of 14.50 and 14.42 g, respectively. These two treatments were on par with each other. However, the lowest ear head weight of 10.29 g was found to be with T<sub>1</sub> (control).

#### 1000 grain weight (g)

The highest 1000 grain weight of 3.37 g was recorded with treatment T<sub>2</sub>: 100% RDF. The treatments T<sub>6</sub>: CPC + BMP + PG + LBF and T<sub>7</sub> (CPC + PG + LBF) recorded the 1000 grain weight of 3.28 and 3.06 g, respectively. The lowest 1000 grain weight (2.89 g) was recorded in control. Application of CPC + PG (T<sub>4</sub>) and CPC + BMP (T<sub>5</sub>) registered the 1000 grain weight of 2.96 and 3.11 g,

respectively. This might be attributed to adequate supply of macro nutrients to the crop from applied NPK fertilizers, which in turn increased photosynthetic activity of plant and helped to develop extensive root system. This would have helped the plant to extract more nutrients from soil resulting in better development of yield attributes [6].

#### Yield

##### Grain yield (kg ha<sup>-1</sup>)

The data on grain yield differed significantly due to application of different combinations of organic nutrient sources viz., coir pith compost, bone meal powder, Panchagavya and liquid bio-fertilizer are presented in (Table 2). The grain yield of barnyard millet differed significantly due to treatment effects. The highest grain yield (2172 kg ha<sup>-1</sup>) was obtained in T<sub>2</sub>: 100% RDF. The next best grain yield of 1923 and 1679 kg ha<sup>-1</sup> were found to be with T<sub>6</sub>: CPC + BMP + PG + LBF and T<sub>7</sub>: PC + PG + LBF, respectively. Application of CPC + BMP + LBF (T<sub>8</sub>) and CPC + BMP + PG (T<sub>3</sub>) were registered the grain yield of 1679 and 1634 kg ha<sup>-1</sup>, respectively. The treatment T<sub>8</sub> was on par with T<sub>3</sub>. However, the lowest grain yield (1067 kg ha<sup>-1</sup>) was recorded in treatment T<sub>1</sub> (control).

Table 2 Grain yield and straw yield (kg ha<sup>-1</sup>) and harvest index of barnyard millet cv. CO 2 as influenced by coir pith compost, bone meal powder, Panchagavya and liquid bio-fertilizer

Treatments	Yield (kg ha <sup>-1</sup> )	
	Grain yield	Straw yield
T <sub>1</sub> : Control	1067	2382
T <sub>2</sub> : 100% RDF	2172	4518
T <sub>3</sub> : CPC + BMP + PG	1634	3514
T <sub>4</sub> : CPC + PG	1239	2733
T <sub>5</sub> : CPC + BMP	1438	3165
T <sub>6</sub> : T <sub>3</sub> + LBF	1923	4071
T <sub>7</sub> : T <sub>4</sub> + LBF	1412	3097
T <sub>8</sub> : T <sub>5</sub> + LBF	1679	3676
S. Ed.	84.22	144.44
CD (P = 0.05)	168.44	289.88

The yield advantage might be due to the fact that the application of coir pith compost, bone meal powder,

Panchagavya and liquid bio-fertilizer have served the sufficient quantity of essential nutrient which led to better root proliferation, nutrient retention, good growth and more leaf area which is responsible for photosynthetic activity which finally resulted in increased yield components and yield [7]. This was also due to adequate supply of nutrients throughout the growth period of the crop as well as presence of growth regulators in Panchagavya contributing to higher grain yield [8].

##### Straw yield (kg ha<sup>-1</sup>)

The data clearly indicated that application of different combinations of organic nutrient sources viz., CPC, BMP, PG and LBF significantly increased straw yield of barnyard millet. The lowest straw (2382 kg ha<sup>-1</sup>) was recorded in treatment T<sub>1</sub>: Control and the highest straw yield (4518 kg ha<sup>-1</sup>) was registered with T<sub>2</sub> (100% RDF). The treatment T<sub>8</sub>: CPC + BMP + LBF registered the straw yield of 3676 kg ha<sup>-1</sup> which was on par with T<sub>3</sub> (3514 kg ha<sup>-1</sup>). Treatments T<sub>4</sub> and T<sub>5</sub> recorded the straw yield of 2733 kg ha<sup>-1</sup> and 3165 kg ha<sup>-1</sup>, respectively [9]. Application of Panchagavya on crop led to better photosynthetic activity and more extensive root system and thus enabled the plant to extract nutrient from soil thereby resulting in better development of yield attributes and increased straw yield [10].

## CONCLUSION

The present investigation clearly concluded that application of 100% RDF recorded the highest plant height, number of productive tillers plant<sup>-1</sup>, number of ear head plant<sup>-1</sup>, ear head length, ear head weight and 1000 grain weight were 149.47 cm, 6.95, 4.43, 18.39, 18.64 and 3.37. The same treatment 100% RDF (T<sub>2</sub>) recorded significantly the highest grain yield and straw yield of 2172 and 4518 kg ha<sup>-1</sup>, respectively. The next best was found to be with CPC + BMP + PG + LBF (T<sub>6</sub>) (grain yield - 1923 kg ha<sup>-1</sup> and straw yield of 4071 kg ha<sup>-1</sup>). Hence, the combined application organic nutrient sources viz., coir pith compost, bone meal powder and Panchagavya with liquid bio-fertilizers is an economical and feasible technology for the farmers for improving the yield of cultivating barnyard millet cv. CO2 in sandy loam soil.

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