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Comparision of Organic and Inorganic Sources of Nutrients on the Performance of *Phyllanthus amarus* Schum and Thonn. under Northern Dry Zone of Karnataka

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ABSTRACT

At the Main Horticultural Research and Extension Center (MHREC), UHS, Bagalkot, Udyanagiri, Bagalkot during 2018–19 *kharif* season, a field experiment using various combinations of organic manures and inorganic fertilizers was conducted to gather data on the effects of various organic and inorganic sources of nutrients on the performance of *Phyllanthus amarus* in the Northern Dry Zone of Karnataka. Application of $M_2V_1F_3$ (15 tonnes FYM, 2 tonnes vermicompost, and fertilizer combination of 150: 60: 60 kg NPK per hectare) has resulted in significantly maximum plant height (79.30 cm), number of leaves per plant (280.33) and number of branches per plant (59.90) than other treatment combinations. The $M_2V_1F_2$ (15 tonnes FYM, 2 tonnes vermicompost and fertilizer combination of 100: 45: 45 kg NPK per hectare) treatment combination considerably increased the growth-related metrics such as plant spread (75.47 cm^2/plant), leaf area (497.67 cm^2/plant) and leaf area index (3.32). $M_2V_1F_2$ also produced the best fresh herbage yield (14.79 t/ha), highest dry herbage yield (6.61 t/ha), most nutrient uptake (N-178.59, P_2O_5-33.72, K_2O-173.88 kg/ha) by the plants, highest net returns (Rs 243709/ha) and highest benefit cost ratio (3.80). However, the highest phyllanthin concentration (0.98 %) was found when organic manures $M_2V_1F_0$ were applied (15 tonnes of FYM along with 2 tonnes of vermicompost).

Keywords Economics, Growth, *Phyllanthus amarus*, Phyllanthin content, Yield.

INTRODUCTION

Phyllanthus amarus Schum and Thonn. is an important herbaceous medicinal plant having pronounced hepatoprotective property, belongs to Euphorbiaceae family. It is popularly known as "Bhumyamalaiki" in the Indian system of medicine. It is native to America and widely distributed in Cuba, Nigeria, Philippines, China, West Africa and other humid tropical countries

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in the world. It has about approximately 800 species which are found in tropical and subtropical countries (Mazumder *et al*. 2006). It is *kharif* season crop found abundantly throughout the hotter parts of India upto 1000 meters altitude, which is grown commonly in Maharashtra, Punjab, Uttar Pradesh, Tamil Nadu, Haryana, Sikkim, Karnataka and Andhra Pradesh. It elaborates medicinally important organic compounds having different classes including alkaloids, steroids, flavonoids, terpenoids, lipids, lignins and coumarins. Among all the compounds, the important lignans *i.e*., phyllanthin (a bitter constituent) and hypophyllanthin (a non-bitter constituent) gaining importance in Indian system of medicine because of its novel antiviral activity against Hepatitis - B virus, In India over 40 million people are Hepatitis - B carriers. While, WHO has recorded the number of Hepatitis - B carriers all over the world at about 257 crores. The problem is that, in allopathic system there is no medicine found for the effective cure of Hepatitis - B, though it has vaccine to prevent it. *P. amarus* also acts against several other biological activities such as kidney and gallbladder stones, cold, flu, tuberculosis, and the liver diseases and disorders including anemia, jaundice and liver cancer. The dry leaves contain high phyllanthin (0.4%) whereas, in root and stem, it is in minor quantities (Sharma *et al*. 2012).

Because of numerous medicinal properties, it is gaining great demand from both Ayurvedic and pharmaceutical industries. So, it needs commercial cultivation to meet its demand. Hence, the challenge is to combine organic manures with chemical fertilizer to optimize nutrient availability to crop plant for optimum growth, yield, quality and with regard to soil health in a specific agro-ecological zone. Keeping this in view, the present investigation entitled "Comparision of organic and inorganic sources of nutrients on the performance of Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.) under Northern Dry Zone of Karnataka" proposed to evaluate the best combination of inorganic fertilizers and organic manures for maximum growth, yield, quality and economics of *P. amarus*.

MATERIALS AND METHODS

The field experiment was conducted in *kharif* 2018–19 on sandy loam soil with pH 8.14, accessible nitrogen (238 kg/ha), phosphorus (34.36 kg/ha), and potassium (821.76 kg/ha) at the Main Horticultural Research and Extension Center (MHREC), University of Horticultural Sciences, Bagalkot. This location is situated in Northern Dry Zone of Karnataka (Zone–3) at 160 10' North latitude, 740 42' East longitude and There were 24 treatments made up of various levels in the experiment, which was set up in a factorial randomised block design with three replications. The three levels of FYM—M_0, M_1, M_2 (0, 7.5 and 15 t/ha), vermicompost—V_0 and V_1 (0 and 2 t/ha) and chemical fertilizers - F_0, F_1, F_2 and F_3 (0: 0: 0, 50: 30: 30, 100: 45: 45 and 150: 60: 60 kg NPK/ha, respectively—are also included. Before seeds were sown, vermicompost, single super phosphate (P_2O_5), potash in the form of muriate of potash (K_2O), and 50% of the prescribed amounts of nitrogen in the form of urea (N) were applied. The remaining 50% of nitrogen was top dressed 35 days after the seeds were sown. The full dose of FYM (Farmyard manure) was applied one week before sowing and mixed well (DAS). Mutant variety CIM Jeevan seeds were line seeded at a depth of 1-2 cm using 1kg seeds per hectare with a row to row spacing of 15 cm and an intra-row spacing of 10 cm. Light irrigation was provided just after seeding. At harvest, the observations were made on five randomly chosen plants from three replications (100 DAS). The observations included measuring plant spread along the East-West and North-South axes using a meter scale, calculating leaf area using a digital leaf area meter (LI-3100 Area Meter), and calculated LAI using the method proposed by Sestak *et al.* (2009). The entire plant was chopped with a sickel at the crown region and dried in the shade to preserve its colour.

Following drying, the plant's N, P and K contents were examined, and the total uptake of each was estimated. Total nitrogen was determined using the Kjeldhal method proposed by Piper (2016). Total phosphorus was determined using the vanadomolybdate method, and total potassium was estimated using the flame photometer method and represented as a percentage on a dry weight basis.

The whole herb's phyllanthin content was calculated using the RP-UFLC technique (Kshrisagar *et al*.

Table 1. Effect of different treatments on growth attributes of Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.) at harvest.

Treat-ments		Plant height (cm)					Number of leaves					Number of branches				
		F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean
M_0	V_0	2489	2900	3797	4513	3425	5053	7193	9647	12233	8532	2026	2450	2991	3503	2743
	V_1	2706	3377	4358	5137	3895	6388	8986	11417	15833	10656	2344	2855	3353	4063	3154
	Mean	2598	3139	4077	4825	3660	5721	8090	10532	14033	9594	2185	2652	3172	3783	2948
M_1	V_0	3137	3900	4873	5470	4345	7327	9427	13733	18040	12132	2580	3073	3983	4573	3553
	V_1	3553	4217	5160	6403	4833	7865	10817	13590	21767	13510	2733	3451	4213	5083	3870
	Mean	3345	4058	5017	5937	4589	7596	10122	13662	19903	12821	2657	3262	4098	4828	3711
M_2	V_0	3720	4507	5763	6997	5247	9023	12273	15117	26367	15695	3007	3710	4487	5573	4194
	V_1	3383	4920	7420	7930	5913	10577	15267	27667	28033	20386	3227	4280	5923	5990	4855
	Mean	3552	4713	6592	7463	5580	9800	13770	21392	27200	18040	3117	3995	5205	5782	4525
Mean of (F)		3165	3970	5229	6075	4610	7705	10660	15195	20379	13485	2653	3303	4158	4798	3728
Mean of (V)	V_0	3115	3769	4811	5660	4339	7134	9631	12832	18880	12119	2538	3078	3820	4550	3496
	V_1	3214	4171	5646	6490	4880	8276	11690	17558	21878	14850	2768	3528	4497	5046	3960

For comparing means of	SEm ±	CD @ 5%	SEm ±	CD @ 5%	SEm ±	CD @ 5%
FYM (M)	068	193	255	725	050	142
Vermicompost (V)	055	157	208	592	041	116
Fertilizer (F)	078	222	294	837	057	164
M x V	096	NS	360	1026	070	NS
M x F	135	385	509	1450	100	283
V x F	110	315	416	1184	081	NS
M x V x F	191	545	721	2051	141	401

Farm yard manure (M)
M_0= 0 t ha^{-1}
M_1= 75 t ha^{-1}
M_2= 15 t ha^{-1}

Vermicompost (V)
V_0= 0 t ha^{-1}
V_1= 2 t ha^{-1}

Fertilizer (F)
F_0= 0:0:0 NPK (kg ha^{-1})
F_1= 50:30:30 NPK (kg ha^{-1})
F_2= 100:45:45 NPK (kg ha^{-1})
F_3= 150:60:60 NPK (kg ha^{-1})

NS= Non significant

2016). The prices of all materials and current labor costs were taken into consideration while assessing the economics of *Phyllanthus amarus* cultivation. Based on the current market prices for the produce that was shade dried, the total income was calculated (Rs 50 kg^{-1}). Additionally, the benefit-cost ratio was calculated. Fischer's method of analysis of variance, as described by Panse and Sukhatme (1999), was used to statistically analyze the data collected throughout the crop period. The results have been discussed at a 5 % probability level.

RESULTS AND DISCUSSION

Growth parameters increased with increasing level of FYM (15 t/ha), vermicompost (2 t/ha) and NPK (150: 60: 60 kg/ha). The yield parameters increased with increasing level of FYM (15 t/ha), vermicompost (2 t/ha) and second highest level of NPK (100: 45: 45 kg/ha). Whereas, in case of quality maximum phyllanthin was observed with application of higher levels of organic manures and without application of NPK (Chemical fertilizers).

The results of the experiment on integrated nutrient management with use of organic and chemical fertilizers showed significant effect on growth parameters (Table 1). Among different nutrients combinations $M_2V_1F_3$ (15 t FYM/ha + 2 t vermicompost/ha + 150: 60: 60 kg NPK/ha) showed significantly maximum plant height (79.30 cm), number of leaves (280.33), number of branches per plant (59.90), which was on par with $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45 kg NPK/ha) followed by $M_2V_0F_3$ (15 t FYM/ha + 0 t vermicompost/ha + 150: 60: 60 kg NPK/ha).

Table 2. Growth and developmental parameters of Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.) as influenced by integrated nutrient management.

Treat-ments		Plant spread (cm^2)					Leaf area (cm^2)					Leaf area index				
		F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean
M_0	V_0	2163	2697	3227	3917	3001	17533	20733	27767	34333	25092	117	138	185	229	167
	V_1	2573	3148	3780	4320	3455	18933	25600	33500	38900	29233	126	171	223	259	195
	Mean	2368	2922	3503	4118	3228	18233	23167	30633	36617	27163	122	154	204	244	181
M_1	V_0	2710	3643	4683	5600	4159	23467	33533	37867	40267	33783	156	224	252	268	225
	V_1	3383	4030	5167	6100	4670	30700	35100	38867	45700	37592	205	234	259	305	251
	Mean	3047	3837	4925	5850	4415	27083	34317	38367	42983	35688	181	229	256	287	238
M_2	V_0	3510	4810	5800	7233	5338	33633	38133	44233	48367	41092	224	254	295	322	274
	V_1	4500	5187	7547	6700	5983	37733	43267	49767	49300	45017	252	288	332	329	300
	Mean	4005	4998	6673	6967	5661	35683	40700	47000	48833	43054	238	271	313	326	287
Mean of (F)		3140	3919	5034	5645	4434	27000	32728	38667	42811	35301	180	218	258	285	235
Mean of (V)	V_0	2794	3717	4570	5583	4166	24878	30800	36622	40989	33322	166	205	244	273	222
	V_1	3486	4121	5498	5707	4703	29122	34656	40711	44633	37281	194	231	271	298	249

For comparing means of	SEm ±	CD @ 5%	SEm ±	CD @ 5%	SEm ±	CD @ 5%
FYM (M)	081	232	416	1185	003	008
Vermicompost (V)	066	189	340	967	002	006
Fertilizer (F)	094	267	481	1368	003	009
M x V	115	NS	589	NS	004	NS
M x F	163	463	832	2369	006	016
V x F	133	378	680	NS	005	NS
M x V x F	230	655	1177	3351	008	022

Farm yard manure (M)
M_0= 0 t ha^{-1}
M_1= 75 t ha^{-1}
M_2= 15 t ha^{-1}

Vermicompost (V)
V_0= 0 t ha^{-1}
V_1= 2 t ha^{-1}

Fertilizer (F)
F_0= 0:0:0 NPK (kg ha^{-1})
F_1= 50:30:30 NPK (kg ha^{-1})
F_2= 100:45:45 NPK (kg ha^{-1})
F_3= 150:60:60 NPK (kg ha^{-1})

NS= Non significant

Among different nutrients combinations, $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45 kg NPK/ha) showed significantly maximum plant spread represented in Table 2 (75.47 cm^2) which was on par with $M_2V_0F_3$ (15 t FYM/ha + 0 t vermicompost/ha + 150: 60: 60 kg NPK/ha). Significantly, the maximum leaf area (497.67 cm^2) and LAI (3.32) was recorded with $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45 kg NPK/ha) which was on par with $M_2V_1F_3$ (15 t FYM/ha + 2 t vermicompost/ha + 150: 60: 60 kg NPK/ha) followed by $M_2V_0F_3$ (15 t FYM/ha + 0 t vermicompost/ha + 150: 60: 60 kg NPK/ ha). This may be the result of higher nutrient release from both organic manures and inorganic fertilizers, which would have improved soil health by enhancing the translocation of photosynthates from source to sink and improving vegetative growth parameters, as well as increased nutrient availability of both macro and micronutrients. Similar outcomes for ashwagandha, coleus and garden rue were reported by Sadhashiv (2010) and Konnur (2018).

The yield of both fresh and dry herbs was significantly impacted by the combined application of M, V and F (Table 3). Significantly, $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45 kg NPK/ ha) had the highest fresh and dry herbage yield, which was 14.79 t/ha and 6.61 t/ha, respectively. $M_2V_1F_3$ (15 t FYM/ha + 2 t vermicompost/ha + 150: 60: 60 kg NPK/ha) came in second, followed by $M_2V_0F_3$. The enhanced major and minor nutrient intake by the plants through FYM, vermicompost and chemical fertilizers in the presence of advantageous bacteria and growth-promoting chemicals may be the cause

Table 3. Effect of different treatments on yield attributes and phyllanthin content in Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.).

Treat-ments		Fresh herbage yield (t/ha)					Dry herbage yield (t/ha)					Phyllanthin (%)				
		F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean
M_0	V_0	435	491	560	658	536	160	193	237	320	227	065	072	069	067	068
	V_1	480	545	636	781	610	199	238	309	400	286	082	078	075	070	076
	Mean	457	518	598	719	573	179	215	273	360	257	073	075	072	069	072
M_1	V_0	523	595	723	879	680	231	280	372	430	328	085	082	079	077	081
	V_1	576	700	853	975	776	246	350	458	522	394	089	086	083	078	084
	Mean	550	647	788	927	728	239	315	415	476	361	087	084	081	077	082
M_2	V_0	680	805	971	1255	928	255	382	470	565	418	085	084	082	079	083
	V_1	754	1048	1479	1469	1188	317	500	661	653	533	085	098	092	082	090
	Mean	717	927	1225	1362	1058	286	441	566	609	475	085	091	087	081	086
Mean of (F)		575	697	870	1003	786	235	324	418	482	364	082	083	080	076	080
Mean of (V)	V_0	546	630	751	930	714	215	285	359	438	324	078	079	077	074	077
	V_1	603	765	990	1075	858	254	362	476	525	404	085	087	083	077	083

For comparing means of	SEm ±	SEm ±	SEm ±	CD @ 5%	SEm ±	CD @ 5%
FYM (M)	008	024	004	012	001	003
Vermicompost (V)	007	019	004	010	001	003
Fertilizer (F)	010	028	005	014	001	004
M x V	012	034	006	017	002	NS
M x F	017	048	009	025	002	NS
V x F	014	039	007	020	002	NS
M x V x F	024	067	012	035	003	NS

Farm yard manure (M)
M_0= 0 t ha^{-1}
M_1= 75 t ha^{-1}
M_2= 15 t ha^{-1}

Vermicompost (V)
V_0= 0 t ha^{-1}
V_1= 2 t ha^{-1}

Fertilizer (F)
F_0= 0:0:0 NPK (kg ha^{-1})
F_1= 50:30:30 NPK (kg ha^{-1})
F_2= 100:45:45 NPK (kg ha^{-1})
F_3= 150:60:60 NPK (kg ha^{-1})

NS= Non significant

of the improvement in yield parameters.

Although considerably unaffected, the phyllanthin concentration (Table 3) was highest (0.98 %) with $M_2V_1F_0$ (15 t FYM/ha + 2 t vermicompost/ha + 0: 0: 0 kg NPK/ha), followed by $M_2V_1F_1$ (15 t FYM/ha + 2 t vermicompost/ha + 50: 30: 30 kg NPK/ha) and $M_2V_1F_2$ (15 t FY This rise in phyllanthin at higher levels of organic manures may be brought on by increased protein synthesis, decreased starch accumulation and improved enzymatic antioxidant activity concentrated in plant mesophyll cells. The current results was consistent with those made by Kumar *et al*. (2013) in the case of stevia and by Sadashiv (2010) in the case of ashwagandha.

The Table 4 displays the total amount of N, P and K nutrients in the plant at harvest. The highest uptake of nitrogen (N-178.59 kg/ha), phosphorus (P_2O_5-33.72 kg/ha) and potassium (K_2O-173.88 kg/ha) were seen with $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45 kg NPK/ha), which was comparable to $M_2V_1F_3$ (15 t FYM/ha + 2 t vermicompost/ha + 150: 60: 60 kg NPK/ha). This may be attributable to FYM, as vermicompost and chemical fertilizers together had improved the nutrients availability to the plants due to the presence of humus-forming bacteria and growth-inducing substances, which led to an increase in nutrient uptake by the plants. Similar findings were observed for mints by stevia by Kumar *et al*. (2013) and Rashid *et al*. (2013) and Ashwagandha by Sadashiv (2010).

The highest net yields (Rs. 243709/ha) and B:C ratio (3.80) (Table 5 and Fig.1) were seen in $M_2V_1F_2$ (15 t FYM/ha + 2 t vermicompost/ha + 100: 45: 45

Table 4. Effect of different treatments on nutrient uptake by the plants (kg ha^{-1}) in Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.).

Treatments		Nitrogen (kg ha^{-1})					Phosphorous (kg ha^{-1})					Potassium (kg ha^{-1})				
		F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean	F_0	F_1	F_2	F_3	Mean
M_0	V_0	1175	1969	3228	5006	2844	527	713	947	1289	869	1592	2491	3351	5060	3123
	V_1	1959	2916	5128	7381	4346	716	903	1247	1772	1159	2495	3271	4688	6727	4295
	Mean	1567	2442	4178	6194	3595	622	808	1097	1531	1014	2044	2881	4020	5893	3709
M_1	V_0	2537	3780	6412	9019	5437	831	1125	1613	2008	1394	3151	4117	5967	8027	5316
	V_1	3097	5738	8788	12194	7454	1001	1447	1956	2407	1703	3509	5426	7844	10470	6812
	Mean	2817	4759	7600	10607	6446	916	1286	1784	2208	1548	3330	4771	6905	9249	6064
M_2	V_0	3421	6555	9346	13661	8246	1029	1644	2159	2826	1914	3850	6467	8902	13274	8123
	V_1	5289	10019	17859	16881	12512	1375	2132	3372	3309	2547	5316	9367	17388	15120	11798
	Mean	4355	8287	13603	15271	10379	1202	1888	2765	3068	2231	4583	7917	13145	14197	9961
Mean of (F)		2913	5163	8460	10690	6807	913	1327	1882	2269	1598	3319	5190	8023	9780	6578
Mean of (V)	V_0	2378	4101	6329	9228	5509	796	1161	1573	2041	1393	2864	4358	6073	8787	5521
	V_1	3448	6224	10592	12152	8104	1030	1494	2192	2496	1803	3774	6021	9973	10773	7635

For comparing means of	SEm ±	CD @ 5%	SEm ±	CD @ 5%	SEm ±	CD @ 5%
FYM (M)	185	526	0225	0641	143	408
Vermicompost (V)	151	430	0184	0523	117	333
Fertilizer (F)	213	744	0260	0740	165	471
M x V	261	607	0318	0906	202	576
M x F	370	1052	0450	1282	286	815
V x F	302	859	0368	1047	234	666
M x V x F	523	1488	0637	1813	405	1153

Farm yard manure (M)
M_0= 0 t ha^{-1}
M_1= 75 t ha^{-1}
M_2= 15 t ha-1

Vermicompost (V)
V_0= 0 t ha^{-1}
V_1= 2 t ha^{-1}

Fertilizer (F)
F_0= 0:0:0 NPK (kg ha^{-1})
F_1= 50:30:30 NPK (kg ha^{-1})
F_2= 100:45:45 NPK (kg ha^{-1})
F_3= 150:60:60 NPK (kg ha^{-1})

NS= Non significant

Table 5. Effect of different treatments on economics in production of Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn).

Treatmentc	Cost of cultivation (Rs/ha)	Cost of fertilizers (Rs/ha)	Cost of organics (Rs/ha)		Total cost of cultivation (Rs/ha)	Dry herbage yield (t/ha)	Gross returns (Rs/t)	Net returns (Rs/ha)	Benefit cost ratio
			FYM	Vermi-compost					
$M_0V_0F_0$	55452	-	-	-	55452	160	79835	24383	144
$M_0V_0F_1$	55452	9476	-	-	563996	193	96296	39897	171
$M_0V_0F_2$	55452	15664	-	-	570184	237	118313	61294	207
$M_0V_0F_3$	55452	21852	-	-	576372	320	159808	102171	277
$M_0V_1F_0$	55452	-	-	10000	65452	199	99314	33862	152
$M_0V_1F_1$	55452	9476	-	10000	663996	238	118793	52393	179
$M_0V_1F_2$	55452	15664	-	10000	670184	309	154595	87577	231
$M_0V_1F_3$	55452	21852	-	10000	676372	400	199863	132226	295
$M_1V_0F_0$	55452	-	10000	-	65452	231	115364	49912	176
$M_1V_0F_1$	55452	9476	10000	-	663996	280	140055	73655	211
$M_1V_0F_2$	55452	15664	10000	-	670184	372	185871	118853	277
$M_1V_0F_3$	55452	21852	10000	-	676372	430	215226	147589	318
$M_1V_1F_0$	55452	-	10000	10000	75452	246	123182	47730	163
$M_1V_1F_1$	55452	9476	10000	10000	763996	350	174897	98498	229
$M_1V_1F_2$	55452	15664	10000	10000	770184	458	228807	151788	297
$M_1V_1F_3$	55452	21852	10000	10000	776372	522	261043	183405	336
$M_2V_0F_0$	55452	-	20000	-	75452	255	127572	52120	169

Table 5. Continued.

Treat-ments	Cost of cultivatio (Rs/ha)	Cost of fertilizers (Rs/ha)	Cost of organics (Rs/ha) FYM	Vermi-compost	Total cost of cultivation (Rs/ha)	Dry herbage yield (t/ha)	Gross returns (Rs/t)	Net returns (Rs/ha)	Benefit cost ratio
$M_2V_0F_1$	55452	9476	20000	-	763996	382	190947	114547	250
$M_2V_0F_2$	55452	15664	20000	-	770184	470	234842	157824	305
$M_2V_0F_3$	55452	21852	20000	-	776372	565	292455	214818	377
$M_2V_1F_0$	55452	-	20000	10000	85452	317	158573	73121	186
$M_2V_1F_1$	55452	9476	20000	10000	863996	500	249931	163532	289
$M_2V_1F_2$	55452	15664	20000	10000	870184	661	330727	243709	380
$M_2V_1F_3$	55452	21852	20000	10000	876372	653	326612	238975	373

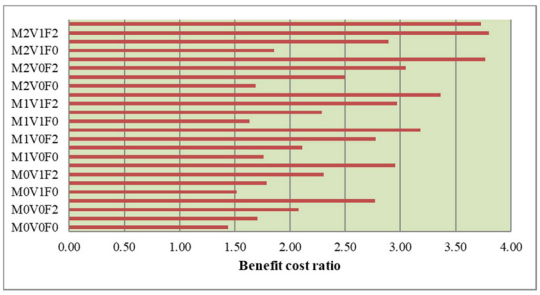

Fig. 1. Effect of different treatments on benefit cost ratio of Bhumyamalaiki (*Phyllanthus amarus* Schum and Thonn.).

Farm yard manure (M)	**Vermicompost (V)**	**Fertilizer (F)**
M_0= 0 t ha^{-1}	V_0= 0 t ha^{-1}	F_0= 0:0:0 NPK (kg ha^{-1})
M_1= 75 t ha^{-1}	V_1= 2 t ha^{-1}	F_1= 50:30:30 NPK (kg ha^{-1})
M_2= 15 t ha^{-1}		F_2= 100:45:45 NPK (kg ha^{-1})
		F_3= 150:60:60 NPK (kg ha^{-1})

kg NPK/ ha), which was followed by $M_2V_1F_3$ (15 t FYM/ha + 2 t vermicompost/ha + 150: 60: 60 kg NPK/ ha). This may be ascribed to the increased herb output as a result of the crop receiving the ideal level of nutrients from FYM, vermicompost and fertilizers.

CONCLUSION

From the current experiment, it can be deduced that the application of 15t FYM + 2t vermicompost + 100: 45: 45 kg NPK per hectare ($M_2V_1F_2$) resulted in the largest fresh and dry herbage yield, acceptable quality and quantity of phyllanthin, maximum uptake of nutrients, greater benefit cost ratio and improvement in soil attributes under northern dry zone of Karnataka.

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