

## Effect of Organic Manure on Growth and Yield of Tikhur (*Curcuma angustifolia* Roxb.) under Eucalyptus (*Eucalyptus tereticornis*) based Agro forestry System

RIYA FELICITATIRKEY, PRATAP TOPPO AND JITENDRA TRIVEDI

College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492001, Chhattisgarh, India

### Abstract

The investigation was undertaken during kharif season 2018 at herbal garden, College of Agriculture and Research Station, Raipur, Chhattisgarh. The experiment was laid out under two system i.e; AFS and Without tree in a factorial randomized complete block design with eight treatments and three replications. Application of organic manure on growth parameters significantly increased the plant height, number of tillers, number of leaves, leaf length, leaf width of tikhur compared to control and also in mother rhizome length, mother rhizome width, length and width of prime fingers, length of roots and yield of rhizome ( $qha^{-1}$ ), gross return, net return and gross b:c ratio were studied. The maximum height of plant was 122 cm, leaf length was 10.62 cm and leaf width was 50.94 cm in Agroforestry system and number of tillers was 4.69, number of leaves 8.66 in without tree. The maximum yield was obtained 47.43  $qha^{-1}$  in without tree (open) while 41.54  $qha^{-1}$  was obtain in agroforestry system by the use of treatment 4 i.e, ( FYM 12.5t/ha + Vermicompost 12.5t/ha ). In case of economic aspects gross return, net return and gross b:c ratio was not found superior under these treatments.

Keyword: AFs, FYM, Vermicompost, Agro forestry, Rhizomes, Tillers, Eucalyptus, Tikhur

### Introduction

*Curcuma angustifolia* (Tikhur) is from Zingiberaceae family and is a fast growing rhizomatous crop. It is commonly known as East Indian arrowroot or white turmeric. Generally, it is propagated by rhizomes and good source of starch and fibre (Misra and Dixit 2012). It is mainly cultivated as medicinal crop under moist deciduous mixed and in forest of Madhya Pradesh, Chhattisgarh and Jharkhand. In Chhattisgarh there are many places where tikhur is found abundantly like in hilly tracts and forest of Baster, Dantewada, Bijapur, Narayanpur, Kanker, Rajnandgaon, Dhamtari, Bilaspur, Raipur, Korba, Korea and Surguja districts. The total collection thikhur rhizomes as a minor forest produce in Chhattisgarh for tikhur (anonymous, 2005). It is medicinal to peptic ulcers, dysentery, diarrhoea, cough, bronchitis, diabetes and colitis.

### Materials and Methods

The investigation was undertaken during kharif season of 2018 at herbal garden of Indira Gandhi Krishi Vishwavidyalaya, Raipur, (Chhattisgarh). The experimental site Raipur is located in the South-Eastern part of Chhattisgarh. With 21°23'39.77"N

latitude and 81.69°44.30"E longitude and having an altitude of 295 m above mean sea level. The experiment was conducted on Eucalyptus (*Eucalyptus tereticornis*) based Agro forestry System. The experiment was laid out in randomized block design with two factors-Agro forestry system and open (without tree).

The plant height, tillers plant<sup>-1</sup>, number of leaves, leaf length and leaf width was estimated from randomly 3 plants and after harvesting of whole rhizomes, primary rhizomes, sub fingers were separated from mother rhizomes of selected plants are weighted and dried and noted. The gross return was obtained by using local market price of tikhur rhizome @ 150 Rs. Kg<sup>-1</sup> calculated by multiplied rhizome yield to local market price, and net return estimated by gross return minus cost of cultivation, gross benefit cost ratio calculated by dividing gross return by cost of cultivation.

### Results and Discussion

#### Plant height

Plant height of tikhur was found significant at

30 to 150 days. Maximum plant height was recorded in 150 days of T2 (Vermicompost 100%) was marked at 122 (cm) followed by T6 was 120 (cm) under agroforestry system. A minimum height was observed at 97.33 (cm) under T8 (without manure) is shown in table 1. Similar findings were reported by Devendrakumaret al. (2016) studied that the maximum plant height (55.52, 55.13, 54.60 cm) was observed in the T2 100% Vermicompost (10 t/ha) and the lowest plant height (43.81, 43.35, 42.74 cm) was recorded in T0 (Control).

#### Number of tillers

Maximum number of tillers plant<sup>-1</sup> of Tikhur was recorded in 150 days in T4 (FYM 50% + Vermicompost 50%) was (4.69) followed by (4.33) in T1 (FYM 100%) and minimum number of tillers plant<sup>-1</sup> was observed at (1.33) under T8 (without manure) is shown in table 1. Similar findings was studied by Brahmacharimayum Joylaxmi Devi (2019) that Number of tillers of ginger crop found higher under open field than agroforestry and in case of spacing it was maximum at S2 (30 x 25 cm) here it can be assumed due to over shading as ginger required partial shade as well as allelopathic effect of eucalyptus in alignment with report of Lalitha Bai (1981) who also found negative effect of excess shading on tillering.

#### Leaf length and width

Maximum leaf length was recorded in 150 days of T2 (Vermicompost 100%) was marked at (10.62) followed by T1 (FYM 100%) was (9.04) under agroforestry system. Minimum was observed at (7.66) cm under T8 (without manure) is shown in table 1. Maximum number of leaf width was recorded in 150

days of T2 (Vermicompost 100%) was marked at 50.94 cm followed by T2 was 43.92 cm under agroforestry system. Minimum number of leaf width was observed at 23.44 cm under T8 (without manure). Similar findings were studied by Pratapet al. (2015) found that higher growth characters like leaf length, leaf width were in the treatment poultry manure @ 5 t ha<sup>-1</sup> as compared to control.

#### Total Rhizome length (cm) and width

The total rhizome length of tikhur was 8.68 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 3.14 cm in T8 (without manure) under Without tree (open) while 4.14 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum was 3.10 cm in T8 (without manure) in AFS with significant variation is shown in table 2. The total rhizome width of tikhur was 4.78 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 5.63 cm in T8 (without manure) under Without tree (open) while 7.96 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum was 4.46 cm in T8 (without manure) in AFS with significant variation.

#### Mother rhizome length and width (cm)

The mean mother rhizome length of tikhur was 3.73 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 1.93 cm in T8 (without manure) under Without tree (open) while 2.93 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum was 1.45 cm in T8 (without manure) in AFS with significant variation is shown in table 2. The mean mother rhizome width of tikhur was 3.26 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 2.08 cm in T8 (without manure) under Without tree (open) while 3.17

Table 1: Effect of organic manure on Plant Height, No of tillers, No. of leaves, leaf length and width of Tikhur intercropped *Eucalyptus teritocornis* under *Eucalyptus* under based agro forestry system

Treatments	Plant height		No. of tillers		No. of leaves		Leaf length		Leaf width	
	WT	WOT	WT	WOT	WT	WOT	WT	WOT	WT	WOT
T1	116.33	84.00	2.36	4.33	7.29	8.66	9.04	8.26	43.92	37.21
T2	122.00	72.00	2.11	3.00	7.83	8.44	10.62	8.33	50.94	36.33
T3	90.33	80.33	1.66	3.99	6.14	6.47	8.65	7.75	30.40	35.66
T4	110.33	85.33	2.66	4.69	6.01	8.45	8.62	8.14	39.47	38.66
T5	112.00	62.66	2.00	1.66	6.46	7.44	8.19	7.05	39.96	32.00
T6	120.33	73.33	2.33	1.66	5.69	7.59	9.01	8.06	42.77	36.33
T7	118.33	59.33	2.33	1.99	6.04	7.35	8.05	8.00	39.00	35.00
T8	97.33	68.66	1.26	1.33	5.48	6.72	7.66	6.71	23.44	18.66
SE(d)	21.29		0.25		2.89		0.51		3.88	
CD (at 5%)	43.47		0.52		5.90		1.04		7.93	
CV (%)	21.36		27.84		19.96		19.96		16.75	

Table 2: Effect of organic manure on total rhizome length, Total rhizome width, Mother rhizome length, Mother rhizome width, Prime finger length, Prime finger width of Tikhur intercropped *Eucalyptus teriticornis* under *Eucalyptus* under based agro forestry system

Trt.	Total rhizome length		Total rhizome width		Mother rhizome length		Mother rhizome width		Prime finger length		Prime finger width	
	WT	WOT	WT	WOT	WT	WOT	WT	WOT	WT	WOT	WT	WOT
T1	7.76	8.32	3.55	4.12	2.33	3.11	2.42	2.73	7.06	8.30	1.20	1.66
T2	6.76	8.26	3.48	4.57	2.66	3.22	3.10	2.54	6.41	7.54	1.26	2.13
T3	6.12	7.44	3.67	4.26	2.12	2.36	2.04	2.07	6.41	6.48	1.10	1.33
T4	7.60	9.13	4.14	4.78	2.93	3.73	3.17	3.26	7.41	8.64	1.68	2.36
T5	5.63	6.66	4.05	4.27	2.16	2.83	2.58	2.76	6.07	5.49	1.21	1.88
T6	7.91	8.68	3.23	4.43	2.43	3.13	2.55	2.83	4.28	8.56	1.38	2.27
T7	7.30	7.53	3.46	4.32	2.18	2.66	2.33	2.66	5.05	6.25	1.14	1.52
T8	4.46	5.63	3.10	3.14	1.45	1.93	2.02	2.08	4.03	5.41	1.03	1.13
SE(d)	0.43		0.28		0.26		0.15		0.75		0.28	
CD (at 5%)	0.89		0.58		0.56		0.30		1.54		0.59	
CV (%)	27.18		34.18		35.23		27.30		41.45		29.39	

cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum was 2.02 cm in T8 (without manure) in AFS with significant variation.

*Finger length and width (cm)*

The finger length of tikhur was 8.68 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 3.14 cm in T8 (without manure) under Without tree (open) while 4.14 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum was 3.10 cm in T8 (without manure) in AFS with significant variation is shown in table 2. The finger width of tikhur was 2.36 cm in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 1.13 cm in T8 (without manure) under Without tree (open) while 1.68 cm in T4 (FYM 12.5t/

ha + Vermicompost 12.5t/ha) and minimum was 1.03 cm in T8 (without manure) in AFS with significant variation.

*Rhizome yield - Fresh & dry wt. (q ha<sup>-1</sup>)*

The rhizome yield of tikhur crop was 47.43 qha<sup>-1</sup> in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 17.35 qha<sup>-1</sup> in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) under Without tree (open field) and 14.43 qha<sup>-1</sup> in T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) and minimum 17.16 q/ha in T8 (without manure) under AFS which was reduced by 30.08%, with significant variation. The yield of oven dry weight of rhizome was found 5.26 qha<sup>-1</sup> in T4 and minimum 1.99 qha<sup>-1</sup> in T8 under open field and 5.18

Table 3: Effect of organic manure on Fresh wt, Dry wt, Gross return, Net return, B:C ratio of Tikhur intercropped *Eucalyptus teriticornis* under *Eucalyptus* under based agro forestry system

Treatments	Fresh weight of rhizome(q ha <sup>-1</sup> )		Dry weight of rhizome(q ha <sup>-1</sup> )		Gross return (Rs. ha <sup>-1</sup> )		Net return (Rs. ha <sup>-1</sup> )		Gross B:C ratio	
	WT	WOT	WT	WOT	WT	WOT	WT	WOT	WT	WOT
T1	26.16	30.75	3.61	4.32	392400	461250	227350	296200	2.37	2.79
T2	30.30	37.66	4.04	4.42	454500	564900	249264	359664	2.21	2.75
T3	19.56	25.33	2.14	3.24	257400	260250	144318	147168	2.27	2.30
T4	41.54	47.43	5.18	5.26	623100	666450	413290	456640	2.96	3.17
T5	25.76	36.88	4.10	4.21	386514	553200	240519	407205	2.64	3.08
T6	30.36	41.68	3.56	3.99	455400	625200	259420	429220	2.32	3.13
T7	25.61	30.17	3.39	3.12	384150	452550	216068	284468	2.28	2.69
T8	17.16	17.35	1.76	1.99	293400	379950	116615	203165	1.65	2.14
SE(d)	0.56		0.87		5.61					
CD (at 5%)	1.16		1.88		8.52					
CV (%)	36.93		42.88		17.40					

qha<sup>-1</sup> in T4 and minimum 1.76 qha<sup>-1</sup> in T8 under AFS (CS-1) which was 3.50 % less in AFS with significant variation is shown in table 3.

*Effect of organic manure on Economic of tikhur*

The effect of organic manure of different treatments has non-significant effect on gross return, net return with the highest value due to application of T4 (FYM 12.5t/ha + Vermicompost 12.5t/ha). Maximum gross return, net return and b:c ratio was recorded highest under the treatment 4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) ranges from 623100, 413290 and 2.96 Rs./ha and minimum was 293400, 116615 and 1.65 Rs./ha in T8 (Without manure) under AFS.

Similarly, Maximum gross return, net return and b:c ratio was recorded highest under the treatment 4 (FYM 12.5t/ha + Vermicompost 12.5t/ha) ranges from 666450, 456640 and 3.17 Rs./ha and minimum was 293400, 116615 and 1.65 Rs./ha in T8 (Without manure) is shown in table 3.

*Suggestion for future research*

The experiment was conducted during one year (2018-2019) further research work required for detail study of the tree-crop interaction, microclimate as well as bio parameters under eucalyptus based agroforestry system for proper recommendation. As per the economical point of view it is recommended that the experiment should require to be done in larger area at least in 1 acre so that it could give maximum economic yield for the stability of the agroforestry system reported.

**References**

Ahimana, C., and Maghembe, J.A. (1987). Growth and biomass production by young *Eucalyptus tereticornis* under agroforestry at Morogoro, Tanzania. *Forest Ecology and Management*, 22, (3-4), 219-298 pp.

Bahadur, M.M., Azad, A.K.M., Hakim, M.A., Hossain, S.M.M., Sikder, S.P. (2000). Effect of different spacing and potassium levels on the growth and yield of turmeric var. sinduri, Pakistan J. Biol. Sci 3, 593-595 pp.

Devi, Brahmacharimayum Joylaxmi (2019). Performance of Ginger (*Zingiber Officinale*) Under (*Eucalyptus Tereticornis*) based agroforestry system in planins of Chhattisgarh. College of Agriculture, Indira Gandhi Vishwavidyalaya, Raipur (C.G).

Hegde, N.K., Sulikeri, G.S. and Rethnum, B.P. (2000). Distribution of Photosynthetically Active Radiation (PAR) and performance of ginger under arecanut shade. In Spices and aromatic plants:-challenges and opportunities in the new century Centennial conference, Calicut, Kerala, India, 20-23, 2000. 107-112 pp.

Joshi, Karuna Kant. (2017), Effect of graded doses of Inorganic and Organic source of nutrients on soil fertility, nutrient uptake, growth, yield and quality of Tikhur (*Curcuma angustifolia* Roxb.). Chhattisgarh, (23).

Khosle, Tumesh Kumar. (2017). Growth and yield of organically grown Aashwagandha (*Withaniasomnifera* L. Dunal.) under karanj (*Pongamiapinnata*) based Agro forestry system. Indira Gandhi Vishwavidyalay, Raipur (C.G).

Swadija, O.K. and Padmanabhan, V.B. (2014). Growth and yield of arrowroot intercropped in coconut garden as influenced by organic management. *Journal of Root Crops* 39 (1), 67-72 pp.

Thakur, Ashwani Kumar, Thakur, Dushyant Singh, Patel Rakesh Kumar, Pradhan, Adikant and Kumar, Praful. (2015). Effect of different plant geometry and nitrogen levels, in relation to growth characters, yield and economics on seed corn at Baster Plateau Zone. *The Bioscan* 10 (3), 1223-1226 pp.

Velmurugan, M., Chezhiyan, N. and Jawaharlal, M. (2007). Studies on the effect of organic manures and biofertilizers on rhizome yield and its attributes of turmeric cv. BSR-2. *Asian Journal of Horticulture* 2 (2), 23-29 pp.

Verma, Satish., Asati K, B.S., Tamrakar, S.K., Nanda, H.C. and Gupta, C.R. (2011). Effect of organic components on growth, yield and economic returns in potato. *Potato Journal* 38 (1).

Xizhen, Ai., Dewan, Zhao. and Jingran, Qu. (1997). Effect of Fertilizers on Growth and Yield of Ginger [J], *China vegetables* 1.