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Influence of spacing on yield, quality and economics of tikhur (*Curcuma angustifolia* Roxb.)

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Abstract
The experiment was carried out to study the influence of spacing on yield, quality and economics of tikhur. The experiment was carried out at instructional farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was consisted of six different spacings *viz*. T_1 - of 45 cm × 20 cm, T_2 - 45 cm × 30 cm, T_3 - 45 cm × 45 cm, T_4 - 60 cm × 20 cm, T_5 - 60 cm × 30 cm and T_6 - 60 cm × 45 cm. Increasing trend in weight, number, thickness and yield per plant was observed with increase in spacing. Closest spacing of T_1 - 45 cm × 20 cm produced highest rhizome yield per plot, rhizome yield per hectare and starch yield per hectare. Starch recovery percent and protein content did not change due to different plant spacing. Spacing of T_1 - 45 cm × 20 cm recorded maximum gross return and net return however maximum benefit: cost ratio was observed in spacing of T_4 - 60 cm × 20 cm.

Keywords: Tikhur, spacing, yield, quality, economy

Introduction
Tikhur (*Curcuma angustifolia* Roxb.) belonging to the family Zingiberaceae is a rhizomatous herb. It is important food (Starch plant) having chromosome number 2n = 42. It is also known as white turmeric, narrow leaved turmeric, East Indian arrowroot, or Bombay arrowroot. Tikhur cultivated as medicinal crop in many parts of the state under moist deciduous mixed and salforest of Madhya Pradesh, Chhattisgarh and Jharkhand. It is generally propagated by rhizomes and good source of starch and fibre (Misra and Dixit, 1983) [4]. It is a perennial flowering plant. It generally grows about height of 90 - 120 cm. Farmers grow tikhur for rhizome production for starch extraction. Farmer's yield less starch due to lack of improved production technologies, high starch yielding genotypes and proper nutrient management practices.

The rhizome of tikhur is light bitter, demulcent, non-irritating, nutritive and fragrant. The fresh rhizomes of tikhur are used for the preparation of starchy flour which has medicinal value and effective for many diseases. The tikhur rhizome are use as appetizer reducing burning sensations and stomach pains, removal of stone from kidney, useful for ulcer patient (Sharma, 2003) [11] and rhizome pulp is used for treatment of headache as well as it gives cooling effect (Nag *et al*., 2006) [6]. The rhizomes of the tikhur can be used to heal peptic ulcers, used in treatments of diarrhoea and colitis and is often employed as an herbal tonic for patients suffering from tuberculosis.

The starch recovery from tikhur rhizome is about 15 - 25 % and is highly nutritious and easily digestible, therefore, it is recommended for infants, weak children and invalids. It is also used for the preparation of many sweet meals and herbal dishes like *halwa, barfi, jalebi* etc. Farmers also prepare herbal drink "*sarbat"* using tikhur starch especially during summer seasons due to its cooling effect (Singh and Palta, 2004) [12]. In addition, scientists have compared the tikhur rhizomes with corn starch. Its binding and disintegration properties make it viable and perhaps superior substitute for corn starch as an excipient in medicinal tablets. Plant spacing is important character, which can be manipulated to attain the maximum production, productivity and good quality and it also gives an equal opportunity to the plants for their survival and best use of the nutrients. The present study was undertaken to study the influence of different plant spacing on yield, quality and economics of tikhur.

Materials and Methods
The invistigation was carried out at Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *kharif* season of 2018 - 2019. The experiment was laid out in randomized block design with four replications on medium black soil with uniform in texture, colour and having good drainage.

The treatments constituted of six different plant spacings *viz*. T_1 - 45 cm × 20 cm, T_2 - 45 cm × 30 cm, T_3 - 45 cm × 45 cm, T_4 - 60 cm × 20 cm, T_5 - 60 cm × 30 cm and T_6 - 60 cm × 45 cm. IGSJT-10-2 Variety of tikhur was planted on 7th July 2018. Farm yard manure was applied 20 tones per hectare and N: 60 kg/ha, P_2O_5:40 kg/ha and K_2O:60 kg/ha during the crop season. Half dose of N and full dose of P and K was mixed in the plots before planting (basal dose) and remaining half dose was applied one months after planting. The plants were grown randomly in each replication in a total of 60 plots of 3.6 m × 1.8. The crop was harvested on 10th January 2019. The harvested rhizomes were cleaned up and mother rhizomes were separated. All the observations of yield, quality and economical characters were taken after harvesting of the rhizomes. The dry matter percent, starch recovery and protein content were estimated and statistically analysed.

Results and Discussion

Plant spacing had significant effect on weight, number and thickness of mother and primary rhizome per plant. Treatment T_6 - 60 cm × 45 cm recorded maximum weight of mother rhizome (50.10 g) and primary rhizome (108.60 g), Maximum number of mother (1.70) and primary rhizomes (6.03) per plant and maximum thickness of mother rhizome (3.06 cm) and thickness of primary rhizome (1.92 cm) per plant respectively (Table 1).

Table 1: Effect of spacing on weight, number and thickness of mother and primary rhizomes per plant

Treatments	Weight of rhizome per plant (g)		Number of rhizomes per plant (g)		Thickness of rhizome per plant (g)	
	Mother	Primary	Mother	Primary	Mother	Primary
T_1 - 45 cm × 20 cm	42.35	87.25	1.23	4.60	2.62	1.59
T_2 - 45 cm × 30 cm	44.65	98.45	1.39	4.75	2.72	1.70
T_3 - 45 cm × 45 cm	46.50	106.85	1.53	5.55	2.97	1.78
T_4 - 60 cm × 20 cm	44.58	94.20	1.37	4.65	2.68	1.65
T_5 - 60 cm × 30 cm	46.00	103.60	1.42	5.25	2.86	1.75
T_6 - 60 cm × 45 cm	50.10	108.60	1.70	6.03	3.06	1.92
SE(m)±	0.47	1.08	0.03	0.17	0.04	0.04
CD at 5 %	1.41	3.27	0.10	0.51	0.13	0.12

The possible reason for obtaining maximum weight, number and thickness of mother and primary rhizomes per plant in wider plant spacing is due to better nourishment of rhizomes, less plant competition, and more availability of space. Similar findings were also reported by Kumar and Gill (2010) [3], Pandey *et al*. (2011) [9], Kiran *et al*. (2013) [2], Datta *et al.* (2017) [7] and Preetham *et al.* (2018) [10].

Table 2: Effect of spacing on rhizome yield per plant, per plot and per hectare.

Treatments	Rhizome yield per plant (g)	Rhizome yield per plot (kg)	Rhizome yield per hectare (t)
T_1 - 45 cm × 20 cm	129.60	9.33	14.40
T_2 - 45 cm × 30 cm	143.10	6.87	10.59
T_3 - 45 cm × 45 cm	153.35	4.91	7.58
T_4 - 60 cm × 20 cm	138.78	7.49	11.56
T_5 - 60 cm × 30 cm	149.60	5.39	8.31
T_6 - 60 cm × 45 cm	158.70	3.81	5.87
SE(m)±	Sig	Sig	Sig.
CD at 5 %	1.26	0.07	0.10

Wider plant spacing of T_6 - 60 cm × 45 cm produced the maximum yield of rhizome per plant (158.70 g) while the minimum yield (129.60 g) was recorded in closer plant spacing of T_1 - 45 cm × 20 cm). Treatment T_1 - 45 cm × 20 cm was recorded the highest rhizome yield per plot (9.33 kg) and per hectare (14.40 t). While the lowest rhizome yield per plot (3.81 kg) and per hectare (5.87 t) was recorded in wider plant spacing of T_6 - 60 cm × 45 cm (Table 2). Datta *et al*. also reported that maximum yield per plant was recorded in (30 × 25 cm) and the lowest rhizome yield was recorded in (20 × 15 cm). Similar results were also reported by Mahender *et al.* (2015). The possible reason for obtaining higher yield from closer plant spacing or higher plant densities is probably because more plants were accommodated per hectare. This results are in agreement with findings of Pandey *et al*. (2009) [8], Kumar and Gill (2010) [3], Modepeola *et al*. (2013).

Table 3: Effect of spacing on starch yield, starch recovery and protein content

Treatments	Starch yield (kg/ha)	Starch recovery (%)	Protein content (%)
T_1 - 45 cm × 20 cm	761.75	10.60	0.54
T_2 - 45 cm × 30 cm	646.27	12.23	0.56
T_3 - 45 cm × 45 cm	492.33	12.86	0.58
T_4 - 60 cm × 20 cm	692.84	11.84	0.55
T_5 - 60 cm × 30 cm	506.77	12.33	0.57
T_6 - 60 cm × 45 cm	381.48	13.01	0.59
SE(m)±	24.73	0.45	0.02
CD at 5 %	74.52	NS	NS

Data presented in (Table 3) shows that Treatment T_1 (45 cm × 20 cm) gave the maximum starch recovery per hectare (761.75 kg). While the minimum starch recovery per hectare (381.48 kg) was produce in T_6 - 60 cm × 45 cm. Starch recovery percent and protein content did not influenced by different plant spacing.

Table 4: Effect of spacing on economics of Tikhur cultivation (Rs./ha)

Treatments	Cost of cultivation	Gross return	Net return	Benefit: Cost
T_1 - 45 cm × 20 cm	193954.75	553526.00	359571.25	2.85
T_2 - 45 cm × 30 cm	143024.75	426620.00	283595.25	2.98
T_3 - 45 cm × 45 cm	109136.30	309399.00	200262.70	2.83
T_4 - 60 cm × 20 cm	155757.25	470227.00	314469.75	3.02
T_5 - 60 cm × 30 cm	117669.75	334769.00	217099.25	2.84
T_6 - 60 cm × 45 cm	92094.75	242864.00	150769.25	2.64
SE(m)±	-	6507.44	6507.44	0.04
CD at 5 %	-	19611.4	19611.40	0.13

Observations recorded in Table 4 indicated that T_1 - 45 cm × 20 cm proved superior as this fetched higher gross return (553526.00 Rs./ha) and net return (359571.25 Rs./ha) Whereas the minimum gross return (242864.00 Rs./ha) and net return (150769.25 Rs./ha) was obtained in T_6 - 60 cm × 45 cm. But highest benefit ratio (3.02) was obtained in T_4 - 60 cm × 20 cm and the lowest benefit cost ratio (2.64) was obtained in T_6 - 60 cm × 45 cm. This might be due to a sizable increase in yield and decreased in cost of planting material. These results are in agreement with the findings of Nautiyal *et al.* (2016) [7].

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References

1. Datta N, Ghosh DK and Sarkar T. Effect of different seed rate and spacing on yield and economics of ginger (*Zingiber officinale* Rosc) cultivation. International journal of current Microbiology and Applied Sciences. 2017; 6(9):1120-1125.
2. Kiran M, Bibi R, Jillani MS, Waseem K, Ullah G, Javeria S *et al*. Effect of plant spacing on profitable yield of turmeric (C*urcuma longa* L.). Pakistan Journal of science. 2013; 65(4):486-491.
3. Kumar B, Gill BS. Growth, yield and quality of turmeric (*Curcuma longa*) as influenced by planting method, planting density and planting material. Journal of spices and aromatic crops. 2010; 19(1&2):42-49.
4. Misra SH, Dixit VK. Pharmaceutical studies on starches of some *Zingiberaceous rhizomes*. Indian J agri. Sci. 1983; 45(5):216-220.
5. Modupeola TO, Olaniyi JO, Abdul - Rafiu AM, Talor OO, Fariyike TA, Oyebamiji TO *et al*. Effect of organic phosphorous fertilizer and plant density on the growth, yield and nutritional value of ginger (*Zingiber officinale* Rosc.). Int. J Agric. Res., 2013; 8(2):94-100.
6. Nag JL., Shukla N, Pararey PM, Soni VK, Netam CR Pandey DK *et al.* Effect of extraction methods on production of edible tikhur (*Curcuma angustifolia* Roxb.). Absract book, National Seminar on Medicinal, Aromatic and Spices Plants Perspective and potential. IGKV, TCB, CARS, Bilaspur, Chhattisgarh, 2006, 75.
7. Nautiyal N, Tiwari D, Upadhyay S, Chauhan RS, Effect of nitrogen levels and plant spacing on growth and yield of turmeric. International journal of applied and pure science and agriculture. 2016; 2(10):2394-5532.
8. Pandey DK, Mishra HR. Effect of various doses of nitrogen and spacing on growth and yield of turmeric (*Curcuma longa* L.) Cv. Medukar. Veg. Sci. 2009; 36(1):122-123.
9. Pandey DK, Mishra DP, Mustafa M. Response of various level of nitrogen and plant spacing on yield and yield attributing characters of turmeric (*Curcuma longa* L.) at farmers field of Azamgarh, (Uttar Pradesh). Progressive Horticulture. 2011; 43(20):320-22.
10. Preetham, Ashwini, Pavan, Kondle R. Evaluation of turmeric variety Salem with different rhizome types and population levels on raised beds. Int. J Curr. Microbiol. App. Sci. 2018; 7(4):3202-3211.
11. Sharma R. J of Medicinal plants India - An Encyclopedia. Daya Publishing House, Delhi, 2003, 75.
12. Singh R, Palta A. Foods and beverages consumed by abujhmarias - A primitive tribe of Bastar in Chhattisgarh. Tribal Health Bull. 2004; 10(1-2):33-40.