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Effect of Organic Seed Rhizome Treatment on Turmeric cv. Salem for Growth, Yield and Quality Attributes

Shashidhar M. Dodamani*, N. K. Hegde, Lakshmi, G. Kallur, and Sharatbabu. A. G.

Department of Plantation, Spices, Medicinal and Aromatic Crops, Kittur Rani Channamma College of Horticulture, Arabhavi - 591 218

University of Horticultural Sciences, Bagalkot, Karnataka, India

*Corresponding Author E-mail: shashru2105@gmail.com

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ABSTRACT

A storage and field experiment was conducted during 2014-15 to study the response of turmeric cv. Salem to pre storage and pre planting organic seed rhizome treatments. Significantly lowest physiological loss in weight (23.15 %) and shrivelling per cent (3.38 %) was recorded in T_4 while the maximum was recorded in T_6 (27.06 %) and (10.12 %) respectively. Significantly lowest sprouting per cent (31.48 %) was recorded in T_4 while highest (41.08 %) was recorded in T_6 during storage under zero energy cool chamber (ZECC). Under field condition results indicated that significantly highest plant height (89.36 cm), number of leaves per plant (13.22), number of tiller per plant (4.94) and leaf area index (5.12) was recorded in T_4 and the lowest was recorded in T_6 (69.31 cm), (10.61), (2.98) and (4.48) respectively. Significantly maximum yield per plant (516.01 g), yield per plot (15.67 kg) and yield per ha (38.22 t/ha) was recorded in T_4 while the minimum in T_6 (322.74 g), (9.67 kg) and (23.91 t/ha) respectively. Significantly lowest per cent disease intensity (34.18 %) was recorded in T_4 while the highest in T_6 (47.43 %). There was no significant difference among the treatments for quality attributes.

Key words: *Curcuma longa, Spice, Cosmetic, Coloring Agent, Flavourant*

INTRODUCTION

Turmeric (*Curcuma longa* L.), a rhizomatous herbaceous plant of the Zingiberaceae family, is usually used as a spice, cosmetic, coloring agent, flavourant and preservative, and also ascribed universally to its aromatic, stimulative and carminative properties. Commercially, it is traded as a spice, dye, oleoresin and source of industrial starch. It is an ancient spice and being used dates back nearly 4000 years to the Vedic culture in India as a culinary spice and dye, and had a wide range of spiritual significance of Hindu religion. Turmeric is valued for its underground rhizome containing a yellow phenolic pigment called curcumin which is used as natural colouring agent for food, cosmetics and dye. Curcumin, the main active ingredient of turmeric, functions as a medicine with anti-inflammatory, anti mutagenic, anti-carcinogenic, anti-tumor, anti-bacterial, anti-oxidant, anti-fungal, anti-parasitic and detoxifying properties[1].

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India is the largest producer, consumer and exporter of turmeric that accounts about 80%, 90% and 60% share, respectively of the world's total[2]. Turmeric is being largely grown in India, Pakistan, Myanmar, Japan and China. India is the major producer of turmeric, which occupies fifth place in area under spices and ranks second in production next to chillies. It occupies 6.3 per cent of spice area and shares 16.91 per cent of spice production. In India it is being cultivated in more than 20 states in an area of 1,94,000 ha with an annual production of 9,71,000 MT. In India, it is mainly grown in Andhra Pradesh, Orissa, West Bengal, Tamil Nadu, Assam, Maharashtra, Karnataka, Bihar and Kerala. Among these, Andhra Pradesh occupies 34.90 per cent of total area and 43.51 per cent of total production of the country. The national productivity of crop is 5 tons per hectare[3].

Though a lot of trials on varietal, fertilizer, spacing, date of planting, size of planting material, mulching material and irrigation schedule etc. have been conducted to increase the production but very little work has so far been undertaken to increase the production through rhizome treatments using various organic sources. Common problems in storage of turmeric are rotting, desiccation and attack of insects. Therefore adopting proper pre-storage treatments will help in minimizing the storage losses of valuable planting material. turmeric is planted during May-June[4]. Rhizomes are harvested during December- February under Kerala condition. Therefore, it is inevitable to store the seed rhizomes in healthy and viable condition for 3 to 3½ months before planting. In the cultivation of rhizomatic spices, the costliest input is the- seed rhizome. Nearly 17-20 per cent of the produce is retained for seed purpose and these rhizomes are perishable in nature, susceptible to rotting, sprouting and shrivelling, therefore proper seed rhizome treatment is necessary to keep them in healthy and viable conditions. Keeping this in view the present investigation was undertaken to study the effect of organic seed rhizome treatment on turmeric cv. Salem growth, yield and quality attributes.

MATERIALS AND METHODS

The field experiment was conducted at K. R. C. College of Horticulture, Arabhavi, Karnataka (India) during the year 2014-15. The trials were laid out in randomized block design (RBD) with three replications using five different seed rhizome treatments namely T_1: *Trichoderma viride* (0.4%), T_2: *Pseudomonas fluorescens* (1%), T_3: Panchagavya (3%), T_4: *T. viride* (0.4%) + *P. fluorescens* (1%), T_5: Cow dung slurry (10%) and T_6: Control (No treatment). Uniform healthy rhizome bits of 30-35 g with at least two buds treated with different sources for 30 minutes and shade dried before storage and field planting. Planting was done in first week of June in ridge and furrow method with a spacing of 45 cm x 22.5 cm. The net plot size was 1.8m × 1.35m. The observations on growth, yield and quality attributes were recorded at bimonthly intervals and analysis was done.

RESULTS AND DISCUSSION

The data presented in table 1- 5 clearly revealed that growth, yield and quality attributes were significantly influenced by seed rhizome treatments. Physiological loss in weight varied significantly among seed rhizome treatments. The minimum physiological loss in weight was recorded in T_4 (23.15 %) which was on par with T_1 (24.42 %), T_2 (24.96 %) and T_3 (25.46 %), while maximum was recorded in T_6 (27.06 %). The similar observations were reported and are in conformity with earlier workers. Kirankumar *et al* (2002) recorded maximum PLW in untreated control (24.47 %). The minimum shrivelling per cent was recorded in T_4 (3.38 %) followed by T_2 (4.08 %) while the maximum was recorded in T_6 (10.12 %). The minimum sprouting per cent was recorded in T_4 (31.48 %) on par with T_2 (34.56 %) and T_1 (32.12 %) while maximum was recorded in T_6 (41.08 %).

The maximum plant height was recorded in T_4 (89.36 cm) followed by T_1 (80.46 cm) while the minimum was recorded in T_6 (69.31 cm). The maximum number of

leaves per plant was recorded in T_4 (13.22) on par with T_2 (13.13), T_1 (12.62) and T_3 (11.62). The minimum was recorded in T_6 (10.61). The maximum number of tillers per plant was recorded in T_4 (4.94) followed by T_4 (4.23) and minimum was recorded in T_6 (2.98). The maximum leaf area per plant was recorded in T_4 (51.83 dm^2) which was on par with by T_1 (49.16 dm^2), T_2 (49.03 dm^2) and T_3 (48.94 dm^2). The minimum was recorded in T_6 (45.40 dm^2). The maximum leaf area index (LAI) was recorded in T_4 (5.12) while the minimum was recorded in T_6 (4.48). The maximum pseudostem girth was recorded in T_4 (5.98 cm) followed by T_1 (5.90 cm) and minimum was recorded in T_6 (5.34 cm) at 180 DAP. Similar results were also reported by Mohanty and Sharma[6]; Sharma *et al.*[7]; Hore *et al.*[8] and Naresh *et al.*[9].

The maximum number of primary rhizomes was recorded in T_4 (7.18) while the minimum was recorded in T_6 (4.03). Number of secondary rhizomes was ranging from 9.63 in T_6 to 13.04 in T_4. The maximum length of mother rhizome was recorded in T_2 (5.22 cm) which was on par with T_4 (5.19 cm), T_1 (5.16 cm), T_3 (5.08 cm) and T_5 (4.67 cm). The minimum was recorded in T_6 (4.04 cm). The maximum length of primary rhizome was recorded in T_4 (6.59 cm) which was on par with T_1 (6.13 cm) T_2 (6.02 cm), T3 (5.96 cm) and T_5 (5.81) while the minimum was recorded in T_6 (4.96 cm). The maximum length of secondary rhizome was recorded in T4 (5.43 cm) while the minimum was recorded inT_6 (4.86 cm). Similar variations in these characters among the seed rhizome treatment were reported by earlier workers in turmeric[4].The maximum girth of mother rhizome was recorded in T_4 (3.01 cm) which was on par with T_4 (3.01 cm), T_1 (2.89 cm), T_2 (2.85 cm) and T_3 (2.77 cm). The minimum was recorded in T_8 (2.18 cm). The maximum girth of primary rhizome was recorded in T_4 (2.08 cm) while the minimum was recorded in T_6 (2.01 cm). The maximum girth of secondary rhizome was recorded in T_4 (1.68 cm). The minimum was recorded inT_6 (1.55). Recovery of healthy rhizomes in different storage treatments must have contributed for the better growth and yield performance in these treatments even in the field. Similar variations in these characters among the seed rhizome treatment were reported by earlier workers in turmeric[6,7,8,9].

The maximum fresh weight of mother rhizome was recorded in T_4 (58.01 g) which was on par with T_1 (56.94 g), T_2 (55.48 g), T_3 (55.09 g) and T_5 (52.06 g) while the minimum was recorded in T_6 (49.41 g). The maximum fresh weight of primary rhizome was recorded in T_4 (268.33 g) which was on par with T_1 (260.46 g) and T_2 (255.33 g) The minimum was recorded in T_6 (172.10 g). The maximum fresh weight of secondary rhizome was recorded in T_4 (189.37 g) followed by T_1 (172.43 g). Compared to minimum was recorded in T_6 (101.23 g). The maximum yield per plant was recorded in T_4 (516.01 g) followed by T_1 (489.83 g) while the minimum was recorded in T_6 (322.74 g). The maximum estimated fresh yield per ha was recorded in T_4 (38.22 t/ha) followed by T_1 (35.68 t/ha) while the minimum was recorded in T_6 (23.91 t/ha). Similar variations in these characters among the seed rhizome treatment were reported by earlier workers in turmeric. The quality parameters like essential oil, oleoresin and curcumin did not vary significantly, essential oil ranged between 4.46 % in T_1 to 4.48% in T_4. The oleoresin content varied from 12.75 % in T_6 to 12.79 % in T_4. The curcumin content was ranging from 4.04 % to 4.07 %. Hore *et al.*[8] reported that rhizomes treated with $KHPO_2$ 0.5 per cent produced significantly higher clump weight (346.28 g), yield per plot (14. 97 kg/ $3m^2$) and projected yield (34. 37 t/ha) as compared to control (258.34g, 10.62 kg/ $3m^2$ and 26.55 t /ha, respectively).

The yield and quality of turmeric after seed rhizome treatments appears to enhance microbial activities in the soil and improved nutritional status in the root zone as well as in the plant system. Similar results were also reported by Mohanty and Sharma[6], Sharma *et al.*[7], Kusum *et al.*[10], Hore *et al.*[8] and Naresh *et al.*[9].

The minimum per cent disease intensity (PDI) was recorded in T_4 (34.18) on par with T1 (35.68), T2 (36.92) and T3 (38.29) while maximum was recorded in T_6 (47.43 %). Similar results were also reported by Dohroo *et al.*[11] and Chowdary *et al*.[12]. Crop duration varied significantly among seed rhizome treatments. The treatment T_4 took higher number days for maturation (234 days) while T_6 took lower number days for maturation (221 days). Higher the intensity of PDI, lower was the duration of crop due to senescence and drying of leaves as well before actual maturity.

Table 1: Effect of seed rhizome treatment on physiological loss in weight (PLW), shriveling percentage and sprouting percentage of seed rhizomes in turmeric cv. Salem at 90 days after storage (DAS)

Seed rhizome treatment	PLW (%)	Shriveling (%)	Sprouting (%)
T_1:*Trichoderma viride*(0.4%)	24.42	4.59	34.56
T_2: *Pseudomonas fluorescens* (1%)	24.96	4.08	32.12
T_3: Panchagavya 3 per cent	25.46	4.13	38.13
T_4: *T.viride* (0.4%) + *P. fluorescens* (1%)	23.15	3.38	31.48
T_5 : Cow dung slurry (10%)	26.26	6.36	39.88
T_6: Control (No treatment)	27.06	10.12	41.08
S. Em±	0.72	0.12	1.11
C. D. at 1%	3.03	0.51	4.68
CV (%)	5.07	4.59	5.65

Table 2: Effect of seed rhizome treatment on growth parameters in turmeric cv. Salem at 180 DAP

Treatment	Plant height (cm)	Number of leaves per plant	Number of tillers per plant	Leaf area (dm^2)	Leaf area index (LAI)	Pseudostem girth (cm)
T_1	80.46	12.62	4.23	49.16	4.86	5.90
T_2	79.93	13.13	4.18	49.03	4.84	5.87
T_3	76.43	11.62	4.02	48.94	4.83	5.79
T_4	89.36	13.22	4.94	51.83	5.12	5.98
T_5	73.49	11.08	3.19	46.23	4.57	5.69
T_6	69.31	10.61	2.98	45.40	4.48	5.34
S. Em±	2.04	0.61	0.06	1.32	0.20	0.30
C. D. at 5%	6.18	1.86	0.18	5.30	0.61	NS
CV (%)	10.23	7.94	11.43	8.60	7.14	8.93

NS= Non significant

Table 3: Effect of seed rhizome treatment on yield and yield attributes in turmeric cv. Salem at 180 DAP

Treatment	Primary rhizomes (No/ plant)	Secondary rhizomes (No/ plant)	Length (cm)			Girth (cm)		
			Mother rhizome	Primary rhizome	Secondary rhizome	Mother rhizome	Primary rhizome	Secondary rhizome
T_1	7.09	12.98	5.16	6.13	5.20	2.89	2.04	1.63
T_2	6.98	12.72	5.22	6.02	5.14	2.85	2.06	1.65
T_3	6.43	11.95	5.08	5.96	5.09	2.77	2.03	1.63
T_4	7.18	13.04	5.19	6.59	5.43	3.01	2.08	1.68
T_5	6.13	11.81	4.67	5.81	5.10	2.36	2.04	1.60
T_6	4.03	9.63	4.04	4.96	4.86	2.18	2.01	1.55
S. Em±	0.62	0.68	0.21	0.26	0.20	0.23	0.18	0.07
C. D. at 5%	1.88	2.05	0.65	0.78	NS	0.69	NS	NS
CV (%)	15.77	9.33	7.43	7.28	6.50	14.16	15.04	12.80

NS= Non significant

Table 4: Effect of seed rhizome treatment on yield and quality attributes in turmeric cv. Salem at 180 DAP

Treatment	Fresh weight (g/plant)			Fresh rhizome yield			Essential oil (%)	Oleoresin (%)	Curcumin (%)
	Mother rhizome	Primary rhizome	Secondary rhizome	(g/ plant)	(kg/plot/ 4.86m^2)	Estimated (t /ha)			
T_1	56.94	260.46	172.43	489.83	15.18	36.28	4.46	12.78	4.07
T_2	55.48	255.33	170.93	481.74	14.93	35.68	4.45	12.78	4.06
T_3	55.09	229.12	157.69	441.90	13.70	32.73	4.45	12.76	4.04
T_4	58.01	268.33	189.67	516.01	15.67	38.22	4.48	12.79	4.07
T_5	52.06	206.63	123.36	382.05	11.84	28.30	4.43	12.76	4.04
T_6	49.41	172.10	101.23	322.74	9.67	23.91	4.43	12.75	4.04
S. Em±	2.01	4.61	4.04	6.56	0.41	0.62	0.20	0.51	0.20
C. D. at 5%	6.11	14.00	12.26	19.90	1.24	2.87	NS	NS	NS
CV (%)	7.22	8.19	8.17	12.40	9.84	8.23	7.93	6.97	8.71

NS= Non significant

Table 5: Effect of seed rhizome treatment on per cent disease intensity (PDI) for *Alternaria* leaf spot at 180 DAP and crop duration (days) in turmeric cv. Salem, DAP= Days after planting

Seed rhizome treatment	PDI for *Alternaria* leaf spot	Crop duration (days)
T_1:*Trichoderma viride* (0.4%)	35.68	230.00
T_2: *Pseudomonas fluorescens* (1%)	36.92	232.00
T_3: Panchagavya 3 per cent	38.29	226.00
T_4: *T.viride* (0.4%) + *P. fluorescens* (1%)	34.18	234.00
T_5 : Cow dung slurry (10%)	43.69	225.00
T_6: Control (No treatment)	47.43	221.00
S. Em±	1.50	2.78
C. D. at 5%	4.56	8.45
CV (%)	7.23	12.09

(days) in turmeric cv. Salem, DAP= Days after planting

T_1:*Trichoderma viride* (0.04%), T_2: *Pseudomonas fluorescens* (1%),
T_3: Panchagavya (3%) T_4: *T.viride*(0.4%) + *P. fluorescens* (1%),
T_5: Cow dung slurry (10%), T_6: Control (No treatment)

REFERENCES

1. Singh, B. K., Ramakrishna, Y., Deka, B. C., Verma, V. K. and Pathak, K. A., Varieties and planting dates affect the growth, yield and quality of turmeric (*Curcuma longa* L.) in mild-tropical environment. *Veg. Sci*., **40(1):** 40-44 (2013).
2. Anonymous, www.spiceboard.nic.in. (2012).
3. Anonymous, Indian Horticulture Database, National Horticulture Board. pp. 17 (2013).
4. Kandiannan, K. and Chandaragir, K. K., Influence of varieties, dates of planting, spacing and nitrogen levels on growth, yield and quality of turmeric (*Curcuma longa* L.*). Indian J. Agri. Sci*., **76(7):** 432-434 (2006).
5. Kirankumar, G., Rokhade, A. K. and Hanamashetti, S. I., Effect of methods of· storage on post-harvest losses and viability of seed rhizomes in turmeric (*Curcuma longa* L.). J. *Plantation Crops*, **30(2):** 68-70 (2002).
6. Mohanty, D. C. and Sharma, Y. R., Performance of ginger in tribal areas of Orissa, India as influenced by method of planting, seed treatment, manuring and mulching. *J. Plantation Crops*, **6(1):** 14-16 (1978).
7. Sharma, Y. R., Nageshwar Rao, T. O., Anandaraj, M. and Rarnana, K.Y., Rhizome rot of ginger and turmeric. Annual Report. National Research Centre for Spices, Calicut, Kerala, India, p.13 (1991).
8. Hore, J. K., Chattopadhyay, N., Samantal, M. K., Murmu, D. and Ghanti, S. Effect of rhizome treatment on growth and yield of turmeric. *J. Crop and Weed*, **10 (1):** 121-125 (2014).
9. Naresh, B., Shukla, A. K., Tripathi, P. C. and Manoranjan, P., Traditional cultivation practices of turmeric in tribal belt of Odisha. *J. Engi. Computers & Applied Sci*., **4(2):** 52-57 (2015).
10. Kusum, M., Ram, D., Poonia and Lodha, B. C., Intergration of soil solarization and pesticides for management of rhizome rot of ginger. *Indian Phytopath*, **55 (3):** 345-347 (2002).
11. Dohroo, N. P., Korla, H. N. and Rattan, R. S., Effect of chemical seed treatments on pre-emergence rot of ginger. Proceedings of national seminar on chillies, ginger and turmeric held at APAU, India, p. 33(1988).
12. Chowdary, E. K., Hasan, M.M., Mustrain, K., Hasan, M.S. and Fancy, R., Efficacy of different fungicides in controlling rhizome rot of ginger. *J. Agro. for Environ*., **3(1):** 179-181 (2009).