"STUDY OF DIFFERENT RHIZOME SIZE AND TREATMENT ON TURMERIC (*Curcuma longa* L.)"

ABSTRACT

The experiment were conducted to "Study of different rhizome size and treatment on turmeric (*Curcuma longa* L.)" at the Department of Seed Technology, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushingar during *Kharif* 2021-22. The experiment was laid out in Randomized Complete Block Design (Factorial concept) with three replications of GNT 2 variety comprising seven treatments and four rhizome size. The rhizome R_4 (mother rhizome) and treatment T_4 (Chiller treatment 4°C for 2 hrs.) revealed that all traits reported. In these investigation mother rhizome given significantly maximum result for germination per cent (80.48%), plant height (64.52 cm), leaf length (36.96 cm), leaf width (13.50 cm), tillers plant^{-1} (3.21), mother rhizome plant^{-1} (2.32), primary finger plant^{-1} (7.33), secondary finger plant^{-1} (7.94), rhizome length (14.89 cm), rhizome width (15.54 cm) and rhizome weight (185.25 g) while, in case of different treatments chiller treatment (4°C for 2 hrs.) given significantly maximum result for germination per cent (85.98 %), plant height (65.35 cm), leaf length (34.51 cm), mother rhizome plant^{-1} (2.38), Primary fingers plant^{-1} (6.70), secondary fingers plant^{-1} (7.95), rhizome length (14.13 cm), rhizome width (15.58 cm) and rhizome weight (187.23 g). Maximum leaf width (12.96 cm) and the number of tillers plant^{-1} (3.24) found by Sodium hypochloride treatment (4% for 2 hrs.) T_5.

KEYWORDS: Chiller treatment, Curcuma longa, Mother rhizome, Sodium hypochloride

INTRODUCTION

Turmeric (*Curcuma longa* L.) is a tropical perennial, underground rhizomatic crop belonging to the family *Zingiberaceae*. Is a cross-pollinated, triploid species (2n = 3x = 63). It is one of the ancient and sacred spices of India. It is the third most important spice crop of India next to chilli and black pepper. It is being used dates back nearly 4000 years to the vedic culture in India as a culinary spice and dye that had a wide range of spiritual significance to the Hindu religion. Also known as "Golden Spice" as well as the "Spice of Life". Turmeric is valued for its underground rhizome containing a yellow phenolic pigment called curcumin. Which is used as a natural coloring agent for food, cosmetics and dye. Curcumin the main active ingredient of turmeric, functions as a medicine with anti-inflammatory, anti-mutagenic, anti-tumor, anti-bacterial, anti-oxidant, anti-fungal, anti-parasitic and detoxifying properties, due to its anti-oxidant properties, controls Alzheimer's disease in human beings (Risch and Ho 1997). Alleppey turmeric is the world's most outstanding and demanded grade. Which is the richest source of curcumin and is extensively cultivated in Kerala.

Curcuminoid the active principle in turmeric rhizomes is known to have some medicinal properties and is used efficiently in the treatment of liver disease, circulatory problems, dermatological disorders and blood purification. It is popularly known as “Indian Saffron”. Rhizome’s richness in curcuminoid pigments (6%) and essential oils (5%), it also contains 69.43% carbohydrate, 6.30% protein, 3.50% mineral and other important elements on a dry weight basis. Turmeric powder is highly valued as a base material for curry production in confectionery industries for food seasoning and in the international market, especially in the US, UK and middle east as a functional food due to its health promoting properties.

India is the largest producer, consumer and exporter of turmeric supplying 94% of the world demand. Its crop duration is generally 7-9 months depending on the variety. In India, sowing takes place in July and harvesting commences from December to February. March-April months are the peak arrival period in the market for turmeric. Turmeric can be grown under diverse tropical conditions with temperatures ranging between 20-30°C and with an annual rainfall of 1500 mm. Well-drained, fertile and friable sandy or clay loam soils having sufficient hu6+mus and neutral pH were reported ideal for turmeric. Because of the prevailing favourable soil and climatic conditions in Ethiopia, the country can play a leading role in turmeric production.

India produces nearly the world's entire turmeric crop and consumes 80 per cent of it, with its inherent qualities and high content of the important bioactive compound curcumin. India turmeric is considered to be the best in the world. Erode a city in the south Indian state of Tamilnadu is the world's largest producer and most important trading centre for turmeric. It is also known as “yellow city” “turmeric city” or “textile city”. Sangli a city in Maharashtra is second only to Erode in size and importance as a production and trading site for turmeric.

The global production of turmeric is around 11 lakh tonnes per annum. India dominates the world production scenario contributing (80%) followed by China (8%), Myanmar (4%), Nigeria (3%) and Bangladesh (3%) Anonymous (2021[a]). In India, during 2021-22 about 306 ha area was covered under turmeric. The important turmeric growing states in India is Maharastra, Telangana, Odisha, Andhra Pradesh, Tamilnadu, Karnataka, West Bengal, Assam. In Gujarat during 2021-22 about 4.28 ha area and production of 16.83 MT Anonymous (2021**[b]**) was covered under turmeric. Major turmeric growing districts in Gujarat are Dahod, Navsari, Surat, Panchmahal and Mahisagar *etc*. India is the largest producer, consumer and exporter of turmeric that accounting for about 80 per cent, 90 per cent and 60 per cent share respectively of the world total.

Evaluating the effect of rhizome size on the growth and development of plants is very important for increasing yield in the plant species producing different sizes of seed (Singh and Singh 2003; Stougaard and Xue 2004). An optimum seed root in the size of a specific root crop may develop healthy seedling and vegetative parts, which subsequently receive higher solar energy and maximize yield in ginger, potato and turmeric plants producing different sizes of propagules. The turmeric plant propagates by the mother rhizome and finger rhizome. The finger rhizomes of the species are considered to be different in size because primary finger rhizomes developed from the shoot base have secondary and tertiary finger rhizomes which are different in size due to the differences in developing time. In addition, all the primary finger rhizomes are not developed at a time from a shoot base. Therefore, it is necessary to determine the optimum size of seed rhizomes for turmeric cultivation.

To fulfil the increasing demand of people for turmeric and improve its quality, it is essential to the production of turmeric considerably. This can be achieved by bringing more area under cultivation and increasing productivity per unit area. The lack of a suitable cultivar for the particular agroclimatic condition is one of the constraints for low productivity. However other factors like high yielding varieties, nutrition, layout, planting material, spacing and time of planting influence the productivity of turmeric (Patil and Borse 1980).

Materials and Methods

The experiment entitled “Study of different rhizome size and treatment on turmeric (*Curcuma longa* L.)” was conducted at the Department of Seed Technology, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *Kharif* 2021-22. Geographically, Sardarkrushinagar is positioned at 24° 19’26” North Latitude & 72° 18’53” East longitude with an altitude of 154.52 meters above mean sea level. The experiment was laid out in factorial randomized block design (FRBD) replicated three times and a spacing of 45 x 30 cm. The variety used for the study was Gujarat Navsari Turmeric 2. Cultural practices were followed as per the recommended package of practices. The treatment comprised of different size of rhizome based on weight as given below (Table 1, Fig.1).

The data on different characters will be analyzed on the mean value of five plants for experimental design. The characters *viz.*, germination per cent, plant height, leaf length, leaf width, tillers per plant, mother rhizomes per plant, primary fingers per plant, secondary fingers per plant, rhizome length, rhizome width, fresh rhizome weight.The observed data were statistically analyzed by appropriate statistical procedures as suggested for Randomized complete block design (Factorial) by (Panse and Sukhatme 1978).

Table 1: Treatment details	
Rhizome size (R)	**Treatment (T)**
R_1 = >35 g finger rhizome R_2 = >20-25 g finger rhizome R_3 = ≤ 5 g finger rhizome R_4 = Mother rhizome	T_1 = 4-second microwave treatment T_2 = 8-second microwave treatment T_3 = Deep freezer treatment (-20°C for 2 hrs.) T_4 = Chiller treatment (4°C for 2 hrs.) T_5 = Sodium hypochloride treatment (4% for 2 hrs.) T_6 = Tap water treatment for 2 hrs. T_7 = Control

Fig. 1: Different grades of rhizomes

RESULT AND DISCUSSION

The analysis of variance (mean sum of the square) for four rhizome size and seven treatments for different characters are given in Table 2 and Table 3.

Growth parameters, yield and its attribute traits

The mean sum squares due to treatments and rhizome size were found to be significant for most of all the characters, indicating the existence of sufficient variability in the experimental materials uses of different rhizome sizes and treatments use under this investigation significantly effect on germination per cent as well as different plant growth parameters. The analysis of the variance of rhizome size showed significant variation. However, maximum germination per cent was found in R_4 (80.48%) and it was at par with the R_1 (80.00%) and R_2 (79.63%), while in the case of different treatments T_4 (85.98%) give significantly higher germination per cent and it was at par with T_5 (85.84%), T_6 (83.61%) and T_1 (81.75%). The results have confirmed the reports of Singh (1985) in turmeric, Yothasiri *et al.* (1997) in turmeric and Watkinson & Pill (1998) in indiangrass.

In the turmeric crop, different growth parameters are also important to obtain a good rhizome yield. In the investigation among the different sizes of rhizome, the mother rhizome gave significantly results for plant height R_4 (64.52 cm) which was at par with the R_1 (62.02 cm), leaf length R_4 (36.96 cm), leaf width R_4 (13.50 cm) and the number of tillers plant^{-1} R_4 (3.21) while different responsible traits for economic yield also found significantly due to mother rhizome maximum mother rhizome plant^{-1} R_4 (2.32) and it was at par with the R_1 (2.24), primary rhizome plant^{-1} R_4 (7.33) followed by the R_1 (6.67), secondary fingers per plant^{-1} R_4 (7.94) followed the R_1 (7.32), rhizome length T_4 (14.89 cm) followed by the R_1 (14.06 cm), rhizome width R_4 (15.54 cm) followed by the R_1 (14.30 cm) and rhizome weight in R_4 (185.25 g) followed by the R_1 (162.15 g). Similar results were reported by Singh (1985) in turmeric, Bandara *et al*. (2000) in garlic, Gracie *et al.* (2000) in myoga, Khan *et al.* (2010) in wheat and Wu *et al.* (2015) in garlic.

The analysis of the variance of the treatments found significant except for the plant height and rhizome length. Among the different treatments used in this experiment, the chiller treatment gave maximum plant height T_4 (62.35 cm) followed by the T_3 (60.82 cm), leaf length in T_4 (34.51 cm) and it was at par with the T_5 (34.37 cm), T_3 (33.92 cm) and T_6 (32.82 cm), mother rhizome per plant^{-1} T_4 (2.38) and it was at par with the T_5 (2.33), primary fingers per plant^{-1} T_4 (6.70) and it was at par with the T_5 (6.61) and T_6 (6.34), secondary fingers per plant^{-1} T_4 (7.95) and it was at par with the T_5 (7.43), rhizome width treatment T_4 (15.58 cm) and it was at par with the T_5 (14.85 cm) and T_3 (14.59 cm). Maximum leaf width found by Sodium hypochloride treatment (4% for 2 hrs.) T_5 (12.96 cm) and it was at par with the T_4 (12.74 cm) and T_3 (12.44 cm) and number of tillers per plant^{-1} T_5 (3.24) and it was at par with the T_4 (3.20). The results have confirmed the reports of Watkinson and Pill (1998) in Indiangrass, Hossain *et al.* (2005) in turmeric, Hailemichael and Tesfaye (2008) in ginger, Padmadevi *et al.* (2012) in turmeric, Wu *et al.* (2015) in garlic, Hore *et al.* (2014) in turmeric and Patel *et al.* (2018) in turmeric.

Table 2: Influence of different rhizome size on germination and its attributes traits of turmeric cv. GNT 2

Rhizome size	Germination (%)	Plant height (cm)	Leaf Length (cm)	Leaf width (cm)	Tillers plant^{-1}	Mother rhizome plant^{-1}	Primary fingers plant^{-1}	Secondary fingers plant^{-1}	Rhizome length (cm)	Rhizome width (cm)	Rhizome weight (g)
R_1	80.00	62.02	33.87	12.57	3.05	2.24	6.67	7.32	14.06	14.30	162.15
R_2	79.63	60.66	32.20	11.85	2.72	2.11	5.62	5.85	12.89	13.49	153.55
R_3	73.97	54.65	29.50	10.91	2.35	2.03	4.86	5.32	12.04	13.45	137.30
R_4	80.48	64.52	36.96	13.50	3.21	2.32	7.33	7.94	14.89	15.54	185.25
S.Em ±	1.30	1.00	0.49	0.20	0.05	0.06	0.11	0.17	0.27	0.28	4.16
C.D. 5%	3.69	2.83	1.40	0.58	0.15	0.16	0.31	0.49	0.78	0.78	11.79

Table 3: Influence of different treatments on germination and its attributes traits of turmeric cv. GNT 2

Treatments	Germination (%)	Plant height (cm)	Leaf Length (cm)	Leaf width (cm)	Tillers plant^{-1}	Mother rhizome plant^{-1}	Primary fingers plant^{-1}	Secondary fingers plant^{-1}	Rhizome length (cm)	Rhizome width (cm)	Rhizome weight (g)
T_1	81.75	60.58	32.36	11.86	2.77	2.05	6.12	6.17	13.70	14.12	160.47
T_2	74.93	59.06	31.82	11.86	2.43	2.03	5.49	5.43	12.76	12.78	143.97
T_3	79.44	60.82	33.92	12.44	2.83	2.20	5.97	6.85	13.02	14.59	159.17
T_4	85.98	62.35	34.51	12.74	3.20	2.38	6.70	7.95	14.13	15.58	187.23
T_5	85.84	60.62	34.37	12.96	3.24	2.33	6.61	7.43	14.02	14.85	167.61
T_6	83.61	59.92	32.82	12.08	2.83	2.23	6.34	7.06	13.21	14.10	154.36
T_7	58.08	59.87	32.11	11.68	2.53	2.00	5.62	5.38	13.44	13.34	144.15
S.Em ±	1.72	1.32	0.65	0.27	0.07	0.07	0.15	0.23	0.36	0.36	5.50
C.D. 5%	4.89	NS	1.85	0.76	0.19	0.21	0.41	0.64	NS	1.03	15.60

CONCLUSION

It may be concluded from the above discussion that of study showed that seedlings from different size finger rhizome and mother rhizome were similarly healthy. From this experiment, the mother rhizome gave the best performance in all parameters because of sufficient food reserves which probably encouraged vigorous plant growth that should have eventually translated into yield. An optimum seed root in size of a specific root crop may develop healthy seedling and vegetative parts, which subsequently receive higher solar energy and maximize yield. The length of chilling treatment to break dormancy to improve the germination and seedling emergence. It was a best for vigor enhancement in turmeric. Almost all characters are positively improved by the application of rhizome R_4 (mother rhizome) and followed by >35 g finger rhizome, while in the case of rhizome treatment T_4 (Chiller treatment) and sodium hypochloride treatment (4% for 2 hrs.) given the significant result for germination per cent as well as in different growth attributes, Therefore, it is found that pre-sowing rhizome treatment can be useful for better turmeric crop cultivation.

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