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# IN-VITRO STUDIES ON TURMERIC (CURCUMA)

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## ABSTRACT

Turmeric is the common name used for dried rhizome of *Curcuma longa* L., a monocotyledonous plant belonging to the family Zingiberaceae. Curcumin is responsible for the biological actions of turmeric and comprises of curcumin, demethoxy curcumin and bis demethoxy curcumin. Generally, the commercially produced curcumin is a mixture of the above with curcumin as the main constituent. Turmeric powder, curcumin and its derivatives and many other extracts from the rhizome were found to be bioactive. Tissue culture, an important area of biotechnology can be used to improve the productivity of planting material through enhanced availability of identified planting stock with desired traits.

**KEYWORDS:** **Turmeric, Tissue culture, Curcuma**

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# INTRODUCTION

The biotechnological research is multidisciplinary and acquires expertise of different areas. Research consists of characterization and testing of different proveniences and genotypes, development of suitable multiplication methods for plants, plant cells or tissues, either in the field, in micro propagation conditions or in bioreactors. The techniques of plant tissue culture offers means for mass multiplication, for biomass energy production as well as for the conservation of important, elite and rare species that are threatened in nature with danger of extinction[1] Plant tissue culture techniques are now being used also for monitoring of their secondary metabolites. The production of secondary metabolites by tissue culture has commercial potential as well as being useful in studying the biosynthesis and regulation of secondary products. The potential of plant tissue culture both source of high value chemicals and as a system for studying secondary metabolism has not yet been exploited[2]. Few attempts have been made to standardize the different factors for *in-vitro* regeneration in an important medicinal *Curcuma.*Nadgauda *et al*. reported rapid multiplication of turmeric *in-vitro* using young sprouting rhizome buds as explants. Rhizome buds were inoculated on MS medium with varying levels of BAP and kinetin. The combination of 0.1 mg/l kinetin and 0.2 mg/l BAP was best resulting in formation of 7-8 healthy green shoots. The survival rate of plants transferred to the field was 80%[3]. Yasuda *et al*reported successful micropropagation of turmeric. Rhizome buds excised from two *Curcuma* spp. inoculated aseptically on MS medium with varying levels of BAP and kinetin produced multiple shoots. For shoot multiplication the concentration of 4.0 mg/l BAP was found to be optimum for all species[4]. Keshavachandran and Khader in 1989 conducted a study on *in-vitro* propagation of turmeric by using bud tissue of turmeric cultivars CO-1 and BSR-1 and were cultured on MS medium supplemented with 1 mg kinetin/1, 1 mg BAP/l and 40% sucrose/l. After 5 weeks the rooted plants were transferred to pots. Two weeks later plants were well established. The average number of shoots produced per bud was 2.11 in BSR-1and 2.5 in CO-1[6]. Balachandran in1990 reported *in-vitro* clonal multiplication of turmeric by using rhizome buds as explant, inoculated on MS medium with 3% sucrose and 0.8% agar, supplemented with BAP or the combination of BAP and kinetin for shoot multiplication. 2.5 mg/l BAP was best. *In-vitro* plants were successfully established in the field and were morphologically uniform[7].Rout *et al*reported *in-vitro* shoot multiplication of cultivars Suroma and PTS-28 was achieved on MS medium supplemented with BA at 4.0 mg/l, IAA at 1.0 mg/l and adenine sulphate at 100-150 mg/l. The frequency of shoot multiplication increased by 4 folds on subculture at 4 weeks interval. Shoots were successfully rooted on half-strength MS medium supplemented with IBA or IAA at 0.25-0.5 mg/l and 2% sucrose. Rooted plantlets were transferred to pots containing sand: soil: cowdung (1: 2: 1) in green house. After one month of transfer 95% of plants survived under field condition[8] Sit and Tiwari in 1997 standardized micropropagation of turmeric using buds of newly developed turmeric rhizome and were cultured on MS medium supplemented with BA (0.0, 0.5 or 1.0 mg/l), Kinetin (0, 1, 2, 3, or 4 mg/l) and IBA (0.2 mg/l). Shoot proliferation after 15 and 21 days of subculture was highest on MS medium supplemented with Kinetin 3 mg/l and BA at 1.0 mg/l. However, shoot length after 15 and 21 days of subculturing was greatest on MS medium supplemented with BA at 1.0 mg/l and Kinetin at 1 and 2 mg/l, respectively. Rooting did not occur in absence of IBA and the number of roots per shootlet was proportional to the IBA concentration[9].Rout in 1998 used Random Amplified Polymorphic DNA (RAPD) markers to evaluate the genetic stability of micropropagated plants of *Zingiber officinales* cv. $V_3S_{18}$. Fifteen arbitrary decamers were used to amplify DNA from *in vivo* and *in vitro* plant materials to assess the genetic fidelity. All RAPD profiles of micropropagated plants were monomorphic and similar to those of field grown control plants. No variation was detected

within the micropropagated plants[5]. Sunitibalastandardized *in-vitro* propagation and rhizome formation in *Curcuma longa*. Multiplication and callus induction starting from the rhizome buds and shoot tips of *C. longa* in MS medium was carried out. A combination of naphthalene acetic acid (NAA; 1.0 mg/l) with kinetin (Kn; 1.0 mg/l) or NAA (1.0 mg/l) with 6-benzylaminopurine (BAP; 2.0 mg/l) was optimum for rapid clonal propagation of turmeric. A concentration of 2.5-3.0 mg/l of 2,4-dichlorophenoxy-acetic acid (2,4-D) was found to be optimum for callus induction[10].

## CONCLUSION

Tissue culture has been used to accelerate plantation development, to shorten breeding cycle and to rapid multiplication. The best use of micro propagation technique is to overcome dormancy problem. Plant tissue culture has been successfully used to micro-propagate medicinal plants. *Curcuma* is mainly propagated by vegetative part (rhizome) because seed germination rate is very low. Since pathogens fungi, bacteria and virus are readily transmitted through seeds and vegetative parts of plants, it is important to develop micropropagation techniques and to make available the disease free *Curcuma* germplasm for commercial use.

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