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Efficient *In Vitro* Propagation Approach for Mass Multiplication of *Curcuma longa* L (Turmeric)

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INTRODUCTION & AIM

- **Mother plant -** *Curcuma longa* L. (Turmeric)
- **Explant** - Turmeric rhizome buds
- **Importance** - Rising global demand from the pharmaceutical, cosmetic, and food industries for curcumin, renowned for its potent anti-inflammatory, antioxidant, antimicrobial, and anticancer properties, underscores the importance of efficient turmeric propagation
- **Problem** - Conventional rhizome propagation is constrained by low multiplication rates and disease risks, emphasizing the need for an optimized in vitro approach for rapid, large-scale, and resource-efficient plant production
- **Aim -**

1. To optimize an efficient and reliable surface sterilization protocol for rhizome buds to ensure maximum aseptic culture establishment
2. To identify the most effective plant growth regulator (PGR) combination that promotes superior shoot induction and robust root development for enhanced *in vitro* propagation efficiency

METHOD

Figure 1: *C. longa* rhizomes in a sealed container with sterilized coir dust

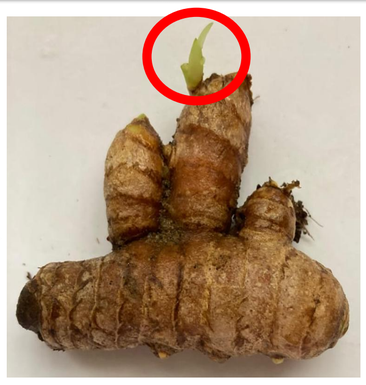


Figure 2: Rhizome buds emerging after 3–4 days

Figure 3:Rhizome bud (Explant)

Table 1: Sterilization treatments for explants

Clorox (%)	Time (min)
10	10, 15
15	10, 15

Table 2: Different plant growth regulator combinations on the shooting and rooting of explants

Treatment	Plant growth regulator combinations
T1	1.5mg/L BAP + 0.5mg/L NAA
T2	2.0mg/L BAP + 0.5mg/L NAA
T3	2.5mg/L BAP + 0.5mg/L NAA

Acclimatization of *in vitro* plantlets (in progress)

RESULTS & DISCUSSION

Experiment 1 – To optimize the standard sterilization protocol for rhizome buds

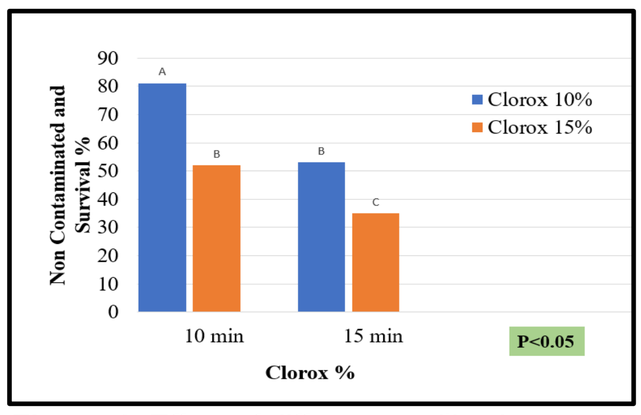


Figure 4: Effect of different sterilization treatments on non-contamination and survival % of buds

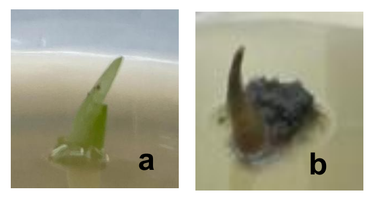
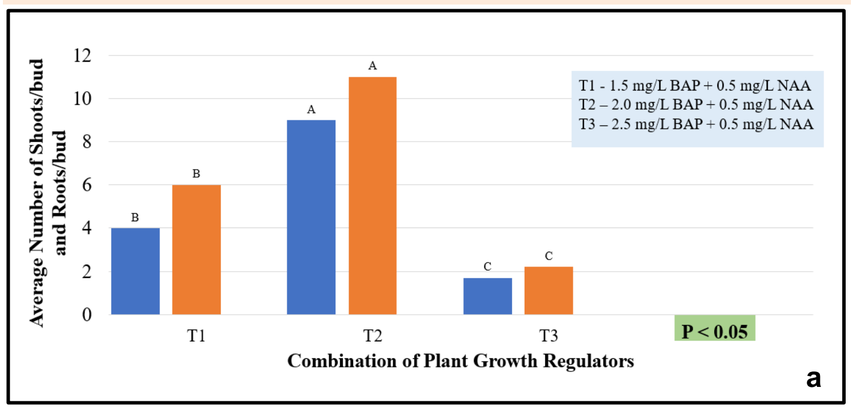


Figure 5: (a) Non-contaminated rhizome bud; (b) Contaminated rhizome bud

- Higher Clorox concentration or longer exposure reduced contamination but caused tissue damage, lowering explant survival and regeneration

Experiment 2 - To identify the most effective PGR combination for shooting and rooting



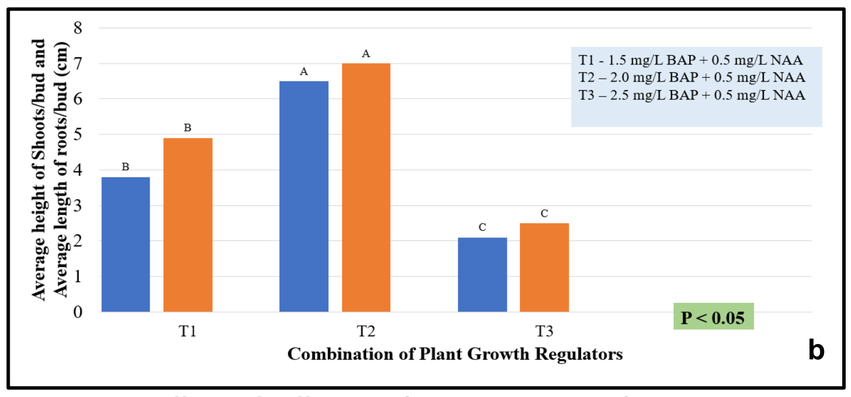


Figure 6: Effect of different plant growth regulator combinations on *in vitro* performance of *C. longa*. (a) Average number of shoots and roots per bud; (b) Average shoot height and root length per bud (cm)

- The combination of 2.0 mg/L BAP + 0.5 mg/L NAA showed the best response for shoot and root formation in *Curcuma longa*
- BAP promoted shoot initiation and cell division, while NAA enhanced elongation and rooting, activating the effect of BAP for balanced growth
- Higher BAP levels caused callus formation and a lack of NAA reduced rooting
- This combination provided the optimal cytokinin–auxin balance, producing vigorous plantlets suitable for large-scale propagation

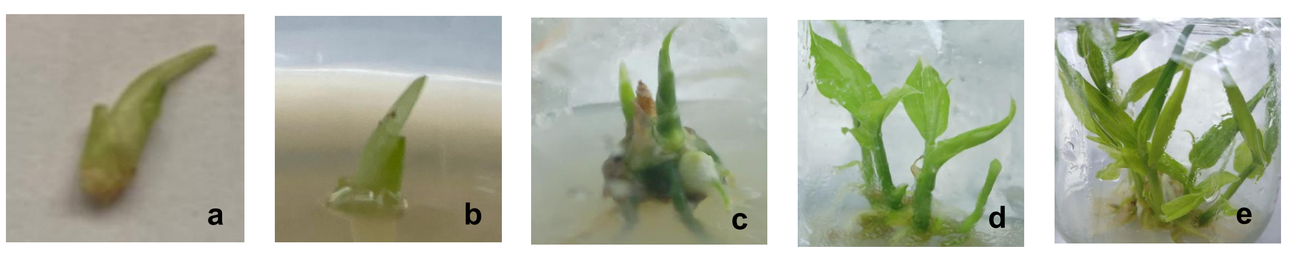


Figure 7: Micropropagation stages of a single *C. longa* rhizome bud within 8 weeks; (a) Rhizome bud; (b) Inoculation on MS medium; (c) Shoot-root initiation; (d) Multiplication stage; (e) Well-developed *in vitro* plantlet

CONCLUSION

- The optimized *in vitro* protocol using 10% Clorox (10 min) ensured high explant survival and contamination-free cultures, while the 2.0 mg/L BAP + 0.5 mg/L NAA combination promoted vigorous shooting and rooting ($p<0.05$)
- Strikingly, a single rhizome bud yielded over 50 uniform *in vitro* plantlets, establishing a rapid, highly efficient system for mass multiplication with elite germplasm conservation

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