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Advancements in cucumber micropropagation – the role of media, growth regulators and explants

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Introduction

Cucumber (*Cucumis sativus* L.) is an economically important vegetable crop cultivated worldwide, and the development of efficient micropropagation systems is essential for both commercial production and biotechnological applications.

Since the 1980s, tissue culture research in cucumber has been directed toward improving regeneration efficiency by optimizing basal media and plant growth regulator combinations.

Murashige and Skoog (MS) medium has remained the most widely used basal medium, typically supplemented with cytokinins and auxins. Among them, 6-benzylaminopurine (BAP) has been established as the principal cytokinin for shoot induction, while auxins such as naphthaleneacetic acid (NAA) and indole-3-butyric acid (IBA) are commonly applied for root induction.

Our current work aims to select suitable protocol for successful micropropagation of different cucumber genotypes.

Results

The genotypes Nomia F1 and SV0091CE were used for gaining initial explants:
- **apical buds with a size of 1-6 mm,**
- **hypocotyls with a size of 0.5 mm and**
- **cotyledons with a size of 1-3 mm.**

The initial explants were inoculated in MS medium, enriched with different combinations of growth regulators:
- **MS1: MS+0.1 mg/l IBA+0.5 mg/l BAP+0.5 mg/l KIN**
- **MS2: MS+0.5 mg/l IAA+3.0 mg/l BAP**
- **MS3: MS+0.1 mg/l IBA+1.5 mg/l BAP+0.5 mg/l KIN**
- **MS4: MS+0.1 mg/l NAA+1.0 mg/l BAP.**

The initial explants were cultured in glass jars in 20-30 ml of nutrient medium. They were placed in growth chamber 25°C, 50% relative humidity, photoperiodism of 16 hours light / 8 hours dark and light less than 50 µmol•m2•s-1.

Seed sterilization and all manipulations with explants were performed under sterile conditions in a laminar flow hood. All glassware and were sterilized by autoclaving.

Results from micropropagation of cucumber on MS medium supplemented with growth regulators.

Discussion

Research on cucumber micropropagation from 1979–2025 shows that regeneration efficiency strongly depends on the type of explant, growth regulator combination, and culture medium. Cotyledons and hypocotyls are the most frequently used explants, though apical buds and leaves have also shown good responses. Murashige and Skoog (MS) medium remains the standard substrate, with variations in auxins (NAA, IAA, 2,4-D) and cytokinins (BAP, KIN, ZEA, 2iP) determining outcomes.

Low auxin–cytokinin ratios often favored shoot induction, while higher auxin levels promoted callusogenesis and somatic embryogenesis. Genotype-specific responses were consistently reported, highlighting the importance of optimizing protocols for each cultivar. Over time, advances have improved bud proliferation, rooting, and even flowering in vitro, underscoring the critical role of growth regulators and explant selection in developing efficient cucumber regeneration systems.

In our study, different cucumber explants were cultured on MS medium enriched with different combinations of growth regulators: MS1 (IBA+BAP+KIN), MS2 (IAA+BAP), MS3 (IBA+BAP+KIN), and MS4 (NAA+BAP).
The further research will evaluate and identify the most effective MS–hormone combination for achieving efficient regeneration in cucumber micropropagation from different explants.

Conclusions

Although substantial progress has been made in establishing protocols, important limitations persist, including explant sensitivity and the risk of somaclonal variation.

Therefore, continued efforts are needed to refine hormonal interactions, ensure genetic stability, and develop cost-effective protocols suitable for large-scale applications.

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