Nitsch and Nitsch Medium

Nitsch and Nitsch Medium in Plant Tissue Culture: Origins, Uses, and Formulation

Plant tissue culture relies heavily on carefully formulated media to provide the necessary nutrients and growth regulators for successful in vitro growth. Among these, Nitsch and Nitsch (NN) medium holds a significant place, particularly for its contributions to specific plant groups. This article explores the origins, applications, formulation, and overall relevance of NN medium in contemporary plant biotechnology.

Origin

Developed by Joseph P. Nitsch and Claude Nitsch in the 1960s, the NN medium wasn’t presented as a single, definitive formulation in one publication. Instead, its evolution reflects a series of experiments aimed at optimizing in vitro growth of various plant species, particularly those challenging to culture. While the exact year of the original formulation is difficult to pinpoint due to its iterative development, its application and recognition gained traction starting in the mid-1960s. The Nitsches’ primary focus was on improving the regeneration and propagation of woody plants and specific horticultural crops, a challenge due to their often recalcitrant nature in tissue culture. Their work significantly impacted the field by demonstrating the critical role of specific nutrient ratios and growth regulators in achieving successful in vitro growth, particularly for species previously resistant to standard techniques.

Applications

Nitsch and Nitsch medium found its niche in plant tissue culture, excelling in situations where other widely-used media struggled. Its strength lies in its promotion of:

- **Anther culture and androgenesis:** The production of haploid plants from anthers is improved using NN medium by carefully controlling the balance of hormones. Several studies have demonstrated successful androgenesis in various crop species using modified versions of the NN medium.
- **Flowering in vitro:** This medium has been used effectively to induce flowering in certain plant species, shortening the breeding and selection cycle. This is especially helpful for plants with long juvenile phases.
- **Shoot multiplication:** NN medium formulations exhibit efficiency in the micropropagation of many ornamental and fruit species, yielding numerous shoots from a single explant.
- **Certain woody species:** Despite not being universally successful, NN medium has demonstrated better results with some woody species compared to other common media like Murashige and Skoog (MS). This is partially attributed to its balanced nutrient provision.

Formulation

The exact composition of NN medium can vary depending on the specific application and plant species. However, a typical formulation includes the following components: (Note:

Concentrations may vary slightly between studies and specific publications. Always refer to the primary source for a specific protocol.)

Component	Concentration (mg/L)	Role
NH_4NO_3	1650 – 2000	Nitrogen source
KNO_3	1900 -2500	Nitrogen source, potassium source
$CaCl_2 \cdot 2H_2O$	440	Calcium source
$MgSO_4 \cdot 7H_2O$	370	Magnesium, sulfur source
KH_2PO_4	170	Phosphorus source, potassium source
$FeSO_4 \cdot 7H_2O$	27.8	Iron source
Na_2EDTA	37.3	Chelator for iron
$MnSO_4 \cdot H_2O$	22.3	Manganese source
$ZnSO_4 \cdot 7H_2O$	8.6	Zinc source
KI	0.83	Iodine source
H_3BO_3	6.2	Boron source
$Na_2MoO_4 \cdot 2H_2O$	0.25	Molybdenum source
$CuSO_4 \cdot 5H_2O$	0.025	Copper source
$CoCl_2 \cdot 6H_2O$	0.025	Cobalt source
Thiamine HCl	1.0	Vitamin B1
Pyridoxine HCl	1.0	Vitamin B6
Nicotinic acid	1.0	Vitamin B3
Myo-inositol	100	Growth regulator
Sucrose	20-30 g/L	Carbon source
Agar-agar	8 g/L	Solidifying agent

Component	Concentration (mg/L)	Role
Growth Regulators (e.g., auxins, cytokinins)	Variable	Varies depending on application and species

Modifications to this basic formulation often involve adjusting the concentrations of growth regulators (auxins like NAA or 2,4-D, and cytokinins like BAP or kinetin) to favor callus induction, shoot proliferation, root formation, or flowering. The sucrose concentration might also be altered depending on the plant's metabolic needs.

Conclusion

NN medium, while not as universally popular as MS medium, maintains its relevance in plant tissue culture. Its strengths lie in its efficacy for specific recalcitrant species and its effectiveness in inducing flowering and androgenesis. Compared to MS or B5 media, NN often presents different nutrient ratios and a unique impact on specific developmental processes. Limitations include the need for careful optimization of hormone levels depending on the application and plant species used. The choice between NN and alternative media often reflects the specific demands of the target plant and the desired outcome of the tissue culture process. The NN medium's historical significance and continued niche applications highlight the importance of targeted medium development in achieving successful plant propagation and regeneration techniques.