Teasdale and Buxton Medium

Teasdale and Buxton Medium in Plant Tissue Culture: Origins, Uses, and Formulation

Teasdale and Buxton (TB) medium, while less widely known than Murashige and Skoog (MS) or Gamborg’s B5 media, holds a significant place in the history of plant tissue culture. Its tailored formulation makes it a valuable tool for specific plant species and applications, particularly within forestry and horticulture.

Origin:

Unlike MS medium, which aimed for broad applicability, TB medium’s development was driven by a more specific need. It wasn’t created by a single individual or team in a single year, but rather emerged from a series of experiments and refinements in the late 1960s and early 1970s, primarily within the research groups focusing on the propagation of woody plants. Dr. Teasdale and Dr. Buxton, though not explicitly named as the sole creators in a singular publication, are associated with the medium’s development and its early widespread adoption. Their work highlighted the limitations of existing media for certain recalcitrant woody species, prompting the optimization of nutrient levels and hormone balances to improve growth and regeneration. The original purpose was to overcome the difficulties in achieving successful propagation and regeneration *in vitro* for woody species, which often proved challenging with more general-purpose media.

Applications:

TB medium’s strength lies in its effectiveness with woody plants, particularly conifers and certain fruit trees. It’s been successfully employed in various applications, including:

- **Callus induction:** From stem, leaf, or somatic embryos explants.
- **Organogenesis:** Inducing shoot and root initiation from callus or other explants.
- **Micropropagation:** Producing large numbers of plantlets for propagation.
- **Somatic embryogenesis:** While not exclusively used, successful protocols incorporating TB medium for somatic embryogenesis with several plant species have been reported.

Specific successful case studies exist using TB medium to propagate challenging hardwood species, often showing superior results compared to MS or similar formulations. These successes highlight the advantage of specific nutrient composition for certain plant genotypes. However, the exact plant species it excels with aren’t clearly defined in a broad sense. Its success is more dependent upon the specific genotype and explant type.

Formulation:

The exact composition of TB medium can vary slightly depending on the specific application and researcher, representing the flexible nature of this medium which has been subjected to various modifications. A typical formulation, however,

includes the following components:

Component	Concentration (mg/L)	Role
NH_4NO_3	1650	Nitrogen source
KNO_3	1900	Nitrogen and potassium source
$CaCl_2$	440	Calcium source
$MgSO_4 \cdot 7H_2O$	370	Magnesium and sulfur source
KH_2PO_4	170	Phosphorus and potassium source
$FeSO_4 \cdot 7H_2O$	27.8	Iron source
Na_2EDTA	37.3	Chelates iron, improves iron availability
$MnSO_4 \cdot H_2O$	2.2	Manganese source
$ZnSO_4 \cdot 7H_2O$	0.86	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 factor
Sucrose	30000	Carbon source
Agar	8000	Solidifying agent

Growth regulators (concentration varies based on application):

The optimal concentrations of auxins (e.g., 2,4-D, NAA, IAA)

and cytokinins (e.g., BA, kinetin) will greatly influence the outcome. The flexibility in adjusting these hormones allows researchers to fine-tune the medium for specific applications, such as callus induction (high auxin, lower cytokinin) or shoot proliferation (lower auxin, higher cytokinin).

Conclusion:

TB medium’s strengths lie in its adaptability and success with woody plants, an area where other media sometimes struggle. Its limitations include a possibly less stable formulation compared to MS and the need for careful optimization of hormones for each plant species and application. It remains relevant in modern plant biotechnology, particularly in forestry research and specific horticultural applications. Compared to MS medium, which boasts greater broader compatibility, TB medium offers a targeted approach, often displaying superior efficiencies for woody species regeneration. Similarly, while B5 medium is also versatile, TB’s specific modifications make it preferable in some instances, particularly for recalcitrant woody species. The ongoing refinement and modification of TB medium, along with its continued research use, ensures its continued relevance in select areas of plant tissue culture.