CELL CULTURE AND PROTOPLAST SYSTEMS: APPROACHES TO REVOLUTIONIZE WEED SCIENCE

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Destaque: Cell culture and protoplast systems have the potential to revolutionize the studies in weed science through simple, versatile and accurate properties.

Resumo: Plant cell suspension cultures and their ability to produce protoplasts (plant cells without cell walls) are vital tools for weed science to study plants at the single-cell level. For decades, these cell cultures and protoplasts have been used in other fields and recently performed single-cell next-generation sequencing, gene expression analysis, CRISPR gene editing, and to study environmental responses. Protoplasts are obtained by enzymatic digestion of cell walls to yield single cells. Protoplasts can be obtained directly from plant tissues in sterile and non-sterile conditions, such as field and greenhouse plants. While protoplast isolation may be possible from any tissues, leaf callus-derived cell suspension culture can be used to obtain relatively homogeneous populations of protoplasts. The methods to get cell culture and protoplasts are simple and do not require expensive facilities. One of the limitations is that cell isolation and cell-wall digestion need specific enzymes, which are costly. Still, progress has been made to use cell wall degrading enzymes used in commercial food processing. One example is a cocktail of food-grade hydrolases used to make apple cider. The cell culture and protoplasts approaches can be employed in weed science to improve accuracy save resources and time. They can be used in studies with herbicide physiology - herbicide transport and metabolism, herbicide dose-response, the discovery of new herbicide sites of action. Also, these techniques can be used in molecular assays such as gene expression, next-generation sequencing, and gene editing. The pros are that the results can be obtained in hours or a few days, reduced facilities usage (field, greenhouses), and resources consumption. The techniques are very versatile, and new applications can be discovered. The cons are that the methods must be adapted for weed science usage and the digestion enzyme costs if food-grade enzymes do not work on target tissues.

Palavras-chave: Improving molecular studies ; Single-cell level studies; Versatile tools; Quick method