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Editorial: Crop production and its relationship with the production of vegetable raw materials

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Editorial on the Research Topic

[Crop production and its relationship with the production of vegetable raw materials](#)

Contemporary agricultural systems are increasingly required to reconcile productivity with environmental sustainability, resource-use efficiency, and the quality of plant-derived raw materials. For decades, crop production has been predominantly evaluated in terms of yield, often overlooking the broader implications of agronomic practices for ecosystem functioning, product quality, and downstream value chains. However, such reductionist approaches are becoming increasingly insufficient in the face of global challenges, including climate change, soil degradation, biodiversity loss, and shifting dietary demands toward higher-quality and functionally enhanced foods (Foley et al., 2011; Tilman et al., 2011).

In response to these challenges, the Research Topic “*Crop production and its relationship with the production of vegetable raw materials*” brings together six contributions that expand the scope of crop production. Rather than viewing primary production as an isolated stage, these studies identify it as a key driver shaping the quality, functionality, sustainability, and end-use value of plant-derived raw materials. Thus, this editorial argues that crop production should be understood as a multifunctional, biologically regulated, and multiscale system in which productivity, quality, ecological processes, and biomass flows are intrinsically interconnected.

A central insight emerging from this Research Topic is that the quality of plant-derived raw materials is not determined solely at harvest or post-harvest stages, but is fundamentally shaped by production conditions. As shown by Ramirez-Castañeda et al., preharvest factors such as irrigation regimes, nutrient availability, and environmental stress not only influence crop yield, but also modulate physiological and metabolic pathways that ultimately determine key quality attributes, including biochemical composition, nutritional value, and post-harvest stability. Their research highlights that management decisions during crop growth can have cascading effects on the accumulation of primary and secondary metabolites, thereby directly linking agronomic practices with raw material functionality.

In this context, Narváez Cadena et al. highlight the potential of underutilized species such as *Plukenetia volubilis* as sources of high-value compounds, particularly in terms of their nutritional and functional properties following thermo-mechanical and

chemical processing. Their findings emphasize that both production conditions and post-harvest processing play a critical role in determining the quality and functionality of plant-derived products, reinforcing the importance of integrating agronomic and processing perspectives.

At the production level, Warghane et al. demonstrate that the use of natural fertilizers can significantly improve growth dynamics and yield performance in *Solanum melongena*, highlighting the role of soil fertility management in enhancing both productivity and the quality of agricultural outputs. These results support the transition toward more sustainable nutrient management strategies. Similarly, El Aalaoui et al. show that integrating botanical extracts with biological control agents can significantly reduce pest pressure in *Vicia faba*, offering an effective alternative to conventional chemical control. This approach contributes to improved crop quality by reducing pesticide residues and supports more sustainable pest management strategies.

The research of Barrera-Siabato et al. illustrates how agroecological approaches can support climate resilience, sustainable land use, and rural development by integrating ecological, social, and economic dimensions. Their analysis highlights the importance of diversified production systems and local knowledge in maintaining ecosystem functions and stabilizing production under variable environmental conditions.

An additional contribution of this Research Topic is the explicit consideration of biomass flows and their role within broader production and energy systems. Ibarra-Mojica et al. demonstrate that agricultural residues represent a significant and often underutilized source of bioenergy, with the potential to contribute to renewable energy generation and reduce dependence on fossil fuels. Their work challenges traditional linear models in which residues are treated as waste, proposing instead a circular bioeconomy approach in which biomass is revalorized. However, they also emphasize the existence of trade-offs, particularly regarding residue removal and its potential impacts on soil organic matter and nutrient cycling.

Taken together, these contributions highlight the need for integrated, multiscale frameworks that link soil processes, plant physiology, crop management, biomass flows, and socio-economic dynamics. Crop production systems should be understood as complex adaptive networks in which interactions among biological, physical, and social components determine both productivity and sustainability. This perspective calls for interdisciplinary approaches to design systems that are productive, resilient, and resource-efficient. Accordingly, crop production should not be viewed solely in terms of yield, but as a multifunctional system where productivity, quality, ecological processes, and resource-use efficiency are interconnected. Advancing this approach will require integrating these dimensions into coherent frameworks that

support food production, high-quality raw materials, renewable energy, and ecosystem services.

Author contributions

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