Sharpening the tools to manage early–stage invasions by alien plants in agriculture: a co–innovative case study based on *Asclepias syriaca*

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Background and Aims
Invasive plants pose increasing risks to agriculture, yet standardized tools for early–stage assessment and management are lacking. To address this, we developed two complementary frameworks – the Rapid Regional Invasiveness Assessment (RRIA) and the Solutions for Early–Stage Invasive Species (SESIS) – and applied them to the invasive *Asclepias syriaca* L. (common milkweed, Apocynaceae) in Canton Ticino, Switzerland. These frameworks provide a standardized approach to evaluate invasion potential during the early stages of colonization and to rapidly identify effective control strategies.and. These frameworks provide a standardized approach to evaluate invasion potential during the early stages of colonization and to rapidly identify effective control strategies.

Methods
RRIA combined field surveys and experiments to assess phenology, sexual and vegetative reproduction, and establishment under different soil conditions and competition levels. Within SESIS, we tested eleven management treatments. Treatment effectiveness was quantified through above–ground and below–ground responses.

Results
RRIA revealed that while sexual reproduction is limited, vegetative regeneration is highly effective and bud–driven, making it the critical invasion strategy. Through SESIS, we found that frequent mowing, early–season glyphosate application, tillage, and electrical treatments significantly reduced stem density, root biomass, and bud number within three seasons. In contrast, low–frequency mowing during peak vegetative growth increased stem density.

Conclusion
Invasion potential and impacts of invasive plants are highly context–dependent, making standardized frameworks such as RRIA crucial for robust and comparable early assessments. Our case on *Asclepias syriaca* in Ticino shows that effective control requires a context–specific, multi–stress approach that combines mechanical, chemical, and other innovative methods. Together, RRIA and SESIS deliver directly applicable tools that help practitioners and authorities implement efficient, evidence–based strategies.

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