



# Integrating crop pollination management, native beekeeping, and silvopastoral systems to improve the cattle sector's sustainability in Latin America.

Narjes M; Cardoso JA; **Burkart S.**  
Alliance of Bioversity International and CIAT, Cali, Colombia.  
**CONTACT:** [s.burkart@cgiar.org](mailto:s.burkart@cgiar.org)

## Introduction

- » Intensification with monoculture pastures in Latin America: associated with biodiversity loss, (e.g., insect pollinators). Major concern for global food security and ecosystem functioning.
- » Inclusion of forage legumes in cattle production systems: may increase plant diversity within a pasture, while providing floral resources for pollinators which in turn boost crop and wild-plant pollination.
- » Sustainable intensification of cattle systems in Latin America: focus, e.g., on silvopastoral systems (SPS).
- » Bottleneck for sustainable intensification: limited availability of legume seed threats to scaling efforts.



## Results and analysis

### The forage legume seed bottleneck

- » Adoption of forage legumes in tropical Latin America is very low.
- » Seed scarcity limits wider use of forage legumes in cattle production systems, which hinders the implementation of more sustainable cattle production systems.
- » Several projects, such as the Sustainable Colombian Cattle Project, support and promote the use of SPS. They have made significant advances (>35,500 hectares of SPS established in Colombia), but a widespread adoption of these systems may be limited by legume seed scarcity.
- » There exists a strong private tropical forage seed sector in Brazil and Mexico, its focus is set on *gramineae* seed production, which leaves legume (*fabacea*) seeds largely neglected.

### Benefits of bee pollination on legume seed production

- » Most tropical forage legumes are self-pollinating but have an increased seed formation when their flowers (rich source of nectar and pollen) are visited by bees (Table 1).
- » Cattle production systems that include legumes (e.g., forage banks or grass-legume systems) are intensively managed to minimize flowering of plants (i.e., no pollination service). The set-up of legume seed production sites allows, (i) the creation of gardens for wild and managed bees, and other pollinators throughout the year; and (ii) overcome differences in flowering times.
- » Pollination gardens enhance the abundance, diversity and community composition of bees and other pollinators; visitation rates of bees to legume flowers, resulting in higher seed yields.

**Table 1.** Some examples of forage legume species with increased out-crossing when visited by different bee species.

Species	Plant growth habit	Pollinating bee species relevant for meliponiculture? [Yes/No]	Interaction type
<i>Cajanus cajan</i>	Herbaceous	Pollinating bee spp. unknown to the authors	Flower visitations with no reference to specific floral resource
<i>Centrosema</i> spp.	Herbaceous	<i>Centris</i> ( <i>Centris</i> ) <i>aenea</i> , <i>Centris</i> ( <i>Hemisiella</i> ) <i>trigonoides</i> , <i>Centris</i> ( <i>Centris</i> ) <i>flavifrons</i> , <i>Centris</i> ( <i>Trachina</i> ) sp.; [No]	
<i>Chamaecrista rotundifolia</i>	Herbaceous	<i>Xylocopa frontalis</i> ; [No]	Foraging for pollen
<i>Desmodium</i> spp.	Herbaceous	<i>Centris</i> ( <i>Hemisiella</i> ) <i>tarsata</i> , <i>Thygater aethiops</i> ; [No]	Flower visitations with no reference to specific floral resource
<i>Gliricidia sepium</i>	Tree	<i>Xylocopa frontalis</i> ; [No] <i>Bombus pullatus</i> ; [No] <i>Melipona favosa</i> , <i>Tetragonisca angustula</i> ; [Yes]	Foraging for pollen Flower visitations with no reference to specific floral resource

## Objectives and Methodology

- » To provide an overview of forage legumes and agroecosystem management tools, available to cattle systems for the conservation of insect pollinators, optimization of crop-pollination services, and tackling legume forage-seed bottlenecks.
- » To discuss the opportunities and challenges of integrating principles of pollinator ecology and native beekeeping into SPS and artisanal and large-scale propagation of legume forage-seeds.
- » To provide interested stakeholders, policy- and decision-makers with a perspective on how such agroecosystems may be designed as mosaics or scaled into multifunctional landscapes.
- » Literature review and expert consultation.

### Proposed interventions

#### At the farm-level:

- » Smallholder on-farm legume seed production
- » Integrated crop pollination
- » Meliponiculture and other forms of traditional beekeeping
- » Silvo-pastoral systems

#### At the public and private sector level:

- » Landscape restoration approach
- » Large scale legume seed production through private seed sector

### Required enabling (macro) conditions

- » Cattle sector policies and development plans: inclusion of pollinator services and forage legume seed production in the payment schemes for ecosystem services (for e.g., SPS), incentives or new value chains with differentiated products.
- » Access to credit and productive inputs for sustainable intensification strategies, smallholder legume seed production, and meliponiculture: crucial for continuous seed supply and harnessing of ecosystem services.
- » Access to/creation of knowledge: legume seed production, treatment and marketing, beekeeping, and honey production, or product differentiation.
- » Research: evaluation of new genetic material key for identifying additional legumes for sustainable intensification scenarios, seed production and integrated meliponiculture.

## Conclusions

- » The development of pollinator friendly environments, based on forage-legumes and SPS and their introduction into cattle systems, brings several benefits.
- » Legume seed production: creation of different revenues, e.g., from bee and seed sales.
- » Interplay of pollinators and forage legumes: benefits can be further extended to the landscape level, affecting positively the yield of nearby pollinator-dependent crops.
- » Enabling conditions, including policies, payment schemes for ecosystem services, incentives or new value chains, must be in place for this approach to work.

### Further reading

Narjes M; Cardoso JA; Burkart S. (2021) Promoting forage legume-pollinator interactions: Integrating crop pollination management, native beekeeping and silvopastoral systems in tropical Latin America. *Frontiers in Sustainable Food Systems* 5:725981. <https://doi.org/10.3389/fsufs.2021.725981>

### Acknowledgements

This work was supported by CGIAR Research Program on Livestock, CGIAR Initiative on Livestock, Climate, and System Resilience. CGIAR is a global research partnership for a food-secure future. Its science is carried out by 15 Research Centers in close collaboration with hundreds of partners across the globe.