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PP-589 [Pollination and Bee Flora]

Historical agroeconomic analysis of the relationship between commercial pollinator use and *Vaccinium angustifolium* (lowbush blueberry) (Ericales: Ericaceae) yield in Quebec, Canada (2015-2021)

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Introduction

Lowbush blueberry is Canada's top fruit export, relying on insect pollination for productivity. As blueberry flowers require insect pollination, blueberry farms rely on commercial pollinators to ensure productivity of their fields.

Our study aimed to assess the impact of commercial pollinator density and diversity on lowbush blueberry yield using historical data, from 2015 to 2021, across various production contexts.

Methodology

Using data from 178 fields (≈3,000 ha; 11% of Québec's production) collected between 2015 and 2021, we assessed how commercial pollinator density and diversity affect yield. We analyzed honey bees (*Apis mellifera*), bumble bees (*Bombus impatiens*), and alfalfa leafcutter bees (*Megachila rotundata*), along with field characteristics, hive strength, landscape, and weather.

Statistical analyses were conducted in R (v4.1.2; R Core Team, 2021) using mixed linear models (nlme::lme). All models included the nested random effects of field, site, and farm, as well as year as a fixed effect.

Honey bees
Apis mellifera

Bumble bees
Bombus impatiens

Alfalfa leafcutter bees
Megachila rotundata

Selected results

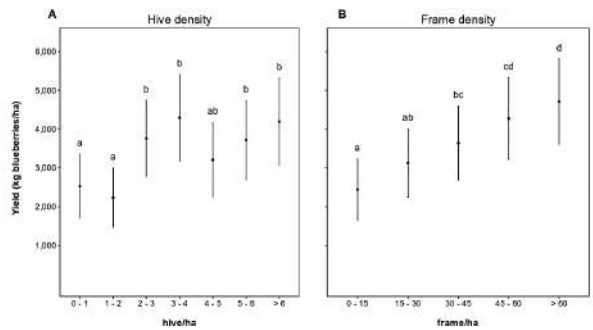

Figure 1. Mean (± SE) yield (kg blueberries/ha) of lowbush blueberry fields in relation to (A) honey bee hive density (hive/ha, n=562) and (B) frame density (frame/ha, n=395) Statistically different groups ($p < 0.05$) have different letters.

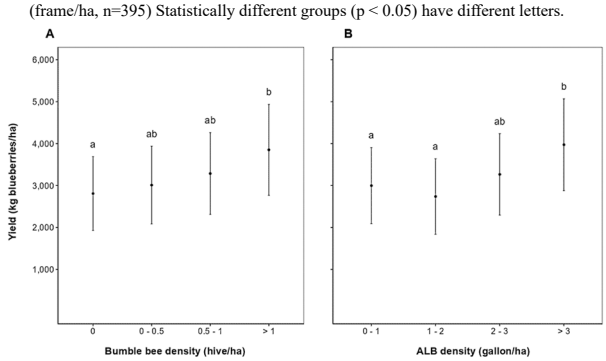

Figure 2. Mean (± SE) yield (kg blueberries/ha) of lowbush blueberry fields (n=562) in relation to (A) bumble bee density (hive/ha) and (B) alfalfa leafcutter bee (ALB) density (gallons/ha). Statistically different groups ($p < 0.05$) have different letters.

Conclusions

- Pollinator density and diversity, combined with environmental factors, play a major role in lowbush blueberry productivity.
- Yields increased with higher densities of honey bee frames, bumble bee hives, and leafcutter bee gallons, and were further boosted by pollinator diversity.
- Yield was also influenced by year, snow cover, field age, and frost during pollination.

Reference manuscript

Levesque M. & al. 2025. Historical agroeconomic analysis of the relationship between commercial pollinator use and *Vaccinium angustifolium* (lowbush blueberry) (Ericales: Ericaceae) yield in Quebec, Canada (2015-2021). https://doi.org/10.1093/jee/toaf242

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PP-589 [Pollination and Bee Flora]

Historical Agro-economic Analysis of the Relationship Between Commercial Pollinator Use and Lowbush Blueberry Yield in Québec Canada (2015-2021)

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Lowbush blueberry (Vaccinium angustifolium Ait.) production has the highest export value among all fruit crops in Canada. As blueberry flowers require insect pollination, blueberry farms rely on commercial pollinators to ensure productivity of their fields. Our study aimed to assess the impact of commercial pollinator density and diversity on lowbush blueberry yield using historical data, from 2015 to 2021, across various production contexts. The analysis included 178 blueberry fields were included in this study, representing approximately 3 500 ha and 12% of total Québec's total crop production area. Data on field size, berry yield, pollinator density/diversity (honeybees; Apis mellifera, bumblebees; Bombus impatiens, and alfalfa leafcutter bees; Megachile rotundata), establishment year, and management type were collected for each field. Additionnally, we examined data on honey bee hive strength, landscape structure, and meteorological factors influencing yield. Results showed significant yield increase with hive density, peaking at ~4-5 hives/ha when hive strength was considered. Yield was also improved with bumblebee densities above 4 colonies/ha, and leafcutter bee density exceeding 5 gallons/ha. The diversity of commercial pollinators used in the fields also increased yield. Key factors influencing lowbush blueberry yield included honeybee density, the year, snow cover duration in winter, field age, management practices, and precipitations during the fruit growth period. This study clarifies the relationship between commercial pollinators and lowbush blueberry yield, demonstrating that a combination of factors significantly impacts field productivity and that commercial pollinators significantly enhances field productivity. Our findings show that increasing pollinator density and diversity lead to higher yields for lowbush blueberry growers.