

Counteracting post harvest-losses in dry beans

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Background

- After all resources have been invested to plant, grow and harvest the crop, much of the harvested beans are lost due to bruchid insect attack in the tropic belt.

- Hence, farmers sell their beans immediately after harvest, when market prices are low, and even refrain from storing seeds for the next sowing season and for family consumption.



Fig. 1: The bruchid *Acanthoscelides obtectus* can cause a complete loss of stored dry beans when they are left unprotected.

- In an initial attempt to limit post-harvest losses, CIAT investigated wild Mexican bean lines and identified the natural storage protein arcelin that could be backcrossed into bean lines under CIAT's development.

- The improved bean lines suppressed one bruchid species, but failed to be directly lethal to the cosmopolitan bruchid *Acanthoscelides obtectus* (Fig. 1).

Results

- Bean lines containing the storage protein arcelin are not only harmless to mammals, they also do not affect food processing (hydration kinetics) (1).

- Some 90% of beans were infested by *Acanthoscelides* larvae already at harvest (2), indicating the potential of measures that control this internal feeder before it emerges as an adult from the beans.

- On-farm trials in Colombia resulted in >90% *Acanthoscelides* reduction by a single introduction of the native parasitoid *Dinarmus basalis*. Commercially available cultivars (without arcelin) were used (3).

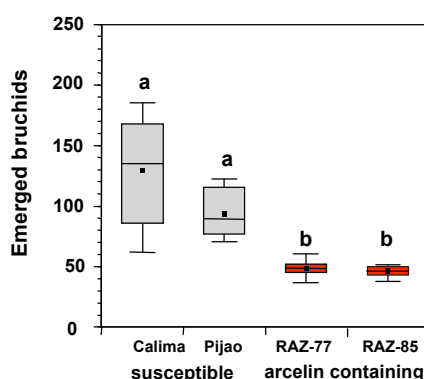


Fig. 2: The combined use of host plant resistance (in red) and parasitoid results in a further reduction of bruchid emergence compared to the use of susceptible beans (in black) and parasitoid (6).

- All subsequent trials used arcelin-containing bean lines. They slowed down pest development and reduced fitness of the next generation (4), a finding that could be implemented immediately.

- Finally, an integrated system was built comprising the parasitoid and arcelin-based host plant resistance. Slow bruchid development increased the window in time for parasitoid attack, and the parasitoid's mode of action was shifted towards quick kill (5). This exploitation of useful multitrophic interactions resulted in a further significant reduction of bruchid emergence (Fig. 2) (6).

- In conclusion, while the single components are useful *per se*, there is a great added benefit of the integrated system, representing 'proof of concept'.

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