Impact of Solarization and Methyl Bromide Alternatives on Greenhouse Hot Pepper Production in Costa Rica

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A Little Bit of Geography

Greenhouse Production in CR

- **It has steadily increased during the last decade.**

- **Small and medium-size coffee farms:**
  - *Low coffee prices.*
  - *Diversification.*

- **Current estimations:**
  - *1080 greenhouses.*
  - *About 340 growers, 62% have <0.1 ha.*

Soilborne Pests

Phytophthora capsici

Meloidogyne spp.

Soilborne Pest Management

- **Methyl bromide (MBr):**
  - *Used for both muskmelon (Cucumis melo) and cutflower production.*
  - *MBr phase-out according to the Montreal Protocol.*
- **Research must be conducted to identify alternatives for soilborne pest control.**

Soil Solarization

- **Previous research:**
  - *Non-chemical alternative to MBr.*
  - *Inconsistent results.*
- **More studies needed to determine:**
  - *Efficacy on pests.*
  - *Practicability.*

Objective

Compare the combination of soil solarization and chemical methyl bromide alternatives for soilborne pest control in hot pepper.

Materials and Methods

- **Plastic greenhouse (Alajuela, Costa Rica):**
  - *1100 m above sea level.*
  - *Deep andosol, used for coffee production for 50 years.*
- **Raised beds: 1.0 m wide by 0.25 m tall.**
- **'Campana' hot pepper seedlings:**
  - *Transplanted 0.5 m between plants.*
  - *Double rows.*
  - *Planting beds were 1.2 m apart from centers.*

- Split-plot design with 4 replications.
- Experimental units: 12 m^2.
- Main plots: Solarized or non-solarized soil.
- Subplots: Fumigants.

Materials and Methods

- **Fumigant treatments:**
  - *Non-fumigated control,*
  - *MBr + chloropicrin (Pic) 67:33 at 450 kg/ha,*
  - *Liquid 1,3-dichloropropene (1,3-D) + Pic 65:35 at 500 L/ha,*
  - *Liquid of metam sodium (MNa) at 600 L/ha.*

- **Fumigants: 3 weeks before transplanting.**

- **Soil solarization: Covering plots with clear plastic mulch for 8 weeks.**

Materials and Methods

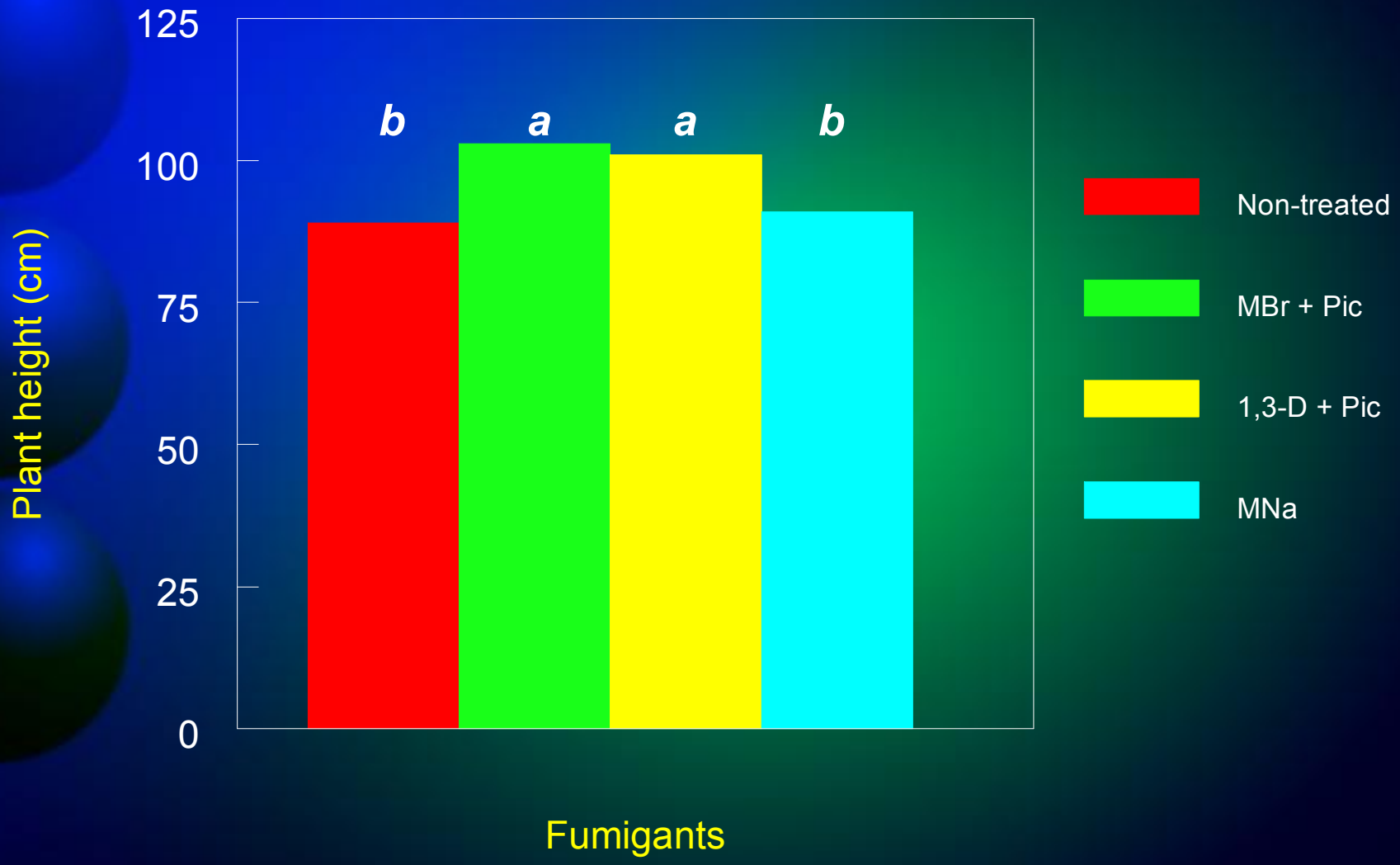
- **At 7 WAT:**
  - *Weed control (0-100%; 0 = no control).*
  - *Nematode population.*
  - *Hot pepper plant height.*

- **At the end of the season:**
  - *Commercial fruit yield (8 harvests).*
  - *Weed and nematode analyzed were transformed before ANOVA by using a $\log_{10} + 1$.*
  - *Tukey's multiple comparison procedure (P=0.05).*

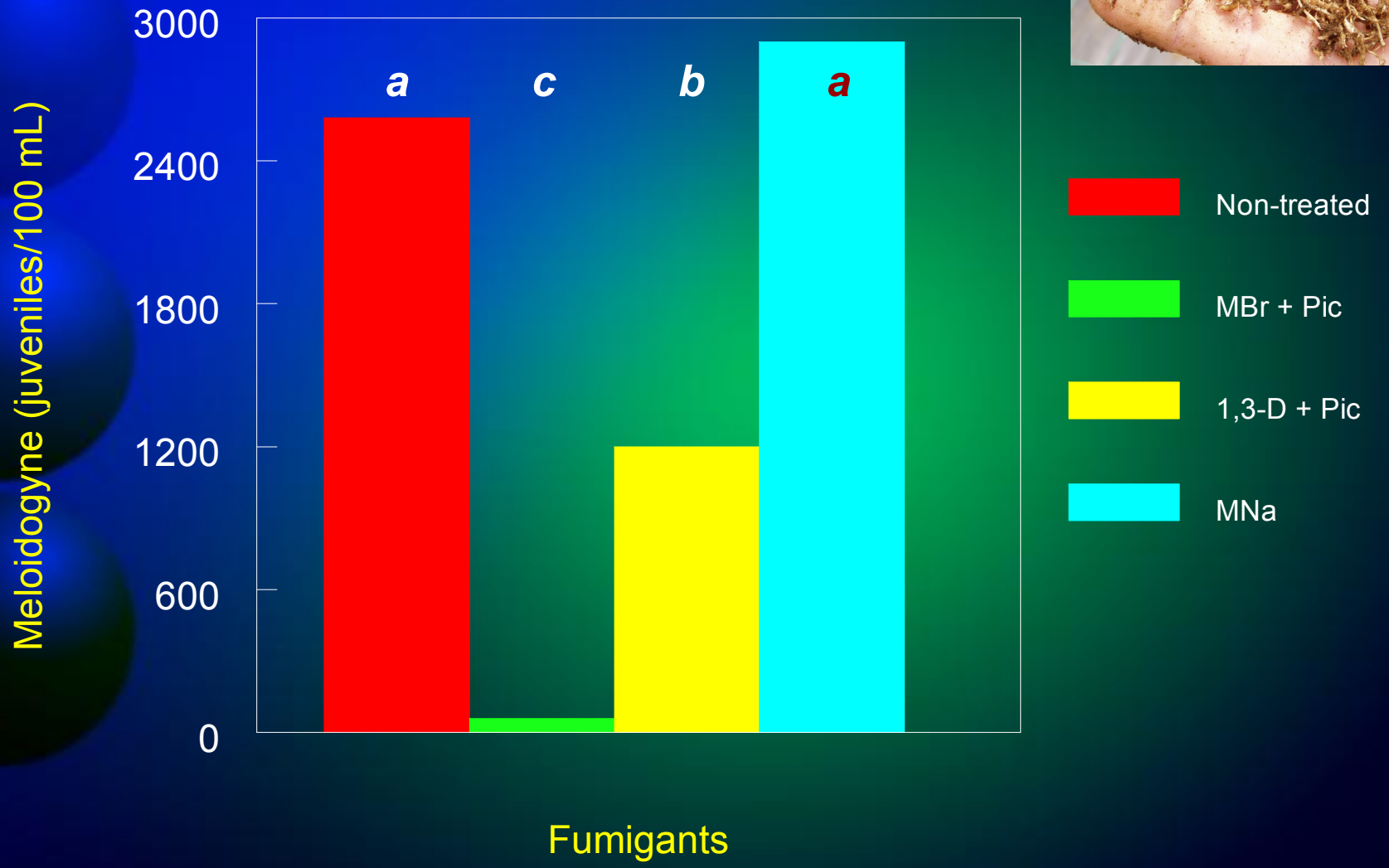
Results

- **Solarization was only effective for weed control:**
  - *100% control with solarization (60°C).*
  - *0% with no solarization (30°C).*
  - *Digitaria* spp. (crabgrass), *Eleusine indica* (goosegrass).
  - *Commelina diffusa* (dayflower), *Portulaca oleracea* (purslane), *Ricardia scabra* (Florida pusley).
- **There was significant fumigant effect.**
- **The interaction was not significant.**

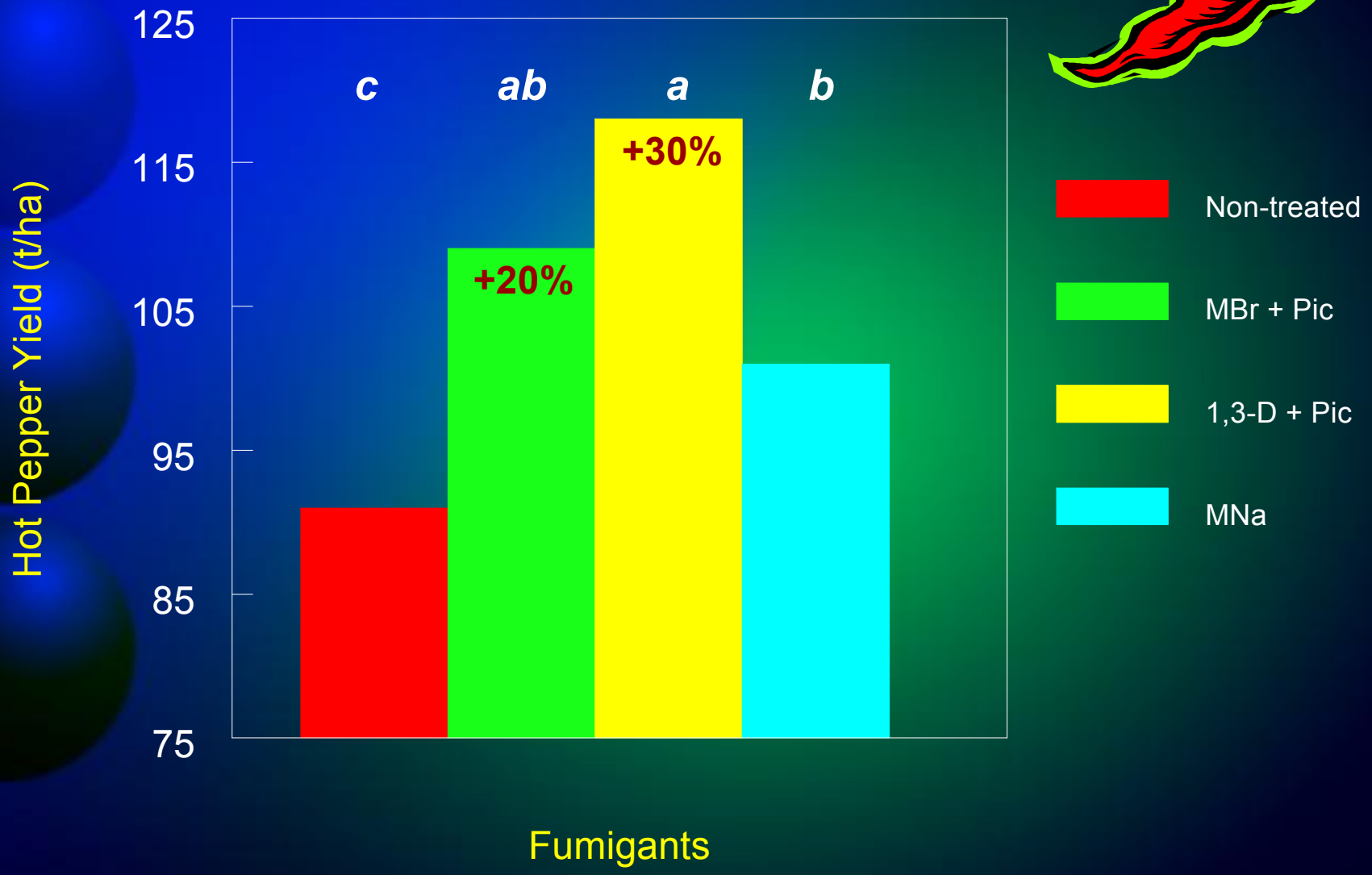
Hot Pepper Plant Height



Root-knot Nematode



Hot Pepper Yield



Summary

- Solarization was not an option for hot pepper yield.
- 1,3-D + Pic comparable to MBr + Pic.
- MNa needs help.
- Currently this study is being repeated.

Thank you!!