

Efficacy of IPM over Chemical method for controlling South American Tomato Leaf Miner (*Tuta absoluta*, Meyrick) : A Review

Prepared by

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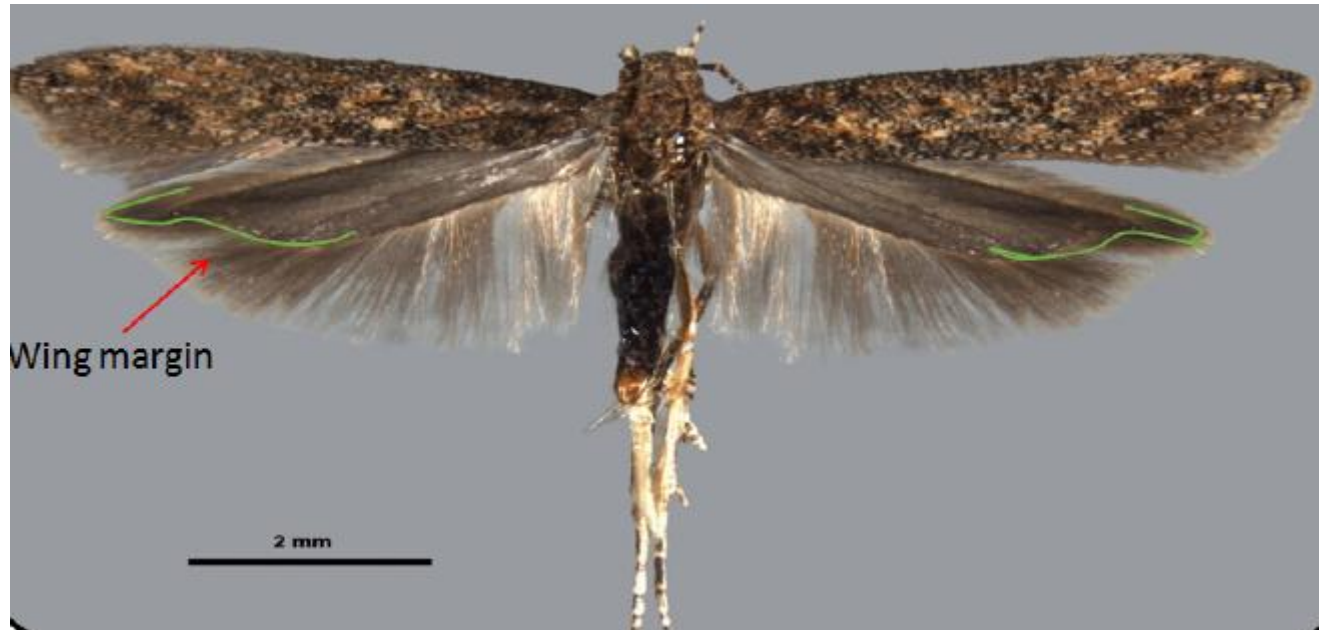
Agriculture and Forestry University

Tuta absoluta



Source : 2017 REABIC

Tuta absoluta



Source : IDENepal

Tuta absoluta

- Nocturnal moth that falls in family Gelechiidae under order Lepidoptera
- *Tuta* was originally described in Peru in 1917 and first recorded in Spain in 2006 (Ogur et al., 2014)
- Spread to South America, Europe, Africa and most recently Asia (Portakaldali et al., 2013)
- In Nepal, leaf miner was first identified by Entomology Division, Nepal Agricultural Research Council from a commercial tomato grower of Balaju, Kathmandu on 16th May 2016 (Bajracharya et al., 2016)

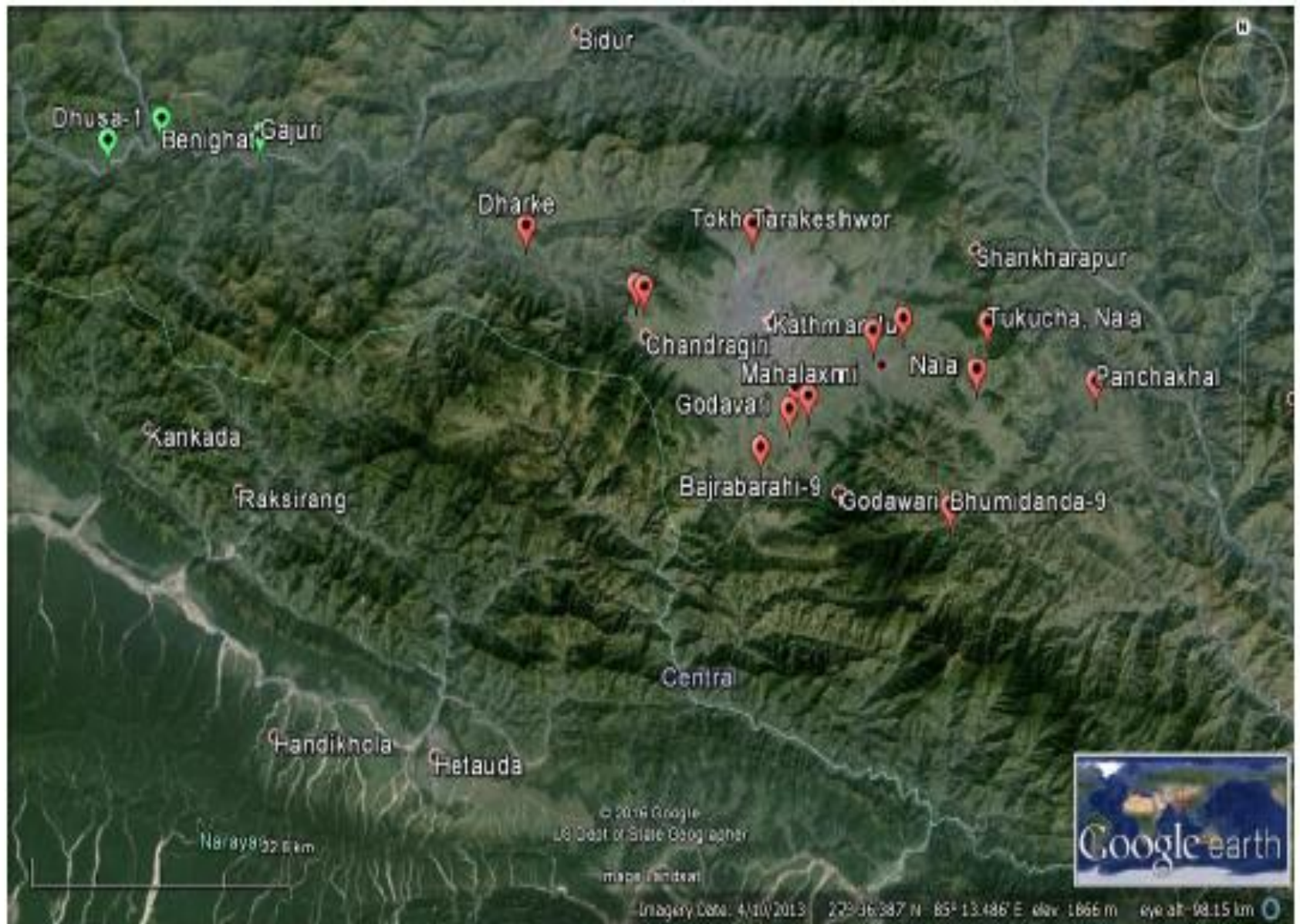


Fig 4: Map showing occurrence and distribution of *Tuta absoluta* in Nepal (Red colored balloons shows presence and green colored balloons shows absence of the insect)

Source : (Bajracharya et al., 2016)

Tomato : Major Host



Damage

- Berxolli & Shahini (2017) reported that *Tuta absoluta* produces large galleries in leaves, burrows in stalks, consumes apical buds and green and ripe fruits
- If not controlled, causes 80-100% damage (Illakwahhi & Srivastava, 2017)
- Feed on mesophyll tissue of leaf leaving the epidermis intact (Bali Rog Kira Pahichan Pustak, 2017)
- Most distinctive symptom for the presence of larva is the blotch shaped mines in leaves (Bajracharya et al., 2016)

Damage contd...

- In fruit, larva is evident by the presence of characteristic pin holes and small heaps of excrement at the entrance hole (Bali Rog Kira Pahichan Pustak, 2017)
- During severe infestation, affected leaves may turn necrotic (Bali Rog Kira Pahichan Pustak, 2017)
- Tomato plant become dead and whole tomato field seems dried (Bajracharya et al., 2016)

Leaf Damage



Source: Usaid- Inma agriculture brochure

Blotch Shaped Mine



Source : REABIC 2017

Fruit Damage



Source : www.irac-online.org

Apical Bud Damage



Source : www.entomoljournal.com

Damage to tomato field



Source : REABIC 2017

Monitoring

Chemical Control, Conventional Practice

Origin of *Tuta absoluta*

Increase in insecticide use in 1980's

- Organophosphates, pyrethroids, abamectin and cartap

Develop pesticide resistance in 1990's and early 2000

New insecticides used

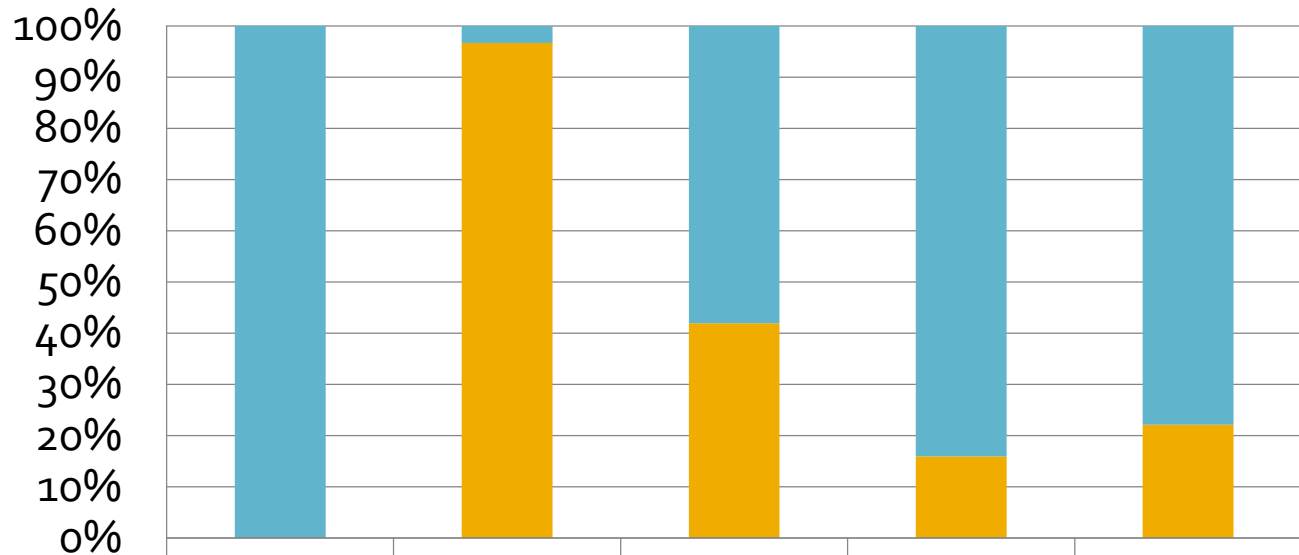
- Indoxacarb, chlorfenapyr, spinosyns, and diamides

Source :
Campos et al.,
2014

Challenges in chemical control

- High dose and frequency, cocktail insecticides and even mixing more than one insecticide with different mode of actions are common practices among commercial tomato farmers of Kathmandu valley and surrounding areas. This could lead to development of resistant population of pest against most of the insecticides (Bajracharya et al., 2016)
- Faster reproducing ability, residual problems of pesticide, possibility of pest resistance development and environmental pollution are the reasons for declining preference of chemical pesticide (Birgucu et al., 2014)

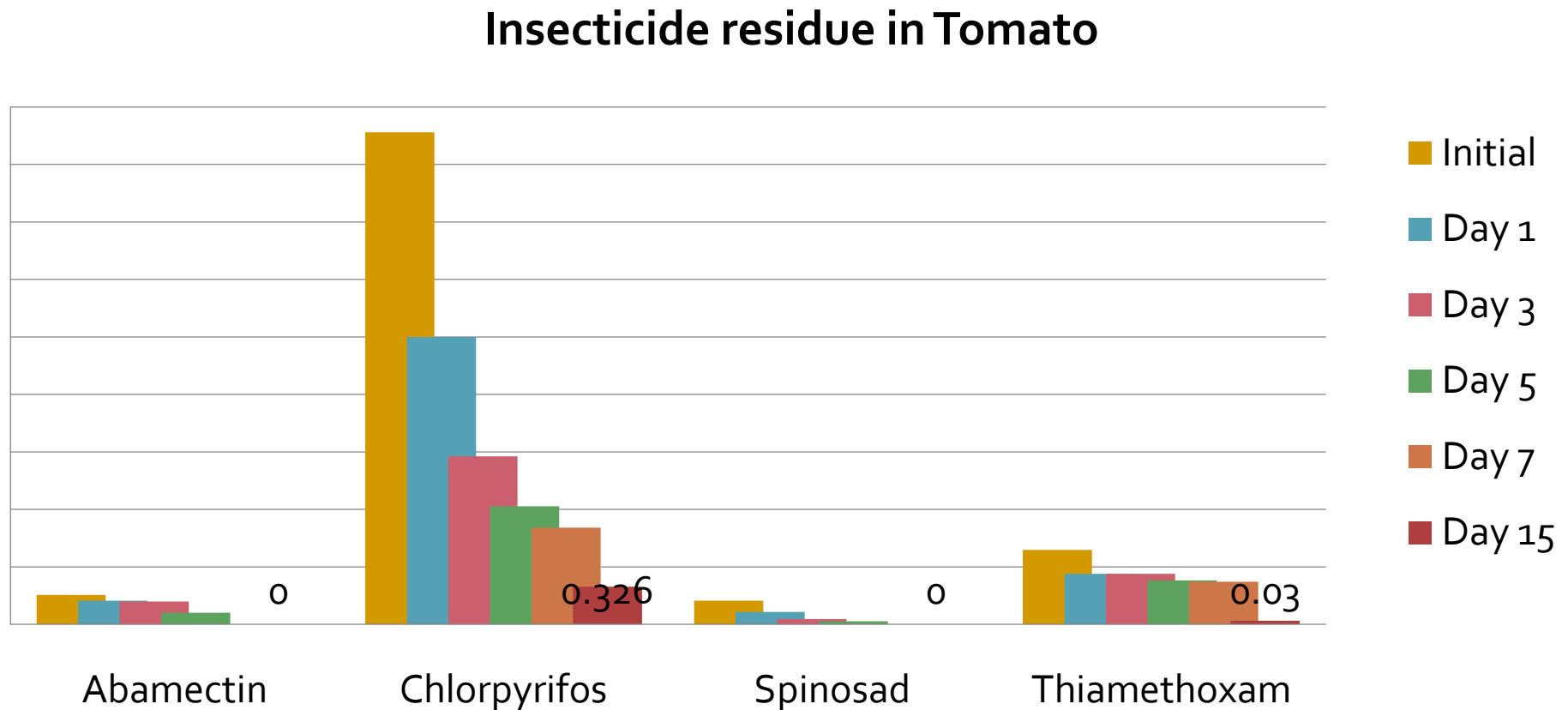
Relative toxicity of insecticides to the parental spinosad-resistant strain and its derived strain after 15-generations of selection for spinosad resistance



	Spinosad	Chlorantraniliprole	Indoxacarb	Abamectin	Chlofenapyr
LC ₅₀ after 15 generation	1717.3	0.42	1.19	2.85	3.8
LC ₅₀ of parental strain	0.41	12.18	0.86	0.54	1.08

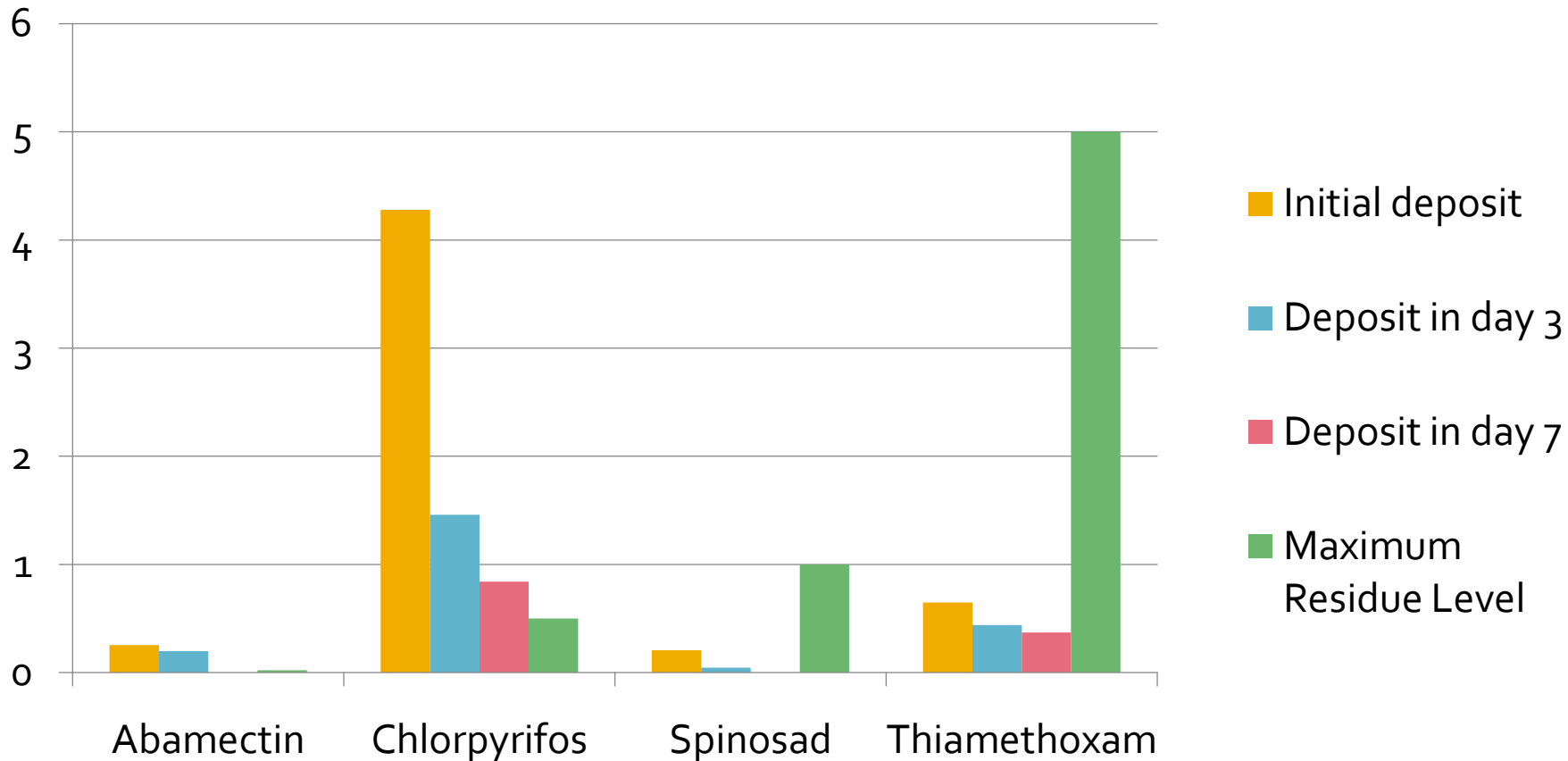
Source : Spinosad and the Tomato Borer *Tuta absoluta*: A Bioinsecticide, an Invasive Pest Threat, and High Insecticide Resistance (Campos et al., 2014)

Amounts of insecticide residues detected in tomato fruit samples under open field condition



Source : Dissipation of four insecticides in tomato fruit using high performance liquid chromatography and QuEChERS methodology (Ramadan et al., 2015)

Comparing Initial deposit of residue and MRL



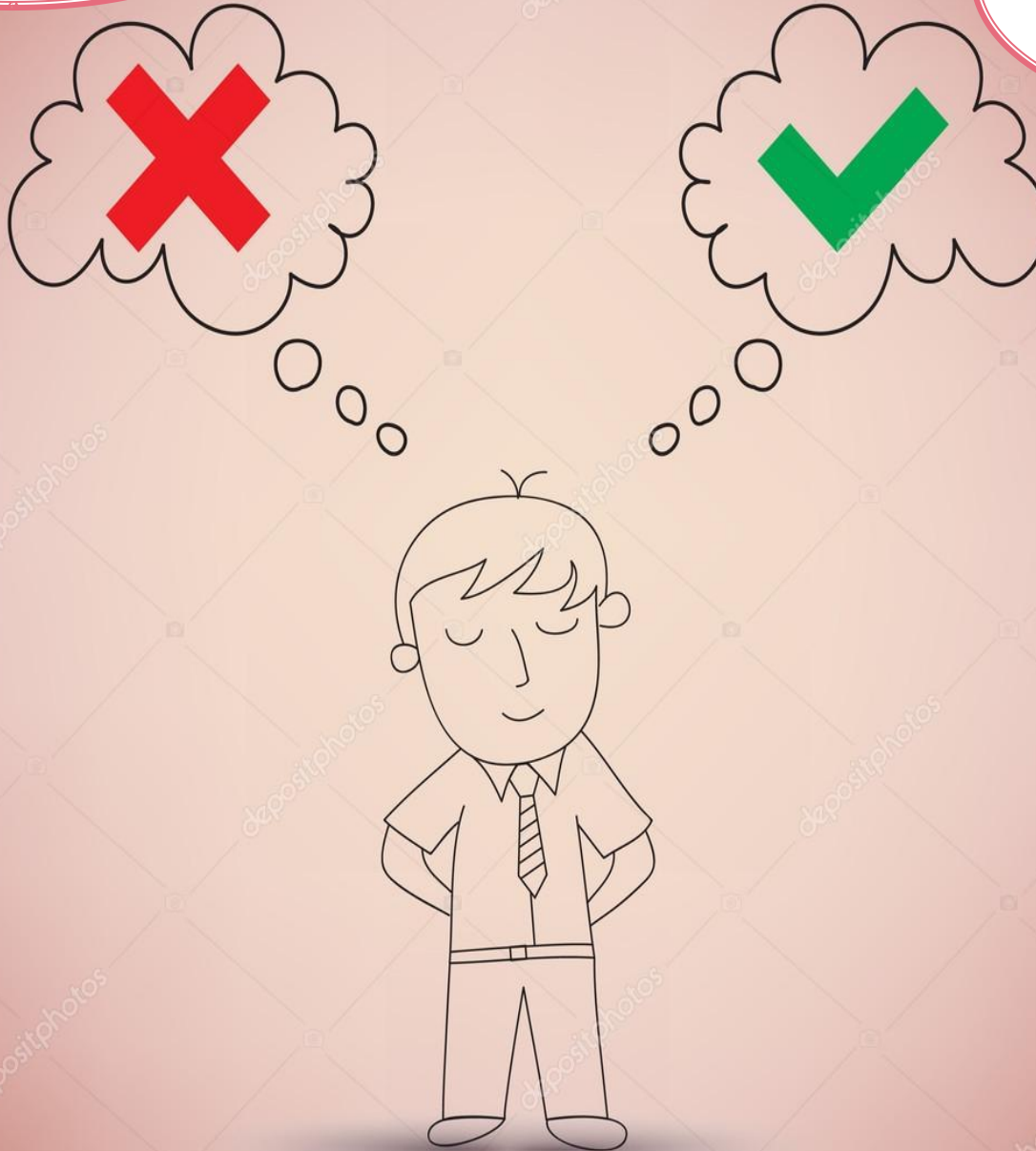
Source : Dissipation of four insecticides in tomato fruit using high performance liquid chromatography and QuEChERS methodology (Ramadan et al., 2015)

Alternative to chemical methods



**Chemical
Method**

**Integrated
Pest
Management**

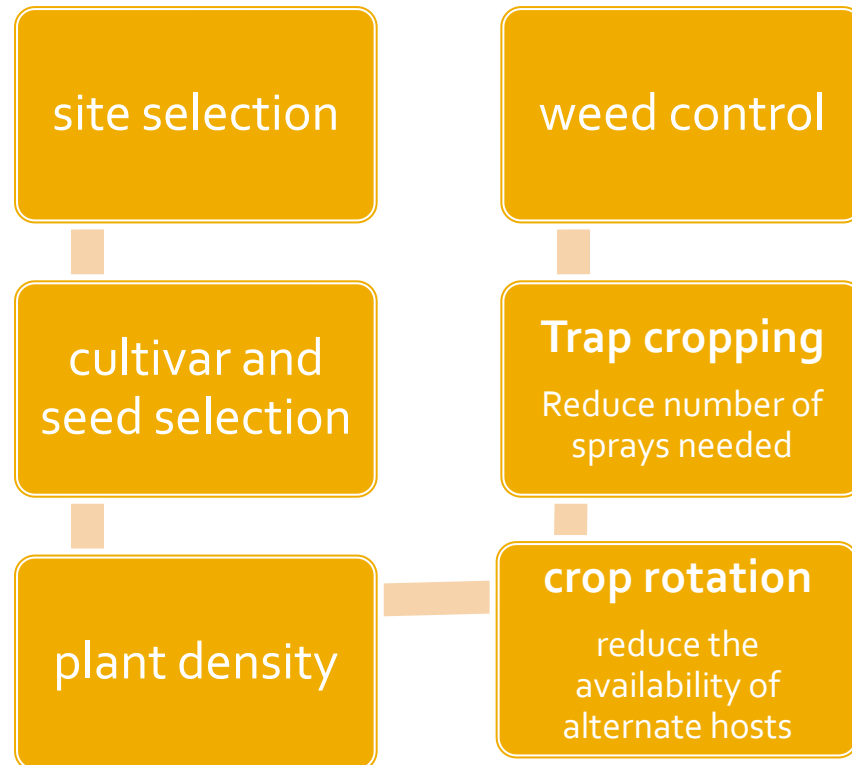


Integrated Pest Management

- An amalgam of cultural, physical, biological and chemical approaches is effective in the management of pests and disease in any field
- Leaves little no toxic residue on agricultural commodities due to judicious use of chemical pesticide (Juma, victor h. Omondi, 2015)
- Environment friendly
- Biodegradable
- Easily available
- Ecologically sound and sustainable

Cultural method

- Making the environment unfavorable to one or more pests (Juma, victor h. Omondi, 2015)



Contd...

- Intercropping tomato with coriander (*Coriandrum sativum*, Apiaceae) and gallant soldier (*Galinsoga parviflora*, Asteraceae) had positive effect on reducing pest density and enhancing natural enemies (Ponti et al., 2013)

Physical control

- It involves protective cultivation of tomatoes under green or net house



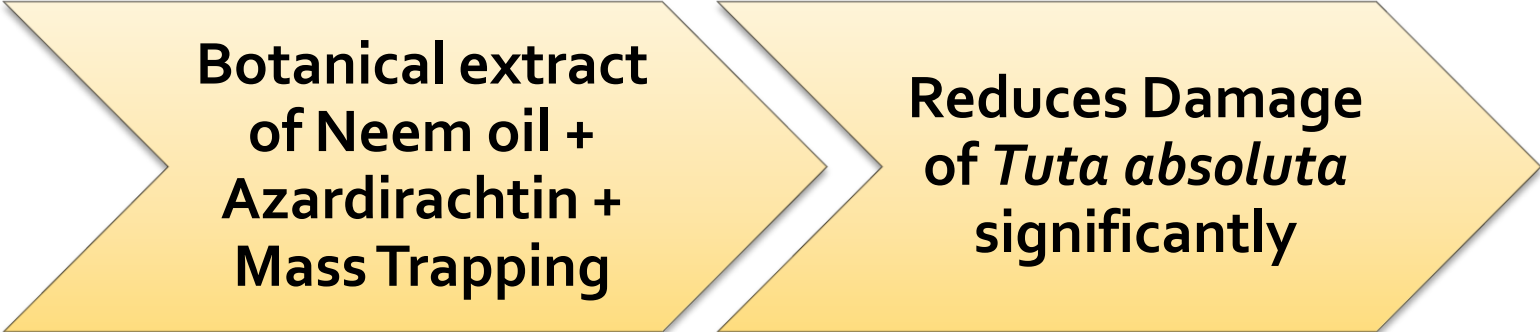
USAID brochure

Pheromone Traps

- Pheromone lures are coupled with sticky trap, water trap, Wota T trap and others
- Red sticky trap caught the greatest number of moths [Taha et al., 2012](#)
- Braham et al (2013) reported, in green house condition, **intensive use of mass trapping is more effective for controlling infestation of *Tuta absoluta* than that of chemical sprays**

Plant Based Pesticide

- Neem, Jatropa, Piper and *Acmella oleracea* as promising plant with insecticidal property for management of *T. absoluta* (Gebremariam, 2015 & Zekeya et al., 2017)



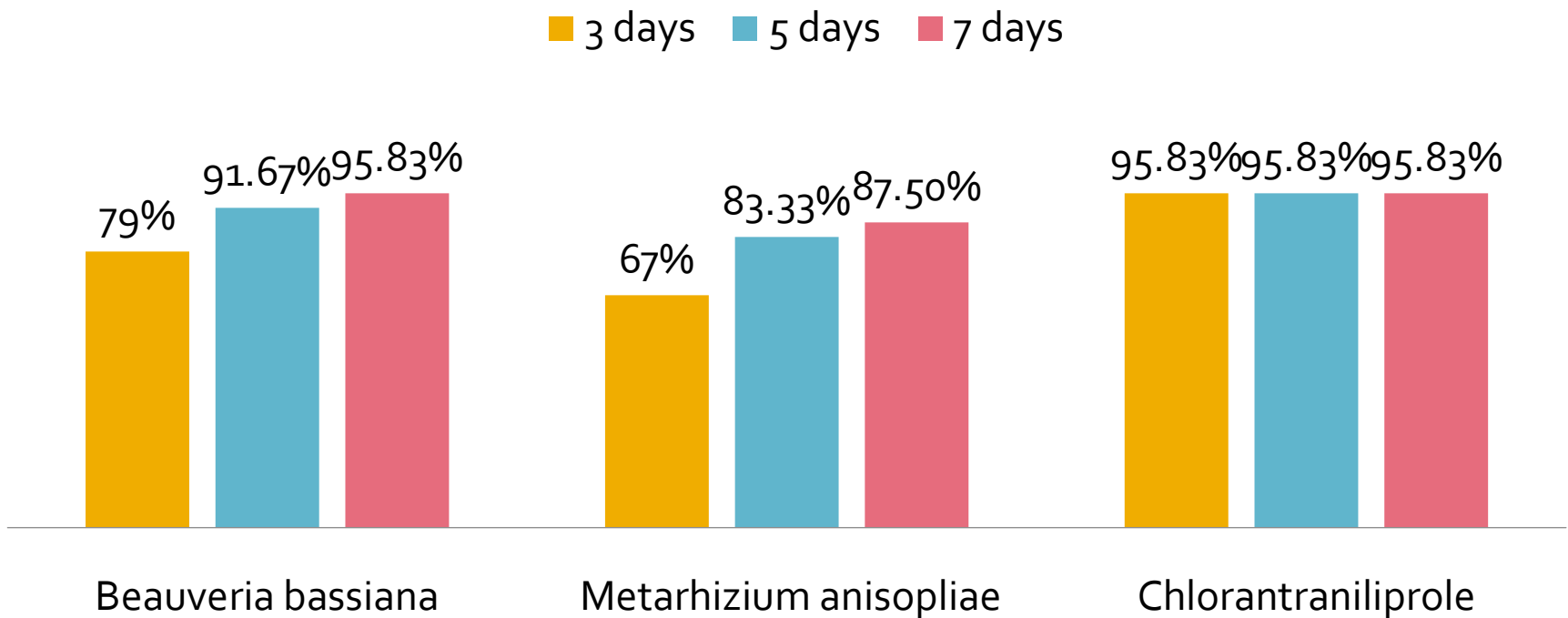
**Botanical extract
of Neem oil +
Azardirachtin +
Mass Trapping**

**Reduces Damage
of *Tuta absoluta*
significantly**

Harbi et al, 2014

Biological Control

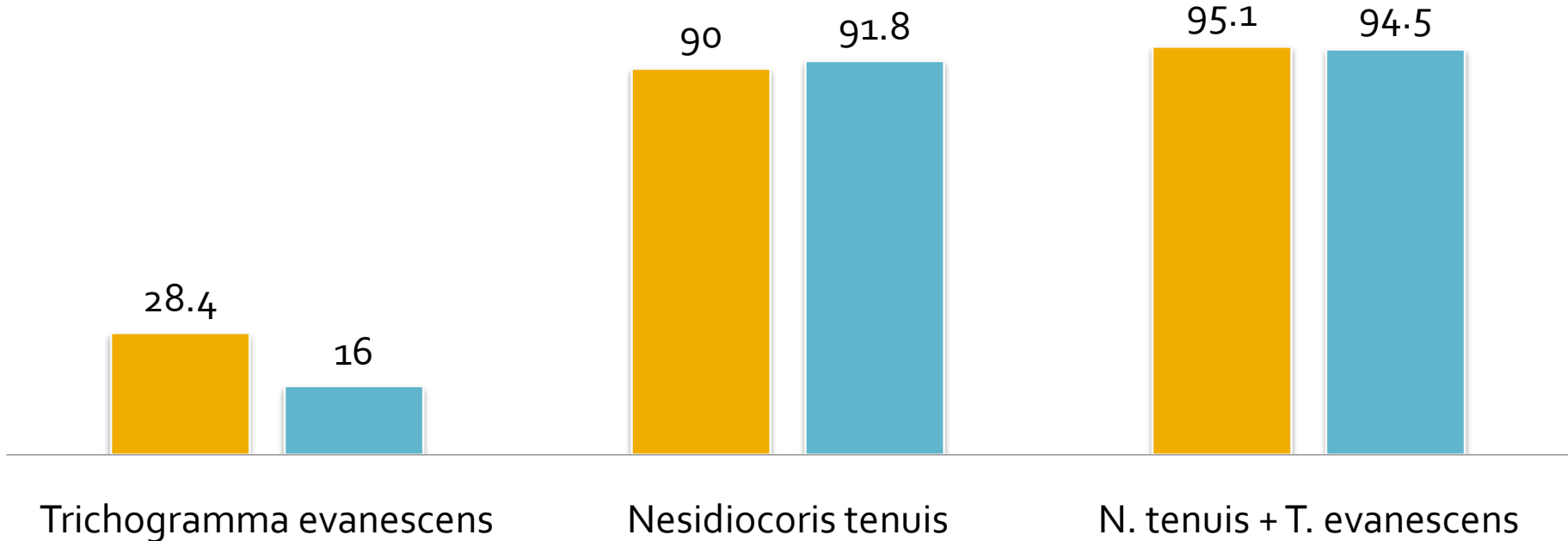
% Mortality rate of *Tuta absoluta* adult using Entomopathogenic microbes



Source : Entomopathogenic Effect of *Beauveria bassiana* (Bals.) and *Metarrhizium anisopliae* (Metschn.) on *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) Larvae Under Laboratory and Glasshouse Conditions in Ethiopia (S, Tadele and G, Emana)

Comparing efficiency of predator and parasitoid for % reduction of infested fruit in 2011-12 & 2013-14

■ % of damage reduction in fruit 2012-13 ■ % of damage reduction in fruit 2013-14



Source : Possibilities for biological control of *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) in the western Mediterranean Region of Turkey (KEÇECİ et al., 2017)

Comparing cost benefits of use of parasitoid, biopesticide and insecticides for control of *Tuta absoluta*

Highest yield production and cost benefit

- from plot where the egg parasitoid *T. bactrae* was released five times combined with mass-trapping

High production following plot using parasitoid

- from plot using bio-rational solution integrated with mass trapping

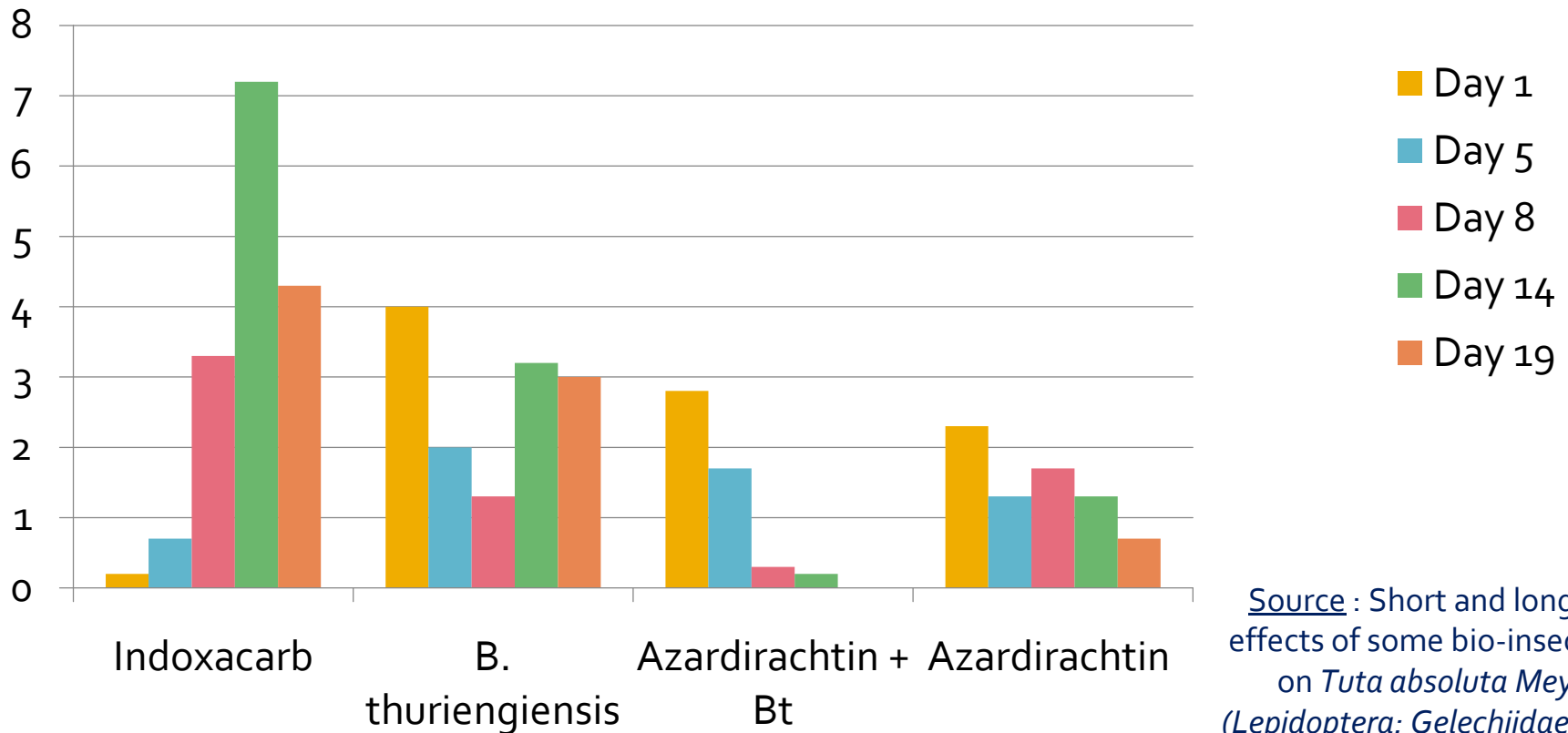
Lowest yield production and highest costs

- from plot using insecticides

Source : Integrated Pest Management of the Tomato Leaf Miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Tomato Fields in Egypt (Goda et al., 2015)

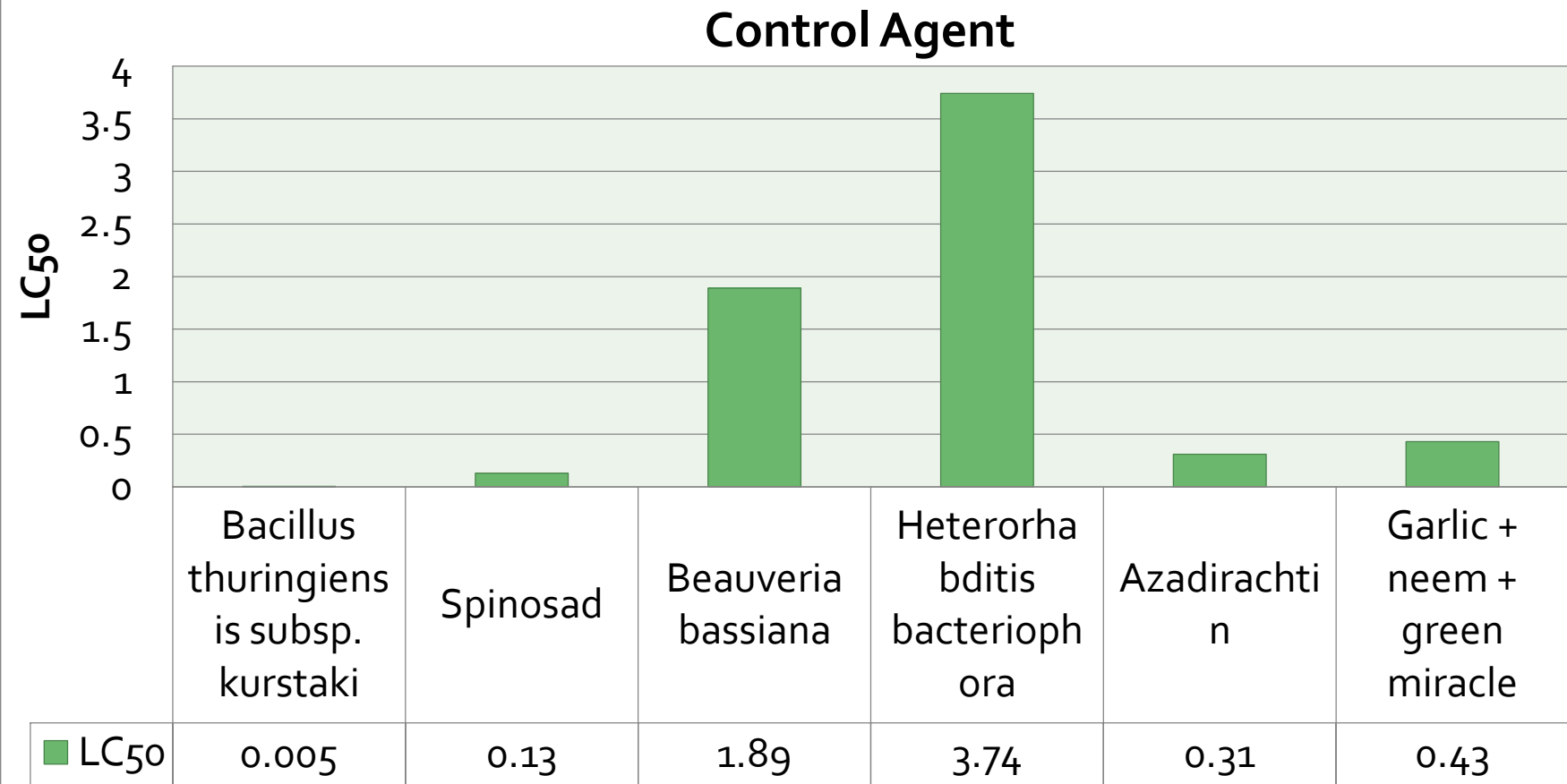
Comparing short and long term effect of chemical pesticide and Bio-pesticide

Comparing mean number of *Tuta absoluta* total live larvae per plant after treatment



Source : Short and long term effects of some bio-insecticides on *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) and its coexisting generalist predators in tomato fields (Nazarpour et al., 2016)

LC₅₀ of different microbial, natural and chemical control agents against tomato leaf miner, *Tuta absoluta*



Source : Evaluation of some microbial agents, natural and chemical compounds for controlling tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) (El-Ghany et al., 2016)

Conclusion

- Inefficacy of chemical method because of development of pesticide resistance, residue deposition and other side effects
- IPM methods gave similar performance as that of chemical insecticides with less side effects
- IPM method has highest long term effect for *Tuta absoluta* control in comparison to chemicals
- IPM methods have cost benefit over chemical method

Recommendation

- Awareness programs should be conducted for promoting the use of IPM techniques in different regions
- A detailed research need to be conducted across the nation to assess the native natural enemy of pest
- Intensive research should be carried out for detection of best IPM practices in Nepalese field condition
- Provision of subsidy for IPM implementers need to be addressed by government and ministry

Acknowledgement

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THANK
YOU!

