

INTEGRATING Bt CORN FOR FALL ARMYWORM (FAW) MANAGEMENT

Purpose: A guide for farmers on managing FAW with Bt corn to maximize benefits

Fall armyworm (FAW) = *Spodoptera frugiperda*

FOLLOW 3 STEPS TO EFFECTIVELY MANAGE FAW WITH Bt CORN



1

PLAN

Build season-long agronomic action plan



2

PLANT REFUGE & MONITOR

Monitor and scout for FAW activity



3

EVALUATE & TREAT

If needed, use IRM principles to control FAW

Consider

Cultural: plant field earlier than other fields in area

Mechanical: remove weeds and previous crop residue

Biological: manage to maximize FAW natural enemies

Host-plant resistance: Bt corn along with refuge

Chemical: pre-determine use of seed-applied technologies and insecticide options that complement IPM

Implement Integrated Pest Management (IPM) Through Entire Season



Remove weeds and crop residue



Monitor adults to determine when to scout. Use Country monitoring efforts if available



Scout fields for crop injury. Determine if % injured plants exceed threshold



Consider insecticides that minimize negative impacts on biological control organisms



TREAT IF NEEDED

If thresholds met, treat fields to avoid additional FAW injury

1 PLAN: BUILD SEASON-LONG AGRONOMIC ACTION PLAN

Proactively **GROW HEALTHY CROP** to decrease FAW risk

1A Remove cover crop and control weeds all season long

- Prevents larval cutting of corn seedlings
- Removes hosts for FAW eggs and feeding
- Reduces competition for nutrients
- Season long weed control minimizes FAW population buildup

1B Select locally adapted corn hybrids

- Select a Bt hybrid that provides FAW protection, if available in your country
- Plant non-Bt refuge as prescribed (a percentage of corn seed should be non-Bt; see next page)
- Consider purchasing seed treated with insecticide for early FAW control (if available)

1C Plant early and apply fertilizer

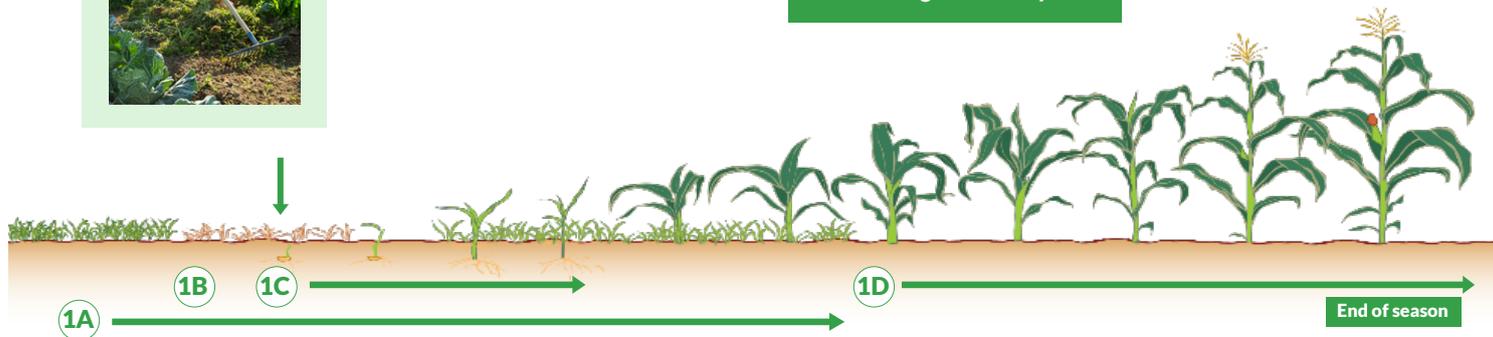
- Reduces early FAW “stem cutting”
- Assists plants in compensating for FAW infestation
- Extra fertilizer will not compensate for FAW plant damage
- Maximizes agronomic yield potential

1D Scout and take post-harvest action if needed

- Destroy infested plants and crop residue to reduce future FAW populations
- Know FAW non-host crops
- Rotate to non-host crops to reduce future FAW populations



Attempt to plant earlier than other corn fields in your surrounding community



PLANT REFUGE & MONITOR: SCOUT FOR FAW INJURY TO CORN PLANTS

Planting refuge preserves Bt corn's ability to control FAW in the future.

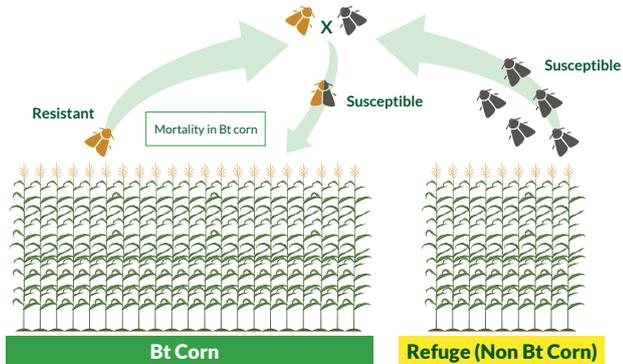
2A WHAT IS REFUGE?

Non-Bt corn planted with Bt corn to allow FAW survival so Bt corn can maintain effective control in the future.

Goal: Maintain a susceptible FAW population

Actions:

- 1 Purchase and plant Bt seed, non-Bt refuge seed, and use seed-applied technology (where available) to protect early-stage corn seedlings.



*Illustrations provided by Naranjo et al. (2020)¹

2B HOW TO PLANT YOUR REFUGE?

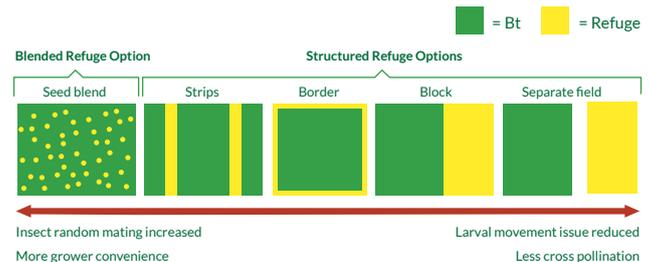
Consider planting options for your Bt and non-Bt refuge corn seed.

Goal: Promote mating of resistant moths with susceptible moths

Actions:

- 1 Discuss field design with seed rep
- 2 Choose and plant from example designs below
- 3 If allowed in your country, "blended refuge" (non-Bt seed integrated with Bt seed) eliminates need to buy and plant separate non-Bt seed.

Biological and practical considerations for refuge placement



Depending upon country independent regulatory requirements, a minimum of 10% non-Bt structured refuge is required. Refuge-in-bag (RIB) or an integrated refuge may also be an option.

2C MONITOR CORN FOR FAW

- 1 Use adult FAW traps to identify when to scout your fields (country monitoring programs may help)

- 2 Scout 100 plants to find leaf and whorl injury between seedling and V12 corn stages.

3 EVALUATE & TREAT: IF NEEDED, USE IRM PRINCIPLES TO ECONOMICALLY CONTROL FAW

Please note: Spraying non-Bt refuge can reduce IRM benefits and harm future plantings of Bt corn. Please see below guidelines.

3A Evaluate percent injured plants in field

- Evaluate both non-Bt corn (refuge) and Bt corn fields
- Scout 20 plants across 5 locations
- Determine percentage of plants that have leaf injury similar too or worse than leaf at right.

Typical damage level to initiate treatment



3B Treat when thresholds are met

- **Structured refuge:** If percentage injured plants is $\geq 20\%$, consider spraying both Bt and non-Bt corn portions (separate or same field). If you find 5-10% injured plants in the Bt corn block, spray both the Bt and non-Bt refuge.
- **Blended refuge:** If the percentage of plants demonstrating injury is $\geq 20\%$, consider spraying the entire field.

Seed production: May require lower threshold and higher spray frequency

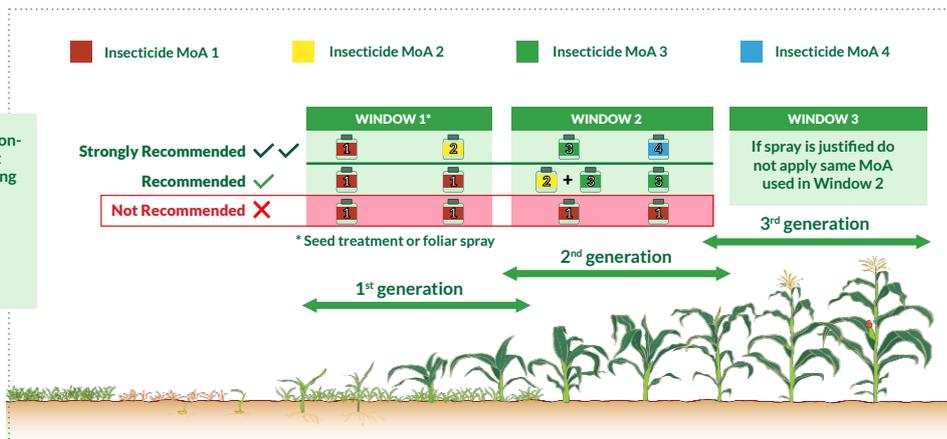
REPORT UNEXPECTED INJURY IN Bt CORN TO YOUR SEED DEALER:

- Report if find 5-10% injured plants in Bt corn.
- Report if find 15-20% injured plants in "blended refuge" (assuming a 10% blended refuge)

3C Best Management Practices

- 1 Rotate insecticides with different modes of action (MoA) between spray "Windows" (Please see companion IRAC FAW Guide: manage Fall Armyworm in 3 Steps)
- 2 MoA numbers will be on product labels. Products with same number have same MoA
- 3 Always apply insecticides according to product labels
- 4 Treating ear-stage corn for FAW generally has low economic value

- Spray all Bt and non-Bt refuge fields at the same time using the same MoA.
- Do not use the same MoA over subsequent generations.



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Note: Bt hybrids that provide FAW protection are not commercially available in all maize-growing countries.

*Courtesy Ken Gray Photograph Collection (P 256), Special Collections and Archives Research Center, Oregon State University Libraries.

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