CONSERVATION ENHANCEMENT ACTIVITY

E595D

CONSERVATION STEWARDSHIP PROGRAM

Increase the size requirement of refuges planted to slow pest resistance to Bt crops

Conservation Practice 595: Pest Management

APPLICABLE LAND USE: Crop (Annual and Mixed)

RESOURCE CONCERN: Animals

ENHANCEMENT LIFE SPAN: 1 Year

Enhancement Description

Bacillus thuringiensis (Bt) plant-incorporated protectants are plants that have been genetically altered to produce proteins that are harmful to certain insect pests. Widespread implementation of Bt crops has decreased insecticide use and increased crop yields, but it must be used as part of an integrated pest management (IPM) approach to protect the crop from pest species that are not susceptible to the Bt toxin and to manage pest resistance.

Crop rotation, scouting and resistance management strategies, such as planting and creating refuges of non-Bt crops, are essential when farming Bt crops. Insects have developed resistance to Bt proteins. To mitigate the development of further resistance, growers are required to plant refuges of non-transgenic crops. These refuges produce numbers of susceptible insects that will help sustain populations of non-resistant insects.

The size of refuge requirement depends on the environment, pest and strain of the crop. The size of refuge is determined by resistance risk and can vary depending on the product. A recent study published in the Journal of Integrated Pest Management revealed, compliance has been a challenge. Only 40% of growers surveyed stated they were planning to plant a refuge (Reisig 2017). Further, EPA (2018) reports document refuge compliance as low as 7% in areas at the highest risk of resistance. Non-compliance arises, in part, due to a

concern for yield loss and thus profit loss if a non-Bt refuge is planted.

Criteria

- This enhancement will increase the size of the required refuge by an additional 10% (of the total crop acreage) in areas with the highest risk of pest resistance to Bt crops[1], Ex. If the label requires a refuge to be 20% of the entire crop, an additional 10% area of non-Bt crop would be needed to be planted for a total of a 30% refuge to receive incentivization under this enhancement.

- Additional refuge planted must adhere to the extant terms of registration for Bt crops. (see Fig 1.)

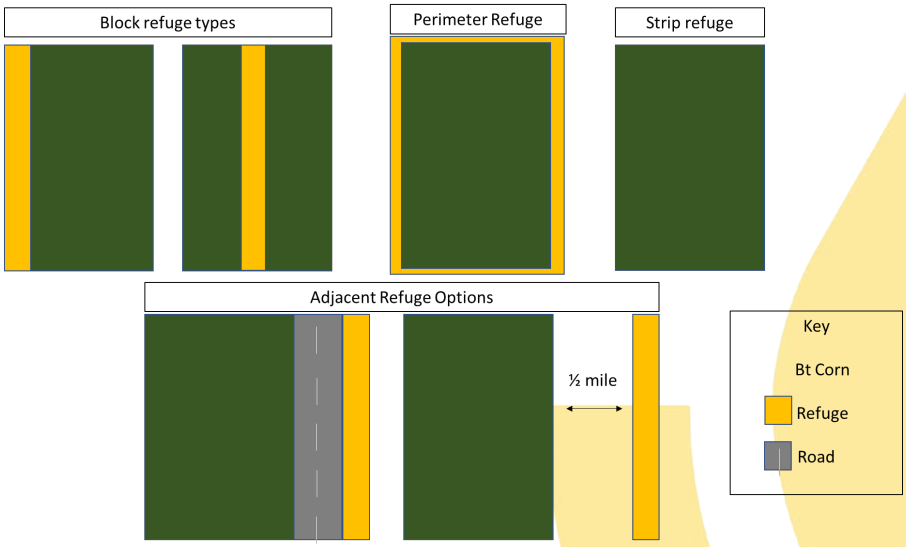

Figure 1. Refuge Planting Design Options

- Refuge designs include separate fields, blocks within fields (e.g., along the edges or headlands), perimeter strips, or in-field strips can be used to achieve the 10% increase.

1-The high risk resistance region consists of the states of Alabama, Arkansas, Georgia, Florida, Louisiana, North Carolina, Mississippi, South Carolina, Oklahoma (only the counties of Beckham, Caddo, Comanche, Custer, Greer, Harmon, Jackson, Kay, Kiowa, Tillman, Washita), Tennessee (only the counties of Carroll, Chester, Crockett, Dyer, Fayette, Franklin, Gibson, Hardeman, Hardin, Haywood, Lake, Lauderdale, Lincoln, Madison, Obion, Rutherford, Shelby, and Tipton), Texas (except the counties of Carson, Dallam, Hansford, Hartley, Hutchinson, Lipscomb, Moore, Ochiltree, Roberts, and Sherman), Virginia (only the counties of Dinwiddie, Franklin City, Greensville, Isle of Wight, Northampton, Southampton, Suffolk City, Surrey, Sussex) and Missouri (only the counties of Dunkin, New Madrid, Pemiscot, Scott, Stoddard) Virginia (only the counties of Dinwiddie, Franklin City, Greensville, Isle of Wight, Northampton, Southampton, Suffolk City, Surrey, Sussex) and Missouri (only the counties of Dunkin, New Madrid, Pemiscot, Scott, Stoddard).

- Refuge area must meet the proximity requirements of the Bt crop type (e.g., if a block refuge is planted it must be within a half mile of the Bt field, if perimeter or in-field strips are implemented, the strips must be at least 4 consecutive rows wide, etc.)
- Required refuge areas must be planted to the same crop as the Bt crop (i.e., a Bt corn field must have a non-Bt corn counterpart). The non-Bt variety must be as similar to the Bt variety as possible using an isoline hybrid if available.
- Growers who receive the incentivization are encouraged to monitor fields for Bt resistance and report unexpected pest damage to Bt crops to the company from which the grower obtained the Bt seed.

Documentation and Implementation Requirements:

Participant will:

- □ Prior to implementation, provide documentation for review showing producer's record of integrated pest management meeting all Conservation Practice Standard Integrated Pest Management (CPS 595) general criteria.
- □ During implementation, keep documentation, such as records, plans, receipts, showing the implementation of the activities selected including:
    - Document the Bt crop and the refuge size requirement from the label.
    - A map showing the non-Bt variety of the crop (refuge area) in relation to the Bt crops, noting the original refuge plus the additional refuge areas.
    - Photographs of Bt and non-Bt crops planted in the field.
- □ After implementation, make documentation and records available for review by NRCS to verify implementation of the enhancement.

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NRCS will:

- ☐ Prior to implementation, provide and explain NRCS Conservation Practice Standard Integrated Pest Management (CPS 595) as it relates to implementing this enhancement.
- ☐ As needed, provide technical assistance to the participant as requested.
- ☐ After implementation, verify implementation by reviewing records kept during enhancement implementation.

NRCS Documentation Review:

I have reviewed all required participant documentation and have determined the participant has implemented the enhancement and met all criteria and requirements.

Participant Name _____ Contract Number _____

Total Amount Applied _____ Fiscal Year Completed _____

_____ _____

NRCS Technical Adequacy Signature Date

2024 Alabama Supplemental Guidance for CSP Enhancement

ENHANCEMENT NUMBER AND TITLE: **E595D:** Increase the size requirement of refuges planted to slow pest resistance to Bt crops

CONSERVATION PRACTICE: 595 – Pest Management Conservation System (PMCS)

BRIEF DESCRIPTION OF ENHANCEMENT: This enhancement is prepared to slow the development of *Bacillus thuringiensis* (Bt) resistant pests by planting a certain percentage of fields with non-Bt crops – called **refuge crops**. A refuge is intended to provide a source of large numbers of Bt-susceptible insects to counter any resistant insects.

IMPORTANT CONSIDERATIONS:

- The size of refuge requirement depends on the environment, pest, and strain of the crop. The size is determined by resistance risk and can vary depending on the product. (For example, refuge requirements for Bt corn are larger in southeastern cotton-growing regions due to a target pest (corn earworm) in this area that feeds on both corn and cotton).
- Utilize the following refuge approaches:
  - **Structured refuges** are a dedicated portion of the farming operation devoted to a non-Bt variety. These refuges are planted as discrete fields (blocks), border rows surrounding a Bt field(s), or rows within the Bt field(s). The key components for structured refuge are its size (as a percentage of the corresponding Bt crop) and proximity to the Bt field(s). Refuges must be planted to the same crop as the Bt crop (i.e., a Bt corn field must have a non-Bt corn counterpart), be close enough to the Bt field so that susceptible insects (from the refuge) and resistant insects (from the Bt fields) can interact and mate.
  - **Seed blends** ("refuge-in-the-bag") incorporate non-Bt seed (refuge) with Bt seed in the same seed bag. The advantage of seed blends is that growers don't need to coordinate the planting of a separate refuge – refuge compliance is therefore assured. To date, seed blends have been approved for some Bt corn PIP products.
  - **"Natural refuge"** refers to wild hosts, or other cultivated crops that can serve as a source of susceptible insects. Such a refuge can be effective if the target pest(s) feeds on multiple plant hosts and doesn't specialize solely on the Bt crop.
- Registered Bt corn and cotton products for commercial use are required to use one of the above refuge approaches. Structured refuges and seed blends have been employed for Bt corn products, while natural refuge has been used for Bt cotton in the southeastern United States.

PROVIDE REQUIRED DOCUMENTS AND IMPLEMENTATION REQUIREMENTS:

- ☐ A map showing the non-Bt variety of the crop (refuge area) in relation to the Bt crops, noting the original refuge plus the additional refuge areas. Photographs of Bt and non-Bt crops planted in the field.
- ☐ Documentation for review showing producer's record of pest management meeting all CPS 595 general criteria.
- ☐ Documentation, such as records, plans, receipts, showing the implementation of the activities
- ☐ Documentation to verify implementation of the enhancement.

The following tables list the current refuge requirements for Bt crops (Source: Insect Resistance Management for Bt Plant-Incorporated Protectants | US EPA).

2024 Alabama Supplemental Guidance for CSP Enhancement

Table 1. Current Refuge Strategies for Bt Corn

Bt Corn Type	Target Pests	Structured Refuge	Proximity to Bt Fields	Seed Blend
Single toxin	Lepidoptera	Corn Belt: 20% Cotton regions: 50%[1]	<1/2 mile	N/A
Single toxin	Coleoptera	All regions: 20%	Adjacent or within	10%
Single toxin (stacked)	Lepidoptera+ Coleoptera	Corn Belt: combined[1] or separate 20% refuges Cotton regions: separate[2] 20% (CRW) and 50% (Lep) refuges	Combined refuge[2]: adjacent or within Separate refuges[3]: adjacent (CRW) and < ½ mile (Lep)	10% (separate refuge for Lepidopteran pests also required)
Pyramid	Lepidoptera	Corn Belt: 5% Cotton regions: 20%[1]	<1/2 mile	5% (separate refuge required in cotton regions)
Pyramid	Coleoptera	All regions: 5%	Adjacent or within	5%
Pyramid (stacked)	Lepidoptera+ Coleoptera	Corn Belt: combined 5% refuge Cotton regions: combined 20% refuge[1]	Areas with Leps: <1/2 mile Areas with CRW only: adjacent or within	5% (separate refuge required in cotton regions)

[1] "Cotton regions" refers to cotton production areas including Alabama.
[2] "Combined refuge" refers to a single refuge meant to address both lepidopteran and coleopteran target pests.
[3] "Separate refuges" refers to two different refuges that are planted for lepidopteran and coleopteran target pests

Table 2. Current Refuge Strategies for Bt Cotton

Bt Cotton Type	Target Pests	Geographic Region	Refuge	Refuge Proximity to Bt Fields
Pyramid	Lepidoptera	Southeastern states (AL, AR, FL, GA, KS, KY, LA, MD, MO, MS, NC, OK, SC, TN, VA, parts of TX)	Natural refuge	N/A

[1] A "sprayed" refuge allows grower to treat the refuge with insecticides to manage pest insects.

THE ATTACHED DOCUMENTS SUPPORT THE FULL IMPLEMENTATION OF THIS CONSERVATION STEWARDSHIP ENHANCEMENT.

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CSP Participant Name Date