



Module 5

Fumigant Reregistration

Good Agricultural Practices (GAPs)

- Soil Preparation
 - Allow adequate time for field prep including decomposition of previous crop and weed residue
 - The area to be fumigated should be tilled to a depth of 5 to 8 inches
 - Adequate tillage will allow for penetration of the fumigant and allow for better post application compression.
 - Tillage implements should allow for maximum pulverization and mixture of soil
 - Fields must have little or no crop residue on the surface
 - Residue can provide channels for fumigant escape and reduce bed compression increasing rate of fumigant off gassing
 - Trash pulled to ends of the field must be cover and sealed with the plastic mulch
 - Trash may have been treated with the fumigant and could result in worker exposure

Let's first discuss Soil Preparation. You must allow adequate time for field prep including decomposition of previous crop and weed residue. The area to be fumigated should be tilled to a depth of 5 to 8 inches. Adequate tillage will allow for penetration of the fumigant and allow for better post application compression and tillage implements should allow for maximum pulverization and mixture of soil. Fields must have little or no crop residue on the surface because residue can provide channels for fumigant escape and reduce bed compression increasing rate of fumigant off gassing. Trash pulled to ends of the field must be cover and sealed with the plastic mulch. If trash has

Soil Sealing

Broadcast Untarped Applications

Soil Sealing

Broadcast Untarped Applications

Broadcast Untarped Applications

Bedded Application

Tarped Applications

Broadcast Untarped Applications

Soil Sealing - Broadcast untarped applications

- A disc or similar equipment must uniformly mix the soil to a depth of at least 3 to 4 inches to eliminate chisel traces
- Following cultivation the soil must be compacted with a cultipacker or roller
- When using equipment similar to a Yetter applicator no additional soil sealing is necessary

Tab Text

Soil Sealing - Broadcast untarped applications

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Bedded Application

Soil Sealing

Bedded Application

Soil Sealing - Bedded application

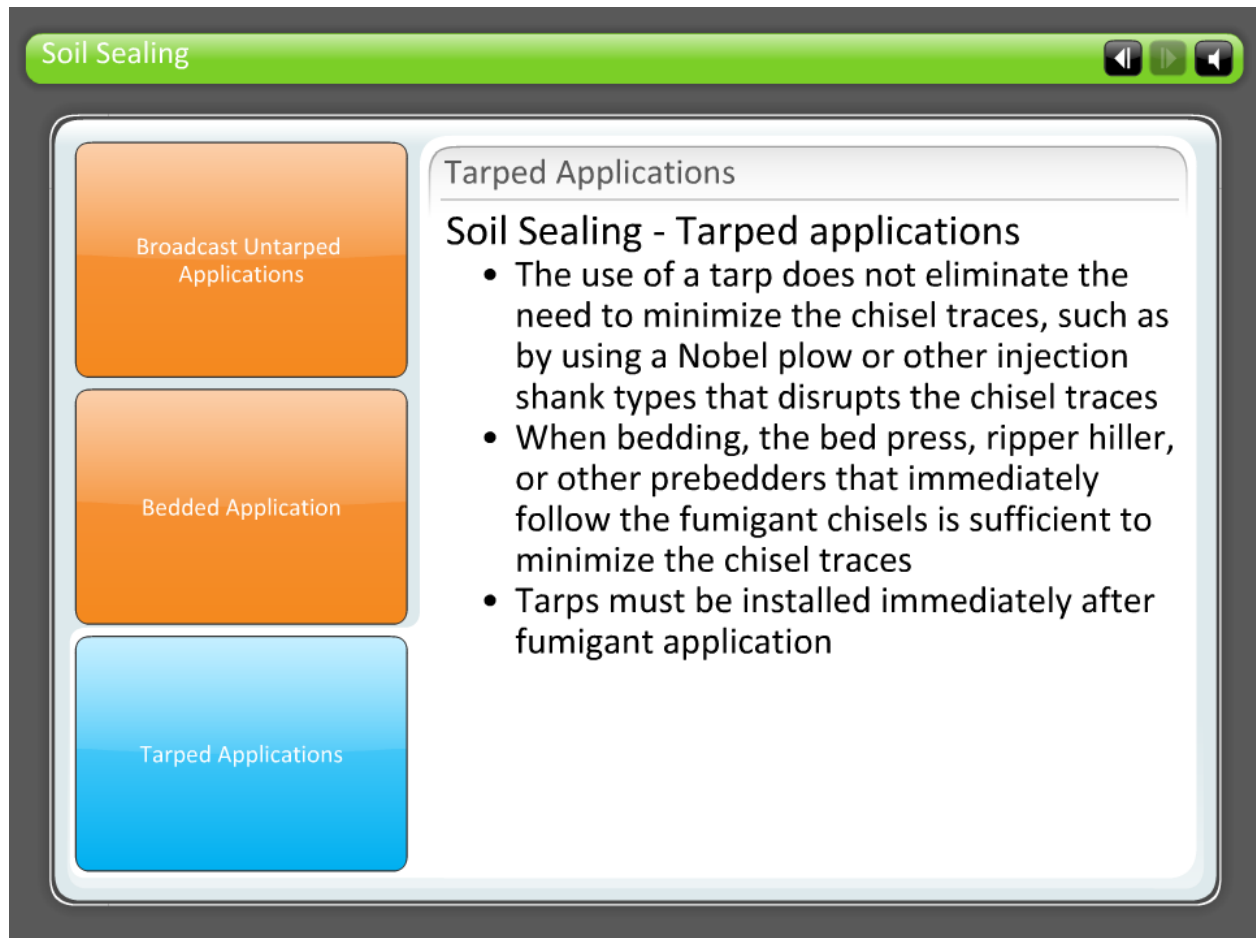
- Preformed beds must be sealed immediately following application to disrupt the chisel traces using press sealers, bed shapers, or cultipackers
- A ripper hiller, hippers, or prebedder may be used following application to disrupt chisel traces
- When using equipment similar to a Yetter applicator no additional soil sealing is necessary

Tab Text

Soil Sealing - Bedded application

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Tarped Applications



The screenshot shows a software window titled "Soil Sealing" with a green header bar. On the left is a vertical navigation menu with three buttons: "Broadcast Untarped Applications" (orange), "Bedded Application" (orange), and "Tarped Applications" (blue). The main content area on the right is titled "Tarped Applications" and contains the following text:

Soil Sealing - Tarped applications

- The use of a tarp does not eliminate the need to minimize the chisel traces, such as by using a Nobel plow or other injection shank types that disrupts the chisel traces
- When bedding, the bed press, ripper hiller, or other prebedders that immediately follow the fumigant chisels is sufficient to minimize the chisel traces
- Tarps must be installed immediately after fumigant application

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Good Agricultural Practices (GAPs)

- Soil Temperature
 - Cold Soil
 - Prevents movement of the fumigant
 - Increases crop plant back interval
 - Decreases efficacy on weeds due to low germination of seeds and vegetative parts
 - Hot Soil
 - Greatly increase fumigant movement within the soil
 - Decreases efficacy due to reducing the fumigant exposure time with pests
 - Maximum soil temperature at the depth of injection shall not exceed 90F at the beginning of application
 - If air temperatures have been above 100F in any of the 3 days prior to application then soil temperature at the depth of the injection must be measured and recorded in the FMP

Soil Temperature

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Good Agricultural Practices (GAPs)

- Soil Moisture
 - Low Soil Moisture
 - Increases fumigant off gassing
 - Reduces the bed compression reducing fumigant exposure time to pests
 - Reduces efficacy due to reducing fumigant exposure time to pests
 - High Soil Moisture
 - Decreases fumigant off gassing
 - Increases crop plant back interval
 - Increases hydrolysis of certain fumigant reducing the concentration
 - Reduces the bed compaction reducing fumigant exposure time to pests
 - Reduces efficacy due to reduction of concentration and exposure time

Soil Moisture

Low Soil Moisture

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Decreases fumigant off gassing

Increases crop plant back interval

Increases hydrolysis of certain fumigant reducing the concentration

Reduces the bed compaction reducing fumigant exposure time to pests

Reduces efficacy due to reduction of concentration and exposure time

Good Agricultural Practices (GAPs)

- Soil Moisture
 - The soil must be moist 9 inches below the surface using the USDA feel and appearance method or by using a soil moisture instrument
 - Measure the soil moisture no more than 48 hours prior to application
 - Moisture levels will be dependent on the fumigant label, but for most they should be in the range of 50 to 75% available soil moisture content. In areas where it is necessary to have more moisture to form a bed, such as sandy soils in the Southeast US, the soil moisture can be above the 75% level
- Irrigation/rainfall concerns
 - Application of high amounts of irrigation either through the drip tape, overhead, seepage, or sub surface methods can lead to trapping of the fumigant in the soil, the same applies to high rainfall amounts
 - Beds must be allowed to return to an acceptable moisture levels as mentioned above to maximize fumigant efficacy

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Good Agricultural Practices (GAPs)

- Soil Moisture – USDA feel method
 - Coarse textured soils (fine sand and loamy fine sand) – the soil is moist, forms a weak ball with loose and clustered sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon
 - Moderately coarse soils (sandy loam and fine sandy loam) – the soil is moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color will not stick
 - Medium textured soils (sandy clay loam, loam, and silt loam) – the soil is moist, forms a ball, very light staining on fingers, darkened color, pliable, and forms a weak ribbon between the thumb and forefinger
 - Fine textured soils (clay, clay loam, and silty clay loam) – the soil is moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger
 - For fields with more than one soil texture the soil moisture in the lightest textured areas must comply with the soil moisture requirements

Soil Moisture – USDA feel method

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pliable, and forms a weak ribbon between the thumb and forefinger

Fine textured soils (clay, clay loam, and silty clay loam) – the soil is moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger

For fields with more than one soil texture the soil moisture in the lightest textured areas must comply with the soil moisture requirements

Good Agricultural Practices (GAPs)

- Weather Conditions
 - Wind, rain, and temperature can adversely affect worker exposure and fumigant performance
 - Low wind can increase fumigant levels in the area of the field workers
 - High wind can cause removal of tarps from the soil and endanger bystanders
 - High rainfall after fumigant application can reduce the efficacy of the fumigant by trapping it in the soil and endanger the placement of the tarps
 - Temperature, either low or high, can affect the fumigant's performance
 - Temperature inversions can contain the fumigant off gassing near the soil surface, increasing the levels in the air, and can endanger workers and bystanders

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Good Agricultural Practices (GAPs)

- Weather Conditions
 - Prior to fumigation the weather forecast for the day of application and 48 hours after application must be checked to ensure no unfavorable weather conditions will occur.
 - Wind speed must be 2 mph at the start of fumigation or be forecasted to be at least 5 mph during application.
 - Do not apply if a temperature inversion is scheduled to occur for more than 18 of the 48 hour buffer zone period. Can sometimes be identified by ground fog or misty conditions.
 - Detailed forecasts can be found at www.nws.noaa.gov

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Do not apply if a temperature inversion is scheduled to occur for more than 18 of the 48 hour buffer zone period. Can sometimes be identified by ground fog or misty conditions.

Detailed forecasts can be found at

Good Agricultural Practices (GAPs)

- Application Depth

- The depth will be dependent on the fumigant and the type of application
- Depth will be measured from the nearest soil/air interface
- Example: an application of chloropicrin in a tarped broadcast or tarped bedded application must be a minimum of 8 inches from the nearest soil/air interface

- Prevention of end row spillage

- Do not allow the fumigant to drain on the surface.
- Allow fumigant to passively drain or purge any remaining fumigant from the shanks prior to lifting the rig from the ground

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lifting the rig from the ground

Good Agricultural Practices (GAPs)

- Tarps (plastic mulch)
 - There are 3 main types
 - Standard
 - LDPE or HDPE (low or high density polyethylene) – this is the standard type that was almost exclusively used 10 years ago. This mulch provides on a minimal amount fumigant retention
 - Barrier
 - Metalized – an LDPE or HDPE mulch with a layer of aluminum that provides better fumigant retention than LDPE or HDPE alone
 - High Barrier
 - VIF (virtually impenetrable film) – an LDPE mulch with a barrier layer inserted in the middle to provide better fumigant than metalized mulch
 - TIF (totally impenetrable film) – an LDPE mulch with a barrier layer inserted in the middle providing the best fumigant retention out of all plastic mulches
 - Selection Considerations
 - Some mulches are listed as high barrier but are only a thicker version of an LDPE or HDPE mulch and will not provide the level of retention seen with metalized, VIF or TIF mulches

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Selection Considerations

Some mulches are listed as high barrier but are only a thicker version of an LDPE or HDPE mulch and will not provide the level of retention seen with metalized, VIF or TIF mulches

Good Agricultural Practices (GAPs)

- Tarps (plastic mulch)
 - Selection of the proper plastic mulch can maximize fumigant efficacy
 - A low barrier film will reduce the fumigation exposure time and will reduce fumigant performance in hot conditions.
 - A high barrier film maximize fumigation exposure time but will increase the plant back interval of crops.
 - Emissions Reduction
 - The higher the barrier quality of a plastic mulch, the lower the fumigant emissions.
 - Certain plastic mulches will be eligible for buffer zone credits, thus any plastic mulch selection will include:
 - Ease of mulch application, the number of crops to be grown on the plastic mulch, buffer credit value, and crop plant back concerns

Tarps (plastic mulch)

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Good Agricultural Practices (GAPs)

- Tarps (plastic mulch) – a written tarp plan must be developed and included in the FMP including
 - Schedule and procedures for checking and repairing tarps
 - Minimum time after application and minimum size of hole (determined by grower) that will be repaired
 - Equipment used to repair tarps and people responsible for checking and repairing tarps
 - Schedule, equipment, and methods used to perforate tarps
 - Aeration plans and procedures following perforation of tarp, but prior to tarp removal or planting/transplanting
 - Schedule, equipment, and procedures for tarp removal (broadcast fumigation)

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Schedule, equipment, and methods used to perforate tarps

Aeration plans and procedures following perforation of tarp, but prior to tarp removal or planting/transplanting
Schedule, equipment, and procedures for tarp removal (broadcast fumigation)

Good Agricultural Practices (GAPs)

- Shank applied fumigant calibration, setup, repair, and maintenance of rigs
 - Do not use galvanized, PVC, nylon, or aluminum piping on rigs
 - Use brass (except metam products), carbon steel, or stainless steel fittings
 - Use polyethylene tubing, teflon tubing, or teflon line braided stainless steel tubing for all low pressure lines. Any pressured lines must be teflon lined stainless steel
 - All rigs must include a filter for removing particulates
 - Rigs must have a flowmeter or constant pressure system with orifice plates
 - To prevent the backflow of fumigant into the compressed gas cylinder applicators must check to ensure the propellant cylinder has at least 200 psi, have a functioning check valve on the cylinder, and always pressurize the system with compressed gas prior to opening the fumigant cylinder. Compressed air systems must also have a check valve

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To prevent the backflow of fumigant into the compressed gas cylinder applicators must check to ensure the propellant cylinder has at least 200 psi, have a functioning check valve on the cylinder, and always pressurize the system with compressed gas prior to opening the fumigant cylinder. Compressed air systems must also have a check valve

Good Agricultural Practices (GAPs)

- Shank applied calibration, setup, repair, and maintenance of rigs continue
 - Before using the fumigation rig for the first time, change or clean filter as necessary, check all tubing, pressurize the system using compressed gas and check for leaks using a soap solution
 - When completed fumigation, close all valves and blow residual fumigant from the system using compressed air or gas.
 - At the end of application, disconnect all fumigant cylinders from the rig
 - At the end of the season seal all ends of open lines with tape to prevent dirt or insect entry

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At the end of application, disconnect all fumigant cylinders from the rig

At the end of the season seal all ends of open lines with tape to prevent dirt or insect entry

Good Agricultural Practices (GAPs)

- Additional GAPs for drip applied calibration, setup, repair, and maintenance of rigs
 - Fumigant must be metered into the line and the mixed using a centrifugal pump or static mixer
 - Irrigation lines must be checked for any leaks and the leaks repaired
 - The system must contain a check valve and low pressure drain to prevent water source contamination. A check valve to prevent backflow into the fumigant container. A valve to prevent fumigant application when the water source is automatically or manually shut down. Functional interlocking controls that automatically shut off the fumigant injection if water flow stops or reduces affecting the fumigant application

Additional GAPs for drip applied calibration, setup, repair, and maintenance of rigs

Fumigant must be metered into the line and the mixed using a centrifugal pump or static mixer

Irrigation lines must be checked for any leaks and the leaks repaired

The system must contain a check valve and low pressure drain to prevent water source contamination. A check valve to prevent backflow into the fumigant container. A valve to prevent fumigant application when the water source is automatically or manually shut down.

Functional interlocking controls that automatically shut off the fumigant injection if water flow stops or reduces affecting the fumigant application

Good Agricultural Practices (GAPs)

- Additional GAPs for drip applied calibration, setup, repair, and maintenance of rigs continue
 - The site of injection must be as close as possible to the site being fumigated
 - The system must be flushed after fumigant application. The total volume of water must be enough to completely remove any excess fumigant from the lines.

Additional GAPs for drip applied calibration, setup, repair, and maintenance of rigs continue

The site of injection must be as close as possible to the site being fumigated

The system must be flushed after fumigant application. The total volume of water must be enough to completely remove any excess fumigant from the lines.

Good Agricultural Practices (GAPs)

- The fumigant management plan (FMP) will require the inclusion of some of many of the required GAPs
- We encourage all applicators to include a copy of the forecast in the FMP or the post application summary

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We encourage all applicators to include a copy of the forecast in

70 h

Module Five Review Questions

Questions

1. The area to be fumigated should be tilled to a depth of _____ to 8 inches.

The area to be fumigated should be tilled to a depth of _____ to 8 inches.

- 2
- 3
- 4
- 5

Correct	Choice
	2
	3
	4
X	5

2. Even if recently untreated, trash pulled to ends of the field must be cover and sealed with the plastic mulch.

Even if recently untreated, trash pulled to ends of the field must be cover and sealed with the plastic mulch.

True

False

Correct	Choice
X	True
	False

3. If broadcast untarped application is your chosen application method, a disc must uniformly mix the soil to a depth of at least 3 to 4 inches to eliminate chisel traces. Next, the soil must be compacted with a cultipacker or roller.

If broadcast untarped application is your chosen application method, a disc must uniformly mix the soil to a depth of at least 3 to 4 inches to eliminate chisel traces. Next, the soil must be compacted with a cultipacker or roller.

True

False

Correct	Choice
X	True
	False

4. Preformed beds do not have to be sealed immediately following application to disrupt the chisel traces using press sealers, bed shapers, or cultipackers because the beds are already compacted.

Preformed beds do not have to be sealed immediately following application to disrupt the chisel traces using press sealers, bed shapers, or cultipackers because the beds are already compacted.

True

False

Correct	Choice
	True
X	False

5. When applying through a tarp application method, the tarp needs to be installed immediately after fumigant application.

When applying through a tarp application method, the tarp needs to be installed immediately after fumigant application.

True

False

Correct	Choice
X	True
	False

6. Maximum soil temperature at the depth of injection should not exceed _____ at the beginning of application.

Maximum soil temperature at the depth of injection should not exceed _____ at the beginning of application.

- 80°F
- 85°F
- 90°F
- 95°F

Correct	Choice
	80°F
	85°F
X	90°F
	95°F

7. In sandy soils in the Southeast US, the soil moisture can be above the 75% level.

In sandy soils in the Southeast US, the soil moisture can be above the 75% level.

True

False

Correct	Choice
X	True
	False

8. The soil must be moist _____ inches below the surface using the USDA feel and appearance method.

The soil must be moist _____ inches below the surface using the USDA feel and appearance method.

- 3
- 5
- 7
- 9

Correct	Choice
	3
	5
	7
X	9

9. High wind can increase fumigant levels in the area of the field workers

Low wind can cause removal of tarps from the soil and endanger bystanders

High wind can increase fumigant levels in the area of the field workers
Low wind can cause removal of tarps from the soil and endanger bystanders

True

False

Correct	Choice
	True
X	False

10. Wind speed must be 2 mph at the start of fumigation or be forecasted to be at least _____ mph during application.

Wind speed must be 2 mph at the start of fumigation or be forecasted to be at least _____ mph during application.

- 4
- 5
- 10
- 15

Correct	Choice
	4
X	5
	10
	15

11. Which plastic mulch type has the best fumigant retention out of all plastic mulches?

Which plastic mulch type has the best fumigant retention out of all plastic mulches?

- Barrier
- Standard
- VIF
- TIF

Correct	Choice
	Barrier
	Standard
	VIF
X	TIF

12. A written tarp plan must be developed and included in the FMP. Which of the following must be included? (check all that apply)

A written tarp plan must be developed and included in the FMP. Which of the following must be included? (check all that apply)

- Schedule and procedures for checking and repairing tarps
- Minimum time after application and minimum size of hole (determined by grower) that will be repaired
- Equipment used to repair tarps and people responsible for checking and repairing tarps
- Schedule, equipment, and methods used to perforate tarps
- Aeration plans and procedures following perforation of tarp, but prior to tarp removal or planting/transplanting
- Schedule, equipment, and procedures for tarp removal (broadcast fumigation)

Correct	Choice
X	Schedule and procedures for checking and repairing tarps
X	Minimum time after application and minimum size of hole (determined by grower) that will be repaired
X	Equipment used to repair tarps and people responsible for checking and repairing tarps
X	Schedule, equipment, and methods used to perforate tarps
X	Aeration plans and procedures following perforation of tarp, but prior to tarp removal or planting/transplanting
X	Schedule, equipment, and procedures for tarp removal (broadcast fumigation)

13. To prevent the backflow of fumigant into the compressed gas cylinder applicators must check to ensure the propellant cylinder has at least _____ psi, have a functioning check valve on the cylinder, and always pressurize the system with compressed gas prior to opening the fumigant cylinder.

To prevent the backflow of fumigant into the compressed gas cylinder applicators must check to ensure the propellant cylinder has at least _____ psi, have a functioning check valve on the cylinder, and always pressurize the system with compressed gas prior to opening the fumigant cylinder.

- 100
- 200
- 300
- 400

Correct	Choice
	100
X	200
	300
	400