
Yuma's Agricultural BMP Acknowledgments

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Guide to Agricultural PM10 Best Management Practices

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Where can I learn more?

If you do not know whether your agricultural operation resides within the PM10 Nonattainment Area, or if you have any questions regarding compliance or specific components of the Agricultural Best Management Practices Record, contact:

Arizona Department of Agriculture

Agricultural Consultation & Training
1688 W. Adams Street
Phoenix, AZ 85007
602-542-3484
800-294-0308
www.azda.gov/ACT/AirQuality.htm

Arizona Department of Environmental Quality

Air Quality Division
1110 W. Washington Street
Phoenix, AZ 85007
602-771-4450
800-234-5677
www.azdeq.gov/environ/air/index.html

Yuma NRCS Field Office

2197 S. 4th Avenue
Suite 104
Yuma, AZ 85364
928-782-0860
(Fax) 928-341-1499

FSA Service Center Office

Yuma County
2197 S. 4th Avenue
Suite 104
Yuma, AZ 85364
928-782-0860 ex-104
(Fax) 928-782-0930

Yuma Mesa Irrigation & Drainage District

14329 S. 4th Avenue
Yuma, AZ 85365
928-726-4353

Yuma Irrigation District

9510 S. Ave 7 East
Yuma, AZ 85365
928-726-1047

Yuma County Water Users Association

3800 W. County 15th Street
Somerton, AZ 85350
928-627-8824

North Gila Irrigation District

1405 S. 16th Street
Yuma, AZ 85364

Yuma County Cooperative Extension

2200 W. 28th St., Suite 102
Yuma, AZ 85364
928-726-3904
(Fax) 928-726-8472

Introduction

Why is the Guide to Agricultural PM10 Best Management Practices needed?

The federal Clean Air Act requires that emissions from all significant sources in areas not meeting the national ambient air quality standards be controlled through effective programs. Through a study conducted by the Arizona Department of Environmental Quality (ADEQ) in 1995, agricultural activities were identified as a source that contributes to the production of particulate matter (PM).

PM10 is particulate matter that is 10 microns or less in diameter (as compared to a human hair that is about 70 microns). These particles are very small and can invade the natural defense mechanism of the human respiratory tract, penetrating deep into the lungs. Consequently, PM10 can cause a wide variety of harmful health effects, especially for children, the elderly, and people with pre-existing respiratory or cardiovascular disease.

Due to a detailed look at the PM10 concentrations during a wind event on August 18, 2002, it was revealed that agricultural fields contributed to the concentrations of PM10 on that day. ADEQ met with stakeholders of the agricultural community over a span of several months and developed an Agricultural Best Management Practices program for the Yuma non-attainment area. The BMP rule was adapted to the unique farming conditions of Yuma County. Yuma's Ag BMP program was conceived and implemented with this in mind. The program is embodied in Arizona Administrative Code R18-2-612 and R18-2-613.

The intent of this guide is to:

- Provide agricultural operators with information and guidance on how to effectively implement individual best management practices (BMPs) and determine compliance with the Agricultural Best Management Practices Record.

- Inform the general public about the efforts Yuma County producers are implementing to improve air quality.
- Provide Natural Resource Conservation Districts (NRCD) and other farm organizations with background information regarding the Ag BMP program and record form.

Where does the Agricultural Best Management Practices program apply?

Any commercial farm of 10 or more contiguous acres of land used for agricultural purposes within the boundary of the Yuma PM10 Nonattainment Area (see reference map insert). Although there are Indian reservations within the Yuma Nonattainment Area, they are exempt from the program.

Who must comply with the Agricultural Best Management Practices program?

Any commercial farmer or nurseryman who farms 10 or more contiguous acres of land shall comply by August 1, 2005. Any commercial farmer who begins a regulated agricultural activity after August 1, 2005, shall comply within 60 days after beginning the regulated agricultural activity.



What does the producer have to do?

- Implement and maintain at least **one** approved BMP (described later in this guide) for each of the three categories: tillage and harvest, non-cropland, and cropland.
- Keep records detailing the BMPs selected for each category. The commercial farmer may document the practices on the Ag BMP record sheet that is provided or develop a record that includes the information that is required. The commercial farmer must make available the record to the ADEQ director within two business days of notice to the farmer.
- It is also recommended, not required, that you keep additional records if implementation of the BMPs is not easily visible. Examples include, but not limited to, photographs, purchase records, receipts, job sheets, contractor invoices, employee timesheets, logs, narrative statements, individual farm policies, statements of understanding signed by employees or contractors, and training records.
- There is no fee associated with the use of the Agricultural Best Management Practices Record or for the services of the Agricultural Consultation and Training Office.



What would happen if I do not comply with the Agricultural Best Management Practices program?

If the ADEQ director determines that a commercial farmer is not in compliance with the Ag BMP program, the following three-stage process would occur:

1. If the farmer has not previously been subject to a PM10 compliance order, the farmer would be required to submit a plan to the local NRCD. The plan must specify the BMPs that the farmer would use to comply with the Ag BMP Record sheet.
2. If the farmer has previously been subject to a PM10 compliance order, the farmer would be required to submit a plan to ADEQ that specifies the BMPs that the farmer would use to comply.
3. If the farmer failed to comply with the plan submitted to NRCD and ADEQ, the director of ADEQ may revoke the Agricultural Best Management Practices Record and require the farmer to obtain an individual fee based permit.

At each stage, the farmer would have the opportunity for a hearing.



Soils, PM₁₀, and Air Quality

Soil consists of various particles including mineral, organic matter, air, and water. These particles vary in shape and size, ranging from large drops of liquid to microscopic dust particles. The mineral particles in soil are classified as sand, silt, or clay. Soils containing high amounts of clay coupled with large silt particles have a greater likelihood of generating PM₁₀.

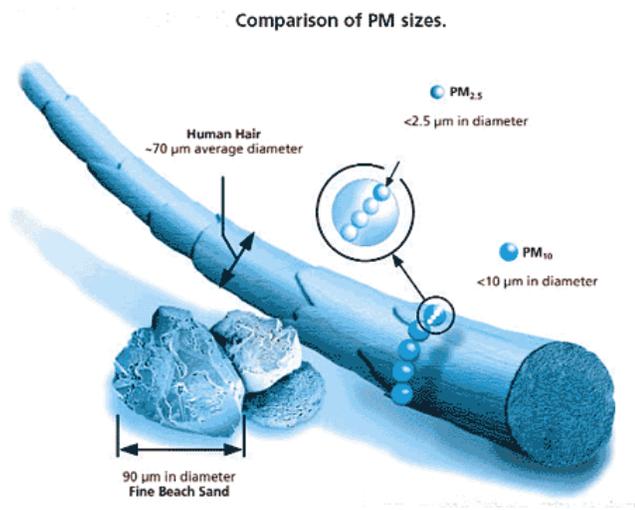
When the natural soil structure is manipulated or disturbed by tillage, animals, weather, or vehicular traffic, the structure can be broken apart from larger pieces, or clods, into smaller pieces. This process significantly increases the potential for soil particles to become suspended in the air. Further manipulation of the soil increases the chance for smaller particles to become PM₁₀.

Particulate matter is typically divided into two categories; particles less than 10 microns are PM₁₀ and particles less than 2.5 microns are PM_{2.5}. The size of a grain of beach sand is about 90 microns in diameter and the size of a strand of human hair is about 70 microns. So, there are about 7 PM₁₀ particles to the diameter of a strand of human hair.

Air quality problems occur when the amount of particles released into the air increase in concentration. Large concentrations of PM₁₀ could potentially violate one of the federal air quality standards, or National Ambient Air Quality Standards (NAAQS), set for various air pollutants. PM₁₀ emissions can also cause visibility impairment (e.g. brown cloud) as well as health impacts. The small particles can pass through nostril hairs and enter the lungs, penetrating deep into the lung tissue where it is lodged and not easily, if ever, expelled.

Two meteorological events have the potential to increase the impacts from high concentrations of PM₁₀: high winds and stagnation. Conditions for both events can occur in the Yuma area. High wind events can occur in both the warm and cool seasons. Stagnation is created by an inversion layer. The presence of an inversion creates a very stable atmosphere and leads to very little mixing of the air, trapping pollutants close to the ground. An inversion is also produced whenever radiation from the surface exceeds the amount of radiation from the sun, commonly at night or in the winter when the angle of the sun is very low in the sky.

Disturbed soil that is broken down into smaller particles can also become a soil conservation problem. Many of the best management practices outlined in this booklet are already used to prevent soil erosion. Other best management practices address ways of limiting PM₁₀ from associated farming activities such as adjoining dirt roads or road shoulders on farmland. The manipulation or disturbance of soil is inherent to the practice of farming. Best management practices are not designed to eliminate particle emissions 100 percent, but they are designed to reduce the activities that can lead to the increased concentration of PM₁₀.



Best Management Practices

As a result of discussions between the EPA, Arizona Department of Environmental Quality, and the Arizona Department of Agriculture, the Arizona State Legislature in 1999 enacted legislation with the support of the Arizona agriculture community to create and implement a best management practices program. The Agricultural Best Management Practice Program allows growers a wide range of choices to reduce PM10 emissions within established nonattainment areas.

An Ag BMP rule in Maricopa County has been approved as a Best Available Control Measure (BACM) by the EPA and has been effective since 2000. It has been upheld in federal court, which found the flexible format uniquely suited to widely varying farm situations. Yuma's topography, soil conditions, crops, and irrigation methods differ substantially from those in Maricopa County. Thus, the Ag BMP rule for the Yuma Nonattainment area was adapted to the unique farming conditions of Yuma County.

The Arizona Legislature has defined a best management practice as a technique verified by scientific research that is practical, economically feasible and effective in reducing PM10 on a case by case basis from a regulated agricultural activity. The following section of this guide summarizes the best management practices approved for the Yuma Ag BMP Program. A wide range of variation in soils and cropping systems exists within Yuma County, which can only be addressed by a wide range of flexible and adaptable management practices. Most methods for controlling PM10 emissions parallel the controls for wind erosion. These methods are based on principles that contain or slow soil movement from fields. Not all BMPs will work equally well on every farm because of variations in wind, soils, cropping systems, moisture conditions and, in some cases, the management approaches of individual growers. Such factors should be considered by individual farmers to ensure they implement effective BMPs. This guide represents steps in helping farmers reduce PM10 emissions from farmlands located within the Yuma Nonattainment Area.



Category I: Tillage and Harvest

Any mechanical practice that physically disturbs cropland or crops on a commercial farm.

Best management practices for use during tillage and harvest:

Bed Row Spacing
Chemical Irrigation
Combining Tractor Operations
Conservation Irrigation
Conservation Tillage
Equipment Modification
Limited Activity During a High-wind Event
Multi-year Crop
Night Farming
Planting Based on Soil Moisture
Precision Farming
Reduced Harvest Activity
Tillage Based on Soil Moisture
Timing of a Tillage Operation
Transgenic Crops

Bed Row Spacing

Rule Definition

Increase or decrease the size of the planting bed area (can be done for field and permanent crops).

Purpose

Spacing adjustments reduce the number of passes and soil disturbance by increasing plant density/canopy through reduction of row width.

Suggestions for Implementation

Planting multi-rows on a wide bed, e.g.: tomatoes or melons in 2 rows on 60” bed; narrow row planting of cotton can reduce two to three cultivation passes; other planting systems may have similar benefits, including but not limited to using 80” wide-bed system as well as a 60” system for either cotton or vegetable planting.



Chemical Irrigation

Rule Definition

Chemical irrigation is applying fertilizer, pesticide, or other agricultural chemicals to cropland through an irrigation system.

Purpose

Chemical Irrigation reduces the number of passes across a field with tractors, sprayers, fertilizer applicators and machinery. Reducing the number of field operations reduces the emissions associated with those activities.

Suggestions for Implementation

The addition of herbicide or fertilizer through water application during irrigation.

- All product application recommendations should be followed to ensure proper implementation.
- The field operations eliminated should be documented to demonstrate the implementation of the practice.



Combining Tractor Operations

Rule Definition

Combining tractor operations is performing two or more tillage, cultivation, planting, or harvesting operations with a single tractor or harvester pass.

Purpose

Combining tractor operations reduces the number of passes or trips that a tractor, implement, harvester or other farming support vehicle makes across a field or unpaved surface, thereby reducing the amount of soil disturbed.



Examples

- Combining multiple heavy tillage operations in a single pass, for example, pulling a ring roller behind a disc.
- The use of one-pass till equipment in ground preparation or crop tillage.
- Cultivating and fertilizing in a single pass. Using specialized machinery to bury stalks and make new furrows in a single pass.

Conservation Irrigation

Rule Definition

Conservation irrigation is to conserve the quantity of water use, e.g.: drip, sprinkler, buried underground line.

Purpose

Conserving water reduces weed populations, which in turn reduces the need for tillage as well as reduces soil compaction.

Suggestions for Implementation

The use of drip or buried lines in crop production. Also, the use of pressure bombs, water flow meters or soil monitoring devices to avoid over-irrigation.

Conservation Tillage

Rule Definition

Conservation tillage (e.g.: no tillage, minimum tillage) is any type of tillage that reduces loss of soil and water in comparison to conventional tillage.

Purpose

It reduces the number of passes and the amount of soil disturbed. It improves soil because it retains plant residue and increases organic matter.

Suggestions for Implementation

Converting and implementing no or low till operations. Adding soil/water amendments to improve resource and reduce tillage needs.

Equipment Modification

Rule Definition

Equipment modification is modifying agricultural equipment to prevent or reduce particulate matter generation from cropland.

Purpose

Modifying and maintaining an existing piece of agricultural equipment or purchase new equipment to prevent PM10 from becoming airborne during tillage and harvest operations, which helps reduce PM10 and soil erosion.



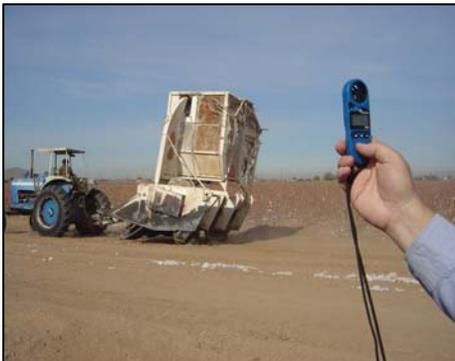
Examples

- Shields or deflectors that redirect vehicle exhaust sideways or upward. This can prevent PM10 from becoming airborne because exhaust is not blowing downward on the soil surface.
- Dust shrouds around tillage implements and harvesters.
- Spray bars that emit a mist to knock down PM10.

Limited Activity During a High-wind Event

Rule Definition

“Limited activity during a high wind event” is performing no tillage or soil preparation activity when the measured wind speed at 6 feet in height is more than 25 mph at the commercial farm site.



Purpose

Limiting activity during a high-wind event will reduce the transport of PM10. Reducing farm operations during a high-wind event, as well as when the wind speed is less than 25 mph, can significantly help reduce PM10 emissions.

Suggestions for Implementation

An individual farm policy should be developed to ensure that no tillage or soil preparation activities occur when the wind speed reaches 25 mph. Subscribe to the Yuma Wind Forecast issued by ADEQ.

Multi-year Crop

Rule Definition

Multi-year crops are crops, pastures, or orchards that are grown, or will be grown, on a continuous basis for more than one year.

Purpose

Surface covers, such as crops, pasture and orchards that are grown and maintained for a long duration, protect the soil surface from erosive winds. The longer a crop or cover is protecting the soil surface, the less time the surface is susceptible to wind erosion.



Examples

- Alfalfa
- Citrus
- Nuts
- Livestock pastures

Night Farming

Rule Definition

Operate at night, if practical, when moisture levels are higher and winds are lighter.

Purpose

The increase in ambient humidity reduces PM10 emissions during the night. Increased humidity increases soil surface moisture thereby helping contain PM10 emissions from tillage.

Suggestions for Implementation

It is suggested to watch for stagnant air conditions and scale down night operations on those nights.

Planting Based on Soil Moisture

Rule Definition

Planting based on soil moisture is applying water to soil before performing planting operations.

Purpose

This reduces PM10 during the planting operation and is effective from the time of planting until the crop establishment. Moisture causes soil to crust and therefore PM10 is not easily transported into the air.

Suggestions for Implementation

Irrigation should be applied as soon after soil preparation for planting as possible. After watering, a thin crust develops on the soil surface, which stabilizes it until planting. The time between bed lifting, irrigation and planting should be minimized as much as possible. Care should be taken to avoid over compaction of the soil, which could result in additional tillage operations.

Precision Farming (GPS Tractor or Implement Management)

Rule Definition

Precision farming is the use of GPS to precisely guide farm equipment in the field.

Purpose

Precision farming reduces overlap and allows operations to occur during inclement weather conditions and at night thereby generating less PM10.

Examples

- Install overlap reduction technology
- Pass markers
- Variable rate application technology



Reduced Harvest Activity

Rule Definition

Reduced harvest activity is reducing the number of harvest passes using a mechanized method to cut and remove crops from the field.



Purpose

Anytime an operation takes place in a field, the soil structure can be modified and some PM10 could be released into the air. Reducing the number of harvest activities can keep the soil structure intact and reduce PM10.

Suggestions for Implementation

An example of reduced harvest activity is the elimination of a harvest or road pass from a cotton harvest. More PM10 is emitted during a normal cotton harvest season because the process requires several harvest passes to remove most of the crop from the plant. The road process produces a significant amount of PM10 because of the nature of the operation.

Tillage Based on Soil Moisture

Rule Definition

Tillage based on soil moisture is applying water to soil before or during tillage, or delaying tillage to coincide with precipitation.

Purpose

Moisture binds soil particles and helps reduce the amount of PM10 released into the air. Fine dry soil can easily erode with increased wind speeds. Sufficient moisture levels can be achieved by irrigating before tillage or tilling after rain. Moisture can also allow large soil clods to form, after tillage, which reduces wind erosion.

Suggestions for Implementation

- Fields should be irrigated to the depth of proposed cut prior to soil disruption.
- The application of moisture or the date of tillage that coincided with precipitation should be documented.

Timing of a Tillage Operation

Rule Definition

Timing of a tillage operation is performing tillage operations at a time that will minimize the soil's susceptibility to generate PM10.

Purpose

Adjusting the time of tillage operations can minimize the amount of time the soil surface is susceptible to wind erosion and generation of PM10. When a field's surface is smooth, dry, and consists of finer grained soil particles, the field is most susceptible to wind erosion, resulting in PM10.

Examples

- Reducing time between leveling (land planing) and bedding, which is when the beds act as miniature windbreaks. For example, a cotton production system where fields are tilled in the fall, land- planed, and then bedded, would be less susceptible to wind erosion and PM10.
- Leaving the field surface with large soil clods for as long as possible prior to preparation of seed beds.

Transgenic Crops

Rule Definition

Transgenic crops are the use of plants that are genetically modified.

Purpose

Transgenic crops reduce need for tillage or cultivation operations, as well as reduces soil disturbance. It can also reduce the number of chemical applications.

Examples

- Genetically altered seed
- Nematode resistant rootstock



Category II: Non-Cropland

Any commercial farm land that:

- *Is no longer used for agricultural production,*
- *Is no longer suitable for production of crops,*
- *Is subject to a restrictive easement or contract that prohibits use for the production of crops, or includes a private farm road, ditch, ditch bank, equipment yard, storage yard or well head.*

Best management practices for use on non-cropland:

Access Restriction
Aggregate Cover
Artificial Wind Barrier
Critical Area Planting
Manure Application
Reduced Vehicle Speed
Synthetic Particulate Suppressant
Track-out Control System
Tree, Shrub, or Windbreak Planting
Watering

Access Restriction

Rule Definition

Access restriction is restricting or eliminating public access to non-cropland area with signs or physical barriers.

Purpose

Reducing the number of trips driven on agricultural aprons and access roads can reduce that area's susceptibility to PM10.

Examples

- Installing physical barriers such as gates, fencing, posts, signs, shrubs, trees or other physical obstructions to prevent or control access to the area.
- Installing "no trespassing" or "limited use area" signs.



Aggregate Cover

Rule Definition

Aggregate cover is gravel, concrete, recycled road base, caliche or other similar material applied to non-cropland.

Purpose

Applying an aggregate cover to unpaved farm roads, parking areas and canal banks helps reduce the amount of soil particles exposed to the surface, thus helping to reduce the generation of PM10. Aggregate cover acts as a surface barrier to erosive forces like wind or vehicle traffic.

Suggestions for Implementation

- The aggregate should be one inch or larger in diameter.
- The aggregate should be applied a minimum of four inches deep.
- The aggregate material should be clean, hard and durable.

Artificial Wind Barrier

Rule Definition

Artificial wind barrier is a physical barrier to the wind.

Purpose

Artificial wind barriers disrupt the erosive flow of wind over unprotected areas thus helping to reduce PM10.

Suggestions for Implementation

- Continuous board fences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and blowing soil.
- Barriers should be aligned across the prevailing wind direction. While 90 degrees or perpendicular is preferred, benefits can still be realized when barriers are aligned as close to perpendicular as possible.
- The distance of 10 times the barrier height is considered the area downwind of the barrier.



Critical Area Planting

Rule Definition

Critical area planting is using trees, shrubs, vines, grasses, or other vegetative cover on non-cropland

Purpose

Critical area planting helps control soil movement and protects the soil surface when adequate cover does not exist. Ground covers reduce dust and wind erosion by shielding the soil with vegetation and anchoring the soil with roots. This practice applies to field aprons, equipment parking areas, turn rows, canal banks, canal excavation spoil piles and bare areas where vegetation is difficult to establish by usual planting methods.

Suggestions for Implementation

Critical area planting consists of any vegetative cover that maintains more than 60 percent ground cover.

Manure Application

Rule Definition

Manure application is applying animal waste or biosolids to a soil surface.

Purpose

Applying manure to maintain or improve chemical and biological conditions of the soil can help reduce wind erosion and PM10

Suggestions for Implementation

- Caution should be used when applying manure to ensure that state and local regulations are not violated.
- Manure should be incorporated as quickly as possible to reduce odor and ammonia emissions, and to preserve nutrient value if the area is to be cropped in the future.

Reduced Vehicle Speed

Rule Definition

Reduced vehicle speed is operating farm vehicles or farm equipment on unpaved private farm roads at speeds not to exceed 20 mph.

Purpose

Reduced speeds can decrease the amount of PM10 generated by vehicles or equipment on unpaved farm roads.

Examples

- Posting speed limit signs.
- Informing all employees, contractors and sub-contractors of speed limits.
- Placing signs in all farm vehicles stating the speed limit on farm roads.
- Installing speed bumps.



Synthetic Particulate Suppressant

Rule Definition

Synthetic Particulate Suppressant is a manufactured product such as lignosulfate, calcium chloride, magnesium chloride, an emulsion of a petroleum product, an enzyme product, and polyacrylamide that is used to control particulate matter.

Purpose

Synthetic particulate suppressants provide a surface barrier or bind soil particles together to retard PM10 on unprotected areas, such as unpaved roads, rights-of-way and abandoned fields.

Examples

- Calcium chloride (CaCL)
- Soybean feedstock (SBF) processing byproducts
- Calcium lignosulfonate (lignin)
- Polyvinyl acrylic polymer emulsion (PVA)
- Polyacrymide (PAM)
- Emulsified petroleum resin

Differences in traffic type and volume, soil types, roadway surface characteristics and topography between sites requiring dust control can cause product performance to vary. Consult the NRCD office or a dust control contractor for specific recommendations. All products should be applied strictly in accordance with manufacturers' specifications.

Track-out Control System

Rule Definition

A track-out control system is a device to remove mud or soil from a vehicle before the vehicle enters a paved public road.

Purpose

Using a track-out control system helps remove mud and soil from the tires of farm equipment and vehicles before they enter a paved public road, where the mud or soil can be crushed into fine particles and easily suspended in the air by passing vehicles.

Suggestions for Implementation

Some examples of track-out control systems are:

- Grizzly – a device similar to a cattle guard, which is used to dislodge mud, dirt or debris from the tires and undercarriage of equipment and vehicles prior to leaving a farm.
- Gravel pad – a pad of crushed stone, coarse gravel or recycled road base located at the point of intersection of a paved public roadway and a farm entrance.

It is recommended that:

- a) The stone or gravel is one inch or larger in diameter.
 - b) The gravel pad is applied a minimum of four inches deep.
 - c) The gravel pad is the full width of the farm entrance.
 - d) The gravel pad is a minimum of 50 feet long.
- Pavement – an area of asphalt, concrete or similar material applied to a farm road at the intersection of a paved public roadway and a farm entrance.

It is recommended that:

- a) The pavement is the width of the farm road.
- b) The pavement is a minimum of 100 feet long from the point of intersection with a paved public roadway.

The farm entrance should be maintained in a condition that will prevent tracking of mud or soil onto paved public roads. The farmer should conduct periodic inspections, maintenance, re-application of gravel and cleaning of paved access road surfaces to accomplish track-out control.



Tree, Shrub, or Windbreak Planting

Rule Definition

Tree, shrub, or windbreak planting is providing a woody vegetative barrier to the wind.

Purpose

Barriers placed perpendicular to the wind direction can reduce wind speeds by changing the pattern of airflow over the land surface, which helps reduce wind erosion and PM10.

Suggestions for Implementation

- The distance of 10 times the barrier height is considered the protected area downwind of the barrier.
- Single row plantings are most popular in field windbreaks because they use less water and occupy the least amount of land area for the amount of protection derived.
- Recommended species for planting can be obtained at all NRCD offices.
- The planting should be done at a time and manner to ensure survival and growth of selected species.
- Moisture conservation or supplemental watering should be provided for plant establishment and growth, as well as the use of drought tolerant species.
- Windbreaks should be aligned across the prevailing wind direction. While 90 degrees or perpendicular is preferred, benefits can still be realized when windbreaks are aligned as close to perpendicular as possible.
- The interval between windbreaks should be determined using current approved wind erosion technology, available at all NRCD offices.



Watering

Rule Definition

Watering is applying water to non-cropland.

Purpose

Applying water from a truck, tractor or other portable spray system to bare soil surfaces, such as unpaved roadways and equipment yards where high traffic areas exist, can help reduce PM10. Watering the soil surface tends to compact the soil so that it is not dispersed into the air.

Suggestions for Implementation

Watering is effective during peak usage times, such as silage harvest time.

- Apply water so that the surface is visibly moist.



Category III: Cropland

Land on a commercial farm that:

- *Is within the timeframe of final harvest to plant emergence,*
- *Has been tilled in a prior year and is suitable for crop production, but is currently fallow, or*
- *Is a turn-row.*

Best management practices for use on cropland:

Artificial Wind Barrier

Cover Crop

Cross-wind Ridges

Cross-wind Strip-cropping

Cross-wind Vegetative Strips

Manure Application

Mulching

Multi-year Crop

Permanent Cover

Planting Based on Soil Moisture

Precision Farming

Residue Management

Sequential Cropping

Surface Roughening

Tree, Shrub, or Windbreak Planting

Artificial Wind Barrier

Rule Definition

Artificial wind barrier is a physical barrier to the wind.

Purpose

Artificial wind barriers disrupt the erosive flow of wind over unprotected cropland fields thus helping to reduce PM10.

Suggestions for Implementation

- Continuous board fences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and blowing soil.
- Barriers should be aligned across the prevailing wind direction. While 90 degrees or perpendicular is preferred, benefits can still be realized when barriers are aligned as close to perpendicular as possible.
- The distance of 10 times the barrier height is considered the protected area downwind of the barrier.



Cover Crop

Rule Definition

Cover crops are plants or a green manure crop grown for seasonal soil protection or soil improvement.

Purpose

Cover crops help control soil movement and protect the soil surface between crops. Cover crops reduce wind erosion by shielding the soil with vegetation and anchoring the soil with roots.

Suggestions for Implementation

It is recommended that:

- Cover crops consist of any vegetation cover that maintains more than 60 percent ground cover.
- Short-term cover is grown between major crops. Plants are then tilled into the soil prior to or during major crop planting.
- Longer-term cover may be maintained by periodic mowing to maintain at least 60 percent cover.
- Specific information on cover crops can be obtained from the Cooperative Extension Service or the NRCD office.



Cross-wind Ridges

Rule Definition

Cross-wind ridges are soil ridges formed by a tillage operation.

Purpose

Ridges formed by tillage operations create protective windbreaks that disrupt the erosive forces of high winds.

Suggestions for Implementation

It is recommended that:

- Ridges formed by tillage or planting should be aligned across the prevailing wind direction.
- While 90 degrees or perpendicular is preferred, benefits can still be realized with ridges as close to perpendicular as possible.
- If ridges deteriorate and become ineffective due to weathering or erosion, they should be reestablished, unless doing so would damage a growing crop.
- This practice is best adapted on soils, which are stable enough to sustain effective ridges, such as clayey, silty and sandy loam soils. It is not well adapted on unstable soils, such as sands, loamy sands and certain organic soils.



Cross-wind Strip-cropping

Rule Definition

Cross-wind strip-cropping is planting strips of alternating crops within the same field.

Purpose

Growing crops or managing residue as a protective cover in strips across the prevailing wind direction can break the effects of high wind events.

Suggestions for Implementation

It is recommended that:

- Cross-wind strip-cropping systems consists of at least two crop or residue cover alternation strips.
- Strip widths should be at least 25 feet but no more than 330 feet.
- Strips should be aligned across the prevailing wind direction. While 90 degrees or perpendicular is preferred, benefits can still be realized when the strips are oriented as close to perpendicular as possible.
- Protective cover includes, but is not limited to a growing crop, grasses, legumes, grass-legume mixtures, standing stubble or tilled residue with enough surface cover to provide protection.

Cross-wind Vegetative Strips

Rule Definition

Cross-wind vegetative strips are planting an herbaceous cover established in 1 or more strips within the same field.

Purpose

Herbaceous cover creates a protective windbreak that disrupts the erosive forces of high winds, especially during critical wind erosion periods.

Suggestions for Implementation

It is recommended that:

- Herbaceous cover should be composed of perennial or annual vegetation, growing or dead.
- Strips consist of at least one row of plants, providing the porosity can be achieved with a single row that contains no gap.
- When two or more rows are required to achieve the required porosity, and to avoid gaps, the rows should be spaced no more than 36 inches apart.
- Annual vegetation strips be composed of more than one row.
- Strips designed for this purpose have a minimum expected height of two feet.
- Strips designed for this purpose achieve a minimum porosity of 40 to 50 percent.
- Spacing between strips (not within row) not to exceed 12 times the expected height of the herbaceous cover.
- Spacing between strips is adjusted to accommodate widths of farm equipment to minimize partial or incomplete passes.

Manure Application

Rule Definition

Manure application is applying animal waste or biosolids to a soil surface.

Purpose

Applying manure to maintain or improve chemical and biological condition of the soil can help reduce wind erosion and PM10.

Suggestions for Implementation

- If the application or storage of manure is near a water source, precautions should be taken to prevent accidental leakage, spillage or runoff that will result in undesirable effects on soil, water and plants.
- Caution should be used when applying manure to ensure that state and local regulations are not violated.
- Caution should be used when certain manures are applied as they can volatilize and contribute to odor and ammonia emissions.
- Manure should be incorporated as quickly as possible to reduce odor and ammonia emissions, and to preserve nutrient value if the area is to be cropped in the future.



Mulching

Rule Definition

Mulching is applying plant residue or other material that is not produced on site to a soil surface.

Purpose

Adding a protective layer to the soil surface reduces soil movement in high wind events. This practice also conserves soil moisture, which can reduce surface movement of soil.

Suggestions for Implementation

It is recommended that:

- This practice can be used after low residue producing crops, like cotton, are harvested.
- Materials for mulching are acquired as waste products from other enterprises.
- These include, but are not limited to: wood bark, chips, shavings, saw dust, food processing waste, and small grain straw/chaff.
- Mulches are applied by blowers, hydro applicators, disk type straw punchers and spreaders.
- When small grain straw is used, spread at least 4,000 pounds per acre, distribute evenly and partially incorporate into the soil.
- When wood fibers are used, spread at least 2,000 pounds per acre or achieve 80 percent cover.

Multi-Year Crop

Rule Definition

Multi-year crops are crops, pastures, or orchards that are grown, or will be grown, on a continuous basis for more than one year.

Purpose

Surface covers, such as crops, pasture and orchards, that are grown and maintained for a long duration, protect the soil surface from erosive winds. The longer a crop or cover is protecting the soil surface, the less time the surface is susceptible to wind erosion.

Examples

- Alfalfa
- Citrus
- Roses
- Livestock pastures
- Nuts
- Sod



Permanent Cover

Rule Definition

Permanent cover is a perennial vegetative cover on cropland.

Purpose

Maintaining a long-term (perennial) vegetative cover on cropland that is temporarily not producing a major crop protects the soil surface from erosive winds.

Suggestion for Implementation

It is recommended that:

- Perennial species of grasses and/or legumes should be used to establish at least 60 percent cover.
- When perennial species are used, maintenance by periodic mowing or swathing/baling is encouraged.
- Specific information on permanent cover types can be obtained from the Cooperative Extension Service or all NRCD offices.



Planting Based on Soil Moisture

Rule Definition

Planting based on soil moisture is applying water to soil before performing planting operations.

Purpose

This reduces PM10 during the planting operation and is effective from the time of planting until the crop establishment. Moisture causes soil to crust and therefore PM10 is not easily transported into the air.



Suggestions for Implementation

Irrigation should be applied as soon after soil preparation for planting as possible. After watering, a thin crust develops on the soil surface, which stabilizes it until planting. The time between bed lifting, irrigation and planting should be minimized as much as possible. Care should be taken to avoid over compaction of the soil, which could result in additional tillage operations.

Precision Farming (GPS Tractor or Implement Management)

Rule Definition

Precision farming is the use of GPS to precisely guide farm equipment in the field.

Purpose

Precision farming reduces overlap and allows operations to occur during inclement weather conditions and at night thereby generating less PM10.

Examples

- Install overlap reduction technology
- Pass markers
- Variable rate application technology.



Residue Management

Rule Definition

Residue management is managing the amount and distribution of crop and other plant residues on a soil surface.

Purpose

Leaving crop and other plant residues on the soil surface can protect the soil between the time of harvest of one crop and emergence of a new crop, thus helping reduce wind erosion and the generation of PM10.

Suggestions for Implementation

Many different residue management systems have been developed. Some examples include:

- Reduced tillage systems, such as mulch-till, which partially incorporates surface residues and involves no plowing.
- No-till, this involves planting directly into the soil without any alteration to the seedbed. One example is planting a new crop directly into the grain stubble.
- Soil protection by crop residues can be increased by leaving residues on the soil surface as long as possible (e.g. by delaying tillage operations until just before planting).

It is recommended that:

- Stubble is left standing at six inches or more.
- Tillage is limited during this period to undercutting tools, such as blades, sweeps or deep tillage implements, such as a ripper or subsoiler.
- Loose residue is uniformly distributed on the soil surface.
- Residues from previous crops are left to maintain 60 percent ground cover.
- Specific information on determining small grain residue equivalents can be obtained from the Cooperative Extension Service or all NRCD offices.
- Consult NRCS Standards and Specification for Residue Management, #329 and 344. This document is available at all NRCD offices.



Sequential Cropping

Rule Definition

Sequential Cropping is growing crops in a sequence that minimizes the amount of time bare soil is exposed on a field.

Purpose

By reducing the amount of time bare soil is exposed, sequential cropping helps reduce the window of time that the cropland is susceptible to PM10 erosion.

Examples

- Planting a winter grain crop between final harvest of a cotton crop and the planting of the next cotton crop.
- Close rotations of vegetable crops.

Suggestions for Implementation

It is recommended that:

- The amount of time bare soil is exposed be limited to 30 days or less.
- Rotations are provided for acceptable substitute crops in case of crop failure or shift in planting intentions for weather related or economic reasons.

Surface Roughening

Rule Definition

Surface roughening is manipulating a soil surface to produce or maintain clods.

Purpose

The formation of clods helps disrupt the erosive force of the wind over an unprotected soil surface. Soil clods can be formed by tillage implements under appropriate soil moisture conditions.

Suggestions for Implementation

- Not all soils are able to form clods. Review the local soil survey or contact the NRCD office to help determine a specific field's soil type.
- Caution should be used to determine the most opportune time to roughen the soil surface while considering the tillage needed prior to planting, crop to be grown and irrigation water management needs (surface roughening can dry the upper soil profile more rapidly than not disturbing the soil).



Tree, Shrub, or Windbreak Planting

Rule Definition

Tree, shrub, or windbreak planting is providing a woody vegetative barrier to the wind.

Purpose

Barriers placed perpendicular to the wind direction can reduce wind speeds by changing the pattern of airflow over the land surface, which helps to reduce wind erosion and PM10.

Suggestions for Implementation

- The distance of 10 times the barrier height is considered the protected area downwind of the barrier.
- Single row plantings are most popular in field windbreaks because they use less water and occupy the least amount of land area for the amount of protection derived.
- Recommended species for planting can be obtained at all NRCD offices.
- The planting should be done at a time and manner to insure survival and growth of selected species.
- Moisture conservation or supplement watering should be provided for plant establishment and growth, as well as the use of drought tolerant species.
- Windbreaks should be aligned across the prevailing wind direction. While 90 degrees or perpendicular is preferred, benefits can still be realized when windbreaks are aligned as close to perpendicular as possible.
- The interval between windbreaks should be determined using current approved wind erosion technology available at all NRCD offices.



Agricultural Best Management Practices Record

Check Only One Crop Per Sheet

- | | | | | | |
|-------------------------------------|---------------------------------|---------------------------------|--------------------------------------|--------------------------------|----------------------------------|
| <input type="checkbox"/> Vegetables | <input type="checkbox"/> Melons | <input type="checkbox"/> Citrus | <input type="checkbox"/> Grain | <input type="checkbox"/> Beans | <input type="checkbox"/> Alfalfa |
| <input type="checkbox"/> Corn | <input type="checkbox"/> Cotton | <input type="checkbox"/> Nuts | <input type="checkbox"/> Other _____ | | |

Name of Commercial Farmer (Print) _____

Mailing Address or Physical Location _____

City _____ State _____ Zip _____

Tillage and Harvest

BMP Implementation Date: _____

- | | |
|---|---|
| <input type="checkbox"/> Bed Row Spacing
<input type="checkbox"/> Chemical Irrigation
<input type="checkbox"/> Combining Tractor Operations
<input type="checkbox"/> Conservation Irrigation
<input type="checkbox"/> Conservation Tillage
<input type="checkbox"/> Equipment Modification
<input type="checkbox"/> Limited Activity During a High Wind Event
<input type="checkbox"/> Multi-year Crop | <input type="checkbox"/> Night Farming
<input type="checkbox"/> Planting Based on Soil Moisture
<input type="checkbox"/> Precision Farming
<input type="checkbox"/> Reduced Harvest Activity
<input type="checkbox"/> Tillage Based on Soil Moisture
<input type="checkbox"/> Timing of a Tillage Operation
<input type="checkbox"/> Transgenic Crops |
|---|---|

Non-Cropland

BMP Implementation Date: _____

- | | |
|---|---|
| <input type="checkbox"/> Access Restriction
<input type="checkbox"/> Aggregate Cover
<input type="checkbox"/> Artificial Wind Barrier
<input type="checkbox"/> Critical Area Planting
<input type="checkbox"/> Manure Application | <input type="checkbox"/> Reduced Vehicle Speed
<input type="checkbox"/> Synthetic Particulate Suppressant
<input type="checkbox"/> Track-out Control System
<input type="checkbox"/> Tree, Shrub, or Windbreak Planting
<input type="checkbox"/> Watering |
|---|---|

Cropland

BMP Implementation Date: _____

- | | |
|--|---|
| <input type="checkbox"/> Artificial Wind Barrier
<input type="checkbox"/> Cover Crop
<input type="checkbox"/> Cross-wind Ridges
<input type="checkbox"/> Cross-wind Strip-cropping
<input type="checkbox"/> Cross-wind Vegetative Strips
<input type="checkbox"/> Manure Application
<input type="checkbox"/> Mulching
<input type="checkbox"/> Multi-year Crop | <input type="checkbox"/> Permanent Cover
<input type="checkbox"/> Planting Based on Soil Moisture
<input type="checkbox"/> Precision Farming
<input type="checkbox"/> Residue Management
<input type="checkbox"/> Sequential Cropping
<input type="checkbox"/> Surface Roughening
<input type="checkbox"/> Tree, Shrub, or Windbreak Planting |
|--|---|