ALABAMA A&M AND AUBURN UNIVERSITIES

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Soil Management To Protect Water Quality

Cropping And Nonstructural Agronomic Practices For Soil Management

Cropping practices and other agronomic management practices may be used very effectively for erosion and sediment control. These practices are effective because they either increase ground cover during erosive periods, increase infiltration, or actually trap eroded sediment. Some vegetative practices that increase plant residues or soil organic matter also reduce soil erodibility.

Common cropping and agronomic management practices to control soil erosion include crop rotations (including sod-based rotations), contour farming, strip-cropping, grass filter strips or field borders, row arrangement, timing of field operations, and soil fertility management. These practices usually require no special machinery and often are not much more expensive than conventional cropping practices. Other practices that could be more expensive or require additional equipment include change in land use, winter cover crops, temporary vegetation, critical area planting, mulching, and crop residue management.

Some of the more important practices, with the exception of residue management, will be discussed in some detail in the following paragraphs. Crop residue management will be discussed in an article on tillage in the water quality series.

Crop Rotations

Used by many farmers, crop rotations minimize the number of years fields are in row crops and allow for the application of many conservation practices.

The key to erosion-control success with crop rotations is soil cover. Grasses and legumes or small grains are more successful than row crops at protecting the soil from water and wind erosion. Grass cover crops convert nitrogen from the inorganic form to the organic form and keep nitrogen from leaching. Rye grass is often used as a cover crop on sandy soils. Legume cover crops can provide additional erosion protection and provide nitrogen for a subsequent crop. Hairy vetch and winter peas are being used as legume cover crops in no-till corn in the South. Smaller growing legumes are being tried in cotton.

Erosion is minimal during any period land has total vegetative cover such as that provided by permanent pasture or meadow. And even when a meadow is plowed under, it leaves the soil with improved infiltration and in a less erodible condition throughout the next year and sometimes for 2 years to come. Sod-based rotations may be essential to keep some highly erosive croplands in production under current USDA conservation compliance programs.

Contour Farming

Contour farming is the practice of tilling and planting across the slope. Because contour channels run across the slope, they prevent runoff from flowing directly downhill and gaining the velocity to cause rill and gully erosion, and they increase rainfall infiltration.

This practice is most effective on moderate slopes from 2 to 7 percent, where it can cut in half the erosion that occurs with uphill and downhill farming. Contouring is often used with terraces and runoff diversions. Contrary to popular belief, contouring can be made to work with large equipment.

On long or steep slopes, contouring also can be taken a step further with contour strip-cropping. This is when strips of sod are alternated with strips of row crops or small grain, all planted on the contour. An ideal method of conservation farming would be to include crop rotations within contour strips of sod, small grains, and row crops. This approach to contour strip-cropping can be fairly simple if the strip widths are multiples of the preferred farming width.

For example, consider an operator who farms in 30-inch rows with six-row equipment giving a width of 15 feet. Assume that the combine also has a 15-foot head. If the conservation plan calls for minimum-width buffer strips of 13 feet for every contour row crop strip of 60 feet, the filter strip could be more

easily rotated if it were 15 feet. (Four widths of 15 feet equals 60 feet.) By using strip widths that are multiples of the preferred farming width for all operations, a farm manager could fit small grain widths of 15, 30, or 60 feet into the same contour strip-cropping rotation sequence at a later date with no problems and have even greater erosion control benefits. Maintenance is easier if buffer strips are considered somewhat permanent.

On steep slopes or under intense rainfall, contouring without sod strips to slow runoff can actually increase the chances of gully erosion. Water stored in the rows can break through and run down slope causing severe erosion.

Strip-Cropping

With strip-cropping, alternating strips of forage or closely grown crops slow runoff and trap sediment from adjacent strips of row crops. The sod strips serve as filters when rows break, and much of the soil washed from a cultivated strip drops out of the runoff as it spreads within the first several feet of the sod strip.

During shallow water flow, a thick grass barrier will collect runoff water in front of it, so a good deal of the silt it carries actually settles out in the cropping area before it washes into the grass strip. A buffer strip can reduce sediment transport and, thus, the loss of herbicides attached to the sediment by as much as 30 to 50 percent.

During deep water flow on steep slopes, grass strips are ineffective. They can not stop sediment moving down hills in gullies or ravines.

The number of contour buffer strips needed depends on the slope of the field and the rate of water flow across it. Strips of 13 feet are the minimum width for NRCS standards. This is the minimum width needed for tillage and planting equipment designed to handle four 38- to 40-inch rows or six 24- to 26-inch rows. As the slope increases, the number of strips needed increases and the distance between them decreases.

Grass Filter Strips Or Field Borders

In addition to being contoured among crops on sloping fields, buffer strips used as field borders can protect streams and ponds from sediment damage. Although not a cure-all for keeping herbicides out of streams and lakes, grass waterways and buffer strips are a large part of many well-designed conservation compliance plans. Compared to terracing, they are usually cheaper to establish and easier to farm with and maintain.

To filter sediment, nutrients, and other pollutants from agricultural runoff before it enters surface water resources, vegetative strips at least 30 feet wide are needed. Vegetative filter strips from 66 to 99 feet wide can now be established along streams and water bodies on Conservation Reserve Program (CRP) lands.

Vegetative filter strips do more than just help stop erosion. If properly maintained, these filter strips of grass, shrubs, and trees provide food and cover for a number of wildlife species. Such strips provide attractive areas for nesting upland game birds and waterfowl. These areas also provide important escape cover and travel lanes around the water's edge where it is often most lacking.

Establishing Grass Filter Strips And Field Borders. The best grasses for filter strips and field borders tend to be sod-forming types such as fescue or slow-spreading rhizome grasses like bermuda. These produce a tight mat to slow the runoff and catch sediment.

Prepare the area to be seeded by grading, if needed, and by removing any brush. Apply and incorporate fertilizer; then firm up the seedbed. Increase the normal seeding rate for fall planting by at least 50 percent to gain a quick, thick stand. Remember, fescue is a cool-season grass that grows well during cool weather while bermuda, a warm-season grass, goes dormant during cold weather. Plant grass seed ¼ to ½ inch deep. (Bermuda can be sprigged.) If you broadcast, harrow lightly. Mulch the area with straw and anchor the mulch using a straight disk. Make only one trip over the mulch.

Mow strips the first year to keep the grass from going to seed and to encourage the grass stand to thicken. Fertilize as needed but try to keep crop herbicide applications off waterways and buffer strips. Interseeded legumes also can be used to supply nitrogen.

Maintaining Grass Filter Strips And Field Borders. Try not to drive over buffer strips or waterways, especially during the first year. Vehicle tire tracks could lead to gullying. If it is necessary to travel in field borders at times, lift farm implements high above the ground before crossing waterways or buffer strips. Be careful to maintain the width of buffer strips and waterways when tilling and planting crops near them. Mow waterways and buffer strips regularly to encourage sod formation and limit weed growth.

Row Arrangements

Arranging row patterns to provide drainage toward a desired outlet can be very beneficial. This practice is more effective on flatter slopes for draining runoff water through a grassed filter strip or grassed waterway prior to entering a stream. On slopes greater than 5 percent consult with NRCS for assistance in establishing a drainage gradient that will

not be erosive. Farm efficiency may even be improved by this practice.

Timing Of Field Operations

The season of plowing determines how long the land is bare. Delaying tillage from fall to spring can significantly reduce soil erosion losses. With fall tillage, the soil is exposed to the erosive forces of freezing and thawing and, thus, more susceptible to erosion from early spring rain. Moreover, with fall tillage soil porosity at planting time is generally less than with spring tillage. The primary advantage of fall tillage is more timely planting, especially where wetness is a problem in early spring. Generally, spring plowing, especially on steep slopes and in fields close to streams, is best for reducing soil loss and sediment associated water quality problems.

Soil Fertility Management

Improving soil fertility can help reduce soil erosion. An improved soil-fertility program will help the crop canopy to develop faster, and a crop canopy protects the soil from raindrop splash. In addition, an improved soil-fertility program can result in crops that leave more residue on the ground following harvest. These residues are extremely important in protecting against erosion.

Other Practices

Change In Land Use. Some land is simply too erosive for intensive farming, even when various conservation practices are put to use. When a combination of cropping practices does not do an adequate job of erosion control, a change in land use may be a more practical solution.

Winter Cover Crops. During the winter and early spring months, crops of close-growing grasses and legumes can be used for erosion control.

Temporary Vegetation. For short-term, seasonal soil protection, close-growing plants with quick-growth characteristics can be planted.

Critical Area Planting. Critically eroding areas should have permanent vegetation established on them.

Mulching. Erosive areas that have been newly planted with grasses or legumes can be further protected with applications of a biodegradable material, such as hay straw, animal manure, poultry litter, or wood shavings.

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