SELECTION AND PLANNING OF BEST MANAGEMENT PRACTICES (BMPs) ON THE MISSISSIPPI DELTA MSEA PROJECT

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INTRODUCTION

The Management System Evaluation Area (MSEA) project includes the study of three watersheds that include oxbow lakes. The chosen lakes are: (1) Deep Hollow-Leflore County, (2) Beasley Lake-Sunflower County, and (3) Thighman Lake-Sunflower County.

One of the major goals of this project is to identify, implement, and evaluate best management practices which have potential for use in the Mississippi Delta. A best management practice is the physical application of land and water management knowledge with the goal of protecting soil and water resources.

BEST MANAGEMENT PRACTICES (BMPs)

Selection Criteria

A multi-agency research project which evaluates and demonstrates best management practices (BMPs) on a watershed size area was begun in the Mississippi Delta in 1994. The (MSEA) project was proposed due to high rainfall amounts and intensities falling on intensively cropped watersheds. Many of the storm events occur during times of the year when soils are most vulnerable to raindrop impacts and subsequent runoff (USDA Handbook 537).

The erosive nature of the soils, combined with the highly refined drainage systems, result in sediment yields which cause water quality impairment to the abundant surface water resources of the Delta. The sediment also serves as a carrier of other potential pollutants; specifically, pesticides and nutrients. These non-point sources and their impact on the surface waters of the Mississippi Delta are the primary concerns of this project.

The Best Management Practices properly selected, designed, and applied should control water movement and limit introduction of pollutants.

Placing the BMPs into major headings leads to a clear and concise reasoning as to why practices were selected. The major practice types are:(1) Runoff reducing, dispersing, and filtering; (2) Erosion reducing (3) Delivery ratio altering; and (4) Pesticide and nutrient reducing.

Eddie Taylor of Worton, Maryland, probably says it best, "If you keep the soil where it belongs, nearly everything you apply to it stays put" (Progressive Farmer 1995). The first line of defense chosen to limit surface water pollution within the chosen watersheds (Deep Hollow, Beasley) was erosion reducing practices. These practices are designed to limit detachment and transport of soil particles. Soil detachment and movement are controlled by rainfall, soils, topography, cover conditions, and land use management.

Soils. The major land resource area (MLRA) known as the Southern Mississippi Valley Alluvium covers parts of five states. This area consists of 23 million acres of fertile, productive soils with fifty five (55) per cent being used for crop production (USDA-NRCS). The gently sloping to nearly level soils are deceiving to some degree in that erosion is considered relatively low. This is true when compared to the more steeply sloping, erodible soils to the east of the Mississippi Delta. Estimates based upon the USLE predict, however, that some of the Delta soils are eroding at levels greater than 10 tons per acre annually. This is twice tolerance and most often occurs on clean tilled cotton fields (USDA-NRCS-FOTG). Even though these levels have not yet impacted production, they are levels high enough to cause concern as related to water quality.

Rainfall. Rainfall dynamics has greatly aided our efforts in practice selection. Rainfall amounts, distribution, and energy intensity are known to be greatest at crop stage periods when soils are most vulnerable to detachment and movement (USDA - HB 537). Almost seventy (70) per cent of Mississippi rainfall occurs during periods of crop production called the residue and seedbed preparation periods. The rainfall during these periods which coincide with the months of November through May also account for approximately fifty eight (58) per cent of the energy intensity associated with falling rainfall. Simply stated, the erosion of the soil is greatest during periods of higher rainfall associated with bare soils exposed to raindrops falling at speeds up to 30 feet per second (Meyer, DeCoursey, and Romkens 1976).

Cover. The answer then seems simple! Delay tillage as long as practical to avoid the rainfall that is sure to come during the seedbed preparation period. Runoff and erosion plots at Holly Springs yielded 20 tons of soil per acre as the result of one rainfall event on May 31, 1982. We cannot always count on long term predictions of storm distribution to design a cover management system. Our first line of defense is in field erosion control practices which are governed by rainfall dynamics and cover management techniques. The practices falling within these perimeters then become:

(1) Conservation Cropping Sequence: A carefully devised crop production system which includes continuous row crop systems, crop rotations, tillage rotations and timing, use of close grown crops and narrow row technology. These are planned using the Universal Soil Loss Equation and the Revised Universal Soil Loss Equation.

(2) Crop Residue Use: The maximum utilization of after harvest residues to cover soils during significant rainfall events. Residue amounts, distribution, and persistence are considered in planning crop residue use.

(3) Conservation Tillage System: This is defined as any tillage system which leaves at least thirty (30) per cent of the soil surface covered after planting (USDA-NRCS-FOTG). This may be as complex as no-till cotton after a cover of vetch or as simple as reducing the number of tillage trips.

(4) Cover and Green Manure Crops: The planting of a cover during the residue period of the cash crop. This is planned when the residue from the cash crop is not adequate or the cultural practices common to the cash crop call for destruction of the residues.

The cover management system chosen for the Deep Hollow Lake watershed is a combination of all of the above mentioned with an emphasis on cover crops and no-till crop production. Proper linking of soils with adaptable crops seems a simple and most often pre-determined concern. Yet when looking at the impacts this simple decision has upon bio-mass production, canopy development, planting, and harvest dates and soil stability; it becomes a major component of the cover management system.

Cotton grows best on well drained soils. To enhance the already efficient drainage systems, most cotton is planted on raised beds or hipped rows. Timely planting also enhances cotton production. This leads the Delta farmer to hip in the fall after harvest. Studies by ARS-Sedimentation Lab have shown much greater potential for higher erosion rates and off-field sediment movement due to these tillage systems (Meyer and Harmon 1978). Soil protection on fields hipped in the fall must be accomplished by planting a winter cover crop. Early planting and proper plant selection will result in a quicker cover and achieve a greater quantity of bio-mass production at an earlier date in the spring. Wheat was the choice on the Deep Hollow Lake watershed. Wheat is economical to plant, can be established easily, quickly covers the row side slopes and middles, can be eliminated with less cost and effort than some other cover crops and produces a stable cover that does not quickly decompose. Planting procedures and timely burndown will limit excess residue and properly selecting a planter will go a long way toward making the no-till cotton following wheat an acceptable and workable choice on the Deep Hollow site.

Reducing, dispersing, and filtering runoff. Reducing runoff and dispersing the flow will limit transportability of sediment (Meyer, DeCoursey, and Romkens 1976). Deposition occurs when transport capability of the runoff is reduced to the point that detached and transported soil material can no longer stay in suspension. Practices which allow more opportunities for deposition within field boundaries or prior to entering receiving waters comprise another component of any BMP system. These practices may be structural or vegetative and include:

(1) Grade Stabilization Structure: The grade stabilization structure is designed to control outlets of concentrated flow and slow runoff prior to exiting the field. Many variations exist and many have been planned and installed at the Deep Hollow and Beasley sites.

Due to design limitations, some of the structures have less ability to slow runoff to the point of dropping its sediment load. However, the structure may be controlling development of gullies at the outlet end of concentrated flow areas. Most, however, are designed to slow and release flow 24 hour storm events, thus causing some deposition to occur. The types that have been installed are: Flashboard risers, slotted inlet and the more typical cantilever overfall pipe.

Where vegetative filter strip establishment and maintenance were suspect due to inundation caused by lake level fluctuations, the pipes were designed with extended levees.

Additional sites have been observed where flows are bringing excess sediment to field edges and the traditional pipe structure cannot be designed. These sites are being studied further for alternative methods of treatment. Such non-traditional methods as toe wall structures, rock rip rap structures, vegetative flumes, or grass hedges are being considered.

(2) Filter Strips: A grass strip 10 feet wide traps an estimated seventy (70) per cent of the soil leaving the field and twenty (20) to fifty (50) per cent of the chemicals (Kidwell 1995). Filter strips of tall fescue grass with widths of fifteen (15) feet have been strategically located at field edges and borders of surface ditches to filter runoff leaving the field in sheet flow. These vegetative measures serve as back up practices for the cover management practices. Tall fescuegrass was chosen due to scheduling and installation restraints. Fescue is not as resistant to herbicides, traffic, nor as effective in trapping sediment as some other species. Spring seeding of switchgrass will be evaluated in the spring of 1996. Due to the erect, stiff-stemmed nature of switchgrass and the resistance it shows to herbicide injury, this species shows much promise in the State of Mississippi. It should also perform better where runoff flow is concentrated.

(3) Grass Hedge: Not yet an approved NRCS practice, the strips or hedges of tall, stiff-stemmed grasses planted across slopes of cropped fields are extremely effective in concentrated flow areas where runoff depths tend to bend traditional grass choices and where sediment levels have potential to cover lower growing grasses. Grass hedges of suitable vegetation also have the ability to regrow after sediment accumulation (Meyer, Dabney, and Harmon 1995). The grass hedge is generally narrower than conventional filter strips and are more acceptable since they require less cropland for installation. Their efficiency at trapping fine silt and clay size particles is greatly diminished over their effectiveness in trapping sand size particles. This is also true for any of the grass filters. Switchgrass may become the grass of choice since the plant does not show the invader characteristics that some other species exhibit.

(4) Riparian Forest Buffer: The effect of riparian zones on agrichemical movement is not fully understood. It would be safe to say, however, that these naturally occurring barriers around most bodies of water in the Delta do have some ability to slow water movement and cause deposition. All of the selected watersheds have riparian zones which range in width from fifty (50) feet to as much as six hundred (600) feet from field edge to waterline of the oxbow lakes. Grassed filter strips were not planned where these riparian areas existed.

(5) Row Arrangement: Carefully arranged rows can result in adequate drainage and allow water movement to and sediment delivery to the field edge to be held to a minimum (Meyer 1981). This practice in many ways may be one of the most difficult to promote. Most Delta farmers have efficient drainage systems and arranging rows to move water as quickly from the field as possible is a major component of that system. Some common ground can be found, however, between the need for drainage and the need to control off site movement of sediment.

Pesticide and nutrient reducing. The Mississippi Delta is one of the major crop producing areas in the United States. Along with crop production goes the use of pesticides and nutrients and there is clear evidence that these have had an impact upon the water resources within the region. Limiting introduction and managing the use of these potential pollutants are the basis of the pest and nutrient management plan.

(1) Pest Management: Evaluating the need for applications by utilizing trained scouts and crop advisors is the primary component of an effective pest management program. The plan also calls for the use of and the following of all directions on pesticides labels. Proper storage and disposal of containers, careful mixing and loading, proper calibration of application equipment, timing of application in accordance with weather forecasts, and the use of equipment which allows for reduced levels of application are other components of an effective pest management program. Most pesticides leave the field attached to soil or organic particles. By reducing runoff and associated sediment and trapping and filtering runoff with other best management practices, the system becomes even more effective.

(2) Nutrient Management: Nutrients from agricultural non point sources have been identified as the main cause of cultural eutrophication in freshwater inland lakes of the United States with phosphorous being most often the

nutrient of concern (Daniel, Sharpley, Edwards, Wedepohl, and Lemunyon 1995). Nitrogen is the nutrient most subject to loss from the soil and much of this loss is due to leaching; therefore, the greatest attention should be given to managing nitrogen (Stanford, England, and Taylor 1970). Soil testing and application of nutrients based test results is the main component of the nutrient management plan. Fertilizer rates, formulation, and method of application can influence loss as much as any of the cultural decisions made during crop production. Placement, timing , splitting of applications, and planting of cover crops that take up excess nutrients or provide organic forms of nitrogen are planned methods of controlling movement of nitrogen or phosphorous into the surface or ground water supplies. All of the noted methods and components are incorporated into the MSEA plans of Deep Hollow.

Social Considerations

Technically correct and well conceived best management practice systems will not always be implemented unless other considerations are reviewed and allowed to become a part of the planning activity. The questions asked of each component of the plan were:

(1) Is it implementable?
(2) Is it economical?
(3) Is it functional?
(4) Is it manageable?
(5) Is it acceptable?
(6) Does it fit the system?
(7) Is it flexible?

If the plan is technically correct and all of the above concerns and questions can be integrated into the plan, it then becomes a workable solution. This is what we believe we have achieved on the MSEA watersheds.

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