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Flatwoods Citrus Best Management Practice: Soil Stabilization[1]

Chris Wilson, Liberta Scotto, Brian Boman , and Jack Hebb[2]

INTRODUCTION

This best management practice describes stabilization practices for erosion-prone soils within flatwoods citrus groves. Much of this information was taken from USDA-NRCS Code 342 and Chapter 13 of the *Florida Agromomy Field Handbook.* These sources should be consulted for more information.

Significant amounts of soil may be deposited in drainage ditches and canals due to the erosion of grove soils. These deposited soils reduce the cross-sectional area for the canal/ditch, thus reducing the capacity for holding and transporting water. In addition, very small soil fractions may be suspended in discharge water for significant amounts of time, ultimately settling out in slower flowing reaches or estuaries. Deposition in these slower flowing areas may destroy submerged aquatic habitats, resulting in the loss of fish, invertebrate, and plant species important for healthy ecosystems.

Figure 1. Coarse sediments removed from an agricultural canal. These sediments settled over several decades. Fine particle fractions likely deposited in the St. Lucie estuary, where water velocities are low. Credits: PCW

SOIL STABILIZATION PRACTICES

A variety of vegetative and non-vegetative slope stabilization methods are available. The following factors should be considered when choosing the soil stabilization methods for your particular situation:

1. Potential for damage due to erosion if soils are not stabilized (i.e. pump damage, downstream habitat damage, costs for repair, etc.);

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2. C. Wilson, Assistant Professor, Department of Soil and Water Science-UF/IFAS Indian River Research and Education Center. L. Scotto, Water Quality Extension Agent, Indian River County Cooperative Extension. B. Boman, Professor, Department of Agricultural Engineering-UF/IFAS Indian River Research and Education Center. J. Hebb, Multi-County Citrus Extension Agent, St. Lucie County Cooperative Extension.

2. Velocity of the water flow or wave action;

3. Steepness of the ditch bank side slopes;

4. Accessibility and practicality for maintaining vegetation at the site;

5. Costs for installation and maintenance.

Stabilization with plant ground covers is generally the least expensive method, but is only suitable for areas that are not subjected to high flow velocities or turbulence. More expensive, rigid materials are needed in areas subjected to high flow velocities or turbulence.

STABILIZATION USING PLANTS

Areas to be planted should be relatively flat (0 to 3:1 slope) if conventional equipment is used for planting and maintenance. When stabilizing erosion-prone areas using vegetation, only species that are adapted to the area where the grove is located should be used. Bare soil surfaces, (except directly underneath the tree canopy and tracks within road beds) should be established with appropriate plant species. The vegetation-free herbicide band underneath the tree canopy should not extend beyond the outer edge of the tree canopy. Generally, grassy species should be selected. These species generally have widely branching, dense root masses that hold soil in place. In contrast, broad-leaved plant species generally have fewer roots, and do not stabilize soils as well.

Figure 2. Well maintained vegetation on ditch side-banks. Credits: PCW

Maintenance of plant ground covers may be difficult and potentially dangerous in areas with unstable or very steep side-banks having a high potential for tractor-roll-over. Areas such as these may be better stabilized with durable, synthetic or natural materials that require little maintenance.

Considerations for Vegetation Establishment

1. Coordinate with plant suppliers before preparing areas to be planted. Depending on the species and season, not all species may be available and delays may result in substantial erosion.

2. The newly planted site will be especially vulnerable to erosion until the plants have become established. Temporary stabilization barriers should be used as needed to prevent erosion during plant establishment. These barriers may include hay bales, erosion control blankets, temporary seeding, nurse crops, and erosion control netting.

3. When the establishment site is located adjacent to water bodies (i.e. drainage ditches, canals, streams, etc.), measures should be taken to minimize movement of soil into them.

4. Apply lime and fertilizers to the planted areas as needed according to a soil test.

5. A fine seedbed should be prepared, distrubing only the minimum area necessary to do the work.

6. If compacted fill is needed before planting, add fill in six-inch layers. Compact each layer by tamping or watering before the next is added.

Selection of Plants for Use in Stabilization

Table 1 lists several species that are recommended by the USDA-NRCS (Code 342) for South Florida conditions. When evaluating the possibility of using plant species other than those listed in Table 1, several characteristics should be considered. Plants should:

1. be suited to the soil, site, and climate;

2. be perennial;

3. not spread rapidly outside the planted area;

4. require low fertility and low maintenance.

Seeded Vegetation

When establishing vegetation by seeding, adequate moisture is needed from irrigation or natural precipitation. Seeding without irrigation requires precise timing to avoid normally dry periods of the year. The NRCS recommends that plants be seeded at least six weeks before the dry seasons begin. For South Florida, recommended dates for planting are 1/15-2/28 and 6/1-9/15 (Code 342). Consider the following when selecting seed:

1. Do not use seed containing prohibited or restricted noxious weeds.

2. All seeds should meet Florida Seed Law requirements. Information on seed regulations can be found on the Florida Department of Agriculture and Consumer Services, Division on Agriculture and Environmental Services website, located at http://doacs.state.fl.us/~aes-fsflab/.

Protection of Seedlings

In some cases, it is necessary to protect young seedlings that are slower growing by planting a nurse crop and/or providing mulch. With nurse crops, the permanent grass seed is mixed with seed of a faster growing annual species. Establishment of the annual species is rapid, thus protecting soil from erosion in the short term, while the slower growing perennial species develops. The perennial species should be fully established by the time the annual species dies. If this is not the case, more seed/propagules should be applied to the area. Examples of nurse crops planted between September and February include: oats, rye, wheat, and ryegrass. Suitable nurse crop species planted between March and August include: brown top millet, pearl millet, Japanese millet (only species adapted for growth in poorly drained soil), and Proso millet 'Dove'. Consult NRCS Code 342 and the *Florida Agronomy Field Handbook* for more information on application rates and recommended seed specifications. Use of mulches, either alone or for seedling protection is described in a later section.

Vegetative Propagules

Establishment of plant ground covers using seed may not always be desirable or possible. Grove situations where high erosion potential exists demand rapid development of the ground cover. Some ground cover species can only be established using vegetative propagules because they do not propagate well from seed. Vegetative propagules include stolons, sprigs, and rhizomes. Consider the following when establishing by vegetative means:

1. Use only fresh, moist planting materials. Materials that are not fresh or that have dried out are much less likely to survive.

2. Plant material (rhizomes, stolons, crowns, etc.) should be spread over the prepared area uniformly. They should then be lightly disced into the top 1-2 inches using a cultipacker or other type of roller. Plugs should be planted using a transplanter or using hand-planting tools.

3. Sprigs should be dug from vigorous stands of plant material. They should be planted when actively growing and adequate moisture is available. NRCS recommended planting dates for South Florida are 6/1 through 9/15 (NRCS Code 342).

4. Rhizomes must be planted when they are dormant. Heavy mortality will result if the rhizomes are planted after breaking dormancy due to a lack of root reserves.

Vegetation Maintenance Considerations

Maintenance considerations are important when using plants for soil stabilization. Since most vegetative species will require mowing at some time, areas should be accessible for mowing equipment. Mowing of vegetation on steep slopes requires specialized equipment to lessen the danger of equipment roll-over and operator injury. When using herbicides for selective vegetation management, only use those materials that will not harm the soil-stabilizing species. If this is not possible, do not

apply the herbicides during the rainy season, when erosion potential is greatest. Always consult herbicide labels for species tolerance and use guidelines.

STABILIZATION USING MULCH-LIKE MATERIALS

A variety of non-vegetative erosion control materials are available for slope stabilization. Many of these materials may be used in combination with plant materials. These erosion control materials range from dry straw or hay to wood cellulose fiber mulches and a variety of erosion-control blankets. Other solid materials may also be used. These are considered in the following sections.

Dry Straw or Hay

Dry straw and/or hay provides temporary protection from erosion and is usually used in conjunction with planted materials. These materials should be spread evenly over the area at a rate of 75-90 pounds per 1,000 square feet so that over 75% of the ground surface is covered (Code 342). These materials are best suited for relatively flat areas. Intact bales of hay or straw should be placed across bare land areas/actively eroding areas where runoff water is channeled to intercept sediment loads.

Wood Cellulose Fiber Mulch

This method of soil stabilization is often referred to as hydro-seeding. Cellulose fibers (typically from recycled newspapers) are mixed with grass seed, fertilizer, and water with this method. The resulting slurry is then sprayed onto ground surfaces using hydraulic seeding equipment. This material has the added advantage that it is self-anchoring due to the wood cellulose fiber mulch and is suitable for steeper slopes. Liquid fertilizers, limestone suspensions, germination enhancers, moisture retention agents, mulch-binder agents, and a variety of other additives can be applied simultaneously to enhance germination and establishment of the grass. Large areas can be planted in a relatively short period of time using this method.

Jute Matting

Jute matting provides temporary protection from erosion and should be used in conjunction with vegetation establishment from seed. This material is an open mesh, woven, heavy jute twine that has the strength to withstand water flow. It degrades naturally in the environment. Consult matting manufacturers for specific planting instructions. According to the USDA-NRCS, half of the seed may be sown before the matting is laid. The other half may then be applied after the matting is laid. The matting is held in place using staples, placed at 5-6 foot intervals on the edges and down the center of each roll. The manufacturer of the matting should also supply the appropriate staples. The outer edges should be stapled sufficiently to prevent wind or water from lifting the matting.

Bonded Fiber Blanket

Bonded fiber blankets are longer lived materials, relative to jute matting. Bonded fiber blankets also provide temporary protection from erosion and are used in conjunction with plant establishment. These materials are available in a variety of forms. They typically consist of a plastic mesh netting laminated to one side of a mulch blanket, or woven through the mulch blanket. Straw and coconut fiber are the most common mulches commercially offered. Specific blankets are commercially available that are suitable for use on irrigation/drainage ditch and canal side banks, as well as on other steep, erosion-prone slopes. Consult the manufacturer's representative for advice on the appropriate material for specific applications. Materials will vary depending on side-bank slopes and water flow velocities. These blankets are usually unrolled and stapled over a prepared and seeded surface. Follow manufacturer recommendations for installation.

Solid Re-enforcement Materials

Solid re-enforcement materials are often needed in areas subject to very high water velocities and on very steep slopes. These materials are more permanent than the other methods, and may or may not be used in conjuction with vegetation. These materials (Figures 3-6) can range from poured concrete to rip-rap, broken concrete blocks/materials,

bricks, gabions, or other solid materials. If very coarse materials (such as crushed concrete) are used in areas subject to high flow velocities, a relatively impermeable material (i.e. woven landscape fabric, rubber pond/roofing liner, etc.) should be placed underneath to prevent erosion of the underlying soil. Care should be taken when working around such stabilization materials, since they may create desirable habitat for a variety of snakes, reptiles, and other types of wildlife.

Figure 3. Ditch side-bank stabilization using broken concrete refuse. Credits: PCW

Figure 4. Stabilization of a grove crossing with concrete wall structures. Credits: PCW

Figure 5. Canal bank stabilization in a high velocity area using a hardened synthetic ground covering. Credits: PCW

Figure 6. Use of gabions for stabilization of a canal side-bank. While expensive, these materials effectively prevent erosion in canal/ditch areas subject to high flow velocities. Credits: BJB

REFERENCES

Code 342. Natural Resources Conservation Service (NRCS) Conservation Practice Standard - Critical Area Planting. Contact local NRCS Office.

USDA/NRCS. *Florida Agronomy Field Handbook*, Chapter 13, Critical Area Planting, Code 342, 190-FLAGRFH. 12 pages.

Yarlett, L.L. 1996. Common Grasses of Florida and the Southeast. The Florida Native Plant Society, Spring Hill, FL. 168 pages.

Table 1. Selected species adapted for growth in South Florida. Taken directly from USDA-NRCS *Florida Agronomy Field Handbook*, Chapter 13. See reference for other species.

Reccommended Plants	Comments
Scarified Bahiagrass (Pensacola, Argentine)	Slow to establish. Should be used in combination with faster-growing species in areas where rapid coverage is needed.
Scarified Bahiagrass+Hulled Common Bermudagrass	Bermudagrass provides rapid germination and coverage, while the Bahiagrass is deeper rooted, providing more stabilization.
Hulled Common Bermudagrass	Germinates rapidly, low-growing, drought tolerant, low nutrient requirements.
Common Centipedegrass	Germinates rapidly, low-growing drought tolerant grass with low nutrient requirements. Seed is expensive.
Common Lovegrass	Bunchgrass well adapted to excessively drained soils. Not a good species to use in waterways alone.
Common Lovegrass+Common Bermudagrass	Mixture of bunchgrass and stoloniferous grass capable of stabilizing waterways on excessively drained soils.
Switchgrass (Alamo)	Perennial tall grass adapted to a wide range of soils and drainage conditions. Also a herbicide tolerant waterway lining. Can only be mowed to 8-12 inches.
Coastal Panicgrass	Perennial tall grass for well and excessively drained soils. Must be drilled 1 inch deep.
Maidencane (Halifax)	Perennial rhizomatous grass adapted primarily to poorly drained soils. Best suited to waterway lining and shoreline protection.
Limpograss (Bigalta, Floralta, Greenalt, Redalta)	Perennial stoloniferous grass adapted primarily to poorly drained soils.