CRITICAL AREA PLANTING

Conservation Practice Standard 342 Guidance

Natural Resources Conservation Service (NRCS) **August 2006**

.

PURPOSE

The purpose of this guidance is to provide additional information for critical area planting operations outlined in Florida NRCS Conservation Practice Critical Area Planting, Code 342.

Soil Amendments

If practical, use a current soil test (< 3 yr old) processed by the IFAS Extension Soil Testing Laboratory or equivalent laboratory to determine the need for liming materials and plant nutrients. Plant nutrients also can be supplied from animal or poultry manure, agricultural by-products, or commercial fertilizer. Animal and poultry manure and other agricultural by-products (see http://edis.ifas.ufl.edu/SS315) can be sources of nutrients, but the material needs to be analyzed for nutrient content prior to use. When a laboratory analysis is not available use the book values in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 4 – Agricultural Waste Characteristics, to estimate nutrient content.

If a soil test can not be made, use the following nutrient rates:

- Apply 1 to 2 tons per acre (45 to 90 lb per 1,000 sq ft) of finely ground dolomite or agricultural limestone per acre.
- For grasses, other than native species, seeded alone use 40 to 50 lb per acre (or 1 lb per 1,000 sq ft) of nitrogen, phosphorous, and potassium at planting and annually each spring. This can be supplied by 400 to 500 lb per acre (or 8 to 12 lb per 1,000 sq ft) of a 10-10-10 formulation. Apply an additional 30 to 60 lb (or 1 to 2 lb per 1,000 sq ft) of additional nitrogen as ammonium nitrate or ammonium sulfate when grass has emerged and begun growth. If native species are planted, follow recommendations for legume plantings.
- For legumes alone or grass and legume mixtures, apply only phosphorous and potassium by using 200 to 400 lb per acre (or 4 to 8 lb per 1,000 sq ft) of a 0-10-20 formulation at planting.
- For woody ground covers, shrubs, vines, and trees planted on prepared seedbeds apply 100 lb per acre (or 2 lb per 1,000 sq ft) of nitrogen, phosphorous, and potassium in 3 split applications during the growing season. This can be supplied by 1,000 lb per acre (or 24 lb per 1,000 per sq ft) of a 10-10-10 formulation.

Application of Soil Amendments

When conventional seeding methods are used:

- Amendments (liming materials and plant nutrients) need to be uniformly applied and thoroughly mixed in to the soil during seedbed preparation when broadcast or drilled planting methods are used.

- When planting individual plants, broadcast liming material on top of ground before preparing holes or furrows. Mix fertilizer with the soil used to fill around plants or placed in separate holes or furrows 3 to 6 inches to the side of plants. When dibbles are used for planting, the fertilizer needs to be placed in a side furrow.

When hydro seeding equipment is used:

- Use only commercial fertilizers and mix them with water in the hydro seeder. This mixture is applied after the seedlings are established. Do not mix fertilizer in the seed-inoculant mixture as it may kill the inoculant.
- Liming materials may be added to the seed-inoculant mixture and applied at seeding or it may be applied with the fertilizer mixture.

Plant selection

Only perennial plants are suited for critical area plantings and the planting is not considered completed until perennial vegetation is established. Because perennials can be slow establishing, short term temporary cover (nurse crop, Table 1) may be necessary.

Care should be taken when seeding perennials with a nurse crop. Faster germination and growth rate of annual nurse crops can result in excessive competition for the perennial species and result in poor perennial establishment.

Perennial warm season herbaceous species approved for use on critical areas are listed in Tables 2 and 3. **At this time, there are no cool season perennial grasses recommended for Florida.** Other herbaceous material not listed here may be suitable, but they need to be approved by the State Agronomist before use.

Seed specifications

- All seed used needs to meet the requirements of Florida Seed Law (http://www.flaes.org/statutesandrules.html).
- Make sure the seed lots used do not contain any prohibited or noxious weeds seeds (see http://www.doacs.state.fl.us/pi/enpp/botany/images/noxiousweedtable1.pdf).
- Do not use a seed lot if the seed has less than 95 percent purity and/or less than 85 percent germination rate without adjusting the seeding rate up based on Pure Live Seed (PLS, see box on page 3). Vegetation established with seed that has low PLS levels often has poor vigor and grows slowly.
- Use inoculant appropriate for the specific legume(s) planted and prior to

Table 1. Annual crops for use as nurse crop.

	Seeding Rate	
	Lb/acre	Lb/1,000 sq ft
Crop – Cool Season[1]		
Oats[2] (*Avena sativa*)	65	1.5
Rye[2] (*Secale cereale)*	45	1.0
Wheat[2] (*Triticum aestivum*)	45	1.0
Annual Ryegrass[3] (*Lolium multiflorum*)	15	0.5
Crop – Warm Season[4]		
Browntop Millet[5] (*Urochloa ramosa*)	20-30	0.5
Pearlmillet[5] (*Pennisetum glaucum*)	20-30	0.5-0.75
Japanese Millet[5] (*Echinochloa frumenatacea*)	20-30	0.5-0.75
Proso Millet (*Panicum miliaceum*)	20-30	0.5-0.75

[1]Seeding is to be done between September and February.

[2]See (http://edis.ifas.ufl.edu/AG175) for more information on small grains and see local extension office for recommended cultivars.

[3]See local extension service for recommended cultivars or see (http://edis.ifas.ufl.edu/AG104).

[4]Seeding is to be done between March and August.

[5]See (http://edis.ifas.ufl.edu/AG157) for more information on warm season annual grasses and see local extension office for recommended cultivars.

the expiration date stamped on the package. Due to extreme conditions often encountered in critical areas, appropriate spreader/sticker needs to be used. Additionally, consider pelletizing the seed prior to planting. For more information on inoculants, see http://edis.ifas.ufl.edu/AG152).

Vegetative planting material specifications

Some species of plants must be planted vegetatively. Follow current University of Florida recommendation for planting vegetative material. Minimally follow the recommendation below:

- Be sure that planting material (sprigs or tops) is from nurseries that are pure as to species or variety and free from common bermudagrass or other weedy grasses.
- Sprigs (consisting of underground rhizomes, plant crowns, and/or stolons) can be dug in mid to late winter before the plant starts growing (before breaking dormancy). Later digging time in the spring usually means plants will have lower levels of energy reserves and poorer shoot development.

"Pure Live Seed" or **PLS** represents the percentage of the material in a bag of seed that is viable seed of the desired species. PLS is not shown on the seed tag.

PLS is determined by multiplying the per cent of pure seed times the per cent of germination. (The % purity and % germination are listed on the seed tag.)

For example, a bag of switchgrass seed has 70% germination and 80% purity.

PLS = 70% germination X 80% purity divided by 100, or 56%. In other words, only 56% of the material in the bag is germinable seed.

The PLS is then used to determine the amount of seed to be used. The actual seeding rate is calculated by dividing the recommended seeding rate by the PLS.

For example: 10 LB/A divided by 0.56 = 17.9 LB/AC. You will need to plant 17.9 LB/A of the switchgrass seed to provide 10 LB/A of pure live seed per acre.

Table 2. Seeded perennial herbaceous warm season species or mixtures.

Species (Area Adapted in State)[1]	Lb /A	Comment
Bahiagrass[2] (*Paspalum notatum)* (N, C, S/ST)	50	Slow establishing, use nurse crop
Bahiagrass + Partridge pea (*Chamaecrista fasiculata*) (N, C, S/ST)	50 + 10	Grass/legume mixture
Switchgrass (N, C, S/ST) (*Panicum virgatum*)	10	Native grass adapted to wide range of sites, do not mow below 8-12 inches
Switchgrass + Partridge pea (N, C, S/ST)	10 + 10	Native grass/legume mixture

[1]See Figure 1.

[2]See local extension service for recommended cultivars or see http://edis.ifas.ufl.edu/AA184.

Fig. 1. From 26 Ecological Communities of Florida, 1989, p. 146, Soil and Water Conservation Society, Gainesville, FL.

- Tops (green stems) also can be used to plant most grasses in the summer rainy season, but the grass needs to be have at least six weeks or more of growth when harvested for planting.
- In the spring, when top growth reaches four to six inches, delay digging and planting of sprigs until after the first hay harvest or harvest of tops for planting. After the first hay harvest, sprigs can also be dug for summer planting.
- Do not allow planting material to dry out or go through a "heat" after harvesting as this greatly reduces quality of the planting material. Time digging or harvesting of planting material so that planting occurs the same day during the summer or within 24 hr in the early spring. Dig or harvest no more than can be planted in one 24-hr period.

Seedbed Preparation

Seedbed preparation is not required where hydraulic seeding or conservation tillage is being used to establish vegetation.

When conventional planting methods are used for broadcast or drilled plantings (seed or vegetative), soil needs to adequately loosened with tillage equipment (e.g., plow, disc, etc.) to a minimum depth of 6 inches to alleviate compaction and then smoothed and firmed for proper placement of seed or sprigs. Tillage operations need to be done on the contour where feasible.

When conventional planting methods are used for individual plants, prepare seedbeds by digging holes, opening furrows, using dibbles or other means appropriate for the plants to be used. Openings need to be large enough to accommodate plant roots without crowding or bending the tap root. See NRCS Conservation Practice Standard Tree/ Shrub Establishment, Code 612, for more information.

Where pine seedlings are to be planted on compacted soils, subsoil under the row 24-inches deep on the contour 4 to 6 months prior to planting when soil is dry.

Table 3. Vegetatively planted perennial species.

Species (Area Adapted in State)[1]	Rate or Spacing	Comment
bermudgrass[2], hybrid (*Cynodon dactylon*) (N, C, S/ST)	Sprigs or stems at 1,000 – 2,000 lb/A	Well drained sites, high nutrient requirement
cordgrass, marshhay (*Spartina patens*) (N, C, S/ST)	Sprigs on 18" X 18" spacing	Sandy saline to brackish flats, low dunes, and tidal shore; and inland sites from waters edge to upland sites, high maintenance
Maidencane (*Panicum hemitomon)* (N, C, S/ST)	Rhizomes on 12" X 12" spacing	Adapted to freshwater sites, waterway lining, and shoreline up to 2 inches deep
panicum, bitter (*Panicum amarum)* (N, C, S)	Rooted cuttings on 18" X 18" spacing	Moderately to excessively drained upland sites on the coast or inland, bluish color
peanut, perennial[4] (*Arachis glabrata)* (N, C, S)	Sod (or rhizomes at 80-120 bu/A)	Moderately drained sites, slow establishing from rhizomes
stargrass[5] (*Cynodon* nlemfuensis) (S/ST)	Stems at 1,000 – 2,000 lb/A	Somewhat poorly drained to moderately drained sites, high fertility

[1]See Fig. 1.

[2]See local extension service for recommended cultivars or see (http://edis.ifas.ufl.edu/AA200).

[3]See local extension service for recommended cultivars or see (http://edis.ifas.ufl.edu/AA218).

[4]See local extension service for recommended cultivars or see (http://edis.ifas.ufl.edu/AA183).

[5]See local extension service for recommended cultivars or see (http://edis.ifas.ufl.edu/AG154)

Planting - Seed or Vegetative Material

Freshly prepare and firmed seedbeds are a must for conventional seeding procedures. Distribute the seed uniformly over the area to be treated with a cultipacker seeder or other mechanical seeder, or by hand.

Adjust seeder so that proper seeding depth is used (usually ½ to 1 inch or see individual planting recommendations) or by disking or cultipacker if broadcast on surface or hand planted. Following the planting operation, the area needs to be cultipacked or firmed with other mechanical or manual methods to ensure good soil contact with seed.

Planting dates for warm season perennials establishment are:

- North Florida – March 1 to August 15
- Central Florida – February 1 to March 15 or June 1 to August 31
- South Florida – January 15 to February 28 or June 1 to September 15

Warm season seeded perennial grasses can be planted with a cool season nurse crop in September through January, but the site need tol be inspected the following summer to ensure adequate stand has established.

Vegetative material can be planted with a commercial sprig planter or large roll bale planter (tops only). A spinner- or slinger-type planter can be used to broadcast either sprigs or tops. Small areas can be hand planted by distributing the material (tops only) evenly over the prepared surface at the rate of 25 to 50 lb per 1,000 sq ft (equivalent to 1,000 to 2,000 lb per acre).

If a large bale planter, slinger, or hand planting method is used, cover the planting material immediately after planting with a disk harrow to depth of 2 to 3 inches. Long tops (stems) can also be pushed into the soil with a "fairway-type" roller.

Regardless of planting method, pack the soil with a heavy roller after planting so that soil capillarity can be established which will keep the soil moist around the planting material.

No-till seeding can be done in killed cover crops or in temporary cover that is sparse enough to allow adequate growth of the permanent species. The appropriate seeding equipment needs to be used for no-till planting.

For hydraulic seeding, seed, inoculant if required, and a seed carrier is mixed with water and applied as slurry, uniformly over the area to be treated. The seed carrier can be a cellulose fiber, natural wood fiber or cane fiber mulch material which is dyed an appropriate color to facilitate uniform application of seed. Use the correct inoculant at four times the rate specified on the package, and apply the seed-inoculant mixture within one hour after mixing. Do not mix fertilizer with the seed-inoculant mixture. Fertilizer needs to be applied in a separate operation after seedlings are established.

Planting – Individual Plants

Consider normal growth rate and proper form when trees and shrubs are planted. Wider tree spacing than desired for commercial plantings is generally better for wildlife. Planting density should be higher on areas where survival will be low or there is an erosion hazard.

When inter-planting in a scattered stand of existing desirable trees or shrubs, seedlings should not be planted closer than the expected canopy diameter at breast height plus 10 feet (i.e., no closer than 20 feet for a tree having an expected canopy diameter at breast height of 10 feet.)

Trees, shrubs, vines, and sprigs can be planted with appropriate planters or hand tools. Plants will be planted in a manner that avoids crowding the roots. A hole should be three to five times the width of the rootball or container and the depth 12 inches or deeper in the center to accept the rootball or rootmass. Machine planting should create a trench about 4-inches wide and 15 inches in depth.

Firm the soil around the roots, and if possible, apply water to settle soil around the roots and prevent drying out of shrubs, vines, and sprigs.

Plant nursery stocks at the same depth or slightly deeper than they grew at the nursery. The tips of vines and sprigs must be at or slightly above the ground surface (Fig. 2).

Planting trees during December through January will provide the best survival. Deciduous shrubs are best planted during late winter; late fall planting is best for evergreen shrubs. Containerized seedlings or burlapped (a.k.a., “balled”) stock can be planted at almost

Fig. 2 Wiregrass (*Aristida* sp.) transplants.

any time during the year **as long as the plants are stored, handled and planted properly, and receive adequate post-planting water and care.**

Consult Florida Plant List for Conservation Alternatives [FOTG II (g) (1)] for approved trees and shrubs and Florida NRCS Conservation Practice Standards Tree/Shrub Establishment, Code 612, for more details on planting.

Mulch

Use mulch on all slopes steeper than 3% and when grass or legumes are planted so late in the fall and winter that germination cannot be expected until spring, on dams and spillways, and on road banks.

Straw bales placed on the contour can be used in addition to mulch on long slopes. Place bales end to end and anchor each individual bale with two stakes.

Dry straw or hay used for mulch needs to be free of weed seed and applied at the rate of 1.5 to 2 tons per acre (75 – 100 lb per 1,000 sq feet) so that above 75 percent of the soil surface is covered.

Wood cellulose fiber used as carrier in hydraulic seeding operations functions as a self-sticking mulch when applied at 500 lb per acre.

If jute matting is used as mulch, half the seed needs be planted prior to the matting being is anchored down and the remainder planted afterward. Anchor jute matting on all edges and down the center of the roll at 5- or 6-foot intervals.

Bonded fiber blankets (1/4 X 1/4 inch plastic mesh laminated to a mulch blanket) can be used on areas highly susceptible to wind or water erosion. Unroll blankets and secure in place after the area has been seeded.

Regardless of the mulching method used, the mulch needs be secured immediately after placing by one of the methods listed:

- Manual – with a square spade, cut mulch in along the contour in 18-inch rows.
- Mulch anchoring tool – an implement with flat notched disks that punches or anchors the mulch into the soil to a depth of three inches. (A farm disk set straight and weighted also can be used.) The site should be moist, free of stones or other obstructions, and loose enough to allow penetration.
- Mulch netting – light weight paper, jute, plastic or wire netting which is unrolled and stapled along the edges and down the center at 5- to 6-foot intervals.
- Peg and twine – after mulch is applied wooden stakes or pegs, 8- to 10-inches long, are driven in the ground to within 2 to 3 inches of the soil surface. Twine is then stretched between the pegs in a criss-cross pattern and secured.
- Pick chain – a rolling spike-chain implement used on slopes of 3:1 or steeper.
- Petroleum-derived mulch – a liquid that is sprayed on in a thin continuous film. It will generally remain intact for a period of 4 to 10 weeks.

See Florida NRCS Conservation Practice Standard Mulching, Code 484, for more information.

Irrigation

Use irrigation when available and needed to ensure establishment. Irrigation may be particularly critical for vegetatively established plants. Irrigation needs be applied at a rate that will not cause erosion.

ADDITIONAL INFORMATION WHEN RESTORING COASTAL BEACH SITES

There are only a few plant species that tolerate the stresses of a beach environment. Beach plants must be able to survive being buried by blowing sand, sand blasting, salt spray, salt water flooding, drought, heat, and low nutrient supply. Many plant species that occur in these areas have actually developed specific attributes to help them survive these harsh environments. These include high growth rates, dense root systems, low profiles, and high flower and seed production rates.

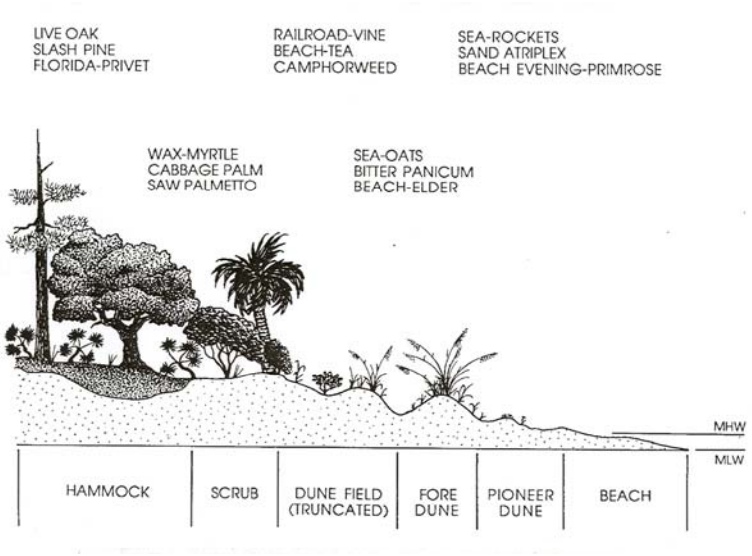

Fig. 3. Typical Florida sand dune showing common vegetation patterns. MLH – Mean High Water, MLH-Mean Low Water. (from Barnett and Crewz,1997).

Beach environments are characterized as low, moderate, and high energy depending on the wave and wind forces acting on the shoreline. The high energy Atlantic coast of Florida has extensive dune systems, while the Gulf Coast south of the Panhandle is relatively low energy and dunes are limited from Anclote Key to Marco Island to the barrier islands. In the Panhandle area, moderately high energy levels have resulted in well sorted “sugar” sands that are nutrient poor. In areas where extensive dune erosion occurs or off shore sand sources are scarce, dunes may be absent.

Wave action prevents the establishment of vegetation on the actual beach area, that area between high and low tides. Landward of the highest tides, pioneer and fore dunes (see Fig. 3) develop by sand trapping action of low growing forbs such as searocket (*Cakile* spp.) and rhizomatous grasses such as seaoats (*Uniola paniculata*) and bitter panicum (*Panicum amarum*). Dune fields, a series of older dunes that are more stable and have higher organic matter, occur landward of the fore dune area. When sufficient organic matter accumulates, colonizing woody vegetation such as wax-myrtle (*Myrica cerifera*) and cabbage palm (*Sabal palmetto*) form a dense scrub/shrub zone that transitions into the maritime forest and hammocks with pines (*Pinus* spp.), live oaks (*Quercus virginiana*), and other species.

Table 4 lists species and recommended selections generally commercially available for Florida coastlines (additional information on plants for coastal restoration can be found at http://plant-materials.nrcs.usda.gov/coastalareas.html). Use local ecotypes when recommended selections are not available or prohibited.

Site preparation

Before starting, permits for installing sand fences, dune walkover structures, and planting are required from the Florida Department of Environmental Protection (FDEP) and possibly local governments. Contact appropriate FDEP (http://www.dep.state.fl.us/beaches/) for more information.

As with inland areas, mechanical reshaping of the dune or beach area may be necessary prior to planting. Sand trapping devices such as sand fences or brush matting need to be included in the revegetation/stabilization plans when appropriate.

A sand fence is an artificial barrier of evenly-spaced wooden slats or approved fabric, erected perpendicular to the prevailing winds, and supported by posts. It reduces the velocity of the wind at the ground surface and traps blowing sand. Sand fences are used primarily to build frontal dunes.

Table 4. Species generally commercially available for Florida coastal sites.		
Species	**Recommended Site**	**Comment**
Codgrass, Salt Meadow or Marshhay (*Spartina patens*)	Back dunes to saline meadows	Perennial, rhizomatous warm season grass less than 40-inches tall. Three cultivars are recommended in Florida: 'Flageo', 'Sharp', and 'Avalon'.
Cordgrass, Smooth (*Spartina alterniflora*)	Intertidal areas of low energy shores to salt marshes	Dominant plant in the regularly flooded intertidal zone. 'Vermillion' was released by the Golden Meadows, LA, Plant Materials Center.
Panicgrass, Coastal (*Panicum amarum* var. *amarulum*)	Mid to upper areas of frontal and back dunes	A strong, perennial, short rhizomatous, salt spray tolerant grass 3 to 7 feet plus in height. The selection 'Atlantic' is recommended.
Panicum, Bitter (*Panicum amarum*)	Mid to upper areas of frontal and back dunes	Perennial, warm season grass, prostrate to a height of 7 feet. The cultivars 'Northpa' and 'Southpa' are recommended for Florida. The selection 'Fourchon' may be adapted to the panhandle area.
Mangrove, Black (*Avicennia germinans*)	Upper intertidal to lower supratidal areas of low energy shoreline	A native shrub or small tree with elliptical, evergreen leaves. A selection called 'Pelican' has been released by the Golden Meadow, LA, Plant Materials Center, but it has not been tested in Florida.
Seaoats (*Uniola paniculata*)	Mid to upper areas of frontal and back dunes	Perennial, erect, strong, rhizomatous, colonizing grass. Local ecotypes readily available. The selection 'Caminada' released by the Golden Meadow, LA, Plant Materials Center may be suitable for the panhandle region of Florida.
Sunflower, Beach (*Helianthus debilis*)	Lower to upper areas of frontal and back dunes	Low growing, broadleaf plant with yellow daisy-like flowers. Acts as a perennial in south Florida and as a reseeding annual further north. The selection 'Flora Sun' is available in the nursery trade.

Use of sand fences is more effective than using vegetation alone to build the dune in width and/or height. Although sand fences are more expensive than using vegetation alone, they are much less expensive than using dozers and/or dredges.

Where turtles and pedestrians do not need access to the beach:

- Erect two sand fences parallel to the water line, 30 feet apart and a minimum of 100 feet (horizontal distance) inland from the mean high tide (MHT) line.
- As the fences fill with sand, additional sets of fencing can be placed over the original ones until the coastal dune has reached the desired protective height (see Fig. 4).
- To widen an old dune, fencing should be set seaward, 15 feet from the base of the old dune.

Fig. 4. Primary and secondary sand fence.

Where turtles and pedestrians require access to the beach, fence sections need to be no longer than 10 feet and placed 7 to 10 feet apart. Each section needs to be angled to the recommended alignment for the different areas

of Florida to take advantage of prevailing wind (see Figure 5 and Table 5).

Fig. 5. Sand fence installation where turtle nesting is a concern.

Table 5. Recommended sand fence alignment for Florida when turtle nesting is a concern.

Area of State	Direction
Northern Atlantic coast	NW-SE
Southern Atlantic coast	NE-SW
Eastern panhandle coast	NE-SW
Central panhandle coast	NE-SW
Western panhandle coast	NW-SE
Southern Gulf coast	NW-SE

Consult Florida Dep. Environ-mental Protection, Bureau of Beaches and Coastal Systems (http://www.dep.state.fl.us/beaches/) and/or U.S. Fish and Wildlife Service (http://southeast.fws.gov) for more information.

Plant Material Criteria and Planting

Because seed is difficult to acquire, most coastal sites are stabilized using vegetative transplants produced by commercial growers. Plants in 2- to 4-inch pots are generally adequate for most stabilization and building work. Liners (1-inch pots) can be used when irrigation is available. Pots larger than 4 inches are necessary only where aesthetics or traffic control is important, or erosion is severe.

Use a tree dibble or spade to plant larger vegetative materials. Large, flat sites can be planted more economically using a tractor-drawn transplanter with planting plows that create furrows 8- to 15-inches deep.

Plantings should be a minimum of 10-feet wide, but wider areas may be required on more severely eroded sites. Plant spacing ranges from 1 to 3 feet in the row, but are typically 18 inches for 1- to 4-inch potted stock or bare root plugs and stolons of the same size. Spacing between rows varies from 1 to 3 feet; stagger plants in adjacent rows to prevent aisles.

.A water adsorbing polymer gel product such as Terrasorb® that has been hydrated according to label directions can be placed in the hole prior to the plant. Use between 8 and 12 oz of hydrated gel per transplant with the higher rates used during the dry season. Large quantities of gel can be mixed in water troughs and transported close to planting site with a four wheel drive vehicle. Smaller quantities of gel can be carried to planting crew using 2.5 to 5 gal buckets.

Fertilization

Initial fertilization is best done at planting with a complete slow-release fertilizer such as Osmocote® 14-14-14 or other slow release fertilizers with similar analysis. Fertilizer can be mixed with hydrated polymer gel just prior to planting or place one ounce per plant under each plant while planting. If mixing with gel, estimate the number of plants to be planted with a bucket of gel and then add appropriate amount of slow release fertilizer.

Initial fertilization may also be provided with 200 to 300 pounds of mineral 10-10-10 per acre, broadcast six weeks after planting. A follow-up fertilization in the second year is recommended in June at a rate of 400 pounds of 10-10-10 per acre.

Apply maintenance fertilization twice annually during the growing season with up to 400 pounds of 10-10-10 per acre split into two applications and applied before September 1. Fertilization is recommended until the plants spread enough to provide complete cover and stands retain good vigor after any storm damage.

Irrigation

Irrigation is advisable, where practical, on all dune plantings to insure adequate moisture during the initial establishment period, particularly if hydrated polymer gel has not been used. The irrigation system consist of mains and laterals, control zones, supports, control valves, fittings, and related hardware that is capable of applying 1/2 inch of water over the entire zone in an 8-hour period.

Irrigation lines need to be located on the windward edge of the planting to compensate for the effect of the wind. Low pressure irrigation systems, those with pressures similar to that found in houses (20 to 50 pounds per square inch) need to have sprinkler heads and irrigation lines spaced no farther than 20 feet apart to minimize wind spray. Field test designs at higher pressures in the wind to plan the spacing. Trickle irrigation can also be used.

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