FOR125

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Overview of Pine Straw Production in North Florida: Potential Revenues, Fertilization Practices, and Vegetation Management Recommendations[1]

Patrick J. Minogue, Holly K. Ober, and Stanton Rosenthal[2]

Introduction

Pine straw is a popular mulch in residential and commercial landscaping for its color, easy placement, and cost. Pine straw raking in Florida is a relatively new enterprise, but as of 2005 it has grown to be a 79 million dollar industry, which is about the same as the value of pulpwood in our state (Hodges et. al 2005). Pine straw moves to market in a variety of ways but the most common is for a pine straw company to pay an annual lease to take the straw. Annual leases may range from 70 to more than 100 dollars per acre, representing substantial potential revenue for landowners.

Longleaf pine and slash pine are the favored southern pine species because their long needles bail well. Pine needle raking may begin when stands are as young as eight years old, when pine needle yield is expected to be between 100 and 150 bales per acre. Maximum pine needle yields occur at about age fifteen when between 200 and 300 bales per acre can be obtained (Duryea 2003). Pine straw must be free of fallen branches, pine cones, twigs, and other vegetation (Figure 1). Prior to raking a cleanup is needed to place debris into piles and often to control groundcover or understory vegetation to facilitate

Figure 1. Old field plantations are favored for pine straw raking because their relatively clean understory facilitates raking straw. Credits: Pat Minogue, 2007.

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2. Patrick Minogue (Pat) is an Assistant Professor of Silviculture and Holly Ober is an Assistant Professor of Wildlife in Forests, The University of Florida, IFAS, at the North Florida Research and Education Center, 155 Research Road, Quincy, FL 32351-5677. Stanton Rosenthal is Leon County Forester, 615 Paul Russel Road, Tallahassee, FL 32301-7060.

raking clean straw. Pine straw companies normally provide this service and lease the area to rake for several consecutive years. When selling pine straw to a producer it is wise to obtain competitive bids. Pine straw yields change as the trees age so consider the stand age in pricing. Pine needles fall all year but the greatest needle drop occurs from September through November, so one of the best times to rake is in the winter.

Management of Undesirable Vegetation

Old field plantings or plantations on cutover sites where competing vegetation is controlled intensively are best suited to clean pine straw production. On cutover sites, vegetation control should begin with site preparation using machinery, herbicides, fire, and various combinations of these treatments prior to planting (Lowery and Gjerstad 1991). After plantation establishment, selective herbicides, which are safe to pines, may be used to remove hardwood trees and brush (Minogue et al. 1991) facilitating raking the ground and limiting the amount of litter from deciduous trees and shrubs. Most techniques involve treating individual hardwood trees or shrubs with hand-held tools, back-pack sprayers, and small machinery such as 4 wheel drive, all-terrain-vehicles and small tractors. Broadcast applications using ground machinery or helicopters may also be done to control hardwoods in established stands. Some of the most common treatments include back-pack foliar sprays, basal stem treatment, cut-stem treatment, soil spot application, and broadcast application. These are chosen largely based on the size and density of stems to be removed.

Back-Pack Directed Foliar Sprays

Where sapling size hardwoods, less than head tall, are to be controlled, back-pack sprayers can be used to direct herbicide spray to the foliage of undesirable brush and sapling trees. Many herbicide products are available for this use, but combinations of Roundup® (glyphosate) and Arsenal® Applicators Concentrate (or Chopper®) (imazapyr) are most cost-effective across a wide range of brush species. A common mixture is 2% Roundup plus either 0.5% Arsenal or 1% Chopper in water. Add 1%-5% methylated seed oil surfactant to improve control, particularly when treating oaks and other species with a thick cuticle (leaf covering). The oil improves penetration into the leaves and fosters good control. Apply this mixture to at least 2/3 of the crown with light coverage; there is no need to wet the foliage. Late summer to the beginning of fall coloration is the ideal timing. Refer to “directed foliar sprays” on the product labels for additional information.

Basal Stem Treatments

Where undesirable hardwood crowns are too tall to reach with a backpack sprayer, or where very numerous sapling size stems are present, consider using a basal stem treatment with Garlon® 4 (triclopyr). There are several approaches described on the product label, but essentially a mixture of herbicide in oil is applied to the basal (lower) portion of the stem. It is best to treat the “root collar”, the base of the trunk where it goes into the soil. The approach is most effective on stems less than six inches in diameter, and is suggested for stems less than three inches. Thin-barked species are easier to control. The cut-stem method discussed below is typically used for larger diameter stems. Basal stem treatments may be done anytime of year, including winter. Applications are made using a “straight-stream” sprayer such as the Gunjet® applicator or a simple squirt bottle.

Soil Spot Applications

Velpar® L (hexazinone) may be applied directly to the soil surface to control susceptible species either by treating the soil at the base of individual stems, or when brush is dense, by making applications in a grid pattern. When labeled rates are applied, pines are tolerant to this herbicide. The amounts of product will depend on the hardwood species, stem diameter, and soil texture; see the product label for details. Undiluted product may be applied with a squirt bottle or by more durable equipment such as a MeterJet®. Optimum timing is from spring bud break to early summer. Rainfall is needed to foster root uptake. Hexazinone is most effective on sandy soils and is particularly effective for controlling oaks.

Cut Stem or "Hack and Squirt" Treatment

A hatchet and squirt bottle may be used to apply small amounts of herbicide directly into the vascular system of undesirable hardwoods. This approach is most appropriate where there are few scattered individuals with diameters greater than 3 inches. Many products are available for this use, but the most popular are Arsenal® Applicators Concentrate (imazapyr) and Garlon® 3A (triclopyr) which are mixed with water or used undiluted. A hatchet is used to cut through the bark in a downward fashion to create a cup in which to place a small amount of herbicide solution, one milliliter or about the amount a typical squirt bottle produces with one pull. Cuts are made around the stem to encircle the stem at a convenient height and different approaches regarding the distance between cuts and solution concentration to use are described on the product labels. From experience, we know to use a sharp hatchet to ensure a deep cut past the bark and well into the wood. Place only as much herbicide solution as will remain in the cut. Imazapyr is the treatment of choice for this purpose because of its effectiveness over a broad spectrum of species and low use rate. Either imazapyr or triclopyr may be applied throughout the year with good results, except during the period of strong sap flow in the early spring. For imazapyr fall applications are optimum.

Broadcast Treatment

Several herbicides may be broadcast by ground or aerial equipment to selectively remove hardwood trees and brush in southern pine stands. The most common materials are Arsenal Applicators Concentrate (imazapyr) and solid formulations of hexazinone (Velpar® ULW, and Pronone® 10 G). Imazapyr is applied in the late summer and early fall as a foliar spray and is effective on a wide range of hardwood species with some notable exceptions including winged elm and redbud. Hexazinone products are applied from spring bud break to early summer and are very effective in controlling oaks. Both products will also control herbaceous vegetation.

Many non-selective herbicide treatments may be applied as a directed spray to target the foliage of undesirable vegetation in pine stands, but pine injury will occur if the pine foliage is sprayed or affected by the herbicides vapors (volatility). Perennial grasses such as Bermuda grass and Bahia grass are often a problem on old field sites until some time after crown closure when light excludes them. A directed application of 2% Roundup (glyphosate) during periods of active growth in the spring is a simple solution to this problem, but be sure to keep it off the foliage of trees or any other desirable vegetation or injury will occur. Chopper may only be used below the pine canopy and is most effective when applied in an emulsion using methylated seed oil. Garlon® 4 is particularly effective on flatwoods vegetation such as gallberry (*Ilex glabra*) and saw palmetto (*Serenoa repens*) but it must be applied below the canopy of pines and volatility may result in injury when applied on warm days. Please see label directions for more details on these treatments.

Straw Harvesting

Pine needles fall all year but the greatest needle cast occurs from September through November, so one of the best times to rake is in the winter. Pine straw harvesting may be done by hand with rakes or with machines that rake straw into windrows. In either case needles are placed into box or round bailers with a pitchfork or by hand. With hand-raking an individual may bail between 100 and 200 bales per day. Using machinery a three person crew can produce 250 to 300 bales per day (Stanton 1986), but there is some concern regarding stem and root damage in the stand with machinery.

Potential Concerns with Straw Removal

Pine straw serves many important purposes in the tree stand and there are concerns that its removal can have detrimental effects on tree growth. Pine straw plays an important role in supplying nutrients for tree growth, and each year a large portion of the nutrients absorbed by trees is returned to the soil via pine needles. As these needles decompose they provide nutrients for uptake by tree roots and thus, are a part of the nutrient cycle in forest stands (Switzer and Nelson 1972, Jorgensen and Wells 1986). Nutrients can be replaced by fertilization, but pine straw also has an important effect on soil moisture,

improving water infiltration and reducing evaporative water loss in much the same way as it does when used in ornamental applications as mulch. Decomposing pine needles add to soil organic matter thus improving nutrient availability and soil water-holding capacity. Removing pine straw can increase tree water stress on dry sites (McLeod et al. 1979, Ginter et al. 1979), and can also increase soil bulk density (Haywood et al. 1998). In the Sand Ridge region there are large areas of deep sand, excessively drained soils with little soil profile development (CRIFF group G), where silvicultural practices should strive to maintain soil organic matter, thus providing better soil moisture availability and tree nutrition (Jokela and Long 2000). Pine litter also protects the soil from erosion, improves water infiltration (Pote et al. 2004), insulates against rapid temperature changes, and provides habitat for some animals. Because of these important benefits of pine litter in the forest, it is recommended that pine straw should not be removed more than five times during the stands life (Duryea 2003).

Fertilization

Fertilizers are commonly applied in southern pine stands at establishment or periodically during the rotation to increase financial returns by enhancing growth rates and shortening the time to harvest (Jokela et. al 1991, Jokela and Stearns-Smith 1993). Mid-rotation fertilization as a means to enhance pine straw production, replace nutrient removals, and foster timber growth is very common. Nitrogen (N) and phosphorus (P) and potassium (K) nutrient removals from pine straw raking are largely a function of the proportion of the harvestable area, site, and stand conditions; but for a single raking range from 5-60 lb N, 0.5-5 lb P, and 0.5-29 lb K per acre (Morris et al. 1992). Prior to fertilization a soil test should be made to identify inherent fertility and nutrient needs. Growers typically apply 150 to 200 pounds of nitrogen, 50 pounds of phosphorus, and 50-80 pounds of potassium per acre using mineral fertilizers such as diammonium phosphate (N+P), ammonium nitrate and urea (N), triple supper phosphate and ground rock phosphate (P), and KCl (muriate of potash) or KSO_4 (potassium sulfate)(K). Nutrient use efficiencies for fertilization of southern pines are typically about 50% (Morris et al. 1992), but are expected to be less on the excessively drained sand ridge sites of the region. Sandy soils have low cation exchange capacity and low soil organic matter so they do not hold nutrients well. Water deficits generally limit pine productivity and responses to fertilizers on excessively drained soils. Additionally, when fertilizing these soils the potential for leaching and groundwater contamination is a concern (German 1997). Morris et al. provide specific fertilization recommendations for old field or cutover sites, different stand ages, raking frequencies, and various site types, but they do not recommend fertilization for sandhill sites characterized by soils with surface horizons greater than 40 inches deep without fine textured subsoils.

Best Management Practices – Silvicultural Herbicides and Fertilizers

Follow pesticide BMPs to protect water quality and aquatic life.

- Choose equipment that directs the chemical only to the target area.
- Do not conduct aerial application or mist blowing of pesticides or fertilizers within any part of the Primary Zone. For perennial streams, the Primary Zone is an untreated buffer on both sides of the stream 35 to 200 feet wide depending on the width of the stream (Anonymous 2004).
- Do not leave pesticide containers on-site.
- Do not rinse spray equipment or discharge rinse water in water bodies, wetlands, or within the Special Management Zone (the buffer around water bodies).

Existing silvicultural fertilization BMPs recommend developing a nutrient management plan based on soil, water, plant and organic material sample analysis and consideration of expected or desired timber yields to supply nutrient inputs efficiently, so that the benefit of fertilization is captured by target vegetation and the adverse effects to water resources are minimized.

- Do not apply fertilizer or locate fertilizer transfer/loading areas within the Primary Zone of the Special Management Zone (SMZ).
- Whenever practical, apply fertilizer to maximize the uptake of nutrients.
- Do not exceed the maximum amounts of fertilizer specified by BMPs.

Elemental Nitrogen:

- No more than 1000 lb per acre over any 20-year period
- No more than 250 lb per acre for any 3-year period
- No more than 80 lb per acre during the first two years after planting

Elemental Phosphorus:

- No more than 250 lb over any 20-year period
- No more than 80 lb over any 3-year period

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For additional information see also:

The University of Florida, Institute for Food and Agric. Sciences http://edis.ifas.ufl.edu

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