With spring weather and homeowners turning their focus to outdoor projects, pine straw sales are beginning to pick up quickly. Pine straw has become a favored mulch on residential and commercial sites. The qualities that make pine straw an essential part of a woodland ecosystem, such as moisture-holding capacity, protection for roots against temperature extremes, providing natural fertilizer, and protecting soils by reducing erosion, also make it a desirable addition to landscaped areas. Forest landowners can successfully include pine straw production as a source of additional income from suitable timberlands when implemented as part of their overall forest management plan. However, there are various things to consider before planning to rake pine straw on your property.

**Species**

The first consideration is the pine species growing on the property, if a landowner will be raking an existing stand, or what species is suitable for planting if establishing a new stand. Pine species’ desirability for straw varies by needle characteristics and the volume of straw produced per acre (Table 1). Longleaf pine is the preferred species for pine straw production due to its needle length and slower needle decay rate. The longleaf needles are raked and baled more easily and interlock once spread, creating a blanket-style mulch layer.

**Stand Age**

Another consideration when deciding to rake pine straw is the age of the stand. Pine straw raking can begin in young stands at full canopy closure, ranging from 6 to 10 years of age based on species. Straw production peaks at about 15 years of age. Besides species and the stand’s age, the volume of pine needles produced each year also depends on the stand’s stocking, site index, and if the site is fertilized to enhance production.

**Stand Stocking**

Stocking is measured by basal area. Basal area is a measure of the cross-sectional area occupied by tree stems for their diameter at breast height (4.5 feet) and expressed on a per-acre basis. Stand densities of 75 ft²/acre to 125 ft²/acre are typical stocking ranges in stands managed for pine straw. Stands with higher densities have an increased risk of forest health issues due to overstocked conditions. Delaying stand thinnings in favor of maximizing straw production can have an overall negative impact on timber quality and quantity.

**Stand Management Practices**

Management practices such as fertilization, herbicide applications and prescribed burning will help you to maximize your pine straw production. Fertilization to enhance pine straw production varies depending on species and site quality. Intensively raked stands on sites with low fertility that are well-to-excessively drained tend to show the most enhanced straw production following fertilization. Although general guidelines are available for fertilization rates, both soil and foliage should be submitted for testing to determine specific rates for the site being raked. Over-fertilization can cause tree mortality. One downfall of fertilization is that it also increases undesirable vegetation in the understory. This can lead to a need for herbicide treatments to control this vegetation.

Herbicide treatments can make a stand more

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**Table 1. Needle characteristics and average production per acre.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Needles/Fascicle</th>
<th>Needle Length (in.)</th>
<th>Rake Yields/ Ac (Avg. # of 20 lb. bales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loblolly Pine Pinus taeda</td>
<td>3 to 4</td>
<td>5-9”</td>
<td>150-275</td>
</tr>
<tr>
<td>Longleaf Pine Pinus palustris</td>
<td>Usually 3</td>
<td>8-18”</td>
<td>80-200</td>
</tr>
<tr>
<td>Slash Pine Pinus eliottii</td>
<td>2 to 3</td>
<td>6-11”</td>
<td>125-250</td>
</tr>
</tbody>
</table>

Continued on Page 2
marketable for straw raking. These treatments reduce unwanted trees and other vegetation in the midstory and understory, improving the quality of the straw being baled. By controlling hardwoods when planting stands and having minor encroachment from undesirable vegetation, your stand can be ready to rake at canopy closure without any additional treatments. Pine straw raking does expose mineral soil, which can stimulate undesirable species’ germination. This is mainly a concern after a stand is thinned, and the reduced canopy allows more sunlight to reach the forest floor. Herbicide treatment method, time of year, and application rate vary with the pine species on-site and with the selected herbicide.

Herbicides that are soil-active can damage pine trees in the stand when misapplied. Foliar active herbicides can be applied in any age stand as long as the spray does not contact the crop trees’ foliage. Hack-and-squirt, basal bark, and cut stump applications are also options on larger stems or when the number of stems to treat per acre is low.

Establishing a pine straw raking schedule can provide the natural benefits of needle decay to a stand. This would reduce the need for fertilization by allowing a portion of the pine needles to remain on site. Peak pine needle fall occurs in October and November. Raking once a year during these months allows a portion of the yearly needle drop to stay in place. A rake every three-year schedule is recommended to optimize the benefits of retaining some needles on the forest floor. This provides an opportunity for decaying pine needles to improve nutrient recycling on site, especially when combined with prescribed burning during a year when the stand is not raked. Also, raking should be postponed during periods of fall drought since removing the pine needles can increase stress to the trees by decreasing the already low soil moisture.

Alternating years of raking with a yearly burn and a year of rest can benefit wildlife habitat and provide some hardwood control. Seasonality of prescribed burning will determine what vegetation will be promoted in the understory and what will be reduced. Winter burns promote herbaceous vegetation and grasses favored by wildlife species while growing season burns can help control undesirable hardwood stems. Burning will also help reduce debris on the site, such as cones and small branches, resulting in cleaner straw.

Baling Methods

The method of pine straw baling can vary depending on stand access, site factors such as slope and soil type, labor and equipment available, and the structure of the stand. Machine baling is possible under dry conditions in stands that have 8 to 12 feet between rows. These stands must also have good equipment access, be relatively level, and not have low limbs. This process is similar to baling hay. The straw is raked into windrows, removing cones, leaves, limbs, and other debris, and then baled into rectangular or round bales. This method can produce as many as 1,000 40 pound bales per day on a good site. These bales are often used for commercial projects.

Hand raking and baling is the most common method and is done on sites with tighter or irregular tree spacing, uneven or sloping ground, and limited access. The straw is raked and then packed into a box baler constructed out of wood that compresses the straw until it is bound with twine. An individual on a hand baling crew can produce between 100 to 200 bales per day depending on the straw’s cleanliness and density. There is no standard bale size or weight, but rectangular bales usually measure 24 to 30 inches in length, with weights varying from 10 to 25 pounds. Whether machine or hand raking, designated piles or rows for debris are created within the stand.

Selling Pine Straw

Research published by the University of Georgia in 2018 found that the per bale price paid to landowners in Georgia for rectangular bales of longleaf straw ranged from $0.50 to $1.25. Slash
bales had a range of $0.50 to $0.65, and loblolly was the least profitable source of pine straw with a range of $0.25 to $0.40 per bale. A landowner who does not want to bale and market their own straw needs to ensure that they have a contract in place which includes stipulations for the raking schedule (months to rake and the number of rakings per year), the length of the contract, and the contract method (per bale or per acre). Landowners who cannot visit their property during raking to spot check the number of bales being harvested should utilize a per acre contract. This method pays a yearly rate per acre and can range significantly depending on the volume of pine straw the stand is producing and how much labor the contractor will need to invest in getting the stand into raking condition. Pine straw contracts should not be written for longer than 3 to 5 years. During this time, you can continue a good raking schedule and implement management practices such as prescribed burning, fertilization, and herbicide applications. This will continue to increase the quality and quantity of the straw, thus increasing its value.

Pine straw contractors will usually remove the straw from a property as it is baled. Landowners who are raking and selling their straw need to ensure they have a site to store the straw until it is ready to be sold. Baled straw that has been exposed to moisture can mold and become unmerchantable. Also, the storage site should be secure enough to prevent theft.

Resources

The list of resources used for this article includes sources that have examples of pine straw contracts and dimensions for constructing a box-baler. For more information on pine straw production or to determine if your property has the potential to generate income from this mid-rotation product, contact your local Clemson Extension Forestry and Natural Resources agent.

Dickens, E.D., Moorehead, D., Morris, L., and Bargeron, C. (2018). Pine straw yields and economic benefits when added to traditional wood products in loblolly, longleaf, and slash pine stands. Athens (GA): University of Georgia Warnell School of Forestry and Natural Resources.


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