AWN REMOVAL OF NATIVE SCRUB GRASSES

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Abstract. In the Florida Panhandle, the native scrub grasses that are the most important in autotrophic succession are: Wiregrass (Aristida stricta Michx), Little Bluestem [Schizachyrium scoparium (Michx) Nash], and Lopsided Indian Grass [Sorghastrum secundum (Ell.) Nash]. These grasses produce significant awns and this study evaluated treatment with sulfuric acid, flash burning, and mechanical methods for removal of awns. Awn removal with subsequent seed survival was more difficult than envisioned. Sulfuric acid was not able to degrade awns to the point that they separated from the seed. Awns proved to be extremely flammable and this combined with the elongate nature of the seeds proved to be disastrous to seed health after burning. Mechanical removal showed promise as some awns were easily detached from seeds while with others the seeds protruded through the nylon mesh with the awns being retained on the inside.

Native environments are of extreme ecological importance, however, the influence of economic development on these native areas has created the need for restoration (Cunningham and Saigo, 1996). One kind of native environment is characterized by native scrub grasses that once were a dominant factor in the recycling of nutrients in areas of secondary autotrophic succession (Engle et al., 1991). In the Florida Panhandle, the native scrub grasses that are the most important are: Wiregrass or Pineland Three-Awn (Aristida stricta Michx), Little Bluestem [Schizachyrium scoparium (Michx) Nash], and Lopsided Indian Grass [Sorghastrum secundum (Ell.) Nash] (Kindell et al., 1996; McCaleb et al., 1963; Means, 1997). All of these grasses are bunch type grasses that produce abundant seed with significant awns (Hitchcock, 1950). Awns are elongated appendages that serve to aid in the dispersal of the mature floret or as a protective appendage during seed development and maturation (Fahn and Werker, 1972; Stefferud, 1961). In the case of A. stricta, S. scoparium, and S. secundum, the awns are a substantial part of the mature floret (Hitchcock, 1935; Kucera, 1961). These awns create problems for human intervention in the repopulation of these grasses, because the awns increase the volume of the floret and decrease the ability of these seeds to pass through mechanized methods of seed dispersal (Fahn and Werker, 1972; Wilson, 1992).

Table 1. Formulas for converting soluble salts readings from one extraction method to another.

<table>
<thead>
<tr>
<th>To convert reading of (x)</th>
<th>Multiply (x) by</th>
<th>Then add</th>
<th>To obtain</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCC</td>
<td>0.89</td>
<td>0.07</td>
<td>PEM</td>
</tr>
<tr>
<td>MCC</td>
<td>0.49</td>
<td>0.14</td>
<td>SME</td>
</tr>
<tr>
<td>MCC</td>
<td>0.39</td>
<td>0.03</td>
<td>1:2</td>
</tr>
<tr>
<td>PEM</td>
<td>0.96</td>
<td>0.07</td>
<td>MGC</td>
</tr>
<tr>
<td>PEM</td>
<td>0.56</td>
<td>0.09</td>
<td>SME</td>
</tr>
<tr>
<td>PEM</td>
<td>0.49</td>
<td>0.04</td>
<td>1:2</td>
</tr>
<tr>
<td>SME</td>
<td>1.36</td>
<td>0.10</td>
<td>MGC</td>
</tr>
<tr>
<td>SME</td>
<td>1.45</td>
<td>0.02</td>
<td>PEM</td>
</tr>
<tr>
<td>SME</td>
<td>0.85</td>
<td>0.10</td>
<td>1:2</td>
</tr>
<tr>
<td>1:2</td>
<td>1.25</td>
<td>0.39</td>
<td>MGC</td>
</tr>
<tr>
<td>1:2</td>
<td>1.45</td>
<td>0.28</td>
<td>PEM</td>
</tr>
<tr>
<td>1:2</td>
<td>0.97</td>
<td>0.19</td>
<td>SME</td>
</tr>
</tbody>
</table>

*These formulas were developed for converting soluble salts readings of plug media only, not suitable for potting media conversion.

Example: Suppose a SS reading of 1.0 dS/m is obtained using the MCC method. To convert this reading to the equivalent PEM, SME and 1:2 reading, use above table as follows:

- PEM: 1.0 x 0.89 + 0.07 = 0.96 dS/m
- SME: 1.0 x 0.49 + 0.14 = 0.63 dS/m
- 1:2: 1.0 x 0.39 + 0.03 = 0.42 dS/m

Therefore, if the PEM, SME, and 1:2 method are used to extract root-zone solution of this plug medium, the SS reading should be 0.96, 0.63, and 0.42 dS/m respectively.

Lit. Cited


Seed de-awning is important in re-establishment of these grasses as it would permit mechanical sowing of seeds in native environments. These grasses are found in forested environments and are in need of serious repopulation efforts (Kindell et al., 1996; McCaleb et al., 1963; Means, 1997). Many environmentalists are also interested in using these grasses in roadside plantings to re-establish native environments in the areas disrupted by humans.

Fire plays a significant role in the health of wiregrass/pineland communities (Clewell, 1989; Outcalt et al., 1999). It removes leaf litter and prepares some seeds for germination (Clewell, 1989). Floral induction in A. stricta also is more abundant after fire (Clewell, 1989). Since awns are appendages of cellulose and are finely divided, the effect of burning was of interest.

The use of acid treatment for the removal of seed appendages is time-tested and the most notable is the de-linting of cotton (Gossypium hirsutum L.) seed (Stefferud, 1961). Mechanical methods are also time-tested, dating back to the first threshing of grains (Stefferud, 1961).

The objective of this study was to evaluate methods of awn removal of seed of A. stricta, S. scoparium, and S. secundum as determined by percentage awns removed and on germination of seeds, in an attempt to increase the efficacy of mecha-nization for the sowing of seeds in areas in need of remediation.

Materials and Methods

Approximately 1.5 kg of seed of each specie, A. stricta, S. scoparium, and S. secundum were obtained from the Nature Conservancy (Arlington, Va.). Seeds were divided into lots of 200 each, and were treated in one of the following ways for the removal of awns:

Treatment with sulfuric acid: Seeds (10 g) were placed in 50 ml of sulfuric acid (63% aqueous). Seeds were observed and the mixture agitated every 2 min for up to a total of 30 min. Any time that awn removal was evident before a 2 min period had elapsed, the acid was decanted and the seeds were rinsed with running tap water for 30 s and spread on paper towels to dry. This was done in three replications.

Flash burned: Seeds (10 g) were placed in a fireproof, tin, cylindrical container with a diameter of 8.5 cm and a height of 3.5 cm. The container was filled with a mixture of propane and air and ignited. The fire was allowed to progress for no more than 5 s at which time the fire was extinguished. This was done in three replications.

Mechanical: Seeds (10 g) were placed in round plastic sleeves, 9 cm in diameter and 16 cm in height, with two openings of approximately 32.5 cm² each in the sides. The plastic sleeves were covered with a nylon stocking tied at one end, filled with seed, and the other end tied. These were placed in a clothes dryer and tumbled without heat (Silva et al., 1982). At hourly intervals, the plastic sleeves were removed from the dryer, observed and the amount of awn removal determined. This was done in three replications.

No Treatment: Seeds (10 g) were separated and placed aside without additional treatment.

Germination of seeds: All treated seeds and untreated controls were evaluated for germination by placing 200 seeds of each treatment and replication in Gerbox® containers that were lined with moist paper towels. Seeds in the containers were incubated at room temperature (20-25°C) for up to 6 weeks, during which time percent germination was determined by counting the number of radicals emerged.

Results and Discussion

Awns of the three species tested appeared to be attached in different manners, which determined the degree of diffi-culty in removing the awns. Awns of A. stricta are an integral part of the lemma and are attached with significant resistance to removal. Awns of S. scoparium are also attached to the end of the lemma. One other features of S. scoparium is the presence of sterile florets that are attached at the base of the fertile floret. These sterile florets are not easily detached and are covered with significant pubescence. Awns of S. secundum are the most easily detached as the awn appears to be attached to the upper part of the seed. Awns are made of very durable co-lenchyma fibers (Esau, 1977) and appear dainty. This presented a unique challenge in their removal.

Treatment with sulfuric acid: Treatment with acid was ineffective in awn removal. However, there appeared to be a slight increase in germination of seeds of S. scoparium and S. secun-dum, while there was a reduction in germination of A. stricta (Table 1). When seeds of A. stricta were placed in acid, the awns relaxed, extended along the axis of the seed, and became supple, however, acid was not able to degrade the co-lenchyma fibers in the awns to the point that they loosened from the seed. Upon drying, awns returned to their original configuration. This straightening of the awns is probably due to relaxing of the cellulose fibers due to moisture. Even the 63% acid used would have had sufficient moisture to relax the awns.

Flash burning: Burning proved to be an ineffective method of awn removal. Seeds of A. stricta ignited and were carbon-ized with little left. The seeds of S. scoparium and S. secun-dum were less carbonized and there was some awn removal, how-ever, seeds were not recognizable and coated with excess car-bon. Awns proved to be extremely flammable and this, combined with the elongate nature of the seeds, proved to be disastrous to seed health after burning.

Mechanical: Of the various methods of deawning that were attempted, the mechanical one gave the most promising re-sults. Sorghastrum secundum was the most easily deawned as the awn is easily detached through mechanical means such as tumbling in a dryer. Awns were dislodged and extrud-ered through the nylon mesh while the seeds remained on the inside. Tumbling and deawning did not have an effect on seed germination (Table 1).

In the case A. stricta, the single long seed extruded through the nylon with the awns serving as an anchor. Within a 3-h period of tumbling, a majority of the seeds (89%) had protruded, however there was no separation of the seeds from

<table>
<thead>
<tr>
<th>Grass species</th>
<th>Aristida stricta</th>
<th>Schizachyrium scoparium</th>
<th>Sorghastrum secundum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid</td>
<td>7.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Burn</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mechanical</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No awn removal</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Percentage germination of three species of native scrub grasses after awn removal attempts with acid, burning, or mechanical methods. Average of three replications of 200 seeds each.
the awns. Protruding seeds permitted removal of awns by snipping of the seed, but this process was slow and not economically feasible with larger volumes of seed.

*Schizachyrium scoparium* seeds did not fair well in the mechanical removal test as every attempt to de-awn seeds caused a rupture of the nylon mesh around the plastic sleeve, which released all of the seeds. It appeared that seeds were rough and sharp enough to rupture the nylon mesh.

Of the three methods tested, mechanical removal by tumbling appears to have the best chance of working. Awns of *S. secundum* were easily detached but seeds did retain their pilose nature and continued to adhere to each other. Seeds of *A. stricta* protruded through the nylon mesh, with awns being retained on the inside. This presented the chance of removal of seeds through snipping off the seed at the junction of the nylon mesh.

Removal of awns is necessary for mechanization of seeding of these grasses in order to remediate areas where these grasses occurred naturally. These grasses provide a significant source of fuel in the undergrowth of forests. These grasses have also been reported to require fire for proper production of fertile inflorescences. Lack of burning will still result in the formation of some inflorescences, but often with seeds of low viability or misformed embryos. Natural burning would therefore be beneficial for growth of these grasses and production of new seed, with plants providing fuel for future burns.

There are several possible explanations why seed germination was extremely low in all of grasses tested. Seed age, storage conditions, and lack of viable embryos could all affect germination. However, in this study, germination was used as a marker against possible damage done by awn removal. Other methods of awn removal must be studied to find a method by which sufficient awns are removed so that mechanization of seed dispersal could occur.

**Literature Cited**


