Incorporating Sunn Hemp in Grazing Systems for Growing Goats

Origin and Uses

*Crotalaria juncea* also known as Sunn Hemp is a tropical legume that originated from Asia and belongs to the pea family *Fabaceae* (Wang, Li, Klassen, and Halon. 2018). This forage should not be confused with Industrial Hemp or the Hemp that is customarily grown in the northern hemisphere and belongs to the plant species *Cannabis sativa* (Swanson, 2015). Sunn Hemp is grown throughout the tropics and subtropics as a source of feed for livestock, and can be used for green manure (see figure 1). As manure, the plant can be plowed back into the earth during its early flowing stage, which can help enrich the soil (Dictionary.com, no dates; Heuze, Thiollet, and Lebas, 2018).

Sunn Hemp is also used as a cover crop to minimize soil erosion, to reduce nutrient losses and to improve soil fertility because of its ability to fix rhizobial bacteria in the plant’s root system. As a result of this symbiotic relationship, nitrogen is produced within the nodules of the roots of the plant (Wright, Mackowiak, Newman, 2007; USDA, 2003). When the plant dies, the nitrogen is released back into the earth and is made accessible to other forages, which helps to improve the overall soil fertility (Postgate, 1998).

In India, this non-wood fiber crop is used to make newsprints, cords or ropes, fishing netting, potting media, twine, floor mats, cigarette paper, and currency notes (Narasimhulu, K., Manasa P., 2018; Cook and White, 1996). Manufactures in North India have harvested this multipurpose plant to produce paper for calligraphy (see figure 2) and pen writing (Etsy, no date). This process involves extracting the pulp from the soft fibers of the plant’s stem then further processing the material for paper.

Characteristics

When planted as a summer annual, Sunn Hemp can produce over 5,000 pounds of biomass and 100 pounds of nitrogen per acre within a 60 to 90-day period. Furthermore, this shrub is known to grow quickly and has the ability to suppress root-knot nematodes, which are parasitic roundworms from the genus *Meloidogyne*. This parasite exits in the soil in the areas where the climate is hot or the winters are short (Starr, 2013; Cook and White, 1996). As mentioned in a previously, Sunn Hemp is a warm-season annual, and requires replanting each year preferably in the spring after the last frost. It is also a non-seed bearing legume (ability to fix nitrogen from bacteria) when grown in North America.
However, Sunn Hemp is able to produce seeds when grown in the state of Florida and Hawaii (up to 15,000 seeds per pound). The plant is best characterized as branched, herbaceous forage that can grow up to 3 to 9 feet in height (USDA, 2003). The leaves of this plant are arranged spirally along the plant’s stem, they are bright green in color and oval in shape. The stems are cylindrically shaped and can grow up to 2 cm in diameter (USDA, 2003; Heuze, Thiollet, Tran, Lebas, 2018).

Sunn Hemp also has a sturdy taproot system, and is drought resistant. When the plant has matured, it will produce a cluster of golden yellow flowers at the tips of the branches and the legume can grow in a wide range of conditions (see figure 3). However, Sunn Hemp performs best on sandy, well-drained soils not on heavy, clay soils or in standing water (Miller, 2018; USDA, 2003). For optimum growth, the pH of the soil should range from 5.0 to 7.5 and the plant should be exposed to plenty of sunlight.

Establishing the Forage

The plant can be established by broadcasting the seeds or by drilling them into the soil. If drilling is the preferred method, plant the seeds ½ to 1-inch into the soil on a well prepared seedbed that is free from weeds. The seeding rate for Sunn Hemp is 40 to 60 pounds per acre if broadcast or 30 to 50 pounds per acre when drilled (USDA, 2003). The seeds should be inoculated with the cowpea-type rhizobia bacteria and planted when the soil’s temperature reaches 65 degrees Fahrenheit (Miller, 2018).

Since Sunn Hemp is a legume, it may not require additional nitrogen or lime, but phosphorous and potash may be necessary if the soil tests indicates a deficiency (Miller, 2018). When integrated into the pastures for goats, Sunn Hemp can be grazed 45 days after the plant has reached 1 ½ to 3 feet in height. Miller recommends that the legume should not be allowed to mature (flowering appears) before grazing unless it is used for other purposes (2018). He also states that Sunn Hemp has the best quality when it is grazed at an early stage of production (2018). Casey, Wynia and Row (2010) found that Sunn Hemp starts losing its protein quality 30 days after planting. Nonetheless, if the plant is allowed to grow beyond 90 days the quantity of forage available for grazing increases abundantly as well as the amount of vegetation.

Pilot Study

In a pilot study conducted at Florida A&M University (FAMU), Research and Extension Center in Quincy, Florida, 27 weaned Boer crossbred kids (80 – 100 days of age) had access to Sunn Hemp in a mixed forage grazing system. The objective of this study was to determine if Sunn Hemp could be used to help prolong the grazing season in North Florida for goats, to access the nutritional value of Sunn Hemp and to determine the nutritional benefits for growing goats consuming Sunn Hemp.

Soil samples were collected prior to the grazing season from each paddock to assess the fertility of the soil. The tests revealed that nitrogen and phosphorus was deficient in some areas therefore, potash and ammonium nitrate were applied in those areas that required it. During the trial, the goats also had access to Iron Clay Peas (Vigna unguiculata) and Signalgrass (Bracharia plantaginea). When the pastures were sufficiently established (Sunn Hemp was between 4 to 6 feet in height and the Signalgrass and Iron Clay peas was at least 5 inches or more above the ground), the goats were divided into two groups (14 animals in group one and 13 in group two). The animals were provided with a trace mineral block and fresh water daily. No other supplements were given during the course of this trial.
Portable electric netting was used to create a temporary paddock to allow the animals to be rotated into a new paddock every 14 days\(^3\). Samples were collected 30, 60 and 90 days after planting to analyze the nutritional composition of the forages.

The results indicated that the crude protein (CP) declined by 40% from June to August. However, the crude protein levels were closely within the acceptable range for growing goats (14% -16%). Total Digestible Nutrient (TDN) taken during the same period ranged from 70.64% (30 days after planting), 67.86% (60 days after planting), and 60.40% (90 days after planting). The TDN value provides an estimate of the energy content of the forages. Any value that is lower than 50% is considered poor quality. Higher quality forages have TDN levels greater than 50%. Therefore, at the time theses samples were taken the quality of the forages were good. Acid Detergent Fiber (ADF) was also a part of the analysis. The values ranged from 27.44% (30 days after planting) 29.82% ADF (60 days after planting) and 36.23% ADF (90 days after planting). The ADF value was acceptable for day 30 and 60 days after planting, but declined as the forage matured (prior to 90 days). These findings indicated that the digestibility of the roughage was lower during the last collection period (in the month of August).

For legumes, the ADF values should range between 20% to the mid-30s for good quality forages. Neutral Detergent Fiber (NDF) on the other hand predicts the level of intake for animals consuming a particular feedstuff (a food provided for livestock). In this case, the NDF increased from 40.37% (30 days after planting), 53.99% (60 days after planting) to 68.5% (90 days after planting) as the plant matured. When the NDF levels are greater than 70% the animal’s intake of the forage will eventually decline. The last value accessed for the forage analysis was Relative Feed Quality (RFQ). The RFQ value for the Sunn Hemp was high for 30 (162%), 60 (162%) and 90 (132) days after planting. Values less than 100% overall feed quality is considered poor and above 100 is good. The results suggest that the overall feed quality from the Sunn Hemp was adequate for the goats in this study.

**Benefits of Sunn Hemp**

Furthermore, the body condition scores (BCS) of the animals in this trial reflected that diet which consisted of Sunn Hemp, Signalgrass and Cowpea were adequate for most of the goats in the study. The BCS values ranged from 2.5 to 3.5 using the 1-5 scale. Body condition scores are best described as a management tool that can be used to evaluate the nutritional status of the animal. It provides an estimate of the energy reserves, which are in the form of muscle and fat. The animals are palpated along the spinal process and assigned a numeric value between 1-5 with increments of 0.5. Goats that have a BCS of 2.5 to 4.0 are considered in good condition. Any goat that has a value below 2.5 is in poor condition or above 4.0 is generally over-conditioned (fat).

Another key finding from this trial, the Sunn Hemp and Iron Clay Peas shows promise as far as extending the grazing season into the fall months. In this trial, the goats were able to graze on the legumes until the first week of October, but the quality and quantity of the forages eventually became an issue as well as the threat of an early frost. When forages mature, the stem loses its quality faster as the plant moves from the vegetative to the reproductive phase.
Furthermore, perennial grasses lose their nutritional quality much quicker than legumes. In grasses, the production of leaves will slow down once the plant starts to flower (Alberta Agriculture and Forestry, 2018). In this study, the Signalgrass began to enter into its’ dormancy phase during the latter part of July while the Sunn Hemp and the Iron Clay Peas were still available. As long as the stems still remained erect and undamaged, Sunn Hemp continued to produce more leaves, but as the time progressed the quantity and quality of the vegetation deteriorated. One solution that will be tested later is to stagger the grazing season where some of the field plots are planted in late March and the remaining in July. This strategy should provide the herd with access to a higher quality forage for a longer period of time until the first frost. Extending the grazing season should also shorten the time that supplemental feeding will be required before the winter or summer pastures have been established.

Other benefits from integrating Sunn Hemp into a mixed forage-based system include forcing the goats to eat higher off the ground (see figure 8), which could help reduce the incidence of internal parasites. Sunn Hemp can also reduce the requirements for additional nitrogen or lime in the soil, thus reducing the cost of purchasing fertilizer and the legume can grow in a wide range of environmental conditions. A dense stand of Sunn Hemp can also create a natural wildlife habitat for migratory birds, deer and many other creatures through the protection and support of various food sources within the foliage (Putnam et al., 2001), which was witnessed during this trial.

Disadvantages of Sunn Hemp

Some disadvantages of growing Sunn Hemp as well as other legumes are it can cause bloat. Frothy bloat is a condition caused by the eating of lush, wet legumes that results in the swelling of the rumen (first stomach of the goat) from the pressure of gas. Without relief, the animal may die, but it is not the only reason ruminants can develop bloat. Free gas bloat is caused by the blockage in the esophagus by any type of feed, concentrate, carrots or apples (eXtension.org, 2012). Although the condition does not occur as frequently with goats as it does with cattle and sheep, reducing the time the animal spends grazing on legumes each day can help (2-3 hours/day) until the goats are adjusted to the new forage.

Other disadvantages of Sunn Hemp are the legume can be very competitive with the other forages, and the seeds from the plant may be toxic to some livestock species such as cattle because of the presence of pyrrolizidine alkaloids. In a literature review conducted by Mosjudis, Burke and Hess (2012), the consumption of Sunn Hemp (foliage) was found to be a good source of nutrition for animals without any effects of toxicity. However, the authors suggest that the seeds should not be incorporated in the animals diet for long periods of time and they should not be allowed to eat a large quantity of the seeds because of potential problems with weight loss and death in some animals (Mosjudis, Burke and Hess, 2013). The USDA also cited similar findings in 2003.
Another disadvantage of Sunn Hemp that was noted at FAMU was when it was time to prepare the pastures for winter grazing it was difficult to plow the excess crop residue from the Sunn Hemp back into the fields. The stems had formed a thick mat on the floor of the field which made it difficult to walk on without tripping and even harder to prepare a new seed bed without the appropriate farm equipment. Hedge trimmers be used for a small field plot were the stems are still standing erect, but this technique can prove labor intensive. A preferably method is using a bush hog. The bush hog can be attached to the rear of a tractor with a front-end loader. The front-end load can push the Sunn Hemp to the ground while the bush hog chops the stems as it mows over it. If a bush hog is not available a sickle mower or a standard rotary swather can also serve the same purpose.

**Feeding Cost**

Table 1. Feed Costs for Young Goats After Weaning (80-100 days of age) from June through October 8th.

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunn Hemp</td>
<td>1-50 lb. bag</td>
<td>$150.00</td>
</tr>
<tr>
<td>Iron Clay Cowpea</td>
<td>1-50 lb. bag</td>
<td>$85.00</td>
</tr>
<tr>
<td>Signalgrass (Mulato II)²</td>
<td>-----------------</td>
<td>------</td>
</tr>
<tr>
<td>Trace Mineral Block</td>
<td>2-50 lb. blk. each</td>
<td>$14</td>
</tr>
<tr>
<td>Potash</td>
<td>1-50 lb. bag</td>
<td>$20</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>16-50 lb. bags</td>
<td>$240</td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>2-50 lb. bags</td>
<td>$120</td>
</tr>
<tr>
<td>Feed</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soil Tests</td>
<td>2- Soil Tests</td>
<td>$14</td>
</tr>
<tr>
<td>Inoculant</td>
<td>1-6oz pkg.</td>
<td>$12</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td></td>
<td><strong>$655</strong></td>
</tr>
<tr>
<td><strong>Cost per Animal (27)</strong></td>
<td></td>
<td><strong>$24.25/Goat³</strong></td>
</tr>
</tbody>
</table>

Figures based on a 2-acre plot.¹
Signalgrass was not planted this season it came up on its own. The price is based a projection on how much it would have cost for a similar grass specie.²
Medical costs were not included³

The cost that was associated with managing the herd during the trial period (June through October 8th) can be viewed in Table 1. The total cost of raising 27 meat goats on pastures was $655. The highest expense was attributed to cost of the fertilizer and the Sunn Hemp seeds. The average cost to feed one goat to market age was approximately $25. Hay or feed was not required because the herd had access to plenty of forages, which helped to keep the cost of production down. Note, veterinarian expenses, labor and equipment use were not provided in this report, but will be included along with marketing costs in future studies of this nature.
Conclusion
The findings from this pilot study suggest that Sunn Hemp can be successfully incorporated in grazing systems for young goats, it shows potential for extending the length of the grazing season, and it can provide adequate nutrition for livestock. There are also a few disadvantages to using this forage, but with the proper management strategies it can become an asset to goat producers. Further studies are also required to determine the nutritional quality of this forage planted in earlier and the later part of the year, the impact of Sunn Hemp on the performance on goats (e.g., pre and post average daily gains) and to determine any cost savings or additional expenses that may occur using this forage.

References


Feedipedia, a programme by INRA, CIRAD, AFZ and FAO, Retrieved from https://www.feedipedia.org/node/313


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