Silvopasture: A Natural Choice

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Abstract
The Appalachian region is one of the most beautiful areas of the world. The mosaic of open areas (pasture and hayfields) and forestland is very productive in terms of animal and timber products. Livestock production can be improved through better herbage and animal management with Appalachian farmers being most adept at both. Woodlot management can increase economic return, species diversity, and farm aesthetics especially through the introduction of sustainable forage species. Silvopasture must have adequate solar radiation reaching ground level to ensure maximized production and quality herbage. Once established, silvopasture with similar fertility management and total diameter at breast height (DBH) values of approximately 50 to 65 feet per acre will produce about 60% the dry matter of open pasture. Animal performance can be expected to be equivalent between pasture types with lambs averaging about 0.20 lb per day gain under our management scheme. Differences in herbage nutrient profiles between pasture types may prove to be advantageous from an animal production and environmental standpoint. Research is currently being conducted to develop management strategies.

Introduction
The Appalachian region is one of the most beautiful areas of the world. The mosaic of open areas (pasture and hayfields) and forestland is very productive in terms of animal and timber products. Livestock production can be improved through better herbage and animal management with Appalachian farmers being most adept at both. Woodlot management can increase economic return, species diversity, and farm aesthetics especially through the introduction of sustainable forage species. Silvopasture development within Appalachia is a “Natural Choice” to improve farm production and
value. Considerations and details with regards to silvopasture development are included in publications by Neel and Belesky (2003) and Neel et al., 2008.

Herbage Production
Research conducted within a pine woodlot by scientists and technicians at the Appalachian Farming System Research Center has shown that herbage production increases as trees are removed from the site. The selective thinning allows more sunlight to reach the woodlot understory where forage grasses can grow (Neel et al., 2008). Maximum herbage production was attained when solar radiation at the soil surface under a tree canopy was 80% of that occurring in the open. Although maximum herbage production was attained, it was approximately 42% of the amount of forage produced in an open pasture during the same year (Neel et al., 2008).

![Figure 1. Open and silvopasture yield across years, presented as dry matter per acre (lb).](image-url)

Figure 1 shows dry matter production within open and hardwood silvopasture across years. Open pasture produced more dry matter during all years with the magnitude being greatest during the first 2 years following establishment. The least productive year for open pasture was 2004. This was an extremely wet year with rainfall being evenly distributed across the growing season. Low solar radiation because of cloudy conditions may have reduced herbage yield. Open pasture yield ranged from 3.8 to 5.4 tons per acre.
while yields from silvopasture ranged from 1.8 to 3.2 across all years. In 2003, we decided that more trees within silvopasture had to be removed in order to ensure forage stand sustainability. During the winter and early spring of 2004, tree total diameter at breast height (DBH) per acre was reduced in silvopasture by about 33%. Generally, our experience shows that DBH should range from about 50 to 65 ft per acre to ensure forage sustainability and maximized production. Desired DBH is influenced by stand maturity, slope and aspect, and tree species. These factors should be taken into account when developing silvopasture and deciding when and how trees should be cut.

Figure 2. Silvopasture yield and rain amount presented as a percentage of open pasture yield and average rainfall amount respectively.

Figure 2 presents silvopasture yield and growing season rainfall as a percentage of open pasture yield and average rainfall respectively. Some people think that silvopasture should have an advantage over open pasture during dry and hot periods because the tree canopy buffers temperature extremes and minimizes the loss of soil moisture. The years of 2003, 2004 and 2006 were extremely wet growing seasons while 2005 was very dry. Across those years silvopasture yield averaged 61% of open pasture (with low variability), indicating no advantage for silvopasture in either wet or dry years. However, given that 2003 and 2004 were wet years and yield as a percentage of open jumped from 56 to 64%, opening of the canopy prior to the 2004 growing season seems to have improved productivity in relation to open pasture and was likely due to increased solar
radiation reaching ground level. We noticed at the end of the 2003 growing season the need for the tree stand to be thinned if forage sustainability was to be achieved.

**Herbage Quality**

A vital indicator of herbage value is its nutrient profile. When forage plants don’t receive enough sunlight, normal growth is not observed and nutrient content can be compromised. Under low light conditions, herbage crude protein can be excessive, nitrate deleteriously high, sugar content low, and energy content is not balanced with protein (Neel et al., 2008). Herbage with such a nutrient profile can reduce animal intake and performance, lower animal nitrogen capture and increase excretion, and in the case high nitrate, result in animal loss. Silvopasture must have adequate solar radiation reaching ground level to ensure maximized production and quality herbage.

**Animal Performance**

![Figure 3: Lamb performance across years presented as average daily gain (ADG) in pounds.](image)

Figure 3 presents lamb performance on open and silvopasture across years. It has been suggested silvopasture may be advantageous to animal performance because of reduced stress on grazing animals during hot periods. We did not detect any differences in animal performance between pasture types. Grazing animals in our experiments did not receive supplemental feed, yet obtained very respectable gains for young lambs on pasture.
Hardwood silvopasture herbage has higher levels of crude protein compared to open pasture at corresponding times throughout the growing season (Neel et al., 2003; Neel and Belesky, 2006). This higher crude protein level seemed to cause increased blood urea nitrogen (BUN) in lambs that suggested excess nitrogen availability to the animal (Neel and Belesky, 2006). Our current research is trying to find ways to use this difference in herbage nutrient profile to improve on-farm nutrient utilization efficiency.

Conclusion
Once established, silvopasture with similar fertility management and total DBH values of approximately 50 to 65 feet per acre will produce about 60% of the dry matter produced in open pasture. Animal performance can be expected to be equivalent between traditional and silvo-pasture types with lambs averaging about 0.20 lb per day gain under our management scheme. Differences in herbage nutrient profiles between pasture types may prove to be advantageous from an animal production and environmental quality standpoint. Ongoing research is underway to develop more efficient and easily applied management strategies.

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References
