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THE SOCIOECONOMIC AND ECOLOGICAL IMPACT OF COOL SEASON FORAGE PRODUCTION: A CASE OF BLACK BELT COUNTIES, ALABAMA

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Abstract

Raising livestock during the lean season of forage production has become a great challenge for small and limited resource farmers because of a high cost involved in procuring supplementary feed. This study was conducted to assess the impact of cultivating cool-season forages on the feeding costs for meat goats and cattle. Three case studies were conducted in three Black Belt Counties of Alabama, Russell, Dallas, and Bullock. The socioeconomic and ecological impacts of developing cool-season pastures were evaluated using the before versus after assessment approach. The findings revealed that all three cooperator farmers reduced costs of procuring hay and supplementary feed after establishing cool-season forages, on average $917 for two goat farms and $4,152 for a beef cattle farm. It is believed that an extensive outreach on forage production would help small and limited resource livestock farmers boost their farm income.
Keywords: Socioeconomic Impact, Ecological Impact, Cool-Season Forage, Year-round Pasture, Alabama Black Belt

Introduction

Raising livestock in Alabama is a significant challenge for small and limited resource farmers because of a high deficit of green forages during the lean months (September/October–March/April). During this period, producers spend money on supplementary feedstuffs such as hay, agricultural byproducts, and commercial feeds/grains to sustain their animals. Raising animals on supplementary feeds during these months every year is economically unfeasible due to the increasingly high price of grains and commercial feeds. Gillespie et al. (2012) argued that the most expensive operating cost was for feed, about 70% of the total operating cost. Therefore, growing enough forage would reduce the increasing feed cost. Accordingly, Bossis (2012) highlighted the importance of using pastures to reduce the requirement for concentrate feed, and thereby the feeding costs of goats. Also, producers have to perform more tasks such as (i) developing and maintaining storage facilities, (ii) working extra hours to feed the animals, and (iii) bearing with storage and feeding loss of feedstuffs.

The situation often results in negligible to no profit despite the hard work of the producers (Karki, 2013b). A forage-based livestock underpins sustainable production systems, which are considered to be a good agricultural practice. Kumar (2007) explained that expenditure on feed and fodder was the major component of the cost of goat rearing on commercial farms, and found that it accounted for 59% of the total variable cost. The concentrate feed and dry fodder, respectively, accounted for 58% and 25% of the total feed cost. Therefore, it is prudent on the part of farmers to economize on the feed cost to enhance profitability. Coffey (2006), emphasized that to raise goats at a low cost, the producer must maximize the use of forage. Coffey further explained that establishing good pasture may reduce winter feeding (supplementary feed) cost by 25% and hay cost by about 13%. However, Kieser (2008) stated that if roughages (green/dry forages) do not contain or supply the required nutrients animals should be given some commercial feed supplement, which is much more expensive than hay. They indicated that hay comprises 18% and grain mix comprises 22% of the 40% of feed cost.

The existing problem of the availability of green forages is only during five months out of the year (May/June-September/October). The crucial time for raising livestock is the lean seven months of the year (Figure 1) when there is a high scarcity of green forages. During this period, farmers have to spend a significant amount of money to procure enough hay, which also includes low quality cereal by-products. Partly, silage can also be another source of winter feed, mostly for large animals. Also, animals should be given some supplement feed (commercial feed) and other feedstuff (e.g., like peanut shells and concentrates) to compensate for the low amount of nutrients available from the dry forages. The situation becomes more challenging when farmers have to feed enough concentrate to pregnant and lactating animals and kids. It triggers an increase in the feeding cost, which is usually unaffordable for small and limited resource farmers. Overall, the quantity and quality of animal feeds have a direct implication on the composition and quality of livestock products.

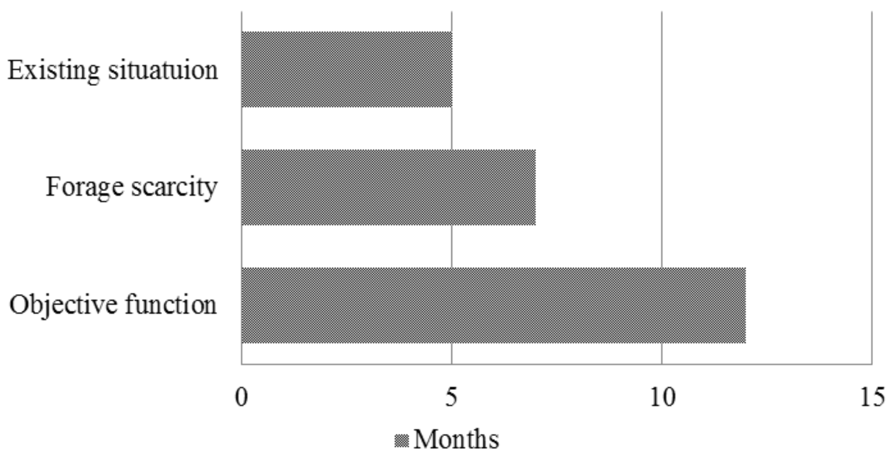

Figure 1. Months with forage availability during the existing situation and the desired extended period of forage production with pasture improvement in Alabama

Luginbuhl (2006) stated that cool-season perennial and annual grasses are generally of higher quality than warm season grasses. Cool-season perennial grasses have a longer productive season than warm season perennial grasses. Cool-season annual grasses provide very high-quality forage for grazing when warm season grasses are dormant. Cool-season perennial grasses generally do not grow well in the hotter parts of the Southeast. Incorporating cool-season perennial and annual forages in a grazing system allow for optimal pasture performance. Therefore, the objective of this study was to assess the socioeconomic and ecological impact of cool season forages on selected farm households.

Literature Review

The single most expensive variable cost in any livestock operation is feed cost. It is about 64% of the variable cost (Solaiman, 2006). Al-Khaza'leh et al. (2015) reported that feed was the highest cost factor accounting for 75% of the total variable costs of raising goats. Similar findings were reported by Eftimova et al. (2014) with feed costs accounting for 44 to 49% of the total production costs. Singh et al. (2014) mentioned that 63% of the total operating cost of raising goats was for feed. Growing enough forages and proper feeding and management can significantly reduce production costs, by minimizing the requirements for purchased feed. Luginbuhl (2016) emphasized developing the year-round grazing system for goats to minimize the production cost.

Goats raised for meat need high-quality feed in most situations and require an optimum balance of many different nutrients to achieve maximum profit potential. Because of their unique physiology, meat goats do not fatten like cattle or sheep, and rates of weight gain are smaller, ranging from 0.1 to 0.8 pounds per day. Therefore, profitable meat goat production can only be achieved by optimizing the use of high-quality forage and browse and the strategic use of expensive concentrate feeds. The former can be accomplished by developing a year-round forage program allowing for as much grazing as possible throughout the year (Luginbuhl, 2006).

Beef cattle production is also reflecting positive trends. The USDA-ERS (2011) reported that organic U.S. beef production has increased over the past decade along with rising consumer demand for the product. Organic beef is increasingly available to consumers mostly through higher-end restaurants and grocery stores, farmers markets, and direct purchase from producers. In 2008, 63,680 beef cows were on U.S. organic farms compared with 13,829 in 2000, an increase of 460%. Despite the relatively small size of the organic beef segment, alternative beef production has received greater attention in recent years as consumers have increasingly demanded natural, local, and/or grass (forage)-fed beef.

According to USDA-AMS (2011), some U.S. cattle farmers opt to raise grass (forage)-fed beef as non-organic rather than producing organic beef. Grass-fed beef is produced without any grains or grain by-products. The animal must have continuous pasture access throughout the growing season and may be fed “hay, haylage, baleage, silage, crop residue without grain, and other roughage sources.”

Wong et al. (2008) stated that grass-fed dairy cattle remain on the pasture their entire lives and are allowed to roam freely. They eat a natural diet, making them strong and healthy; therefore they have no need for antibiotics and hormones like cows in conventional dairies. They grow naturally and produce wholesome and natural products.

Beef cattle production systems based on perennial pastures are potentially more sustainable than those based on annual crops and stored feeds **(**Jannasch et al., 2002). Also, these authors found **t**he cost of production was $0.26/kg in the feedlot compared to $0.10/kg on pasture. Pastured cattle netted $0.13/kg of gain, or $68.00 per head, while feedlot cattle broke even. McCaughey (1993) reported production costs of $0.44-0.66/kg on pasture compared to $1.10/kg in the feedlot. Notably, the total profit on pasture-raised cattle was $0.13/kg of gain or $68.00/head, while feedlot animals broke even, indicating that grass/legume pasture can be an economical alternative to feedlot beef under prevailing economic conditions.

Other issues such as rotational grazing, control of internal parasites, pollution and soil degradation are important in livestock production. A carefully planned rotational grazing program can enhance pasture production and help control internal parasites. High-quality pastures and small-grain pastures are good for kidding since they provide excellent feed for milk production. Supplemental grazing in stubble fields, corn fodder, small-grain pastures, and brassicas can be used to either extend the grazing season or boost required nutrient levels for some critical phase of production. For example, Barkely et al. (2017) explained that moving goats out of pasture before the grass is less than 3 inches tall will help prevent internal parasite infection. Further, they mentioned that, in general, growth rates for meat goats are slower than those of sheep. Under favorable nutritional conditions, meat goats may gain at a rate of more than 200 grams (0.45 pounds) per day from birth to 100 days of age.

According to McEachern (2009), only about 10% of chemical pollution in the water comes from factories and other industrial sites; about two-thirds of water pollution mostly comes as run-off from agricultural pesticides and fertilizers. On the contrary, when legume forages are established and managed in pastures, the possible pollution from commercial nitrogen (N) fertilizer can be minimized. *Rhyzobium* bacteria in association with legume roots fix nitrogen, which is utilized by the legumes and associated grasses for their growth and development. The economic value of the N fixed by legumes depends on the market price of the nitrogen fertilizer. Karki et al. (2013) highlighted cultivating different kinds of legumes and non-legume forages help conserve farmlands, promote organic production, and reduce environmental pollution, which all add to the value of the land.

ALFA (2014) emphasized that grass fed cattle are a key element in the carbon cycle. By grazing and through manure deposition, cattle help foster pasture growth and hence contribute to carbon sequestration in both plants and soils. Contrary to popular misconception, grass fed cattle when rotationally grazed help reduce land degradation, desertification, and soil erosion.

Methodology

Case Study

The case study was carried out at three sites in rural Alabama: Selma, Phenix City, and Union Springs. The first two sites were for meat goats and the third one was for beef cattle production. Cool-season grasses and legumes were planted (annual clovers, hairy vetch, and winter peas). All three sites were supported with required technical assistance to improve their pastures. The study in Phenix City was carried out only in 2012. Therefore, a comparison was made with another goat producer in Selma in the same year; however, the study in Selma still continues. The case study about beef cattle operation started in 2013 and still continues.

Data Collection and Analysis

Data were collected through seven techniques. These were farm recording, farm inspection, training, field days, support services, monitoring and inspection, and economic value of nitrogen. The "Before and After" Approach and other impact assessments were used to assess the data. They are described in details below.

Farm Recording

A simple and handy recording format was developed. In line with Tackie (2008), farmers were encouraged to enter data in the given recording format on a weekly basis. The cooperator producers were trained on how to keep records of all activities that happened on the farm, especially the feeding expenses that accrued while procuring hay, minerals, supplementary feed, hired and family labor, as well as costs for veterinary services.

Farm Inspection

In the beginning, Tuskegee University Cooperation Extension (TUCE) personnel gathered farmers' information and identified the cooperating farms. After that, they visited the farms and observed the entire farms and their facilities and discussed the potential areas for improvement. The primary areas of focus during the visit was: explaining the importance of cultivating cool season forages and developing year-round pasture, calculating stocking density, exploring the sources of forage seeds, fertilizers, and exploring the no-till drill for renting, explaining application of farm management principles and practices, reducing production costs, and increasing the gross margin.

Training

Farmers were trained intensively in establishing and managing cool-and warm-season forages for extended grazing. Similarly, the grazing component was one of the prime focuses on how to effectively utilize and preserve the available forages. Briefly, the training consisted of, but was not limited to the following: the importance of year-round forage production and grazing/browsing management; forage definition and classification; suitable forages for goats; basic agronomic and physiological principles of forage production; suitable forages for developing year-round grazing systems for cattle in the Southeast; facility development for pasture-based goat production under continuous, rotational, and other grazing systems; sustainable grazing management; identification and management of different browse species adapted to the Southeast; pasture weed identification and management; economics of year-round grazing; resource conservation and erosion control through a proper grazing plan and design, and supplemental feeding of grazing animals. During the training, participants were provided with educational materials (flyers, pamphlet, handbooks, and recording formats).

Field Days

Producers had opportunities to interact with peer groups of farmers, share their experiences, and learn from each other regarding: forage establishment and grazing management, supplementary feeding to grazing animals, economic benefits of developing year-round pastures, information on how to collect and composite soil samples, identify different forages, measure the forage height, calculate the available biomass, tour the site, observe planting equipment, fencing, and facilities (shelter, watering, and feeding), and discuss the local solutions.

Support Services

Farmers were supported with forage seeds, fertilizers, grazing sticks, a soil test, and a rental charge for the planting equipment. They received the required technical and managerial assistance as needed to establish the year-round pasture and cultivate cool season forages and manage them to ensure a long-term productivity of the pasture. The farmers also received assistance in farm management practices, such as least cost principle while feeding; making sheds clean and tidy to avoid diseases and parasite infestations, and searching for animals with proven health records.

Monitoring and Supervision

All three cooperating farms were monitored and supervised regularly from the beginning to the end of the production season each year. The farmers were given orientation through farm visits, in-person-contact, telephone conversation, workshops, and training. All of the field activities, namely, land preparation for planting forages, application of seeds and fertilizers, grazing management of the pasture field, perimeter and cross fencing, animal husbandry (hoof trimming, drenching, shed management, water and feed trough management, feeding practices, etc.), and marketing farm animals, were constantly monitored and supervised. This was done make sure that every activity on the field happened on time and went as planned.

Economic Value of the Fixed Nitrogen (N) by the Legumes

Leguminous forages have dual advantages: (i) reduce the negative externality of N fertilizer as they absorb atmospheric N and make it available for the plants to use, and (ii) save an equivalent dollar amount of buying N fertilizer. Thus, in addition to saving in feeding costs, legumes save an equivalent cost of buying N fertilizer based on their absorption rate (which was calculated using the information presented in Table 1).

Table 1. Value and Amount of N Fixed by Various Legumes

Forages	N fixed lb/Acre/Year Range		N value ($) @ 50 ¢/lb Range	
Red Clover	75	200	37.50	100.00
Vetch	50	150	25.00	75.00
Sericea lespedeza	50	150	25.00	75.00
Peanut (perennial forage legumes)	50	150	25.00	75.00

Source: Ball et al. (1996), Note: N = Nitrogen, lb = Pound

Before Versus After Approach

The condition of all three farms was compared using the baseline information before the interventions were introduced and the condition of the same farms after the intervention. One-year data pertaining to feeding costs of the two goat farms and two-year data of the beef cattle farm were compared using a *Before versus After* impact assessment approach. Figure 2 compares the baseline information (feed cost incurred before the cool-season forage establishment) of the cooperator farmers, represented by A, with the improved conditions after the intervention (forages available) of the same farmers, denoted by B. Thus, the difference in the feed cost (B-A) would reflect the direct impact of pasture improvement, provided the influence of exogenous factors are isolated.

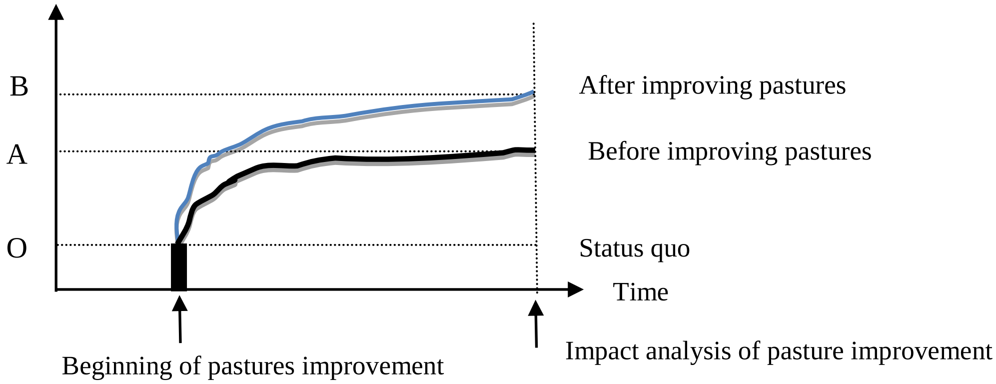

Figure 2. Schematic Diagram of Before Versus After Impact Assessment Approach
Source: Modified from Bauer (2001)

Other Approaches to Impact Assessment

Figure three broadly illustrates the possible areas of impact assessment of the project. The increased knowledge and skills regarding small farm management practices were assessed as human capacity. Similarly, the potential amount of money saved by lowering the feed and labor costs was measured as economic impact. Farmers' exposure and connection with their peer groups, professionals, and agribusiness individuals and institutions were assessed as social impact. Furthermore, the ecological impact was also assessed as an added value of the land, vegetation coverage, and economic valuation of the potential nitrogen fixation by the legume forages. The study also investigated spill-over impact of the project on friends, families, relatives, and the people in the community and beyond. This latter aspect is also considered as an indirect impact without any direct cost involvement.

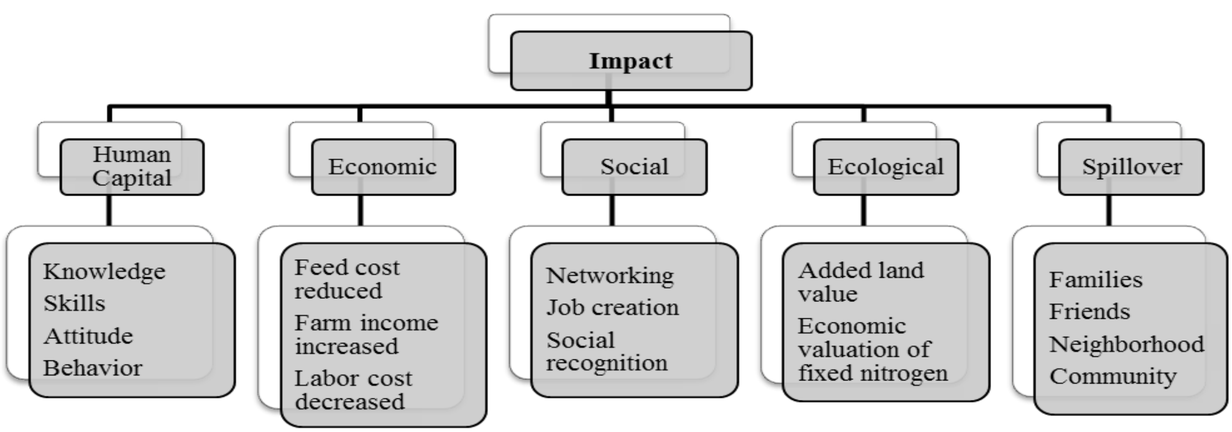

Figure 3. Approaches to Measuring Impact Assessment of a Project

Results and Discussion

The Case of the Meat Goat Farms

Meat Goat Farm 1, Phenix City

This was a first generation beginning farmer, with 6 acres of land. Initially, the farm had less than ten goats and no cool season pastures (legumes and non-legumes). The entire 6 acres of farmland was covered by bushes, thorny plants, trees, and unwanted wild weeds. The owner was then trained on forage cultivation, goat production, and pasture management. The farmland was cleared of the unwanted vegetation, and proper pasture established, including cool season forages. The planted cool-season forages were Marshall ryegrass, arrow leaf clover, berseem clover, crimson clover, hairy vetch, and winter peas. The pasture was enclosed by perimeter and compartmental fencing to introduce a rotational grazing system for better pasture management. As the pasture improved, the number of goats gradually increased to 35. The herd comprised of mixed breed of Boer, Kiko, and Spanish. The herd was rotationally grazed for better management when forages were ready.

Meat Goat Farm 2, Selma

Just like the farm in Phenix City, this farm also had few goats at the beginning. Also, as a beginning farmer, there had never been any pasture improvement program on this farm. The farm had 13 acres of land, which was covered by bushes, thorny plants, trees, and unwanted wild weeds. The owner was trained on forage cultivation, goat production, and pasture management. Subsequently, the farmland was cleared of unwanted vegetation and cool season legumes and non-leguminous forages, as in Farm 1, were planted on 8.47 acres in 2012. These forages were expanded to cover 14.47 acres in 2015 (Tables 3 and 4). Simultaneously, the farmer started steadily increasing the number of his goats, and the herd reached 40 heads a mixed of Boer, Kiko and Nubian. Again, rotational grazing was introduced to make the best use of the available pasture when forages were ready to let goats in.

Economic Impact

The study revealed that farmers had to procure hay and commercial feed due to the lack of enough forages during October-December (2012). The money was spent on variable expenses, mostly for procuring hay and commercial feeds, and agricultural byproducts when there was not enough forage available for grazing. These costs were greatly reduced after the cool season pasture improvement on these farms. The 'before and after' intervention data implied that there were not enough green forages to feed animals during the lean season before pasture improvement, and abundant cool-season forages were available for goats and beef cattle to graze after the forage establishment.

In Selma, the record revealed that the average feed cost per month before the establishment of cool season forages was $301.00 (1205*3/4 [25% of the purchased feed was saved for the rest of the season] = $904/3 months), whereas the feeding cost per month after developing cool-season forages (January to April) was reduced to $80.00 ($320.00/4 months). Thus, the cooperator producer in Selma was able to save $221.00 (320.00-80.00) per month while feeding 40 goats after developing the cool season forages (Karki, 2013a). Other factors remaining constant, a large reduction of feed cost by 73% was the direct economic benefit of the pasture improvement (Table 2).

Table 2. Comparison of Feeding Costs (Figures are in $) Before and After Pasture Improvement (2012)

Farm	Purchased feeds	Before the cool season forages Oct	Nov	Dec	Total	After the cool season forages Jan	Feb	Mar	Apr-Jun	Jul-Sep	Total	Difference
Selma	Hay	60	325	200	585	50	0	0	0	0	50	535
	Commercial feed	300	220	100	620	110	75	85	0	0	270	350
	Total	**360**	**545**	**300**	**1,205**	**160**	**75**	**85**	**0**	**0**	**320**	**885**
Phenix City	Hay	300	200	100	600	50	0	0	0	0	50	550
	Commercial feed	400	400	400	1200	200	0	0	0	0	200	1000
	Total	**700**	**600**	**500**	**1,800**	**250**	**0**	**0**	**0**	**0**	**250**	**1,550**

Source: Adapted from Karki (2013a).
Note: 25% of the purchased feed in Selma was saved for the rest of the season.
50% of the purchased feed in Phenix City was saved for the rest of the season.

In Phenix City, the record revealed that the average feed cost was $300.00 per month during the lean months of October-December to feed 35 goats ($1800/2 [50% of the purchased feed was saved for the rest of the season] = $900/3 months) before the cool season forages were established. The feeding costs per month after developing cool-season forages (January-April) were reduced to $62.50 ($250/4 months). Thus, the introduction of cool season forages enabled the farmer to save $237.50 (300.00-62.50) per month (Karki, 2013a) (which was $950.00 for the period of four months). In other words, the feed cost was reduced by 79% for the four months (Table 2). When there was enough green forage for the goats to graze, from March-June (on cool-season forages), no additional feeding cost was recorded.

Ecological Impact

The economic value of nitrogen fixed by leguminous forages is presented in Table 3. Farmers in Phenix City and Selma, respectively, saved $213.00 and $424.00 in 2012. The farm in Phenix City was in direct observation only in 2012. Therefore, the comparison between the farms was made only for one year. According to Karki (2013b), when legumes are planted, it is not necessary to apply N fertilizer if the forage stand consists of 33% or more legumes.

Table 3. Economic Value of the Nitrogen Fixed by the Leguminous Forages (2012)

Items	Phenix City	Selma
	Types of forages planted: Annual clover, Hairy vetch, Winter peas, Sericea lespedeza	
Area planted (Acre) (a)	4.25	8.47
Average N fixed lb/Acre/year (b)	100	100
Total N fixed/ year (c=a*b)	425	847
Average N value ($) @ $0.5/lb (d=c*0.5)	212.5	423.5

Note: N = Nitrogen, lb = Pound

Unlike the farm in Phenix City, the farm in Selma still continues producing cool and warm season forages. The owner expanded the area to 14.47 acres since 2015, and the estimated N fixed by legumes was equivalent to $2,717.50 over five years (Table 4).

Table 4. Economic Value of the Nitrogen Fixed by Leguminous Forages

Items	2012	2013	2014	2015	2016	Total
	Site: Selma					
Types of legume forages planted	Annual clover, Hairy vetch, Winter peas, Sericea lespedeza, Hairy Vetch, Winter Peas					
Area planted (Acre) (a)	8.47	8.47	8.47	14.47	14.47	54.35
Average N fixed (lb/Acre/year) (b)	100	100	100	100	100	500
Total N fixed (lb/year) (c=a*b)	847	847	847	1447	1447	5435
Average N value ($) @ $0.5/lb (d=c*0.5)	423.5	423.5	423.5	723.5	723.5	2,717.5

N = Nitrogen, lb = Pound

The Case of the Beef Cattle Farm, Union Springs

The beef cattle farm in Union Springs is a cow-calf operation, and had, on average, 40 heads in 2013-2014 and 54 in 2014-2015. The farm had never cultivated cool season forages before the project intervention. After a series of personal communications with the owner regarding economic and environmental advantages of cultivating cool seasons forages, the owner participated in workshops, training programs, and field days organized by TUCE. Apart from participating in these events, the owner was given enough educational materials (handbooks, pamphlets, brochures, and related publications) and one-on-one coaching at the production site. Initially, the forages were cultivated in 8 acres on 2013 and 2014. After realizing the economic benefits and improved health condition of animals and pastures over the two-year period, the owner expanded the area to 15 acres in 2015 (Table 5). The increased biomass production also motivated the owner to increase the number of cattle from 40 to 54. Additionally, the farm also hosted two farmer field days. Currently, the farm is used as a demonstration site for improved pastures and grazing management by TUCE.

Economic Impact

The cost of buying hay naturally goes up during the lean months as the green pasture converts into dry. Thus, the owner fed hay from mid-October to March. The lowest amount of hay was fed in October ($690.00) and the highest amount was in December ($1,426.00). In addition to feeding hay, $240.00 was spent each month on sack feed during four months of the lean season. Thus, the average cost of hay and grain per month during the lean period of forage availability was $1,384.00 (Table 5).

Table 5. Feeding Costs (Figures are in $) of a Cow-Calf Operations in Union Springs, Alabama (2014-2015)

Purchased feeds	Oct	Nov	Dec	Jan	Feb	Mar	Apr-Jun	Jul-Sep	Total
Hay ($)	690	1,380	1,426	1,313	1,204	1,333	Cool season forages	Warm season forages	7,346
Commercial feed ($)			240	240	240	240			960
Total ($)	690	1,380	1,666	1,553	1,444	1,573			8,306

The sole purpose of this cool season forage production was to reduce the feed cost by building capacity of the farmers to produce enough forage to feed their animals throughout the year. The intervention reduced the hay and grain cost from $1,384.00 (8,306.00/6) per month to virtually a minimal amount or no cost at all during April-June. Accordingly, the farmer saved $4,153.00 (1,384.00x3) within three months (April-June) due to the production of cool season forages. However, prevailing challenges for the farmer seem to be, but are not limited to (i) how to increase the productivity of the cool season forages to make enough hay to feed the animals during the lean months, and (ii) how to expand production of legumes and other nutritious grasses with minimum variable costs.

Ecological Impact
The economic value of the nitrogen fixed by the legumes in Union Springs was estimated to be $2,300.00 over the period of four years (Table 6). The estimated figures (fixed nitrogen and its economic value), improvement in animals' health, and biomass production were encouraging to the farmers. Accordingly, the area was expanded from 8 acres in 2013 and 2014 to 15 acres in 2015.

Table 6. Estimated Economic Value and the Amount of Nitrogen Fixed by the Leguminous Forages

Items	Site: Union Springs				Grand Total
	2013	2014	2015	2016	
Types of legumes planted	Crimson clover, Arrow leaf clover, White clover				
Area planted (Acre) (a)	8	8	15	15	46
Average N fixed (lb/acre/year) (b)	100	100	100	100	100
Total N fixed (lb/year) (c=a*b)	800	800	1500	1500	4600
Average N value ($) @ $0.5/lb (d=c*0.5)	400.00	400.00	750.00	750.00	2,300.00

Other Impacts
Human Capital Impact
The project enhanced farmers' knowledge and skills positively regarding forage-based sustainable livestock production that consisted of the basics of farm economics (inputs, outputs, income, gross margin, costs), production (soil testing, liming, fertilizing), and management (grazing, labor, money, feed storage, field days). Similarly, their attitude and behavior changed positively towards farming (such as expanding acreage under production) and keeping an active life style (working with animals, plants, marketing).

Social Impact
The farmers got the opportunity to extend their networking pool with similar farms, professionals, related companies/industries, and business owners, while participating in numerous events. They also strengthened their business communication skills and leadership quality by interacting with many people during these events. Buying inputs (e.g., seeds, fertilizers, liming, and fencing materials) and supplying the products (e.g., goat and cattle for meat) may have supported and/or created a few more jobs in the respective industries and communities. The derived income and involvement in various activities supported family values such as children's education and increased social recognition in the community. As an example,

the owner of the Selma farm delivered a couple of guest speeches regarding the impact of cool season forages.

Spillover Impact

All these cooperating farms are considered as demonstration sites where others, such as, beginning farmers, existing farmers, persons interested in farming, youths, and professionals, can learn from them. In addition, their families, friends, and other community members visited and/or heard about their improved farming activities. It was estimated that the effect of the interventions spilled-over to 500 people (Phenix City 50, Selma 100, Union Springs 30, and training and workshops 320).

Other Benefits of Cool Season Forages

Besides the economic benefit calculated in monetary values, the goat producers have expressed that they observed lower parasite infestation and other health problems, and better performance of the animals as compared to previous years during the same lean season. Similarly, they recognized that the labor requirement was reduced by an hour/day (Karki, 2013a). Hence, several hundred man-days were saved that otherwise could have been used for feeding, management, and taking care of goats and cattle during the lean season of forage production. Similarly, according to the owner of the Selma farm, the value of the land with improved pastures went up. Likewise, the increased biomass production resulted in increased feed intake and increased the live weight of the goats, improved their health, and produced healthy kids. Simultaneously, the farmers mentioned that they produced more manure and that resulted in improvement of soil fertility and reduction in fertilizer cost.

Conclusion

Goat and cattle producers in Alabama and other places with similar climatic conditions can improve their pastures, and eventually reduce the cost of production. Cultivating year-round forages is a perfect example of underpinning sustainable livestock production. Reaching out to farmers and potential farmers, and providing massive education followed by constant technical assistance to increase their profit margins are the basic ways to retain farmers. Further research is required to measure the impact in monetary terms regarding savings in labor, increase in body weight of meat goats or beef cattle, the extent of reduced fertilizer cost due to increased manure production, and reduced parasite infestations.

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