Influence of cattle grazing alone and with goats on forage biomass, botanical composition and browse species on reclaimed mine land

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Reclaimed mined-lands have been successfully used for forage production in the Appalachian region. However, the encroachment of undesirable invasive plant species reduces the utilization of these pasturelands by cattle and conventional control methods are not cost-effective. An experiment was initiated in spring 2006 in Virginia to determine the effects of mixed grazing goats with cattle on forage biomass, botanical composition and browse species. The three treatments were a no grazing control, cattle alone grazing, and mixed grazing goats with cattle. Treatments were arranged in a randomized complete block design with 3 replications of each grazing treatments and 2 of the untreated control. The treatment with cattle alone had three crossbred steers while the mixed grazing treatment utilized three crossbred steers and 15 young intact male goats. Forage biomass yield was determined in spring, summer and fall by clipping 8-0.25m² square quadrants per grazing treatment and 4-0.25m² in the control treatment to a 2.5 cm height. Prior to clipping, botanical composition and groundcover were assessed visually. Autumn olive (*Elaeagnus umbellata* Thunb.) measurements included branch length, shrub height, and shrub survival. Eight shrubs were randomly identified and tagged with a letter in each treatment replication while four shrubs were used in the control treatment.

Mixed grazing of goats with cattle can have positive influences on botanical composition and invasive plant species control on reclaimed coal-mined lands in the Appalachian region. When compared to control and cattle alone grazing, forage availability was lower for mixed grazing over the entire grazing season. Groundcover percentage tended to be lowest for mixed grazing particularly during the summer season. Goats showed a clear preference for browse species and forbs such as sericea lespedeza. The grazing behavior of goats influenced the growth pattern of sericea lespedeza from an erect, woody, less leafy plant to a shorter, more palatable, and more leafy plant. The shorter and leafier sericea lespedeza was more acceptable and thus was readily grazed by cattle. In 2006, grazed treatments resulted in a reduction in undesirable weedy species. Furthermore, by the end of the 2007 grazing season, the grazing treatments reduced the weed percentages below 30% (Tables 1 and 2). By the end of the two grazing seasons, the grass component of the grazed pastures increased while legumes particularly clovers declined (Tables 1 and 2). The change in botanical composition of the pastures due to grazing can be attributed to the grazing pattern and diet preference of the grazing animals. The grazing behavior and diet selection of goats greatly differs from cattle. This makes the mixed grazing of cattle and goats an alternative management technique for managing diverse pasture swards.

Goat browsing had negative impact on autumn olive shrubbery. In 2006, branch length was negatively impacted by goat browsing but not in 2007. Differences in autumn olive height showed differences in summer-fall period 2006 and spring-summer period 2007 but no differences in shrub height at the end of the growing seasons were noted. Shrub survival was lower in mixed grazing (up to 80%, Figure 3)) by the end of the experiment compared to the other treatments. Standing on their hind legs and placing their weight on branches resulted in

the development of a browse line, broken, and dead branches. Bark stripping and girdling further crippled autumn olive shrub vigor.

Mixed grazing goats with cattle is a viable practice on reclaimed coal-mined lands. It resulted in greater utilization of pasture resources mainly due to the different grazing habit of goats and cattle offering opportunities for complementary pasture use. Goats provided biological control for invasive plant species, such as autumn olive. Therefore, goats could have a major role in low-input farm enterprises in the Appalachian coal-mining region. These results suggest that goats and cattle grazing together in botanically diverse pastures could maximize the efficiency of utilization of both herbaceous and woody species.

Table 1. Effect of control, cattle alone, and mixed grazing treatments on botanical composition -2006.

	Treatments		
Component	Control	Cattle	Mixed
	……Spring…….		
Groundcover	81.0a	84.2a	69.5b
Grass	44.0a	40.2a	36.8a
Legume	18.0b*	32.8a*	5.2c*
Weed	38.0b	27.0b	58.0a
	.....Summer……...		
Groundcover	91.0a	85.0a	63.5b
Grass	25.0b	48.8a	55.0a
Legume	18.0ba	27.7a	9.2b
Weed	57.0a	23.5b	35.8b
	……..……Fall……...		
Groundcover	80.0a	79.7a	66.2b
Grass	52.0c*	63.7b*	76.3a*
Legume	4.5b	27.5a	7.0b
Weed	43.5a	8.8b	16.7b

Values followed by capital letter signify significance within row
*indicates significant differences at P = 0.10

Table 2. Effect of control, cattle alone, and mixed grazing treatments on botanical composition – 2007.

Component	Treatments Control	Cattle	Mixed
	……Spring…….		
Groundcover	67.5ba	75.2a	55.2b
Grass	72.0a	72.5a	52.7b
Legume	0.5b	19.5a	16.7a
Weed	27.5a	8.0b	30.7a
	.....Summer……...		
Groundcover	63.0a	61.5a	57.8b
Grass	41.0b	77.3a	70.7a
Legume	0.0c*	8.2b*	16.5a*
Weed	59.0a	14.5b	12.8b
	……..……Fall……...		
Groundcover	83.5b	75.7a	59.7b
Grass	49.0b	83.3a	72.8a
Legume	0.0a	5.8a	5.5a
Weed	51.0a	10.9b	21.7b

Values followed by capital letter signify significance within row.
*indicates significant differences at P = 0.10

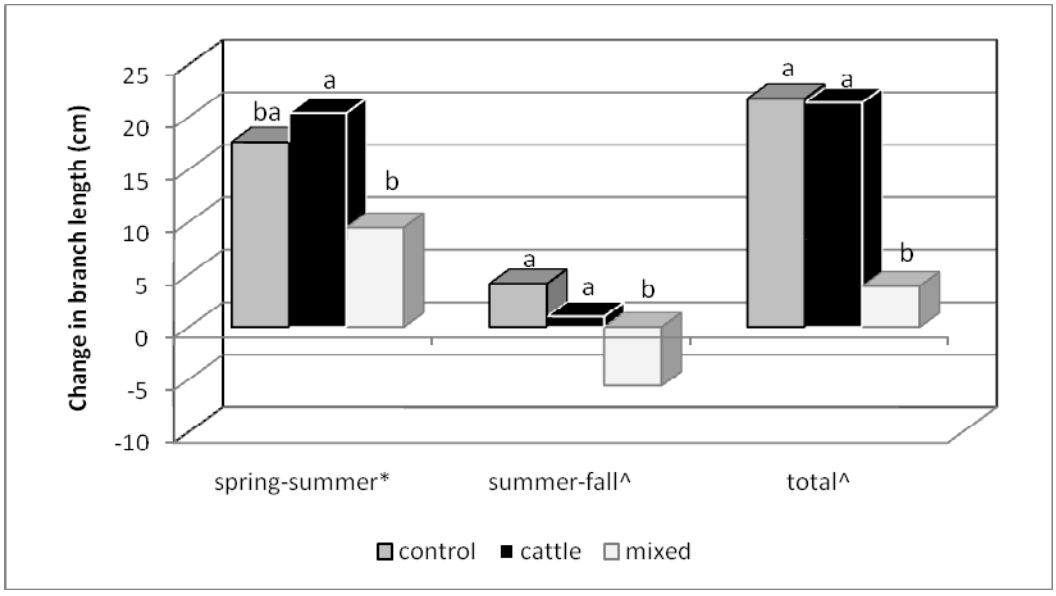

Figure 3. Influence of cattle alone and mixed grazing vs. no grazing control on seasonal and total change of branch length (cm) of autumn olive for 2006
(values within season followed by the same letters not significant at P = 0.05).