Summary of Mob Grazing in Virginia

Benjamin Tracy, Ph.D.

Associate Professor, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA

Introduction

This paper summarizes several research studies that addressed mob-type grazing in Virginia. The studies were conducted from 2012 to 2016 and compared three grazing systems: mob, rotational and continuous grazing. Various system characteristics were measured including forage productivity, forage nutritional value, animal performance, clover populations and indices of soil health.

Mob vs Rotational Grazing

Mob grazing is a type of rotational or managed grazing that involves intensive decision-making to control livestock stocking rates and forage removal from pasture to produced desired outcomes (Allen et al., 2011). Mob type grazing was first promoted by Allan Savory in the 1980s as part of a more holistic approach to rangeland management (Savory, 1988) and then adopted to some extent in eastern pasturelands (Salatin, 2008). With mob grazing, a large number of animals are restricted to a small area, either eating or trampling all the plants before being moved to new grass - sometimes just after a few hours. Grazing usually starts later in the season (e.g., late May/June in Virginia) when pastures have more growth. Mob grazing is then followed by a long recovery period – usually 90 days or longer. Mob grazed pastures may be grazed just once or twice per season as a consequence. By comparison, typical rotational grazing uses recurring periods of grazing and rest among three or more paddocks. It is similar in principle to mob grazing except stocking density is lower and pasture recovery periods are much shorter – e.g., 15-30 days. However, typical grazing management in Virginia usually involves minimal management of stocking rate or control of forage removal. This management is often called continuous grazing.

Research and observational studies from pastures have described the benefits of mob and rotational stocking methods (Jones, 2000, Salatin, 2008). They include:

1. Healthy soil, with high organic matter, water-holding capacity, and an abundance of microorganisms, earthworms and dung beetles.
2. An even distribution of recycled soil nutrients and organic matter across pastures from the intensive management of animal stocking density.
3. Desirable plant diversity with few weeds and consistent seasonal ground cover that will help builds organic matter and reduces soil erosion.

Although various studies have compared rotational with continuous grazing, less formal research has been done on mob grazing. Nonetheless, mob grazing methods have been embraced increasingly by researchers and livestock producers (Earl and Jones, 1996, Jones, 2000, Salatin, 2008, Tietz, 2011). Part of our goal was to collect field data to help evaluate the potential benefits of mob grazing in an environment like Virginia. The main objective of our work was to compare **mob, rotational and continuous grazing** methods to determine how they affected forage productivity, forage nutritional value, animal performance, indices of soil health, and clover populations.

Study Sites and Measurements

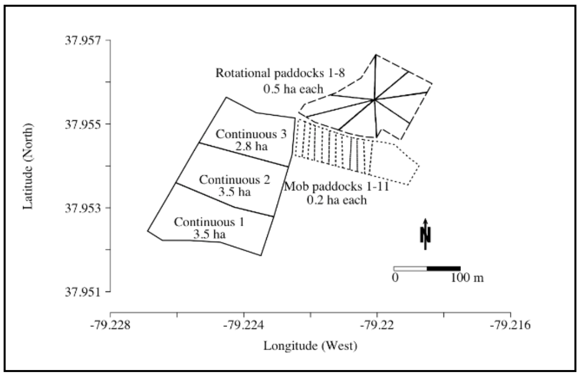

Figure 1. Stocking method layout at Raphine.

Research was conducted at three locations: two demonstration farms in Blacksburg and Raphine, Va. from 2013 to 2015 and an additional site at the Virginia Tech Shenandoah Valley Agriculture Research and Experiment Center in Steeles Tavern, VA (SVAREC) from 2014 to 2016. Mob, rotational and continuous grazing systems were installed at all locations. Grazing treatments were not replicated at the demonstration farms (Figures 1 and 2). The grazing systems were replicated 3 times at the SVAREC site **(Figure 3)**. Detailed site descriptions will not be provided here, however, soils were predominately silt loams and the vegetation at each location was dominated by tall fescue, orchardgrass, and Kentucky bluegrass. Commercial fertilizer and lime was applied according to soil test recommendations before the studies began. Ladino clover (*Trifolium repens* L. 'Will') and medium-sized red clover (*Trifolium pratense* L. 'Cinnamon Plus') were broadcast in February 2013 and 2014 at 1 and 2.5 kg ha^{-1} (3 and 6 lbs. acre^{-1}), respectively to all systems.

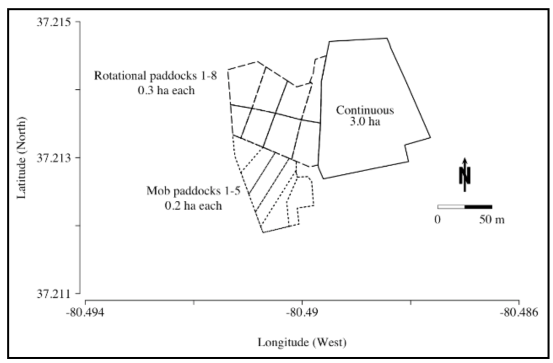

Figure 2. Blacksburg site.

Cattle and Grazing

Beef cows (aver 610kg/1300 lbs.) and steers (aver 310kg/ 680 lbs.) were stocked at the Blacksburg and Raphine locations, respectively. Stocking rates were similar (~1 Animal Unit (AU)/2 acre) where; 1 AU = 454 kg/1000lbs live BW). Water and mineral were offered *ad libitum*. At the Raphine and Blacksburg sites, mob stocking consisted of two stocking periods each year of 12- to 16-h duration, stocking densities were 138,000-155,000 kg live BW ha^{-1} (125,000 - 140,000 lbs. LW/acre on 0.1 - 0.2-ha (0.25-0.50 ac) paddocks, and rest periods were 90- to 120-d during the growing season. Rotational stocking consisted of 6 to 7 stocking periods of 3- to 4-d duration on 0.3 to 0.8 ha (0.75 to 2 ac) paddocks with fixed 28-30-d rest periods.

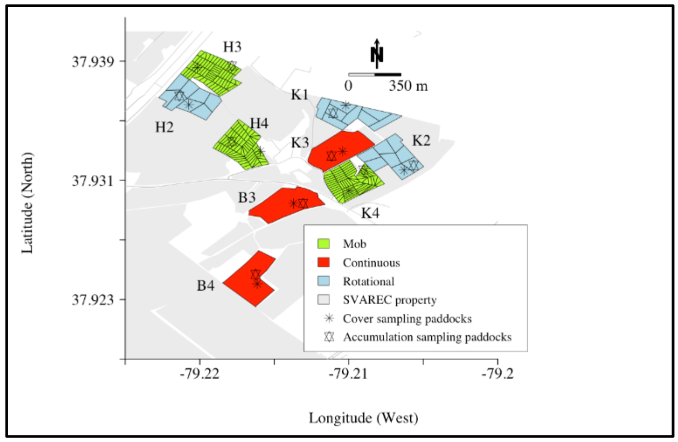

***Figure 3**. Stocking method layout at the SVAREC site. Steels Tavern Va.*

'Mob' grazing at the SVAREC location consisted of three stocking periods each year, on 0.1 ha paddocks that were allocated to the cattle every 24 h. Paddocks were not back-fenced to allow access to water at a fixed location on one end of the pasture. Each pasture was rested for a fixed period of 64-d. Stocking density of approximately 43,000 kg live BW ha^{-1} (~ 40,000 lbs. /ac.) was maintained on the paddocks. Rotational and continuous grazing protocols were similar to the demonstration sites. Beef cattle cow-calf groups grazed the SVAREC site.

Measurements

Forage mass and nutritional value samples were taken monthly from April to October each year of the study and analyzed using standard procedures. Plant species composition was taken using a percent ground cover method and done 3x each year – spring, summer and fall. Only clover abundance will be reported in this summary paper. The soil samples to evaluate soil carbon pools and health indices were collected in late May 2015 at the two demonstration farms. For each stocking method, samples were collected along 2 transects at 3, 5, 10, 20, 40, 60, and 80m from water sources. Transects were in two directions from the water in the continuous pastures and in two paddocks in the rotational and mob pastures, allowing for any differing slopes and aspects. Soils were returned to Virginia Tech and analyzed for basic soil nutrients and pH and along with soil carbon and nitrogen pools. Soil compaction at each location was measured in early spring 2015 using a soil penetrometer at 20-30 locations within each grazing system. Animal performance only could be measured at the SVAREC site using the replicated treatments. Cow weights and BCS were taken in December before breeding. Calves were weighed at birth (October) and weaning (early May).

Results and Discussion

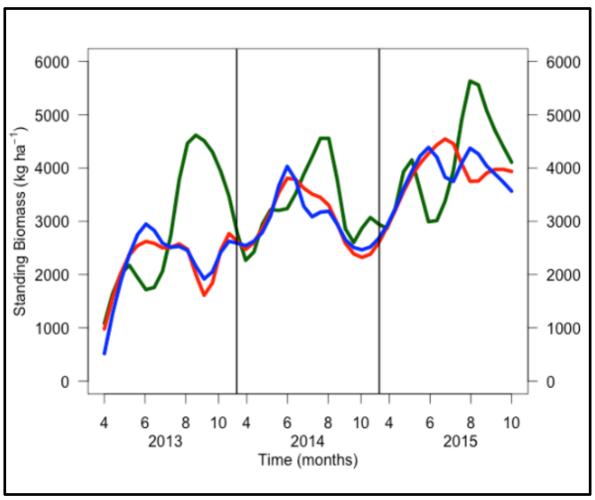

***Figure 4**. Forage mass measured over the three years of the study. Green line = mob, red line= Cont. and Blue line= rotational*

Forage production and nutritional value: At Blacksburg and Raphine, the amount of forage mass differed among the stocking methods **(Figure 4)**. Mob grazed paddocks contained on average 600 kg ha^{-1} (540 lbs. /ac.) more forage than rotationally or continuously stocked paddocks. Forage mass was about 350 kg ha^{-1} (315 lbs. /ac.) greater at Blacksburg compared to Raphine. Mob grazed pastures tended to accumulate more forage during the late summer compared with the other stocking methods (green line in Figure 4). Forage accumulation did not differ among the stocking methods, but disappearance (i.e. use by cattle) was lower under mob stocking (data not shown). Overall, these findings suggest that mob grazed pastures accumulated more forage mainly because cattle ate less probably due to much of the grass being trampled down making it difficult to graze.

The main effects of grazing method on for-age nutritional value were not different until 2014 and 2015. As shown in **Figure 5,** for crude protein (CP), continuous pastures generally had higher concentrations especially in 2014 and 2015 (red line on graph). The higher nutritive values were mainly due to the higher amount of white clover in continuous pastures. Cattle often preferentially select clover because of their high protein content and palatability (Mourino et al., 2003) (Chapman et al., 2003). Trends for fiber components (ADF and NDF) were similar to CP so were not shown. Nutritive values did not dip below the limiting threshold set for cow maintenance (e.g., 90 g kg^{-1} or 9% for crude protein). However, values were getting close to falling below the threshold for mob grazed pastures in 2015. The findings suggest forage nutritive values under mob grazing are reasonable for dry cows but may worsen over time since grasses were allowed to become excessively over-mature each year before grazing. Forage production and nutritive value data at the SVAREC site has not been completely analyzed, but preliminary data show similar trends to those at the demonstration farms.

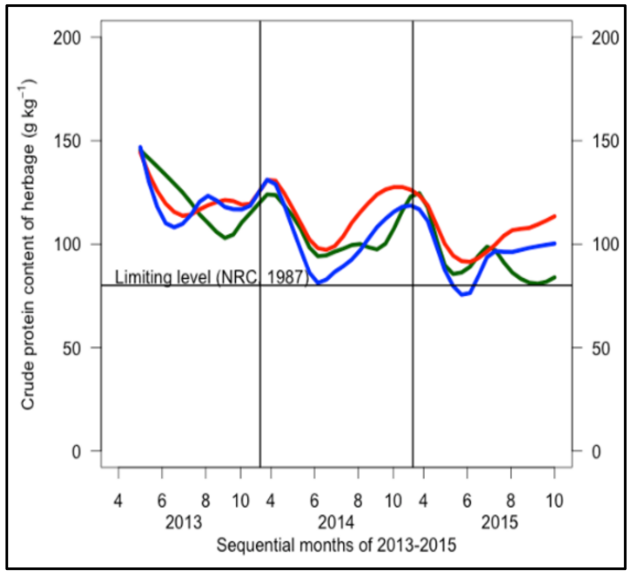

Figure 5. Forage crude protein measured over the three years of the study. Green line = mob, red line= continuous and Blue line= rotational.

Plant Species: Clover Abundance: A major interest in the plant species composition measurements was to evaluate how clovers would establish after overseeding them. As shown in **Table 1**, continuous pastures had more white clover than other stocking methods. Continuous pastures were grazed shorter than the other systems, which tends to favor white clover establishment especially if rainfall is adequate (Schlueter and Tracy, 2012). The amount of bare ground was lowest under mob grazing likely due to the high amount tall grass that was trampled during grazing. Bare ground was low in all stocking methods, however. The upright growth habit of red clover likely helped reduce shading by grasses during mob and rotational stocking and allowed it to establish relatively well (Taylor and Smith, 1995). White clover also tends to colonize bare ground via stolon growth. This situation would explain why continuously stocked areas had greater white clover cover than mob grazed areas. Species composition data from the SVAREC pastures show a similar trend (data not shown). Red clover appeared to establish particularly well under mob grazing at the SVAREC, possibly due to above average rainfall in spring and early summer. In terms of other plants (e.g. weed species), we found no real notable differences among the grazing systems. Overall, it appears that clovers can establish reasonably well under mob grazing – especially red clover when rainfall is adequate.

Table 1. The ground cover percentage of white clover, red clover and bare ground averaged over the growing seasons at the two demonstration farms. SE is standard error of the mean.

	Cover type		
Grazing method	**White clover**	**Red clover**	**Bare**
		%	
Continuous	7.5	4.2	3.3
Mob	2.5	3.6	1.1
Rotational	3.0	3.1	3.3
SE	2.0	1.2	1.2

Soil Health Indices: Another objective of the study was to evaluate how the grazing methods would change soil nutrients and health over time. Soil variables were measured only at the demonstration farms. In terms of soil health, we were particularly interested in indices that could be linked to potential carbon sequestration (e.g., soil organic matter). To do this, we took soil samples at the start and end of the study in geo-referenced grids at each site. Soils were analyzed for pH, macro and micronutrients and soil organic matter (SOM). SOM averaged between 3-3.5% at both sites. Organic matter concentrations did not change at the Raphine site, but they increased about 10% in Blacksburg (data not shown). Overall, mob or rotational grazing did not increase SOM or other nutrients substantially more than continuous grazing over this three-year period.

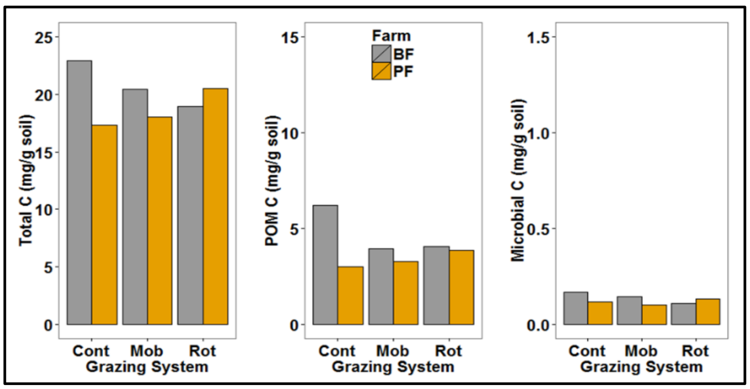

Figure 6. Three of the soil carbon pools measured in 2015 at the Raphine site (BF, left bars) and Blacksburg (PF, right bars). Note the variation between sites.

Several indices of soil health were measured in the study mostly associated with soil carbon and nitrogen pools. These pools have a major impact of soil nutrient availability for growing plants so can influence the productivity of pasturelands. Soil compaction was also evaluated in 2013 and 2015 as a physical index of soil health. **Figure 6** shows data on three soil C pools (total, particulate, and microbial C) and how they varied by site. Soil C pools appeared to be more strongly affected by site that grazing system. The similarity among grazing systems was not surprising given the three-year duration of the study. However, it should be noted that these grazing systems were being imposed on soils that had been in pasture for many years. In all likelihood, soil C pools were probably at or close to saturation in the surface soil layers where we sampled (top 10-15 cm, 4-6 inches). Given the natural site differences and high soil C concentrations, we speculate that it may take 5-10 years to begin to see significant soil changes associated with grazing methods. Soil compaction was comparatively low under mob stocking in 2015 **(Figure 7)**. Soil compaction was actually greatest under rotational grazing, but this was mainly a reflection of pre-existing soil conditions at the Raphine location. Soil compaction measured when grazing began in 2013 also showed high compaction in the rotational area (data not shown). Although differences were found among the three systems, soil compaction was not severe enough reduce forage growth (Drewry, 2006; Flores and Tracy, 2012).

Soil Nutrient Distribution near Watering Areas: In pastures, it is common to find nutrient build up (especially for P, K, and N) near water or shade areas where livestock conger-gate and deposit manure and urine (West, et al., 1989; Mathews, et al., 1994). We hypothesized that high-density grazing in the mob system might prevent this from happening. To test this idea, we took soil samples along transects in each system starting from water sources to mid pasture. Interesting trends were found for net nitrogen mineralization, which is an index of plant available N in soil. We expected high N mineralization rates near watering areas and a gradual decline as distance increases. This trend would be expected when cattle congregate near water areas and deposit of manure and urine. This pattern was seen under continuous and rotational stocking but not mob stocking (data not shown). Under mob stocking, N mineralization was relatively constant across the pasture. In fact, N mineralization rates from 0-10m from waters was almost twice as high under continuous and rotational grazing compared with mob grazing. Although not shown, data for particulate organic C (POM-C) show a similar trend. POM-C is a carbon pool that represents easily decomposable organic matter and is usually more sensitive to management changes than total carbon. Overall, the patterns might suggest different cattle behavior with less congregation near water areas under mob grazing and hence less urine and manure deposition there. This result supports the idea the mob grazing with high cattle densities may generate a more even distribution of soil nutrients across pastures rather than the usual high concentration of waste depositions that occur near water or loafing areas.

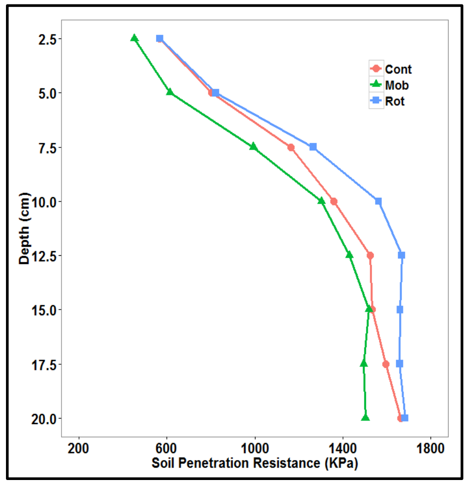

***Figure 7*. Soil compaction measured in 2015. Green line (left most) = mob, red line= Cont. and Blue line (right) = rotational.**

Animal Performance: Animal performance could be measured only at the SVAREC site. Cow and calf data were taken in 2014 and 2015. Cows at breeding (December) were significantly lighter than cows from the other systems especially in 2015 (Table 2). Body condition scores (BCS) taken at the same time also reflect these differences. Calf birth weights were actually lowest in the rotational systems (Table 2). The difference in birth weights did not carry over to weaning weights as these were con sistently lower for calves in mob grazed pastures. We can only speculate on why cattle performed more poorly in the mob grazed systems. One idea is that the long rest periods in the mob paddocks created a situation where most tall fescue plants (70-90% of all grasses) had produced seed heads before grazing. Tall fescue seeds have the highest alkaloid toxin concentrations within the plant (Roberts and Andrae, 2004). Possibly, cows could have been consuming more tall fescue seed and, in turn, more alkaloid toxins in the mob

Table 2. 2014 and 2015 animal performance data. Data are means from both yrs. *** P < 0.001, ** P < 0.01, * P < 0.05.

	Continuous	Rotational	Mob	Statistical Difference (P < 0.05)
Cows				
Breeding Wt. (lbs)	1490	1403	1367	**
Body Condition Score	7.1	6.4	5.9	***
Calves				
Birth Wt. (lbs)	84	75	82	**
Wean Wt. (lbs)	440	426	407	*

grazed paddocks. If this was the case, the alkaloids might have had a carry-over effect not only on cow performance but calves as well – possibly though reduced milk production (Thompson and Studedemann, 1993). The possibility that cows had less available forage due to trampling also could have contributed to the lower production values observed. The higher performance on continuous grazed pastures may have been the result of several factors: the conservative stocking rate (1 cow/2 acres pasture), a high abundance of clover especially white clover, and above average growing season rainfall in 2014/15. Regardless of the specific mechanism, our findings suggest that mob-type grazing where tall fescue is the predominant grass could lead to sub-standard cow-calf performance.

Summary and Conclusions

We learned much about application of mob-type grazing in Virginia from these studies. Although mob grazed pastures can accumulate more forage than continuous or rotational systems, significant forage mass is trampled down and not eaten. Forage quality in mob grazed pastures was reasonably good despite high amounts of over-mature grasses and probably suitable for dry cows. We hypothesized that mob grazing would suppress clover establishment due to shading effects, however, red clover established well in all systems. Rainfall was high in especially in early spring and summer during these studies and that likely benefitted clover establishment. Indices of soil health were measured mostly to evaluate soil carbon sequestration potential. Overall, we found few differences in the soil variables across grazing systems. We did, however, find some evidence to suggest that mob grazing may help spread out manure and urine derived nutrients across pastures better than continuous grazing. Cow-calf performance was significantly poorer under mob grazing in 2014 and 2015 possibly because cows were consuming more highly toxic tall fescue seeds and less forage overall than in the other systems. In summary, we found little evidence to support broad adoption of mob grazing in Virginia over standard rotational grazing practices. Mob grazing efforts appear to be better suited to specific, short-term management tasks (e.g., vegetation control) rather than year-round grazing in our tall fescue-based systems.

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