Horse and Pasture Responses to Stocking Methods: Rotational versus Continuous

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Abstract. Rotational grazing management offers potential advantages for economic and environmental sustainability, as well as for horse health. Rotational grazing has the potential to increase pasture yields and available forage for grazing, and therefore reduce supplemental feed costs. A rotational grazing management strategy can also prevent or mitigate negative effects of overgrazing, with implications for pasture productivity and the environment. Overgrazing can reduce vegetative cover over time, increasing the potential for erosion and nutrient run-off. Overgrazing may also result in long-term decreased forage stand persistence and weed invasion, necessitating more frequent pasture renovation. All of this can negatively impact the horse's nutrition and therefore their condition. This presentation will highlight fundamentals of rotational grazing and recent research on the benefits of this practice on horse condition and pasture productivity.

Background

Grazing is an economical way to feed horses a well-balanced diet, provide voluntary exercise, and reduce behavioral and health issues. While grazing systems have been studied extensively for livestock, grazing data extrapolated from these studies may be of limited value in crafting horse grazing recommendations, as horse forage preference and grazing behaviors differ from those observed in other species. Several studies have investigated potential benefits of a rotational system on pasture productivity over a short period of time with no replication of pastures. An observational study in Maryland reported effects of rotationally grazing horses at a low stocking rate (0.49 ha/horse), although a comparison with continuous grazing was not included. Benefits included increased horse body weight (BW) and body condition score (BCS), high vegetative cover and low weeds, and enhanced economic value as forage grown in excess of horses' requirements was harvested for hay (Burk et al. 2011). Virostek et al. (2015) and Daniel et al. (2015) used the same rotational system and compared effects of continuous vs. rotational equine grazing systems on pasture condition and forage chemical composition over two years. Virostek et al. (2015) observed no difference in biomass yield between systems, but botanical composition shifted towards a higher proportion of grasses and fewer weeds in the rotational system. Daniel et al. (2015) found significantly higher digestible energy, water soluble carbohydrates, and sugar in the rotationally grazed pasture due to plants remaining in a vegetative state. However, neither of these studies utilized replicated pastures and evaluated grazing under relatively low stocking density.

Rotational Grazing Equine Pasture Studies

A series of studies using the Rutgers University Ryder's Lane Best Management Practices Horse Farm in New Brunswick, New Jersey, aimed to determine the effects of rotational grazing on pasture, soil and horse condition, along with integration of novel forage options to maximize the summer grazing season. The site included 6.25 ha of fields that were loam and silty clay loam primarily composed of FapA (Fallsington loams) with NknB (Nixon loam) and NkrA (Nixon moderately well drained variant loam). A year prior to the studies, pasture fields were chemically treated to eliminate the existing vegetation, plowed to a depth of approximately 18 cm, disked, and pasture forage was reestablished. Soil fertility was adjusted to optimum with lime and fertilizer, and pastures were seeded with Jesup MaxQ endophyte-friendly tall fescue (*Festuca arundinacea*) at 7.9 kg/ha, Camas Kentucky bluegrass (*Poa pratensis*) at 12.9 kg ha^{-1}, and Potomac orchardgrass (*Dactylis glomerata*) at 8.2 kg ha^{-1}. The pasture site was divided

into two rotationally (ROT or R) grazed areas and two continuously (CON or C) grazed areas for a total of four grazing systems.

Pasture and Horse Responses to Rotational Grazing Management

Twelve Standardbred mares were paired by initial BW and BCS, and randomly assigned to either the R or C grazing systems for a stocking density 0.52 ha horse^{-1}. This study was one of the few exploring the impacts of rotational vs. continuous grazing of horses, and one of even fewer replicated, multi-year studies (Williams *et al.* 2020). Overall, the study found that the continuously grazed horses maintained higher BCS and percentage of body fat than the rotationally grazed horses. The effects of grazing system on pasture condition were significant, with R pastures showing greater sward heights, herbage mass, and vegetative cover. Forage chemical composition varied between treatments, with R pastures having greater digestible energy, acid detergent fiber, and calcium and lower crude protein than C pastures. A companion paper from this study also demonstrated that while rotational grazing was effective in increasing pasture forage productivity, it had minor influences on soluble carbohydrate content and ultimately had no apparent glycemic or insulinemic implications for the grazing horse (Williams *et al.* 2019). The results with these studies support the recommendation of rotational grazing for purposes of optimizing pasture yield and preventing deterioration of vegetative cover, which has important environmental and ecological implications.

In addition to horse condition and impacts on pasture forage, a companion study investigated effects of stocking method (continuous vs. rotational) on pasture soil. This study found that continuous grazing damaged soil structure through compression of soil macropores, while rotational grazing promoted greater water infiltration rates at the range of pressure potentials predominantly controlled by macropores (Kenny *et al.* 2023). A greater macropore abundance is likely to contribute to the sustainability of the grazing system by increasing soil water content, decreasing soil temperature, and promoting the recovery of the pasture vegetation from trampling and abiotically induced stresses.

Winter Recovery and Rotational Grazing

Following completion of the two-year rotational grazing study, a follow-up study was conducted to assess the ability of pastures to recover after winter rest. This study revealed that the choice of grazing system (continuous vs. rotational) has clear effects on pasture forage production in a subsequent growing season so much so that winter rest alone may not be sufficient to overcome the negative consequences of overgrazing continuously grazed pastures (Weinert and Williams 2018). Differences in sward height and herbage mass between CON and ROT managed pastures persisted throughout much of the growing season following winter grazing exclusion, and a total of nine months of rest was required for herbage mass in the CON pastures to reach similar levels as the ROT pastures. Effects on pasture botanical composition, however, still remained at the end of the study period, with a greater prevalence of planted grasses pastures that had been rotationally grazed. Furthermore, vegetative cover in ROT was consistently above the recommended levels for prevention of erosion and nutrient runoff, while low levels of vegetative cover in CON presented an increased erosion risk in the early spring.

Preventing the summer slump

Traditional pasture forages in temperate regions of the United States are mainly perennial cool-season grasses adapted for survival of cold winters and growth in periods of cooler temperatures during spring, early summer, and fall. However, these species are less tolerant of heat and drought, which leads to a period of low forage productivity often called the “summer slump”. The “summer slump” presents management challenges to horse producers, with implications for both economic and environmental sustainability of equine operations. Supplemental feed is often needed to meet the nutritional needs of horses during the “summer slump,” resulting in higher feed costs during this period. In the previous studies investigating effects of stocking methods, horses managed in rotational pastures were restricted to

a stress lot during times of low forage availability during the late summer to early fall when hot, dry temperatures led to a decrease in the vigor of cool-season pasture grasses. Therefore, a subsequent study was conducted to determine if the warm-season annual *Quick-N-Big* crabgrass (*Digitaria sanguinalis*) could be utilized to bridge the "summer slump" forage gap in cool-season grass equine rotational grazing systems.

The results of this study indicate that implementing an integrated rotational grazing approach incorporating the warm-season annual *Quick-N-Big* crabgrass may offer production advantages when compared to traditional cool-season grass rotational grazing systems (Weinert-Nelson et al. 2021). Carrying capacity and herbage mass were greater in crabgrass vs. cool-season pasture sections during the critical "summer slump" period from mid-July to mid-September. However, in this study, integrated grazing resulted in lower pasture production during late-season grazing, and further research is needed to identify strategies to improve season-long production in integrated rotational systems. The integrated rotational grazing approach did provide adequate nutrition to meet daily nutrient requirements and maintain body condition in grazing horses. Integrated rotational grazing did not, however, result in marked differences in forage nutritional composition or horse condition in comparison to a traditional cool-season system.

Conclusions

Results from these studies taken together indicate that implementation of rotational grazing systems may increase pasture production and soil health over continuous grazing systems and therefore strengthen recommendations for implementation of rotational grazing systems in equine pasture management. The results will also aid in informing equine grazing management decisions through educators and farmers with the goal of improving environmental sustainability of horse operations.

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