



agement systems remained fairly constant. Midgrasses not only produce more grazeable forage than stoloneferous shortgrasses but they also help reduce surface runoff and erosion (Taylor et al. 1980, Thurow et al. 1987).

Research projects, on the Sonora Research Station, have closely examined the effects of livestock impacts under SDG on the soil hydrologic characteristics (McCalla et al. 1984, Warren et al. 1986a, Warren et al. 1986b, Thurow et al. 1986). These experiments were conducted on sites with bare soil (no vegetation cover) and on sites

with a natural cover of vegetation.

In general, these studies indicated that infiltration rates were lower and sediment production (erosion) was higher for treatment pastures following short-term grazing periods in SDG compared to control pastures (no livestock) (Fig. 3). Thurow et al. (1988) attributed the majority of the treatment effect to the amount of plant cover. "The amount of cover was more important than the type, indicating that protection of soil structure from direct raindrop impact was the primary function of cover on infiltration." These results indicate that a minimum of about 300–500 lb/ac of total organic cover is necessary to reduce the harmful effects of raindrop impact and to provide enough obstacles to slow overland flow of water so that soil erosion is kept to a minimum.

The clayey soils on the Experiment Station, although subject to deterioration when abused, are resilient and if given proper management (i.e., moderate stocking rate, proper rest period) will recover. Livestock churning the soil with their hooves will further break down the remaining soil aggregates (Fig. 4). Therefore, in terms of SDG, three very important questions should be asked, "What is the optimum number of pastures needed, what is moderate stocking rate, and what is a proper rest period for soils of the Edwards Plateau?"

Our results indicate that in the Edwards Plateau, HILF grazing tactics should be employed during the major part of the growing season (May–September) to allow long rest periods for both the soil and vegetation to recover. For the dormant period of the year, SDG tactics can be employed to enhance livestock production, without damaging the warm-season midgrasses.

If breeding sheep and goats are part of the animal mixture, they should be removed from the grazing system during lambing and kidding season or they should be dispersed among all of the pastures and left until kids and lambs are large enough to travel with their dams without being separated. Annual forbs can represent a rather large portion of the vegetation complex during the late

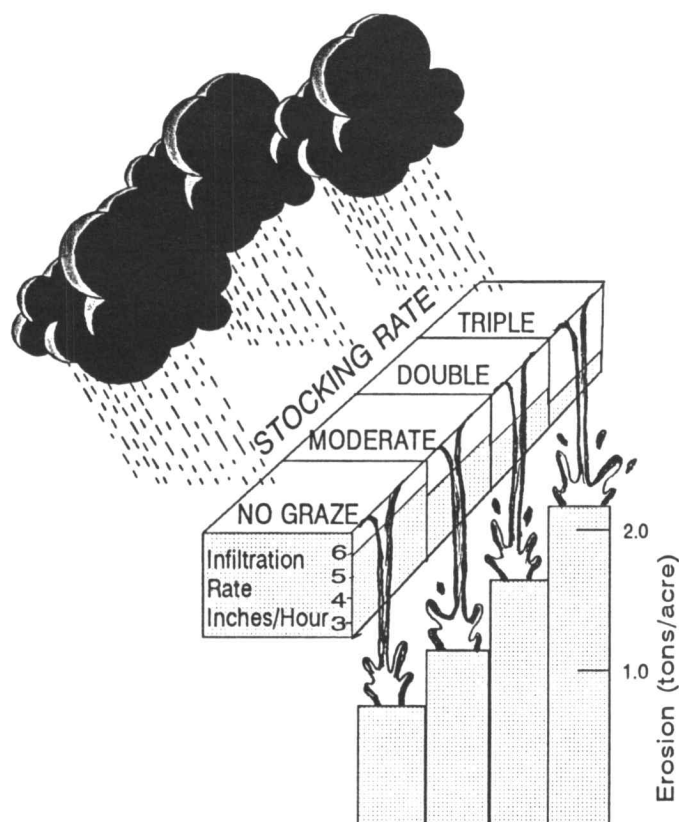


Fig. 3. The Effects of Stocking Rate on Water Infiltration and Soil Erosion.

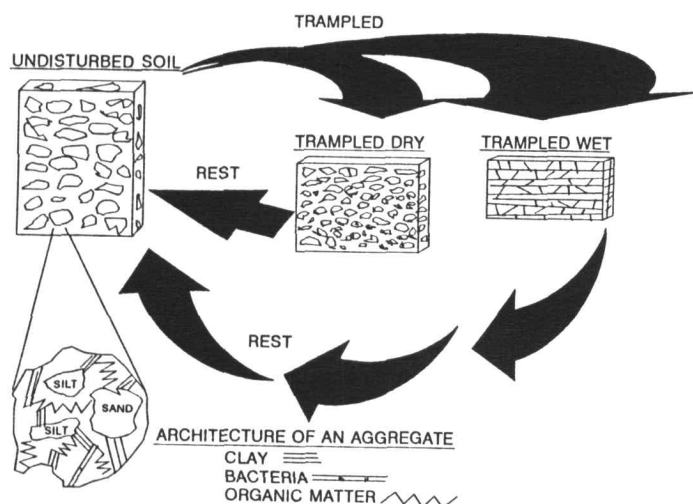


Fig. 4. Conceptual Architecture of a Soil Aggregate and the Changes in Soil Aggregate Structure caused by Trampling under Wet and Dry Conditions.

dormant and early spring period. We feel the most efficient way to harvest these plants is to disperse the sheep and goats over the entire grazing system and allow them to graze each pasture continuously. We believe that adopting this type of grazing system management in conjunction with moderate stocking rates will allow the resource manager to meet his goals of soil stability and vegetation improvement.

Based on our previous experience and research results we present the following conclusions relative to vegetation and soil response to intensive grazing systems:

- * Rest, rather than intensive livestock activity, appears to be the key to soil hydrologic stability. Results indicate that a minimum of 90 days of rest may be needed, under certain environmental conditions, for the soil to recover from intensive livestock grazing. Short rest periods of 50 days or less during this growing will favor the shortgrasses (Fig. 5).
- * Expectations of rapidly improving deteriorated rangeland using SDG is a *false-positive* perception. Regeneration of preferred species will always be a slow process due to the presence of competing vegetation and influenced by precipitation, soil type, intensity and frequency of grazing, and length of deferment.
- * SDG systems stocked at greater than moderate stocking rates significantly reduces the midgrass component of the vegetative complex.
- * The protection of soil structure from direct raindrop impact is the primary function of cover on infiltration. A minimum of 300–500 lb/ac of total organic matter cover is necessary to reduce the harmful effects of raindrop impact. Midgrasses (i.e., sideoats grama, cane bluestem, Texas cupgrass) allow significantly greater amounts of water infiltration and significantly less amounts of soil erosion than short grasses (i.e., common curlymesquite, red grama, hairy tridens).

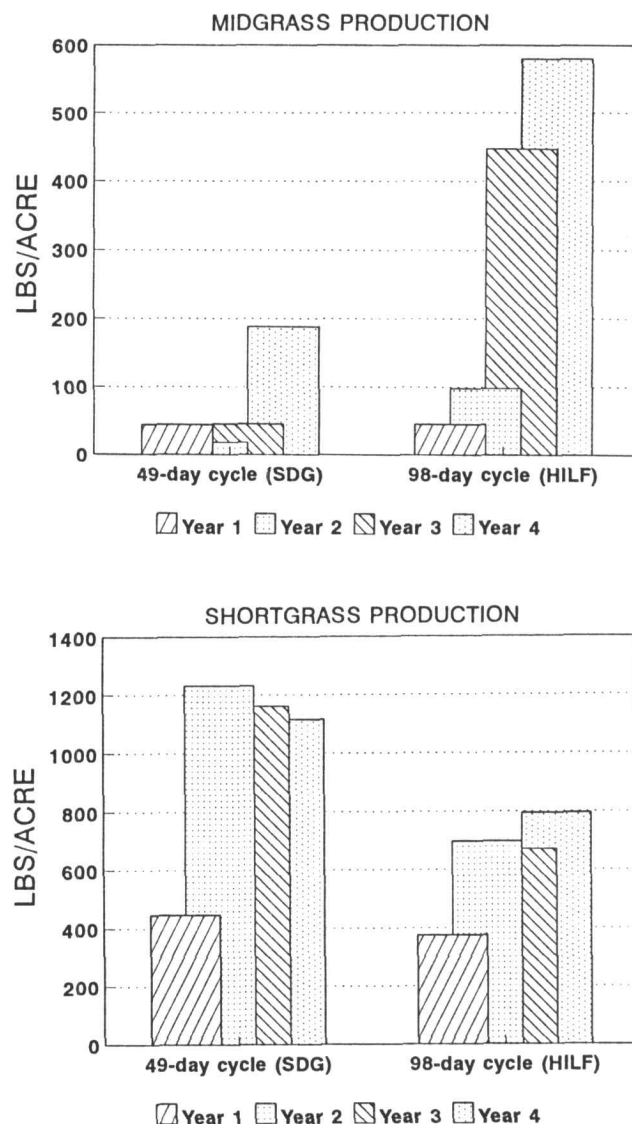


Fig. 5. Midgrass and Shortgrass Production Measured from SDG and HILF Grazing Systems.

- * There is no evidence of any hydrologic benefit from livestock trampling or "hoof action". However, there is strong evidence that as intensity and frequency of trampling increases, soil hydrologic properties decrease.
- * Infiltration rates are mostly reduced immediately after trampling. This would seem to accelerate drought conditions due to an immediate, mechanically induced decrease in infiltration rates due to trampling.

It must be remembered that the inherent low potential productivity of Edwards Plateau rangeland severely limits the alternatives available to ranchers to enhance productivity or correct management mistakes. Since recovery may be slow and expensive, grazing management on these ranges should be planned carefully to avoid mistakes that result in deterioration of the soils and vegetation.

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Grazing Systems on the Edwards Plateau of Texas: Are They Worth the Trouble?

II. Livestock Response

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Grazing systems implemented on *rangelands* have generally been designed to improve or maintain range condition. Grazing systems designed for use on *tame pastures* generally aim to maximize animal production. During the past decade, grazing systems developed for tame pastures have been applied to rangelands in an effort to increase livestock production.

Before we discuss the effects of grazing systems on livestock production, it seems appropriate to discuss differences between range management and tame pasture management. Tame pastures usually have a few plant species that are highly resistant to grazing. Expensive cultural practices may be employed to increase forage quality and quantity (i.e., fertilizer, irrigation, etc.). High stock density and grazing pressure may be necessary to improve grazing distribution and prevent the accumulation of mature forage (most forage is consumed at a immature growth stage). Grazing is usually restricted to the growing season, thus removing the need to conserve forage for dormant season grazing. Tame pastures are usually developed in high rainfall areas or on deep, productive homogeneous soils with access to supplemental

irrigation. All of this results in large investments per unit area of land, with increased emphasis on livestock production.

In contrast, rangelands consist of irregular terrain and complex mixtures of plant species that vary in palatability, production and resistance to grazing. Most rangelands are located in arid and semi-arid regions where precipitation is low and variable. Soils may be very shallow or very rocky and may be very heterogeneous and subject to severe erosion if adequate amounts of vegetation are not present. Grazing pressures and animal densities are generally moderate to low; this, in combination with the differential growth and maturation of range vegetation makes grazing distribution problems the rule rather than the exception. Plant growth is usually limited to very short periods during the year; regrowth following defoliation may be very slow or non-existent due to lack of moisture. Livestock may have to survive on dormant vegetation for many months of the year and secondary plant succession is necessary for the forage resource to survive.

Unfortunately, tame pasture management techniques have been attempted on Texas rangelands without a full understanding of the effects of increased animal impact. Some supporters of intensive rotation grazing systems propose that heavy stocking and high livestock densities

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