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The Origin, Method, Benefits and Criticisms of Cell Grazing

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Review Article

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ABSTRACT

Cattles have been our companion since beginning. There was a time when feeding cattle was not of much concern. Growth in human population, advancements in our life, deforestation and reduction in grazing land, constant rise in dairy technology and human need altered the situations drastically, especially in the urban areas. At present, dairy firms are looking forward for smart and readymade feeding solutions for their livestock production units. Yet it is scientifically accepted that natural grazing is the best option for growing the livestock naturally and better way. Natural grazing not only helps in receiving the fresh food directly from the source, along with food grazing habits supports the cattle to use natural resources for their health and remedies based on their instinct, feeling and psychology. Several dairy firming industries, therefore, turning towards a natural solution and looking for solution to use the limited natural or artificially created grazing fields to its maximum limits. Cell grazing is such a concept which received appreciations as well as criticism from the concerned fraternity. This particular review is an attempt to summarize cell grazing where information has been presented from different views. We hope in future we will have an optimized solution for this important issue and will be able to provide natural resources easily to the livestock. This, in turn will improve the quality of life of the cattle as well as the quality of the dairy product.

INTRODUCTION

David Hampton is a grass fed beef producer in northern Queensland, Australia. Recently he has been experimenting with a new practice, which involves splitting a 10-acre paddock into much smaller areas and rotating his herds frequently between them. Since beginning this new practice six months ago, Hampton has found he has been able to save land and grow more and better quality pasture along with a range of other benefits. This practice, though experimental at the Hampton property, is actually a widely used grazing system referred to as cell grazing. There are however various terms for this practice including holistic management, prescribed grazing, and management intensive grazing along with others. Cell grazing involves rotating dense numbers of livestock frequently between various smaller paddocks in order to mimic wild herds and restore land degradation. Unlike rotational grazing, cell grazing is timed in response to the land and integrates all aspects of the system including business, environment and lifestyle. This practice was developed in a response to worldwide desertification due benefits such as improved water retention, pasture cover and nutrient cycling. Studies comparing the practice with continuous grazing and analysing its use in Australia produced similar findings. Cell grazing has however faced many criticisms, and the debate on whether the practice is an effective as reported still continues.

DISCUSSION

Origin

Before settlement took place in most areas of the world, large, wild herds of herbivores migrated on grasslands. In doing this they grazed, defecated, stomped and salivated on the land, building up soil and deepening plant roots ^[1]. Eventually European settlement brought small herds of sedentary livestock. The land was fenced and continuously grazed resulting in less fire, vegetation cover and soil structure degradation, turning nutrient rich soil to desert land ^[2]. This occurred throughout Africa, North

America and other parts of the world including Australia. In 1788, European farming was introduced into Australia resulting in livestock being used in areas that previously only supported soft-footed native animals such as kangaroos and other minimal impact marsupials ^[3]. The introduction of hard hoofed animals and extensive vegetation clearing along with the unpredictable climate led to severe degradation.

Throughout the 19th century, the quality of land continued to decline, thought to be due to overgrazing from livestock. In response to this, livestock were removed from the land, however desertification continued. In the 20th century, writers such as Andre Voisin and Arthur Sampson noted this and produced the idea that overgrazing was actually a consequence of how long a plant is exposed to grazing rather than the number of animals it is exposed too ^[3,4]. It was found that following extreme grazing after the exclusion of livestock from pastures resulted in rapid, positive vegetation responses ^[4]. Thus the idea of rotational grazing was formed. Voisin's research was integrated in various parts of the world such as Cuba and Brazil but was unfortunately disregarded in Africa, Australia and the United States where desertification still continues today ^[3]. Similar ideas can be traced back to convertible husbandry of the 18th century England and its use of livestock manure for sustaining and increasing crop production ^[5].

Rotational grazing was then transformed and adapted by Allan Savory who compared the practice to wild herds. Savory promoted minimising overgrazing through maintaining a high graze and rest period ratio, claiming that this method could restore degraded land ^[6]. This method was named Holistic Management or cell grazing, as it is referred to throughout this essay. Cell grazing is different from traditional rotational grazing as it involves concentrating livestock in individual pastures with frequent rotation as well as integrating goal setting, financial planning and ecological benefits.

Desertification

Unsustainable land management in agriculture significantly contributes to a various interrelated environmental issues including climate change, biodiversity loss, drought and desertification ^[7]. Drylands cover 41% of the Earth, two thirds of which is used for livestock production ^[7]. Livestock production is a key cause of desertification resulting in the land loosing water, nutrients and carbon. Globally, 12-18 billion tonnes of carbon have been lost due to desertification whereas appropriate land management practices currently sequester an estimated 1 billion tonnes of carbon each year ^[7].

As stated earlier, desertification also occurs where livestock have been removed from the land. In the dry season, grasslands must decay biologically in order to return nutrients to the soil and prepare for the wet season ^[3]. If this process does not take place, oxidisation occurs, smothering the soil below, releasing carbon. Fire is used to stop oxidisation however this leaves the soil bare and releases 6000 cars worth of pollutants into the atmosphere for every hectare of land burnt ^[3]. This land however can be recovered using cell grazing and copying how bison once lived in the prairie. Large herds originally grazed the grasslands, moving constantly in response to predators, meaning they excreted and grazed in a concentrated area and moved on, preventing the land from being overgrazed ^[3]. Savory is currently conducting an operation mimicking this natural process in Zimbabwe, which has resulted in increased in production, biodiversity and profit ^[3].

The constant application of high physical impact on the soil results in plant and soil recovery. As the animals trample on the soil, they break the soil crust allowing the soil to absorb more water and plants to germinate and establish ^[6]. Standing plant material is also returned to the soil surface earlier than it would have naturally, resulting in increased conversion of plant material to litter, which is essential for biological decay ^[6]. However, trampling of soil for too long results in increased erosion, decreased plant recovery and dung and urine becoming pollutants, thus rotation is essential.

Method

There are various things a producer needs to be able to do in order to operate a cell grazing system effectively. They must be able to understand how grazing stimulates pasture health and growth in order to maintain soil cover and manage plant species composition and feed quality ^[7]. They also should be able to understand environmental conditions and pressures such as climate change so they can be ready to adapt.

The main difference between cell and rotational grazing is timing. The primary objective is to prolong pasture reproductive development and health. When a seed sprouts it aims to grow quickly in order to capture water and nutrients and grow enough leaf area to capture the suns energy before its energy reserves are depleted ^[5]. New plants will grow slowly until the seedlings gain enough solar capacity to grow rapidly. This point is the ideal time to graze when the plants have enough energy to support a root system and before they shift too much energy towards reproducing ^[5]. To align with this stage, the amount of time in between grazing a pasture (rest) and the grazing time needs to be managed carefully. This can however be complicated, as some pastures may not reach the same stage of growth as others and different plant species may grow at different speeds ^[5].

To compensate for this, managers should have flexible plans and use the following principles provided by McCosker ^[8]:

1. Control rest to suit the growth rate of the plan
2. Adjust stocking rate to match carrying capacity

3. Plan, monitor and manage grazing
4. Use short graze periods to increase animal performance
5. Use maximum stocking density for the minimum time
6. Use diversity of plants and animals to improve ecological health
7. Use large mob sizes to encourage herding

Benefits

There are benefits with producing beef using cell grazing. The practice improves pasture, reduces inputs and in turn increases profit as well as being environmentally sound. Pasture is benefited in a number of ways. Water retention and filtration is increased and nutrient cycling is improved due to the accumulation of organic matter results in increased growth, biomass and diversity of species ^[7]. This in turn reduced the risks associated with prolonged droughts and unreliable rains. Greater pasture production has also been linked with an increase in animal production per hectare ^[9].

Nutrient levels in the soil also increase with cell grazing, reducing the need for fertiliser. It has been found that grass root mass increases in cell grazing systems in response to soil biological activity and an increase in available phosphorous ^[8]. In addition to fertiliser no longer being necessary, the need for artificial weed control also decreases or ceases. Due to the increase in pasture quality, it has also been found that substitution feeding with hay, silage or grain could be significantly decreased ^[8]. Each of these benefits results in a decrease in inputs and therefore costs for producers. Profit will therefore increase as well as the product value.

Hampton provides evidence of the benefits of cell grazing. Fertiliser, which used to be used on the farm, costing \$20,000 AUD each year, has not been needed for seven years. Pesticides are also not used and feed is minimal. Hampton has found that the pasture is of higher quality with better moisture and carbon retention. The pasture is also more resistant to the frequent cyclones in Queensland due to its increased retention capability, reducing water runoff and erosion.

Cell grazing is a cost effective and sustainable land management practice as it can increase land productivity, livestock stocking rates and profits ^[4]. As well as being a means of livelihood, this system also produces a way in which vast renewable grasslands, which are not consumed by humans, can be converted into food (Kunzig 2014).

Comparison with Continuous Grazing

There are various different livestock grazing practices. These include continuous grazing, rotational resting, rotational grazing, multi camp rotational grazing and time control grazing methods (cell grazing) ^[8]. Continuous grazing involves grazing on one paddock for extended periods of time without rest. Each of the other methods involves some sort of rotation between paddocks but varies on the number of paddocks, the timing of rotation and the density of livestock. When cell grazing, herds are rotated based on the growth rate of pasture and its requirement for rest rather than a set calendar like in other rotational grazing systems ^[8].

A study by Earl and Jones assessed 3 properties in New South Wales, Australia who conducted both cell grazing and continuous grazing in order to compare the two methods (1996). The cell grazing systems allowed each paddock (26-35 in total) to be rested for over 95% of the year with intermittent and short grazing periods. It was found continuous grazing changed the paddock vegetation structure as the most palatable grass species declined significantly due to the lack of rest. The opposite occurred in the cell grazing systems with decline in the least palatable species and an improvement in the abundance and mass of palatable species ^[2].

After two years of grazing using each method, it was found that percentage ground cover was much higher in the cell grazing systems than continuous grazing. This led to various benefits including higher soil biological activity, energy flow and water infiltration rates ^[2]. Higher ground cover also restricted nutrient and organic matter loss to leaching and erosion. Continuous grazing led to root systems being overgrazed, reducing plant efficiency in acquiring nutrients and water as well as the ability to withstand insect damage or moisture stress. Cell grazing systems resulted in improved root systems and diversity, which led to higher soil aeration, structure and levels of microbial activity. Overall it was found that cell grazing systems obtained many long term benefits including erosion control, improved nutrient and hydrological function as well as animal production stability ^[2].

Cell Grazing in Australia

Dr Stan Parsons introduced cell grazing in Australia in 1989 ^[9]. Since this time it has had varied responses and has been adapted by many though is still far from being the norm. In response to the demand for sustainable foods due to the environment, food safety and animal welfare, many producers are shifting towards an agro-ecology paradigm rather than traditional productivity values ^[9]. Cell grazing represents this ideology in order to integrate lifestyle, business, biodiversity and animal welfare. McCosker ^[8] states that cell graziers in Australia have generally had an increase in:

- Profit - two to three times previous amount

- Soil quality - two times available phosphorous where previous phosphorous application was needed
- Rainfall efficiency – 50-100% previous moisture content levels
- Biodiversity
- Animal performance (variable)

Richard and Lawrence produced similar conclusions to McCocker in their study of cell grazing in central Queensland, Australia (2009). It was found that most producers continue to use continuous grazing practices. This resulted in deterioration of vegetation composition, reduced ground cover, increased soil erosion and supplement use. Vegetation clearing as a result of this practice has led to dry land salinity in 5.7 million hectares throughout Australia and this is expected to reach 17 million hectares in the next 50 years ^[8].

Producers in the study found that despite criticisms of cell grazing, they had received a range of benefits from the practice in relation to animal welfare, business and ecological outcomes ^[9]. Cell grazing had been criticised in relation to animal welfare with statements that the cattle have increased stress levels and health risks due to intensive herding. Cell graziers in the study found the opposite however. Case studies stated that the animals have improved temperament as they are used to being in contact with humans, reducing the need for mustering teams and dogs ^[9]. Due to the high management in cell grazing, herds are constantly being seen meaning that any sickness can be detected earlier.

Cell grazing is a holistic approach to livestock production. This meant that most cell graziers in the study had off-farm investments such as other businesses or shares so they weren't so dependent on the market or climate, reducing the need to intensify ^[9]. Nearly everyone in the study also had networks with other cell graziers for support in relation to the farm, business strategies or otherwise. It is this holistic approach that allows cell grazing to be so successful as all aspects of life are integrated.

Criticisms:

As cell grazing is relatively new in the pastoralism world, there are still many criticisms of the practice. Many studies found different results when analysing cell grazing from the perspective of a producer and as a researcher ^[8]. An experimental research program in the 1970s found that rotational grazing could work but does not necessarily for various ecological purposes. The study found cell grazing does not increase plant or animal production or enhance surface hydrology compare to continuous grazing in similar conditions ^[4]. Examples of the benefits of cell grazing also face criticism due to the lack of experimental design and controls. Savory argued against these statements by expressing that scientific methodology couldn't evaluate the system as it is a flexible practice and varies from system to system ^[4].

Cell grazing is characterised by many interacting components and is complex and adaptive, this along with the human aspect of the system is not taken into account by researchers. For example, initial investment in fencing and water leads to greater managerial interest and commitment. Producers then pay more attention to subtle ecological and socio-economic indicators and response more rapidly to new opportunities in turn leading to improved systems ^[4]. This however could not be qualified in research. Cell grazing should be viewed as a flexible framework that takes into accounts the unique characteristics and circumstances of each grazing program and ecosystem as well as the objectives and constraints of the managers ^[4]. In order to document the effectiveness of cell grazing accurately, research framework is needed that integrates the social and ecological components of the system.

CONCLUSION

Overall cell grazing appears to be effective in sustaining both environmental health and the livelihoods of graziers. As cell grazing mimics what naturally would have occurred in the wild, it is difficult to disagree with the method. Though initial infrastructure is expensive the benefits have been widely realised. By timing rotation to align with the pasture growth, the holistically managed system has been found to produce various benefits. Generally these include improved pasture quality and growth, increased hydrology and nutrient cycling, reduced inputs as well as improved animal welfare. Studies have also reported the benefits of cell grazing by comparing it with continuous grazing systems. It was found that cell grazing resulted in an increase in palatable grass species, increased ground cover and therefor a reduction in leaching and erosion among other benefits. Cell grazing was also proved to be beneficial in Australia and though there are also many criticisms of the system, it was found that no current research method could effectively evaluate the system due to its complexity. In conclusion, there is a lot of support of the benefits of cell grazing however sound scientific evidence is lacking. Until the system can be evaluated holistically as it is managed, the only way to judge its effectiveness is with the word of the cell graziers themselves.

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