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IS PASTURE REST TIME OR TIMING?

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INTRODUCTION

Everybody understands that pastures have to be rested, but ask a collection of people what "pasture rest" is and surprisingly there is no consensus. However, it is those who prefer to use the term recovery, in preference to the term rest, who appear to have better understanding. They appreciate that the central issue is actually allowing plants to grow and become healthy, rather than the removal of animals from pastures for a specific length of time.

WHAT PASTURE REST SETS OUT TO ACHIEVE

Pasture rest is more than just attending to the needs of plants. It is also about maintaining the health of the soil in which the plants grow. To remain healthy, plants require a healthy soil that supplies them with water and nutrients. For the soil to remain healthy there has to be ongoing carbon compounds provided by plants.

The soil is full of living organisms responsible for restructuring it and making it less compacted (more friable/crumbly). They ensure water and air are able to enter easily, as well as improving its fertility. All these living things that maintain soil health have to be fed, just like the living things above the ground.

It is plants that are responsible for feeding/maintaining all the living organisms in the soil. Plants are the beginning of the food chain in the soil, just as they are above the soil. Above ground, plants feed the herbivores which are in turn consumed by carnivores. Below ground, similar consumption processes relying on plant parts and other organic matter occur.

All living organisms contain carbon and rely on carbon compounds to function. The only way carbon can be introduced from the atmosphere to the biosphere is through photosynthesis in plants. Plants are the first living thing carbon enters. Humans are 18% carbon. Therefore, life as we know it on this planet would not exist without plants.

ENERGY, NUTRIENTS AND WATER ALL FOLLOW CARBON

The concept of pasture rest must be linked to the carbon processes which form part of the carbon cycle. However, before this is achieved, the role of carbon must be understood.

Energy: All living organisms, be they above or below ground, require energy. Plants capture the energy of the sun during the process of photosynthesis and make it available to the two food chains. They do this by using the energy of the sun to break the bond between carbon and oxygen in CO_2 and form the more complex carbon structure of carbohydrates. The energy of the sun is stored in these more complex carbon bonds. This energy is released during consumption when carbon is reunited with oxygen to form CO_2. This CO_2 is then released back to the atmosphere as part of respiration.

$6\ CO_2$	+	$12\ H_2O$	+	Light	=	$C_6H_{12}O_6$	+	$6\ O_2$	+	$6\ H_2O$
Carbon Dioxide		Water		Chlorophyll		Carbohydrates (Glucose)		Oxygen		Water

Separate from the energy contained in plant parts, during photosynthesis plants store energy in reserve, to call on later. Perennial grasses need them to break dormancy. It is during growth driven by photosynthesis that plants build extensive root systems necessary for sourcing water and nutrients out of the soil.

Nutrients: The origin of organic matter is predominantly from plants with the remainder coming from everything else that lives above and below the ground. Organic matter (carbon compounds) is the "store of nutrients" that plants require. These potential nutrients exist mainly near the soil surface. It is moisture that activates the soil microbes to consume organic matter and release nutrients in a form suitable for plant uptake. Growing plants support soil microbes directly by releasing energy directly to them through root exudates. In healthy soils full of organic matter, there is a higher population of the free living microbes that are able to fix atmospheric nitrogen in the soil.

Water: Organic matter has a greater water holding capacity than clay. Furthermore, well structured soils with high humus levels, from ongoing consumption of organic matter by soil microbes, have a lower bulk density. This in turn supplies the small cavities that increase water holding capacity.

RAINFALL INSTIGATES CARBON PROCESSES

It is moisture which triggers processes in plants and soil microbes. Nature has designed the system so that water activates the storage of carbon in the landscape via photosynthesis. By consuming new plant growth following rainfall, it is possible for animals to adversely impact on the entry of carbon from the atmosphere. Not only are they reducing above ground growth, the root volume and energy reserves of plants, but they are also interfering with the short and long term soil structuring process of the soil microbes. It is when the landscape is bare and perennial grasses are initially coming out of dormancy, that animals have the greatest impact.

On the positive side, it is moisture that instigates photosynthesis**.** However, on the negative side, it is moisture that can deplete the energy reserves held in the roots of perennial grasses. This is because plants will keep trying to grow while there is moisture. If animals are allowed to consume all the above ground growth every time plants emerge from dormancy, then the plants are forced to keep drawing on their energy reserves instead of relying on photosynthesis to promote growth. Given that plants will keep trying to grow when there is moisture and warmth available, it is possible for their energy reserves to become exhausted.

Moist soil conditions following rain support the decomposition of organic residues by soil microbes. This is when the soil microbes convert the nitrogen in organic matter to the nitrate form (mineralise it and make it plant available) and when they also produce growth promotants for plants. At the same time, soil microbes are supported in their actions by plants, as this is the time when plants are releasing energy (root exudates) to help them function (consume organic matter). Apart from soil moisture, this is simply the time plants have most in their favour to grow, as they are supported by soil organisms. How much nitrogen soil microbes make available to plants, after using this for their own bodies, is determined by the quality of organic matter, which is dependant upon previous pasture management. It is essential to utilise nitrogen at the time soil organisms are making it available to plants. Nitrogen is subject to loss through leaching or amonification, if not used when it is available.

THE CARBON GRAZING® PRINCIPLE

The principle of Carbon Grazing is "*strategic / tactical rest",* based on the premise that nature does not have a predictable pattern. It is about following the instructions of nature. Strategic rest improves the natural resource base because it coincides with when nature wants to grow plants and regenerate the landscape through all the processes that occur with plant growth. *Stated simply, we must allow nature to transfer carbon from the atmosphere to the landscape according to it's time frame***.** Carbon Grazing is not

based on what might happen, but what is about to happen. The instructions from nature never go astray, as they are always left in the rain gauge.

Carbon Grazing is the removal of livestock from pastures for 4-6 weeks after pasture growing rain. It is based on the premise that pasture rest is TIMING and not TIME.

This is a "general principle", so it is important to not get caught up on the exact time of animal removal, as there will always be variables such temperature. It is important to realise that the actual rest period does not start until the plants begin to respond to rainfall, not necessarily the day after the rain. This aspect is consistent with the practical issues of shifting animals. Carbon Grazing is a management procedure, which can be carried out more than once a year. However, the emphasis should be on doing it at least once a year.

Resting for set periods of time when it is not raining is a consumption issue, not a production and regeneration one and should not be confused with strategic / tactical rest. The exception is when a regeneration event has occurred and freshly germinated perennial seedlings need to be protected to allow them to establish. However, when landscapes become bare from over consumption by animals, the landscape stock of carbon, built up by tactical rest, is reduced.

Identifying pasture rest as "timing and not time" is critical to the uptake of better carbon management. **If pasture rest is seen as time, animals have to be sold.** The terms of trade in agriculture are not favourable enough to allow most producers to be out of production. **However, if pasture rest is seen as timing** (and not for long as this paper suggests) **the animals only have to be removed for a short period of time. Maintaining the animals for a short period of time elsewhere is considered practical and commercially viable.**

THE MECHANICS OF CARBON GRAZING

Carbon Grazing rests all plant types in a pasture. It is based on an understanding of what animals will select to eat at any given time. Unless of course the animals choose to consume it, a specific plant is being rested, even if animals are on the pasture.

To fully understand why removing animals for 4-6 weeks rests all pasture species; we must focus on the relationship between growth rates and the palatability of the three plant groups (annuals, perennial grasses and perennial edible shrubs).

Plant groups;

1) Annuals.
2) Perennial grasses.
3) Perennial edible shrubs.

The plant groups are listed in order of decreasing palatability. In the same order, their growth cycle is slower. The most palatable annuals grow the fastest, and are also the least drought resistant. At the other extreme, the most drought resistant plants, the perennial edible shrubs, grow the slowest and are the least palatable. For a functional system, it is essential to have these differences between the plant groups as the climate and seasons are so variable.

To understand the big picture, the plant characteristics need to be considered in conjunction with how animals function. Animal's select for protein/nitrogen and digestibility. Hence they chase green pick.

At opening rains, perennial grasses respond the quickest, and their succulent shoots are readily eaten by stock, as they are available before the germinating annuals. If stock can be removed after such rain for 4-6

weeks, to allow these shoots to grow, then when stock are returned, the choice and bulk of feed is much greater. The grazing pressure on perennial grasses will be much lower with the return of animals, if the more palatable annual plants have germinated and established in the absence of stock. If the annuals are well enough established, then even although they are the preference of the animals, they will still succeed in setting enough seed for the future because their growth cycle is faster.

When animals are not removed after regenerating rain, the landscape suffers on two counts. The animals over consume the fresh new shoots of the perennial grasses produced by energy reserves. As well, they also pull the more favoured annuals out of the ground before they have time to develop a good root structure. This means the annuals are not able to produce the bulk of elite fodder they are capable of producing, nor stop the over consumption of new growth on the perennials.

Livestock do not consume all the plants the first day they are re-introduced to pastures. Therefore, even for the most palatable plants, the actual rest time will always be longer than the exclusion time of animals. The more the most palatable plants have bulked up, the more they remove grazing pressure off each other when domestic animals are returned to the pastures.

Quantifying increases in production and hence carbon

Discussions with South African rangeland scientists revealed their focus on rest after rainfall. They suggested that with average pastures, 3-8 weeks rest after rain can see an increase in pasture production of 50-80%. Their suggestion of 50% increase within 3 weeks and 80% increase with 8 weeks highlights the importance of the period immediately following rain. At the time when pastures are emerging from dormancy, there is the potential for so much lost production.

CONCLUSION

Carbon Grazing, which is four to six weeks of rest after plant growing rain, achieves the following outcomes:-

1) Spells all plant species for greater health and increased production;
2) Promotes plant regeneration in favourable years;
3) Increases soil fertility and its ability to absorb and hold water;
4) Postpones drought;
5) Maximises profit; and
6) Contributes to carbon sequestration and methane reduction and all the other environmental issues like water quality, salinity, erosion, biodiversity, acid soils and estuary health.

Carbon management has always been important, but with climate change, it is going to be even more important. It is increased carbon that provides the landscape with increased resilience. The bulk of the carbon enters the landscape in the short period following rain. It is ironic that climate change is going to make us focus on what we always needed to do to run a successful rural operation, “manage carbon better”.

Carbon Grazing® is the unification of all the carbon processes. Therefore the only logical conclusion is that the time to prepare for drought and a more sustainable world is the period immediately after rainfall. This is why pasture rest is TIMING not TIME.”

For more information log onto www.carbongrazing.com.au