BROWSE PLUS®

DIGESTIVE MODIFIER TANNIN INHIBITOR

Give them a healthy appetite during unfavourable times.

Utilise all available plant material with **BROWSE PLUS** Digestive Modifier and Tannin Inhibitor

Virbac

Shaping the future of animal health

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1. What is BROWSE PLUS

For more than two decades, Browse Plus has been successfully increasing palatability of plant material. Added to drinking water or feed it encourages the browsing and digestion of existing plant material during unfavourable times.

Improved Digestion = efficient nutrient utilisation

During unfavourable periods, the intake of dry roughage in the form of grass, bush or crop residue is important. Because the rumen microbe populations of livestock/wildlife are reduced over this period, the ability of the digestive systems to process dry roughage and extract nutrients is limited.

Browse Plus is an orally administered formula for domestic and wild animals. The formula is a digestive modifier having multiple modes of action, of which the neutralising of polyphenolic anti nutrients, in particular tannins and lignified plant material, is the principal action. Additional modes of action include the counter chelating effects of tannins on a range of micronutrients such as zinc, copper, selenium and cobalt; the restoration and promotion of rumen microbial populations; and the restoration of normal gastro-intestinal function.

Ingredients

Ingredients are:

- Polyethylene Glycol (PEG)
- Polyvinylpyrrolidone (PVP)
- Calcium hydroxide $Ca(OH)_2$
- Ethyl Concentrate (MDDS)

2. Digestive modifiers

2.1. What is a digestive modifier?

It is a product or a combination of products that can be used to improve the digestive process of ruminants to utilise available food sources more optimally.

2.2. When is the best time to make use of a digestive modifier?

- During winter months when the pastures are dry, physiologically matured or killed by frost.
- When unpalatable, low digestible plants with high fibre content or high tannin levels have to be utilised.
- When animals are forced to browse.
- During drought conditions.
- When animals show signs of malnutrition or nutritional deficiencies.

2.3. Questions with which every farmer is struggling.

2.3.1. How do I get the most possible value from the available pasture during the dry season?

The answer to this question is being influenced by:

- The amount (kg of available grass).
- The quality / nutritive value of the plants (kg of digestible nutrients).
- The palatability (kg of edible feed).
- The stock density (Type, nature and number of animals/Ha).

2.3.2. Are my animals satiated/is the amount of available feed enough?

The answer to this question is being influenced by:

- The seasonal influence and rainfall pattern.
- The available grass material (overgrazing, rainfall).
- The animal type and stock density. (Grass or leaf eaters, stock management).
- The available leaf material (edible bushes and shrubs).

2.3.3. How do I get the most possible digestive value from the available pasture?

The answer to this question is being influenced by:

- Soil and water quality.
- Plant physiology and stage of maturity.
- Rainfall patterns and seasonal effects (Late start of rainfall season, First frost already occurred).
- Under and over utilisation of available pastures.

Keep in mind that the nutritive value of plants are being influenced by normal factors such as:

- Amount of rainfall during the season (nutritive value is lower due to faster growth rate).
- Maturation of plants (nutritive value decline dramatically with stage of maturation).
- Seasonal changes (nutritive value and palatability declines with winter frost).
- Drought conditions (palatability, nutritive value and digestibility declines).
- Available leaves and shrubs (Usually higher nutritive value but less palatable).

2.3.4. Will the animals eat the available plant material, and how do I increase the palatability of the available feed? (The higher the palatability, the better the ingestion of plant material will be.)

The answer to this question is being influenced by:

- The physical limitations of plants (thorns, waxy layers, lignin or woodiness).
- The chemical limitations of plants (tannins, terpenes, resins and oils).
- The plant physiology and age (stage of maturation, plants of previous seasons).

Physical

Age

Chemical

3. Keep the following in mind for optimal utilisation of grazing:

- The negative effect of tannins and resins must be neutralised.
- The negative effect of lignin (woody fibre) on digestibility.
- The continuous increasing of fibre content with plant maturity and the related negative effect on:

Palatability, digestibility and nutritive value.

- The palatability must be increased.
- The highest possible nutritive value of the plant material must be available to the ruminant.
- The rumen population of organisms must be maintained.

3.1. Grazing sources are divided between “grassy” and “woody” grazing materials.

3.1.1. Grassy plants.

In green grass, ruminants digest the highly digestible cell membranes which are high in nutrients. These nutrients are trapped in the cell sap and consist of sugars, proteins, amino acids, vitamins and minerals. The plants absorb water and soil nutrients during the rainy season and under the influence of sunlight by the process of photosynthesis, they too produce these nutrients as well as β carotene which is converted to Vitamin A by the ruminant. Annual plants do not build up much structure, but they too produce seed for survival.

3.1.2. What remains when plants/grass are killed by frost?

Green grass that is killed by frost or drought conditions still has the dissolved nutrients in its cellular membranes which will be available to the ruminant. A certain percentage of fibre content will be in the plants but usually lower than when the plant dies of maturity. This will keep the animals in condition for some time although the grass has been damaged by environmental conditions.

3.1.3. What remains when mature plants/grass die?

Matured grass that gradually goes down before winter pushes its nutrients into the roots which serves as good resource for the next growing season and the plant has much fewer nutrients available for the animal. Late in winter the low digestible fibre and indigestible lignin content is usually higher and of a very low palatability and digestibility value to the ruminant.

Farmers must apply digestive modifiers before this plant physiological stage is reached as the rumen organisms have by then suffered tremendous damage.

3.2. Woody plants.

These plants contain high proportions of lignin (wood) that is not digestible to the ruminant and usually been utilised by defoliation.

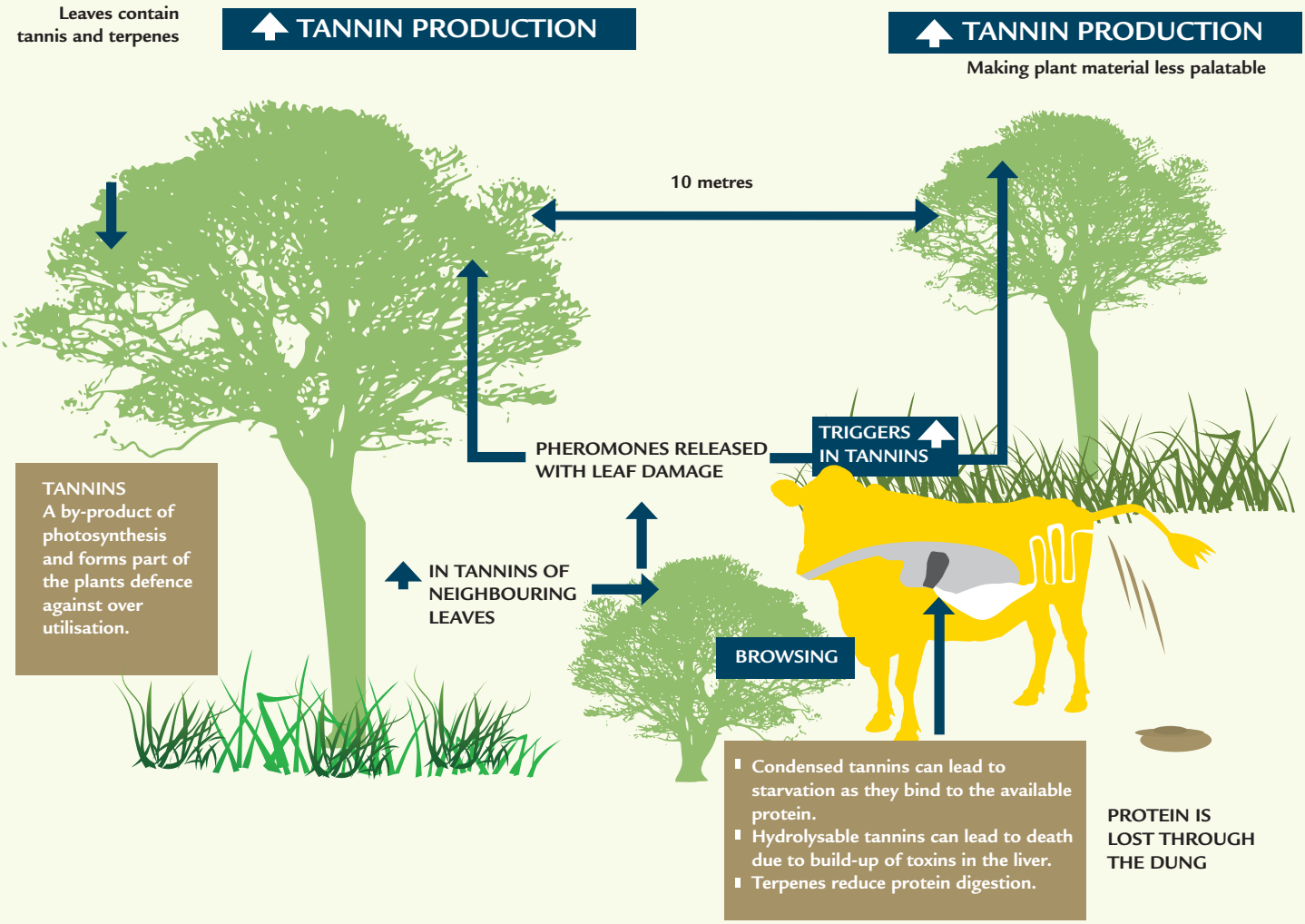
These plants protect them against defoliation by means of:

- Thorns such as Acacia species.
- Tannins which are particularly concentrated in leaves and pods of trees and bushes.
- Terpenes.
- Resin (sticky glue).
- 80 % of all woody plants and 15 % of tropical grasses contain different levels of tannins.

3.2.1. Thorns.

- Thorns act as a physical protective mechanism against utilisation by animals.

Overgrazed | Normal grazing | Rested

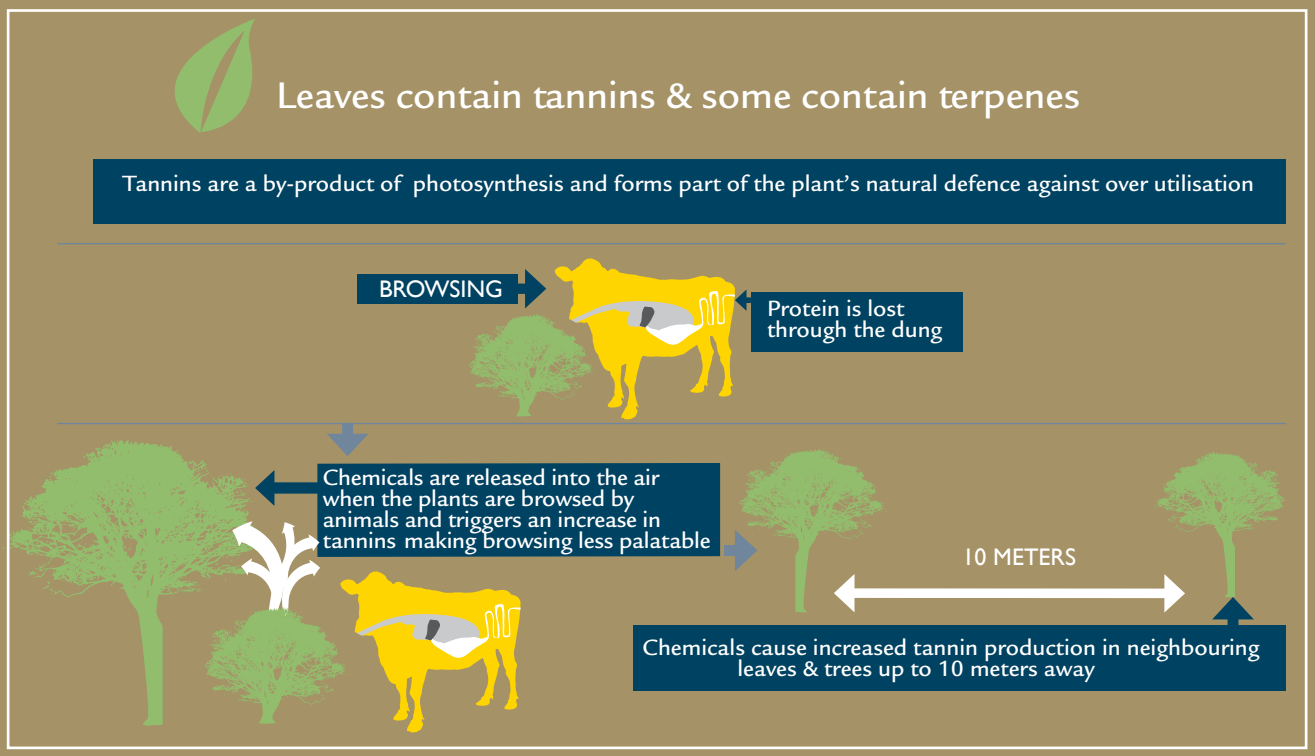

Leaves contain tannis and terpenes
TANNIN PRODUCTION
TANNIN PRODUCTION
Making plant material less palatable
10 metres
PHEROMONES RELEASED WITH LEAF DAMAGE
TRIGGERS IN TANNINS
IN TANNINS OF NEIGHBOURING LEAVES
BROWSING
TANNINS
A by-product of photosynthesis and forms part of the plants defence against over utilisation.
Condensed tannins can lead to starvation as they bind to the available protein.
Hydrolysable tannins can lead to death due to build-up of toxins in the liver.
Terpenes reduce protein digestion.
PROTEIN IS LOST THROUGH THE DUNG

3.2.2. Tannins.

Tannins are divided into condensed tannins (which mainly bind with protein molecules) and hydrolysable tannins (which can lead to liver toxicity).

Tannins and rumen digestion:

- Tannins protect plants against viral and fungal infections.
- Tannins act as a defence mechanism against defoliation by game and livestock.
- Tannins inhibit digestion of protein and carbohydrate molecules.
- Tannins are unpalatable and lead to low food intake.
- Tannins are toxic substances and can lead to liver toxicity and death of the rumen organisms.
- Tannins can damage the rumen wall and mucous membranes of the digestive tract.



3.2.3. Terpenes.

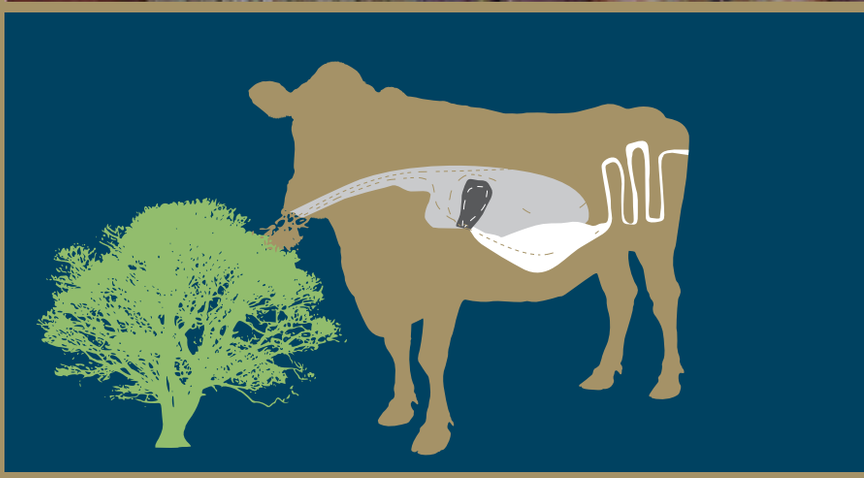
- Occur naturally in some plants and interfere with the action of proteolytic enzyme activity which plays an important role in the digestion process of proteins.

4. Plant Digestion

Plant digestion is influenced by various factors, of which fibre percentage being one of the most important ones.

4.1 Fibre is a feed component that:

- Consists of various nutritive components such as polysaccharides, cellular membrane proteins and lignin.
- Resists the digestive process and shows variable digestibility, and are usually partially digestible.
- Slows down the digestive process and creates the “filling effect” in ruminants mainly as a result of the ADF fraction of the fibre content which adds to low feed intake by animals which feed on these types of pastures. Animals that experience the “filled effect” show low feed intake and usually lies down.



4.2 Lignin (wood fibre) is a feed component that:

- Originates from structural carbohydrates when the plant matures.
- Reduces palatability, ingestion of dry material and digestibility of polysaccharides, cellulose and hemi-cellulose negatively.
- Is chemically linked to carbohydrates and proteins in the plant material to form a physical barrier against digestion.
- Continuously increases with plant maturity and as the other plant components increase.
- Is linked primarily to plant structure and not as part of the plants defensive mechanism.
- Forms a part of the plants cellular membrane and protects the cell sap.
- Limits water loss.
- Forms the second most common component of plants.

5. Factors influencing lignification and thus palatability and digestibility.

Lignification of plant material being influenced by:

5.1. Environmental factors.

- Climate and rainfall changes.
- Seasonal changes.
- Soil fertility and fertilisation effects.

5.2. Plant species.

- The protein content and digestibility of legumes are higher than those of grasses but have a lower fibre content than grasses and therefore, the lignin has a reduced effect on the digestion of legumes compared to that of grasses.

5.3. Plant physiology and biochemistry.

- Lignification is increased in plants under warm conditions, reduced with sulphur fertilisation while Nitrogen fertilisation shows no effect on lignification.

5.4. Plant anatomy.

- Lignin concentrations vary from one type of plant cell to another and can increase to maximum levels in cells adjacent to the meristem with one day.

5.5. Plant morphology.

- Lignin concentrations increase as plants reaches maturity and thus is a function of morphological change rather than increasing age.

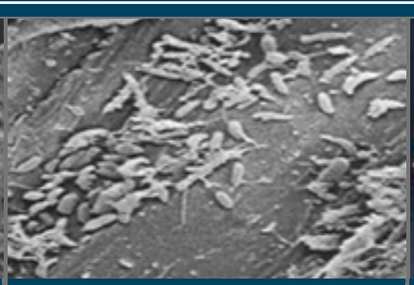
5.6. Lignification is reduced in plants when:

- They grow under conditions of poor soil fertility.
- They grow under deficient or excessive moisture.
- Light intensity is low.
- There is any other condition that impedes plant growth.

6. Where all this takes place?

In the rumen of the ruminant animal under influence of the rumen microbe population that consist of rumen bacteria, rumen fungi and rumen protozoa.

Rumen/fungi



Rumen bacteria

Rumen protozoa

6.1 The rumen microbe organisms are:

- Temperature and pH sensitive.
- Specific to an animal as well as the available nutrition.
- Time sensitive and takes approximately 14 days to adapt to changed nutrition.
- Organisms that live from plant food resources and have a lifespan of about 12 hours.
- Responsible for the break down of cellulose, hemicellulose as well as being a destructor of lignin in the rumen to be utilised by the rumen population as well as being absorbed by the rumen wall.

6.2 The rate of rumen digestion being influenced by:

- Quality of roughage (good quality of cellulose and hemicellulose lead to a fast digestion rate with a short rumen refill time).
- Soundness of the rumen microbe population (the healthier the rumen microbes the better and faster the rumen digestion of plant material).
- The usage of digestive modifiers (help the rumen microbe population to digest the rumen content).
- The presence of chemical plant barriers (digestive modifier has to neutralise the negative effect of chemical plant barriers on the effectiveness of the rumen microbe action on plant material).
- Seasonal changes.

6.3. Rumen microbe organisms and the dry period.

- Important physiological changes take place in the rumen as well as in the rumen microbe population during the dry periods that slows down the rumen digestion and rumen refill time.
- The microbe population declines and the ingestion of dry material decreases leading to a reduced pass-through time of fodder through the rumen with reduced amount of available by-pass bacterial protein, animals experience the filling effect and are not interested in grazing with a drop in condition score as a result.

6.4 Rumen microbe by-pass protein.

The microbes (bacteria) in the rumen multiply very quickly, with a life span of about 12 hours, breaking down the plant material and utilising the available nitrogen as part of their nutrition. The dead bacteria are digested in the intestines and absorbed as by-pass microbial protein by the ruminant as a source of protein nutrition. The importance of a healthy microbe population in the rumen can be seen as an important protein source for the ruminant animal.

6.5. Dung evaluation indicates the rumen function.

The consistency of dung gives a good indication of rumen health and the quality of the rumen microbe population. Dry, hard individual droppings give an indication of slow rumen activity with low digestible nutrition. This leads to a suffering microbe population in the rumen with the result of condition loss. Whereas, a soft cake like dropping indicates a healthy rumen microbe population with a faster rumen refill time as well as a better rumen digestion of the available nutrients.

The positioning of the usage of a digestive modifier during difficult times is to support the rumen organisms to breakdown the available (usually low quality roughage) more successfully to ensure enough available nitrogen for their multiplication and to increase the rumen refill time with better food intake for maintaining condition score. That will lead to the change of dry, hard individual droppings to a more softer cake like dropping.

7. Chemical resources

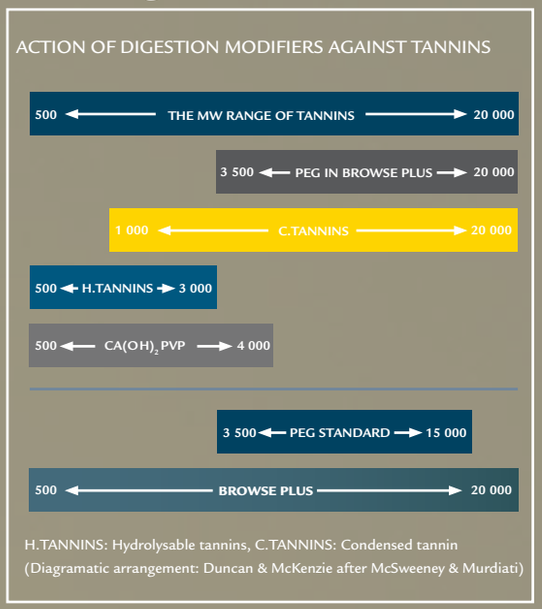
Available chemical substances with a history (each one with a single effect) of improving rumen digestibility include:

- Polyethylene Glycol (PEG)
- Calcium hydroxide $Ca(OH)_2$
- Polyvinylpyrrolidone (PVP)
- Molasses

The ideal is a combination, in the correct ratio, of all above mentioned substances to support the rumen digestion process in full.

7.1 Functions of these chemical resources in rumen digestion include:

- The breakdown of the bonds that were formed between tannins and protein molecules.
- Preventing the negative effects of tannins and other chemical plant barriers on the ruminant digestive tract.
- Prevent the forming of toxins.
- Prevent inflammation of the rumen wall with subsequent decreased rumen function.
- Help to buffer the pH in the rumen.
- Improve the breakdown of rumen degradable protein.
- Improve the microbial by-pass protein fraction of the ruminant animal.
- Enhance enzyme (Pepsin) functioning.
- Ensure a healthier rumen microbe population.



H.TANNINS: Hydrolysable tannins, C.TANNINS: Condensed tannin
(Diagramatic arrangement: Duncan & McKenzie after McSweeney & Murdiati)

7.2. Chemical resources in BROWSE PLUS

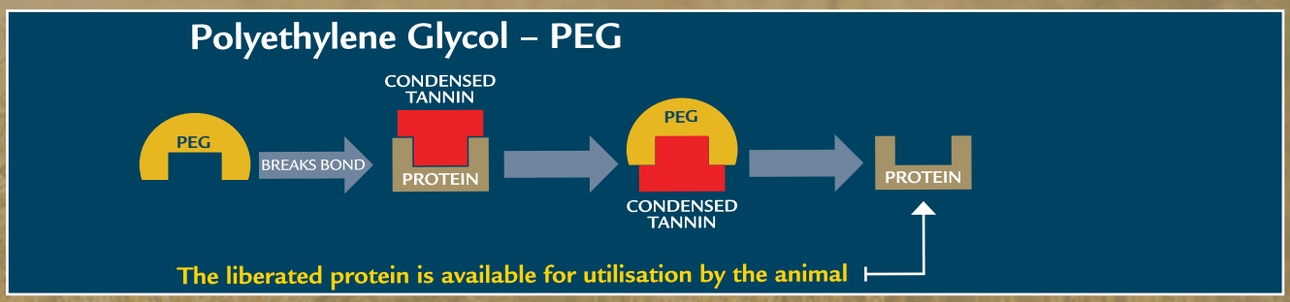
7.2.1. Polyethylene Glycol (PEG)

PEG reacts against condensed tannins by -

- breaking down the bond between protein and tannin.
- binding with tannin.
- releasing protein for digestion.

PEG promotes rumen microbes and thus rumen function:

- Tannin kills microbes because they do not get proteins.
- Available rumen-degradable proteins promote microbe growth.
- Available proteins promote performance of microbes and general rumen function.



PEG prevents inflammation of the rumen wall:

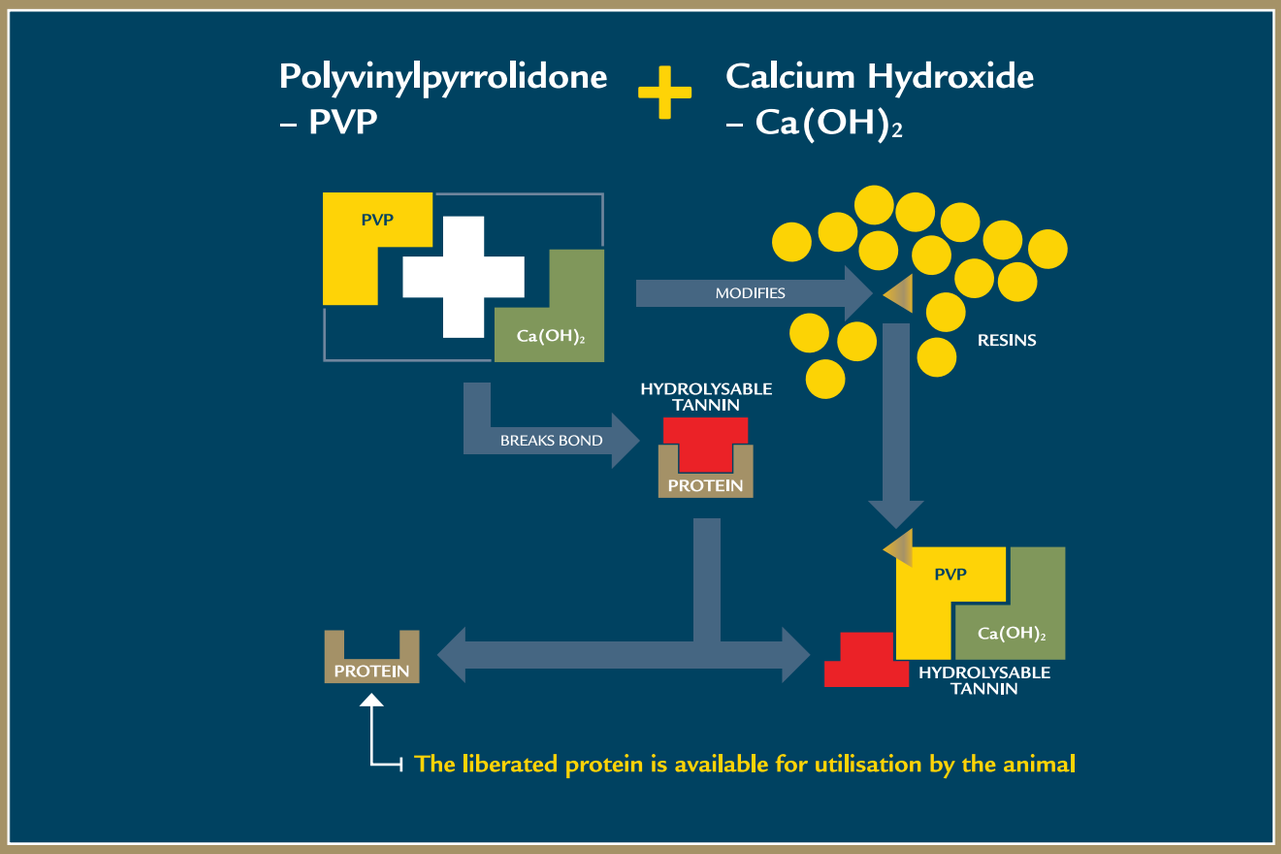
- Tannins leads to inflammation and erosion of the rumen wall.
- Polyethylene glycol bonds with tannin.
- Bound tannin cannot end up in the bloodstream.

7.2.2. Polyvinylpyrrolidone (PVP)

- PVP and $Ca(OH)_2$ forms a bond with hydrolysable tannins and leads to protein being released.
- Hydrolysable tannins are therefore not converted to toxins.
- The PVP in Browse Plus neutralises the effect of the resins.

7.2.3. PVP + $Ca(OH)_2$

- This prevents bonding of tannins with pepsin (pepsin = protein digestive enzyme).
- Available pepsin enhances digestive action.
- It prevents harmful action of resins.
- The calcium hydroxide in Browse Plus feeds die protozoa.



7.2.4. Calcium hydroxide $Ca(OH)_2$

- It reduces excessive acids in the digestive track.
- It reacts together with PVP.

7.2.5. Molasses

- Molasses serves as a source of energy for the rumen organisms.

8. Feedlot Cattle trials
Weight gain & dressing % of post weaner calves in a feedlot *Dr Martin Ferreira (November 2015)*

The aim of the study was to determine the effect on the daily weight, total weight gain and dressing percentage of post-weaned, Brahman-cross calves in a feedlot, with a total mixed ration, consisting of 60 % roughage and 40 % concentrate, supplemented with a digestive modifier, namely Browse Plus (polyethylene glycol 930 g / kg, polyvinylpyrrolidone, calcium hydroxide and molasses-based powder at 70 g / kg, Virbac RSA) over a feeding period of 117 days.

8.1 Carcass dressing percentage

- Dressing percentage is one of many factors effecting the value of a slaughtered animal.
- If the farmer can improve the dressing percentage of his slaughtered animals by using certian supplementations in the ration of these animals, it could be of important financial value for the farmer.
- Dressing percentage is calculated by dividing the warm carcass weight by the shrunk live weight (live weight of the animal after transportation to the abattoir) and expressing the result as a percentage.

8.2. Factors affecting carcass dressing percentage

Dressing percentages is influenced by many factors such as:

- Live weight.
- Fat levels.
- Breed effects.
- Gender effects.
- Seasonal effects.
- Days in the feedlot.
- Diet effects.

8.3. Carcass dressing percentage

- Cattle on a high-roughage diet, such as hay, silage or pastures show a lower dressing percentage than cattle on a high-proportion grain diet, even if the cattle are marketed at very similar fat levels.
- That can be because the weight of the filled digestive tract of cattle on high-roughage diets is heavier than that of cattle on diets with a higher proportion of concentrate.
- Cattle fed on a high-concentrate ration can show a difference of up to 8 % higher dressing percentage than cattle fed on roughages, but when the carcass weights were based on body weight, excluding gut fills, there was no difference in dressing percentage between steers on either diet.

8.4. Discussion of cattle feedlot trial

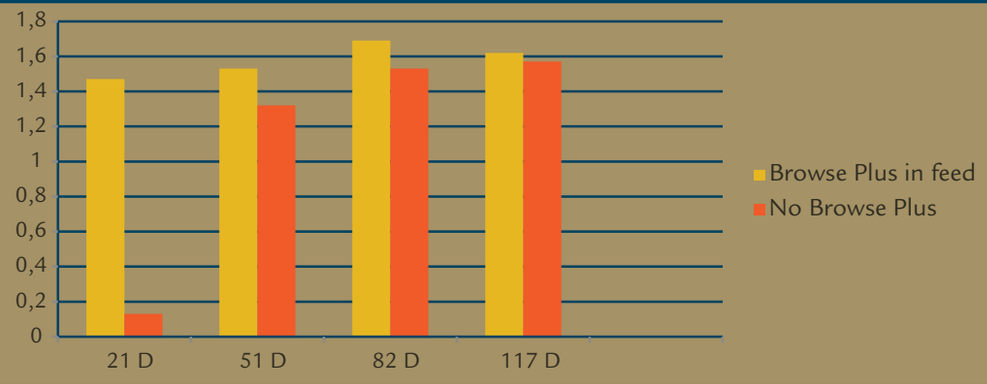
The following parameters were evaluated:

- Average weight of calves on day 0.
- ADG of calves with Browse Plus supplementation compared to unsupplemented control group.
- Comparison of ADG with Browse Plus supplementation compared to that of untreated control calves.
- Average slaughter weight, carcass weight and dressing percentage of Browse Plus supplemented group of calves.
- Average slaughter weight, carcass weight and dressing percentage of unsupplemented control group of calves.
- Comparison of average slaughter weight, carcass weight and dressing percentage between the two groups of calves during the trial period.
- Average live weight, carcass weight, carcass dressing percentage and price on day of slaughter.
- Effect of dressing percentage on rand value of a single animal.
- Increased R value/individual animal above benchmark due to variation in dressing percentage because of Browse Plus supplementation.
- Financial effect of dressing percentage on rand value over 90 animals.

TABLE 1. **ADG with Browse Plus in feed vs No supplementation**

ADG	21D	51D	82D	117D
Browse Plus in Feed	1,47 kg	1,53 kg	1,69 kg	1,62 kg
No Browse Plus	0,13 kg	1,32 kg	1,53 kg	1,57 kg

Figure 1.

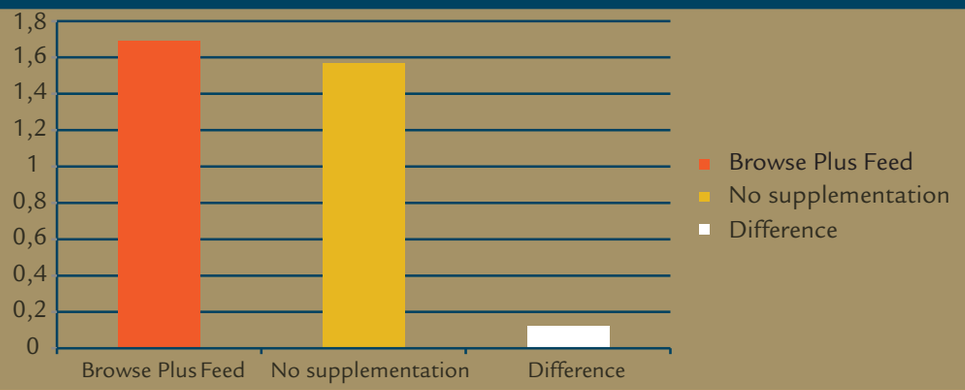


The difference in ADG on day 21 of 1,34 kg / day in the Browse Plus supplemented group of calves can be an indication of the faster adaptation of the rumen microbes, due to the digestive modifier, to the new diet of the calves in the trial group.

As the Browse Plus was the only difference between the ration of the two groups of calves, the faster adaptation of the rumen microbes to the diet can be seen as a beneficial effect of the added digestive modifier to the diet.

TABLE 2. **ADG with Browse Plus in feed vs No supplementation ADG on day 117**	
Browse Plus in Feed	1,69 kg
No Supplementation	1,57 kg
Difference	0,12 kg

Figure 2.



The increased ADG of 120 g/day/calf more in the Browse Plus supplemented group than in the untreated control group of calves can be possible due to the digestive modifier (Browse Plus) that leads to a better rumen environment for the micro organisms which lead to more efficient bacterial, protozoa and fungi degradation of the available nutritional sources.

The more complete digestion and degradation of fiber and neutralising effect of possible tannins or other chemical barriers by Browse Plus could end up with more available nutrients for the trial group of calves.

TABLE 3. **Average slaughter weight, carcass weight and dressing percentage of Browse Plus supplemented group of calves**	
519,8	Slaughter weight (kg)
262,4	Carcass weight (kg)
50,61	Dressing %

Figure 3.

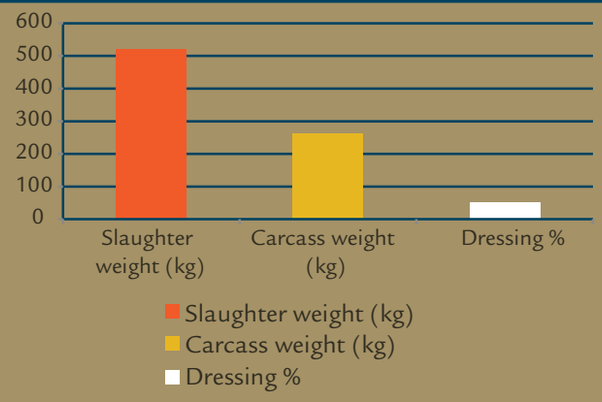


TABLE 4. **Average slaughter weight, carcass weight and dressing percentage of unsupplemented group of calves**

510,4	Slaughter weight (kg)
244,6	Carcass weight (kg)
47,7	Dressing %

Figure 4.

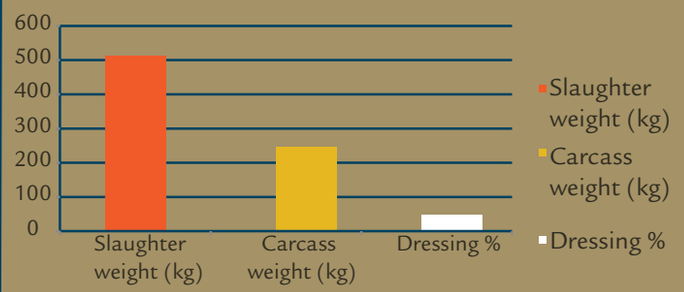
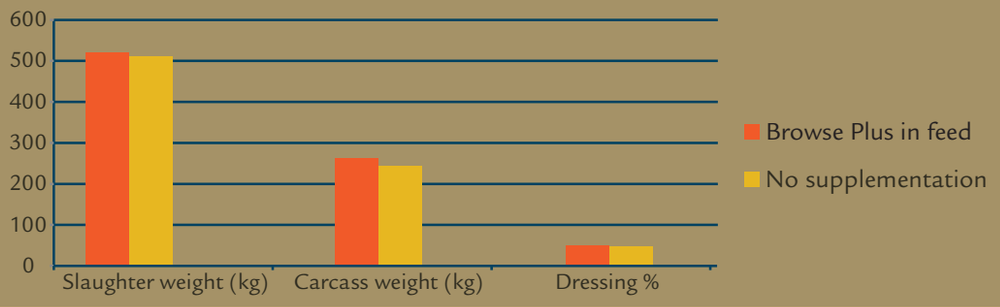


TABLE 5. **Comparison of average slaughter weight, carcass weight and dressing percentage between the two groups of calves during the trial period**

	Slaughter weight (kg)	Carcass weight (kg)	Dressing %
Browse Plus in feed	519,8	262,4	50,61
No supplementation	519,4	244,6	47,7

Figure 5.



The 9,4 kg difference in slaughter weight between the trial and untreated control group of calves on day of slaughter, is an indication that the feed intake before slaughter, live weight loss during transport and stress experience between the two groups of calves were very similar.

It is also an indication that the gut fill and weight of the filled digestive tract, that was taken into account when determining carcass dressing percentage, were very similar for the two groups of calves on point of slaughter.

The 2,91 % higher carcass dressing percentage in the Browse Plus supplemented group of calves is the reason for the 18,4 kg heavier warm carcass mass.

The difference in carcass dressing percentage, with the same carcass grading, between the trial and untreated control group of calves can be the effect of more efficient production results because of optimal utilisation of available nutrients by the rumen microbes due to the supplementation of the digestive modifier (Browse Plus) to the ration of the trial animals, as that was the only difference between the rations fed to the two groups of calves during the trial period.

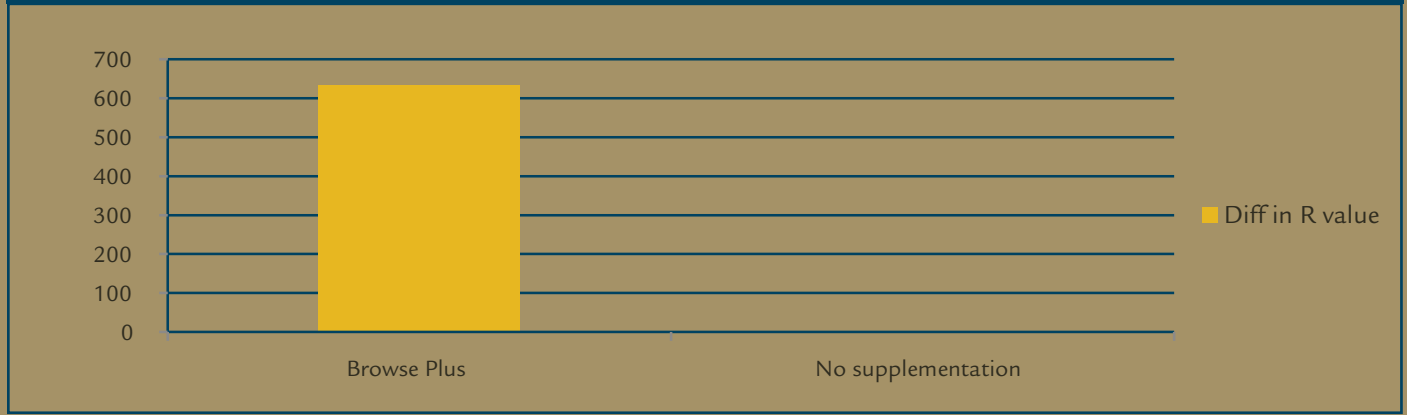
TABLE 6. **Average live weight, carcass weight, carcass dressing percentage and price on day of slaughter**

Group	Browse Plus Supplementation	No Supplementation
Avg Live weight (kg)	519,8	518
Avg Warm Carcass weight (kg)	262,4	244,6
Carcass grading	A2	A2
Avg Dressing %	50,6	47,7
Carcass Price	R35,50	R35,50

TABLE 7. **Effect of Dressing % on the Rand value of a single animal**

Group	Browse Plus	No Supplementation
Avg Live weight (kg)	519,80	510,40
Avg Warm Carcass weight (kg)	263,00	244,60
Carcass grading	A2	A2
Avg Dressing %	50,6	47,7
Carcass price	R35,50	R35,50
Total value per head	R9 336,50	R8 683,30
Diff in R value / animal	R653,20	R0,00

Figure 6.



The increased R value/individual animal above bench mark (Carcass value of the control animal carcasses) due to variation in dressing % because of the Browse Plus supplementation was R653,20 higher in the treated animal than in the untreated control animal carcasses.

8.5. Summary

8.5.1. Dressing percentage

- To evaluate the effect of the supplementations on carcass dressing percentage, it was necessary to ensure that most of the factors that can influence carcass dressing percentage, were standardized among the groups as well as for the duration of the trial.
- Both groups of animals (Browse Plus supplemented and untreated control) were on the same high percentage roughage and relative low percentage concentrates, compared to the traditional percentage concentrate inclusions of the commercial feedlot for the period of 117 days.
- The difference in dressing percentage (2,9 %) can be seen as the effect of the supplementation of a digestive modifier (Browse Plus - Virbac RSA) to the total mixed ration, as that was the only difference between the two rations fed to the different groups of calves.

8.5.2. Financial benefit

- The average live weight at slaughter, warm carcass mass, dressing percentage, carcass grading and carcass price were taken into account at the evaluation of the financial benefit of supplementing the ration of feedlot calves, on a high roughage diet, with Browse Plus.
- The carcass grading (A2) and carcass price (R35,50/kg) were the same for all the carcasses. (Table 6). The average live weight at slaughter, average warm carcass weight and dressing percentage differ between the different groups (Table 6).
- The average live weight at slaughter of all the calves (combined) that were in the trial was 515,10 kg.
- The average live weight of 515,10 kg was used to demonstrate the effect of dressing percentage on the rand value of a carcass between the different groups of calves.
- The rand value of the carcass with no supplementation being taken as R0,00 and used as the bench mark for the other supplemented groups of carcasses.
- The carcass value of the calves with Browse Plus supplementation show an added carcass value of R653,20 (Table 7)
- The difference in dressing percentage leads to an additional rand value of R653,20 per carcass in the Browse Plus supplemented group of calves when compared to the bench mark value of the carcasses of the untreated control calves.
- If the untreated control group of calves that participated in the trial were also on the same Browse Plus supplemented ration and the farmer could average the same dressing percentage as the average dressing percentage of the trial group of calves it would mean an additional rand value of R29 394,00 for the farmer.
- Taking the additional cost of 52c/calf/day (R60,84/calf/trial period) for the supplementation of Browse Plus at a inclusion rate of 4 g/animal/day, for the trial period of 117 days, into calculation the net capital gain was R592,36/calf.

8.6. Conclusion

The supplementation of a high roughage diet with a digestive modifier, Browse Plus, for feedlot calves could lead to a financial benefit for the farmer.

The usage of a digestion modifier, Browse Plus, can lead to a financial benefit to the farmer and develop the opportunity to expand his farming business vertically during financial difficult conditions.

The use of these aids to add value for the farmer will become more important with continuous pressure on food supply.

9. Feedlot Sheep trials
Supplementing feed of lambs in a feedlot

Dr Martin Ferreira (November 2015)

9.1. Objective.

The aim of the study was to determine the effect of, supplementing the feed of lambs in a feedlot, with the test product namely Browse Plus, Polyethylene Glycol 930 g, Excipients 70 g, (Polyvinlpyrrolidone/Calcium Hydroxide/Dry powdered molasses stillate) of Virbac RSA, on the daily weight and total weight gain over a feeding period of 45 days. The difference in weight gain among the different groups of lambs can be seen as the effect of the tested products on the digestibility and nutritional value of the total mixed ration as fed for the lambs, as the tested product being the only difference between the two groups of lambs and their feed.

9.2. Material and Method.

The field trial was carried out using 60 (sixty) post weaned Mutton Merino ram lambs, all randomly selected. The animals were marked by means of numerical identification (1 to 30) with two different coloured ear tags. Every second animal was identified with the same colour ear tag and numbered accordingly.
The animals were then divided into 2 (two) groups, the one being the control and the other the trial group of animals.
The 2 groups of animals were put into separate camps after identification, for the duration of the trial and no mixing of lambs took place.
On day 0 (the day the trial started) all the animals were weighed and recorded accordingly. They were put in a feedlot system and all the animals were allowed adlib feeding of the same total mixed ration and clean water.
All the animals were weighed on specific days (4 weighting's for the duration of the 45 days) using an electronic scale, and recorded according to the animal's identification and group number.
The animals in the trial group were fed additional to the total mixed ration, a nutritional modifier (Browse Plus) at a rate of 3 g/sheep/day for the period of 45 days, by means of mixing it in the ration, every time the feeding troughs were cleaned and new feed was put out. The control group of lambs were fed the same total mixed ration but with no nutritional modifier added to it.
The feeding troughs were cleaned twice a day and all the remaining feed was removed and new feed was supplied. The total cost of the ration (excluding the Browse Plus) was R2 422/ton and the Browse Plus was calculated at 35 c/3 g per sheep per day.

9.3. Results.

Feed intake

There was no marked difference in feed intake over the trial period of 45 days and the average feed intake was 1,1 kg/sheep/day for both the control and trial groups of animals.

Weight differences on day 0

TABLE 1. Differences in average live weight (kg) on day 0	
Control	36 kg
Trial	34,5 kg
Difference	1,5 kg

The average of live weight of the selected trial group of lambs was 1,5 kg lighter than the untreated control group of lambs on day 0. This difference happened by random selection of the lambs and was taken into calculation at a later stage.

TABLE 2. Differences in average live weight (kg) on day 45	
Control	46,6 kg
Trial	47,8 kg
Difference	1,2 kg

The difference in average live weight per lamb was 1,2 kg and the trial group of lambs being the heaviest. This difference in average live weight at the end of day 45 in the feedlot was the actual weights and the initial weight difference at day 0 was not brought into calculation.

9. Feedlot Sheep trials Continued ...

TABLE 3. Average weight gain (kg) over 45 days	
Control	10,6 kg
Trial	13,3 kg
Difference	2,7 kg

The average gain in live mass was 2,7 kg more in the trial group of lambs with the Browse Plus supplemented ration than the untreated control group of lambs over the 45 day period.

TABLE 4. Difference in average live weight gain per weighing intervals				
Date	16.09.2014	2.10.2014	21.10.2014	30.10.2014
Control group	36,00 kg	42,50 kg	44,70 kg	46,60 kg
Trial group	34,50 kg	42,60 kg	44,93 kg	47,80 kg
Difference	-1,50 kg	0,10 kg	0,23 kg	1,20 kg

The Browse Plus supplemented group of lambs shows a marked weight increase over the first 16 days of 1,6 kg above the untreated control group of lambs.

TABLE 5. Actual average live weight gain per group (kg) (Equalized)			
	Avg weight day 0	Avg weight day 45	Avg weight gain
Control group	36,00 kg	45,10 (46,6 - 1,5) kg	9,10 kg
Trial group	34,50 kg	47,80 kg	13,30 kg
Difference	-1,50 kg	2,70 kg	4,20 kg

The trial animal show an actual average weight gain of 4,2 kg over the 45 days, above the untreated control group of lambs if the 1,5 kg weight difference on day 0 was taken into calculation.

TABLE 6. Average (%) of average live weight gain over 45 day period		
Date	16.09.2014	30.10.2014
Control group	0	29,6 %
Trial group	0	38,6 %
Difference	0	9,0 %

The Browse Plus treated group of lambs showed an average growth of 9 % more than the untreated control group of animals over the 45 day period in the feedlot.

TABLE 7. Feeding cost @ R2 422/ton and feed intake of 1,1 kg/sheep/day over 45 days.		
	Control group	Trial group
Total mixed Ration	R119,88	R119,88
Browse Plus addition	R 0	R 15,52
Total	R119,88	R135,40
Difference	R 0	R 15,52

The addition of Browse Plus at 3 g/sheep/day leads to a price increase of R15,52/sheep/45 days on the total mix ration compare to the untreated ration of the control group of lambs as well.

TABLE 8. Rand value in average live weight gain @ R29,00/kg over 45 days.			
	Weight gain	R29,00/kg	Total
Control group	10,6 kg	R29,00	R307,40
Trial group	13,3 kg	R29,00	R385,70
Difference	2,7 kg	R29,00	R 78,30

The Browse Plus treated group of lambs show an average growth in rand value of R78,30/lamb more than the untreated control group over the 45 day period.

TABLE 9. Average gross profit gain per lamb at R29,00/kg over 45 days.			
	Rand value gain	Feeding cost	Gross profit/lamb
Control group	R307,40	R119,88	R187,52
Trial group	R385,70	R135,40	R250,30
Difference			R 62,78

The Browse Plus supplemented group of lambs showed a gross profit above feed cost of R62,78/lamb more than the untreated lambs over the 45 day period in the feedlot.

TABLE 10. Difference in average gross profit/60 lambs with Browse Plus over 45 days.	
Without Browse Plus	R11 251,20
With Browse Plus	R15 018,00
Difference	R 3 766,80

Difference in gross profit above feed cost could be R3 766,80 more when using Browse Plus in the ration of the control group of lambs as well.

Feedlot sheep trial continued

9.4.1. Feed intake.

There was no marked difference in feed intake over the trial period of 45 days and the average feed intake was 1,1 kg/sheep/day for both the control and trial groups of animals. From this it is clear that the Browse Plus that was added to the ration leads to a more efficient digestion of the nutrients and that the animals in the trial group didn't eat more per sheep on a daily basis as the lambs in the untreated control group.

9.4.2. Difference in average live weight among the two groups.

The average live weight of the selected trial group of lambs was 1,5 kg lower than the untreated control group of lambs on day 0. This difference happened by random selection of the lambs and by implication means that the untreated control lambs were stronger lambs post weaning and supposed to have adapted better to the stress of weaning. We should expect that the stronger lambs would have better food intake and digestible potential on the newly formulated ration than the weaker lambs. The stronger lambs should have a better advantage to stress and diet adaption and should have a stronger growth curve than the weaker lambs.

9.4.3. Average live weight on day 45.

The difference in average live weight per lamb was 1,2 kg at the end of the trial with the trial group of lambs being the heaviest. This difference in average live weight at the end of day 45 in the feedlot was the actual weights and the initial weight difference at day 0 was not brought into calculation. The lambs in the trial group (being on average 1,5 kg lighter than the control lambs), adapted very well on the new ration as well as the post weaning stress. By implication it can be assumed that the addition of Browse Plus in the ration helped the development of the rumen flora to be more effective in digestion of the nutrients and so counter the negative effect of stress, adaptation to the diet and new environment.

9.4.4. Average live weight gain over 45 days.

The average gain in live mass was 2,7 kg more in the trial group of lambs with the Browse Plus supplemented ration than the untreated control group of lambs over the 45 day period. Weight gain is a good example of efficiency of feed conversion and rumen health.

9.4.5. Average live weight gain per weighing intervals.

The Browse Plus supplemented group of lambs showed a marked weight increase over the first 16 days of an average of 1,6 kg above the untreated control group of lambs, taking the 1,5 kg weight difference on day 0 into calculation. The trial group of lambs grew on average 0,23 kg better during the next weighing (19 days) and 1,2 kg during the last weighing (9 days) than the lambs in the untreated control group. That can be interpreted as a faster and better adaptation of the rumen micro-organisms to the total mixed ration as these lambs were weaned and directly put into the feedlot with no adaptation period to the change in feedstuffs. It is also indicative of a more efficient digestive process and more efficient utilisation of available nutrients in the ration.

Feedlot sheep trial continued

9.4.6. Actual live weight gain over 45 day period.

The actual weight gain on average weight of the trial group of lambs was 13,3 kg and the actual live weight gain of the control group of lambs was 9,1 kg over the 45 day period if the equalisation were taken into consideration of the 1,5 kg weight difference at day 0. The trial animals show an average weight gain of 4,2 kg more than the control group of lambs over the 45 days. That can be interpreted as the better function of more and healthier rumen microbes digesting the cellulose and hemicellulose part of the ration more efficient.

9.4.7. Average daily weight gain.

The Browse Plus treated group of lambs showed an average growth of 60 g/day more than the untreated control group of animals over the 45 day period in the feedlot. That means that the feed conversion of the Browse Plus treated group of lambs was 5,45 % (60 g/1,1 kg) more efficient than the untreated control group of animals. The more efficient utilisation of nutritional substances is essential in modern day farming with the ever increasing input costs.

9.4.8. Percentage live weight gain over 45 day trial period.

The Browse Plus treated group of lambs showed an average of 9 % better growth measured in live weight gain over the 45 day period in the feedlot than the untreated control group of lambs. That means a 9 % better return on investment over a 45 day period by using a digestive modifier like Browse Plus.

9.4.9. Cost of total mixed ration.

The cost of the total mixed ration as used in the feedlot was R2 422,00/ton, excluding labor cost. The average daily intake of both groups was 1,1 kg/lamb/day that counts to R119,88/lamb/45 days. The addition of Browse Plus at 3 g/sheep/day leads to a price increase of R15,52/sheep/45 days on the total mix ration compare to the untreated ration.

Feedlot sheep trials continued

8.4.10. Gain in rand value.

The Browse Plus treated group of lambs showed an average growth in rand value of R78,30/lamb more than the untreated control group over the 45 day period due to the better feed conversion and weight gain by using Browse Plus as a digestive modifier.

9.4.11. Gross profit above feed cost.

The Browse Plus supplemented group of lambs showed a gross profit above feed cost of R62,78 per lamb more than the untreated group of lambs over the 45 day period in the feedlot.

9.4.12. Gross profit per 60 lambs.

According to the figures, the assumption can be made that the farmer could earn R3 766,80 more gross profit above feed cost over the 45 day period, if he used Browse Plus as digestive modifier in the feed of all the lambs that were in the feedlot.

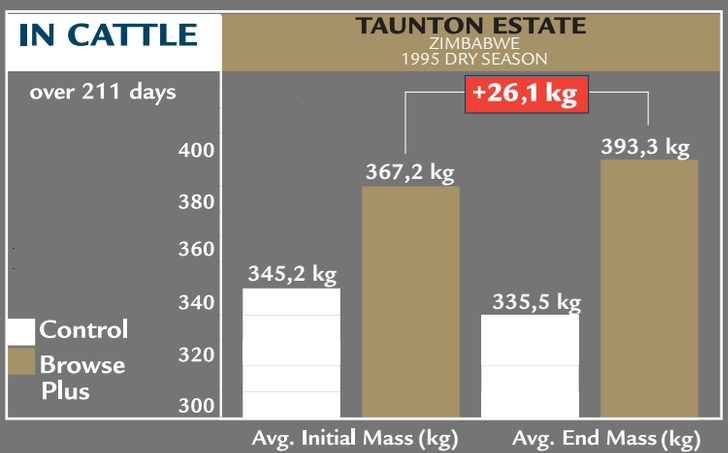
9.5 Conclusion

The financial benefits to the farmer by using a digestive modifier such as Browse Plus, is clearly visible from the results of this feedlot trial.

The increased efficiency of utilisation of feedstuffs creates the opportunity for the farmer to add value to his product with very little increase in cost. The cost benefit of using Browse Plus in this feedlot trial was 1:4.04.

10. Field Trials

10.1 Cattle trials



Mopani Rand Cattle - Mass Gain

1995 DRY SEASON
Mopani Ranch Mwenezi

TABLE 1.

	CONTROLS	BROWSE PLUS
Initial mass	330 kg	334,4 kg
End mass (211 days)	366,4 kg	397,2 kg
Total gain	36,4 kg	62,8 kg
Advantage over controls	--	26,4 kg
Daily gains	0,172 kg	0,297 kg

*All figures = Live mass

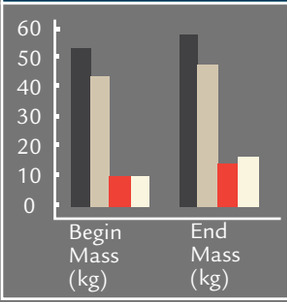
Cattle Trial 2010 Vryburg

	Browse Plus	Control
Total kg	17 046	14 575
Average kg	426,08	404,88
Diff kg	14,37	8,25
ADG	24,0 g	13,8 g
36 Heifers per group		
Trial over 60 days (Oct - Dec 2010)		
3 g/animal per day in the drinking water		

* data on file

10.2 Sheep Field Trials

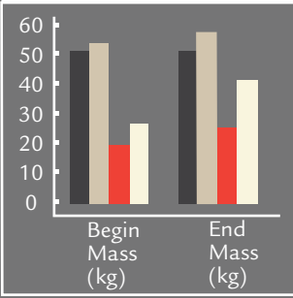
Carl Moller – Van Wyksvlei
Sheep Trials – 30 days (1998)



Control Ewes
Treated Ewes
Control Lambs
Treated Lambs

	Begin Mass	End Mass
Control Ewes	52,28 kg	56,36 kg
Treated Ewes	42,41 kg	46,84 kg
Control Lambs	9,43 kg	13,05 kg
Treated Lambs	9,21 kg	15,57 kg

Bertus Steenkamp – Carnarvon
Sheep Trials – 25 days (1998)



Control Ewes
Treated Ewes
Control Lambs
Treated Lambs

	Begin Mass	End Mass
Control Ewes	49,83 kg	50,65 kg
Treated Ewes	53,87 kg	56,66 kg
Control Lambs	19,28 kg	23,71 kg
Treated Lambs	28,95 kg	38,9 kg

Sheep (Cross Dorper) Trial 2011 Southern Namibia (Gochas) Grass

	Browse Plus	Control
Total kg	1 221	1 115
Average kg	40,7	37,17
Diff kg	5,1	2,6
ADG	45,5 g	22,9 g
30 animals per group		
All animals aged between 4-5 months		
Trial over 112 days (August - Nov 2010)		
3 g/animal per day in the drinking water		

* data on file

11. Articles

11.1. The hidden factor

In many parts of Southern Africa the yearly cycle may be divided into two, categorized as the Wet and Dry Seasons. The rains, the wet season, gives rise to an abundance of green grazing and generally adequate quantities of nutrient for livestock/game. When the rains end, the dry season begins and this is characterized by a drying up of the grazing. This is the period of reduced basic nutrient for livestock and game that loses condition and mass.

It has been the practice for many years, where such conditions exist, to provide supplementary feeding in the form of feed licks, blocks or pellets. Two factors are important in this sort of scenario: Firstly, the supplementary feed offered, as the name implies, is designed to "supplement" the overall nutritional requirement and not supply the total nutritional daily requirement of livestock/game. Secondly, this supplementation takes place in the veld for one very important reason – It allows the supplemented animals continued access to whatever environmental nutrient remains such as grazing and Browse Plus

The hidden factor

Supplementary or maintenance feeding has been practiced for many years. It is accepted as good basic management and it is true that the practice has been an enormous benefit for livestock. However, for just so many years there has been an unconsidered factor which, unwittingly overlooked, has prevented stockmen from enjoying a greater benefit from this practice.

Cattle that consume the supplement and continue foraging in the environment afterwards are bound to do some browsing. The extent of this browsing will depend on how much browse is available and how palatable it is. Most browse contains tannins in two states: Firstly there will be tannin which is already bonded to the nutrient in the plant, mainly protein. Secondly there will be free tannin which is not bonded to any nutrient. This free tannin exists because there is no more nutrient for it to bond with in the plant. It therefore remains in a free state until it comes into contact with something with which it can bind. Such contact may be facilitated by the protein in the feed supplement which will bond with the free tannin thus rendering it indigestible and therefore unutilised by the feeding animal. This is the hidden factor.

The extent to which this hidden factor becomes problematic will depend on the nature of the browse plants available. Some plants produce low levels of tannin and therefore have some free, unbonded protein. These plants will be regarded as useful Browse Plus types.

However, it is known that many plants are able to raise their tannin levels in response to browsing as a defense measure, so often the benefits of having plants which produce free, unbonded protein are sometimes negated by the browsing activity. Since tannin synthesis in plants is a very complex process it is impossible to tell exactly how problematic the endless variety of Browse Plus plants may be in any given situation. One can only generalize by taking note of the volumes of scientific literature available on the subject and devising strategies based on that information.

The hidden factor discussed above may be dealt with successfully by using Browse Plus in any situation where livestock is supplemented in the veld. This will be the best and most cost effective way of dealing with this problem. It is recommended that Browse Plus be included, if possible in the lick, block or pellets to be offered as supplementary feed in the veld. The inclusion rate should aim at delivering a minimum of 3 g per livestock/game unit daily.

11.2. Because they are worth it

If you watch TV you will have seen an ad by a well known cosmetic company which, after exonerating the use of its product, ends with the words: "..because you're worth it!"

Of course the point being made in the ad is the suggestion that the viewer is "worth it" and will hurry off to buy the product that will increase that cosmetic's "worth". This article is not about enhancing your cosmetic "worth", however, it is most certainly about enhancing the worth of your livestock operations and creating for your livestock a decided advantage going into the drier months and will make them "worth it" at the end of the dry season.

As we move into the drier season there are a multitude of products and practices all glamoring for attention and there are times when the stockman will be confused by this endless array of options. We need to end the confusion and focus on the priorities. A huge priority in the dry months is the question of adequate nutrition. True, that also can lead to a variety of options, all of which may be good and profitable making it difficult to recognize the priorities.

Let's sharpen the focus further. To help us do this we need to recognize the transition that takes place in the environment. There are clearly three stages:

- The High Nutrition period when grazing is still green and nutritive content high.
- The Transitional period when grazing is drying up and nutritive content is declining.
- The Low Nutritional period, when the grazing is dry and nutritive content is low.

It is a fact that as the drier season approaches there is the tendency in the minds of many stockmen to engage the "remote supplementary/maintenance feeding mode" button before considering what residue environmental nutrient remains – the grass and the browse. Remember, this residue is the lowest cost feed immediately available and it makes sense to utilise it as much as possible before having to commence supplemental/maintenance feeding. We must bridge the gap that lies between the wet seasons - when grazing is plentiful - and the dry period when environmental nutrient is depleted.

True, it is a simple matter to work out what nutrients livestock need going into winter. However, the problem arises with the part that is still in the environment, namely the grass and the browse. Why? Simply because it is not always possible to determine just how much of what is left in the environment in the dry season can be successfully utilised by your livestock. The quantity, quality and palatability play a large part in determining this. However, the animal's ability to successfully utilise what is there is the telling factor. If we add to this the kind of situation that many stockmen will be confronted with in many parts of South Africa this year, then we add another dimension to the problem: I am referring to the heavy rains in some parts, which has resulted in rapid, and in many cases rank growth of grass.

Often stockmen mistakenly see this as a good year when the increased bulk will be a great benefit, however, the experienced and perceptive stockman will know that abundant rains produce good grass growth, but such conditions also result in rank growth with inferior nutritive value of the grass to that which is available in a normal year. All this means that the grazing animal will need to ingest greater bulk in order to derive the same benefit enjoyed in a normal year. Lowered protein values in the grass results in a drastic reduction in the microbial population in the rumen so grazing livestock simply do not have the capacity to process this extra bulk.

It makes sense initially in the drier season to consider effective utilsation of the residue environmental nutrient before commencing supplementary feeding. There is an important reason for this. This residue nutrient comes free, and will provide valuable roughage. Such a pre-supplementary feeding period bridges the gap between the wet season when green grazing is abundant, and the dry season when nutrient is low and when supplementary feeding usually begins.

Browse Plus is a product well suited to help bridge this gap and kick-start the recovery of healthy microbial populations in livestock. It will increase the throughput of the rank grazing we are talking about and will enhance the ability of livestock to utilise the residue nutrient remaining as the dry season approaches. The continued use of Browse Plus as the dry season progresses will enhance the browsing activities of animals, while at the same time making more protein available through neutralising the anti-nutrient effects of Browse Plus tannins in the diet. It will prevent the loss of expensive feed protein to free browse tannins, the result of dry season browsing by livestock. Importantly it will generate an active digestive system which will lay the foundation for better utilisation of supplementary/maintenance feed when this commences. Because Browse Plus results in rapid recovery of the rumen microbial population, less feed protein is required to achieve this and is therefore available for nutritive utilisation.

Browse Plus, is now established and recognized as a vital part of the dry season nutrition. Use it on your livestock. After all "...they're worth it!"

11.3. The "IF ONLY.." syndrome
Dry season nutrition for livestock

These are the first two words of one of the most often repeated statements made by stockmen during dry season periods. It is made during the time of the year when animals are subjected to considerable nutritional stress and when farmers look hopefully for some sort of relief from a parched environment in order to provide much needed nutritional relief.

"If only they would eat this grass..." is the complete statement. It is often uttered while the farmer gazes out wistfully across a parched veld which, in the summer rainy season, is green and nutritious. Not so in the dry season months. Not only is the grass dry but it is unpalatable and the protein level would have dropped to about 3 %. Much of the carbohydrate also cannot be utilised as it is in an indigestible form. It can be a tauntingly hopeless situation, especially when there is an abundance of this grass.

The question arises: "Why should livestock eat this grass?" After all it is dry, unpalatable and low in nutrients. Surely it makes more sense to find something more attractive and nutritious for these animals to eat in the drier months? Wrong! Dry grass, depending on the type of grass, can provide valuable roughage in the drier months and some nutrients too. It is a common practice among stockmen to supplement or maintain livestock with manufactured feed concentrates in winter. However, it is also a common misconception that if the correct amount of supplement is offered, that this is all that is needed. This is only partly true. Supplements without roughage limits the effectiveness of the supplements if the required amounts of roughage are not given. If the intake of roughage can be increased, intake and effectiveness of the supplemented feed will increase proportionately.

It is important in the drier months to ensure that roughage is available. This can take the form of either grass or crop residue, i.e. maize stover. In many cases the ability of livestock to consume more dry roughage material is limited; this is due to a number of factors: first and foremost is the fact that dry roughage in the form of grass or maize stover is relatively unpalatable; secondly, the rumen microbe populations of ruminant livestock are reduced in drier periods. This is the result of the animal eating mainly dry material. Consequently the ability of the digestive system to process large quantities of grass or maize stover is also reduced since microbes play an important part in breaking down this material. This in turn reduces the animal's ability to utilise supplementary feed effectively.

You do not have to live with this "If only" situation. The technology is now available to enable livestock to better utilise dry, unpalatable grasses and stover. This technology is available in the form of the product known as Browse Plus. True, this product has been used for a good many years to enhance browsing activity by neutralising anti-nutrient tannins.

However, experiments conducted in a number of Southern African situations, has shown that cattle on Browse Plus increased their browsing activity by as much as 20 %. In one experiment on maize stover, treated cattle consumed a staggering average of 3,18 kgs of stover per day, while untreated animals consumed only 1,97 kgs per day.

Browse Plus has a pronounced effect on restoring normal rumen activity. It has been demonstrated that the rumen microbe population in treated animals is rapidly restored and the gastro intestinal tracts of these animals become more active resulting in increased intake of grass and / or maize stover. This increases the potential for more efficient utilisation of supplemented feeds.

There is no longer any need to gaze longingly at the dry season grasslands and say "If only!" The grass and stover can be put to good use.

This can be done cost effectively and efficiently with Browse Plus!

11.4. Tannins: a review

Dr. Lourens Havenga (BVSc) (lourens@multiminusa.com)

The production of tannins as a defence mechanism by plants , has been researched and proven. It is only during the past 20 – 30 years that the true economic impact on game has become evident as more and more game farms are fenced off. The purpose of this review, is to state facts from research and explain why animals die from tannin poisoning as well as to suggest certain measures which can reduce the effects of tannin toxicity on game farms.

Different types of tannins are produced and effect animals differently:

Condensed Tannins (Proanthocyanidins)

This is the most commonly found tannin. This group causes enzyme inhibition, protein precipitation and hence nutritional deficiency. Lesions of the gut mucosa, affect absorbtion. High concentrations in foilage, leads to reduced intakes, due to the astringent taste effects. Astringency is due to the binding of the tannins with salivery glycoproteins. Visible effects on the animal, relates mainly to protein malabsorbtion – hence emaciation.

Hydrolyzable Tannins:

Rumen degradation of hydrolyzable tannins, results in the production of pyrogallol, a hepato - and nephrotoxin. Acute deaths can be attributed to this toxicity. Major lesions at necropsy include haemorrhagic gastroenteritis, liver necrosis and proximal tubular necrosis in the kidney.
Depending on the type of tannin dominating, one can either find emaciated weak animals dying from protein malnutrition, or animals in good condition dying acutely.

How do animals cope with tannins in nature?

Browsers produce proline-rich glycoproteins in the saliva. The main contents of the saliva: small glycoprotein containing large amounts of proline, glycine and glutamate/glutamine. The main purpose of these substances, is to form complexes with the tannins, binding with them and prohibiting the tannins from further action in the rest of the GIT. Browsers also have more nitrogen in their saliva due to recycling.

These substances are absent from grazer saliva, hence the severe impact of tannins on grazers.
Research in moose from North America and Scandinavia has proven that even in the same species, there is a marked difference in the binding of tannins in saliva. This difference was dependent on the species of trees browsed on (A point to consider when re-locating browsers to vastly different habitat).
Rumen adaptability to digest tanniferous browse: Several studies have proven that, giraffe, greater kudu, eland, duiker, impala and nyala do not posses any rumen microbes that can digest or inactivate tannins. On the contrary, the addition of polyethylene glycol (the main active ingredient of Browse Plus*) increased digestibility and nitrogen production in above species.

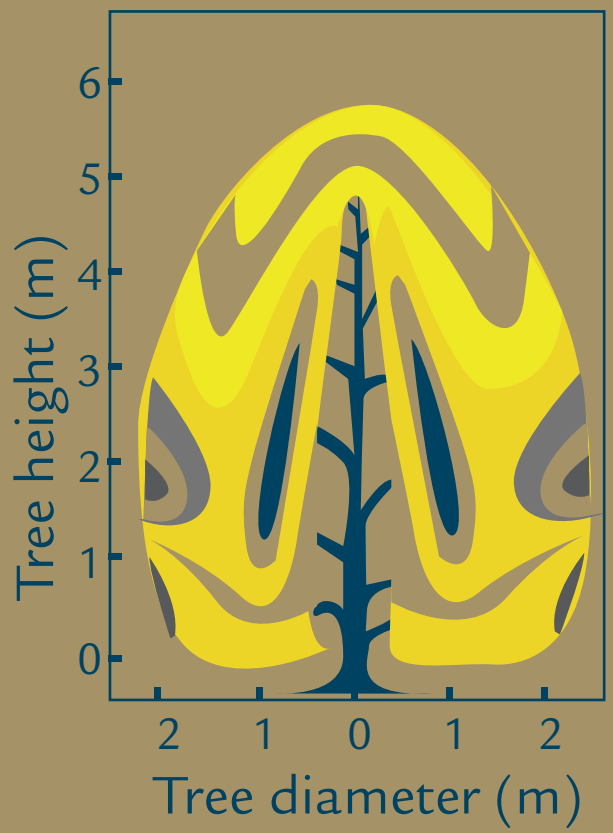
Tannin dynamics in browsed plants

Tannin producing plants have several ways in which the tannin levels fluctuate:

Fluctuation between different areas in the canopy spread. Figure 1 (Furstenburg & Van Hoven)

Fluctuation between different areas of sunlight exposure. Tannin levels are higher in the shaded area.

Condensed tannin anti-defoliate agent - giraffe



Distribution of condensed tannin (% of dried leaf weight within the canopy of Acacia nigrescens in cross section)

Daily, cyclic fluctuation. Tannin levels decreases with increasing temperature during the day and increases with decreasing temperature through the night. Fluctuation between different phenological leaf stages in the same tree. Young and premature leaves contained twice as much condensed tannin than mature leaves. Change in leaf tannin levels in reaction to browsing. Most browsers, browse selectively, selecting plants which contain < 5 % (dried leaf mass) condensed tannin. Increase in tannins after browsing commensed, starts within 2 - 10 minutes (hence animals move from tree to tree, never browsing one tree totally). Recovery to predisturbed levels takes 40 - 66 hours. (This explains why browsers even if they keep to a single area, rarely are to be found at the exact same location day after day as is the case with many grazers.) DISCUSSION: - Game ranch dynamics - During the drought period of 1981 - 1986, a significant amount of kudu died in the now Limpopo province. Dr Van Hoven did research on the mortalities and found two related parameters, namely:

·Number of kudu/100ha

·Condensed tannin content of the major species browsed

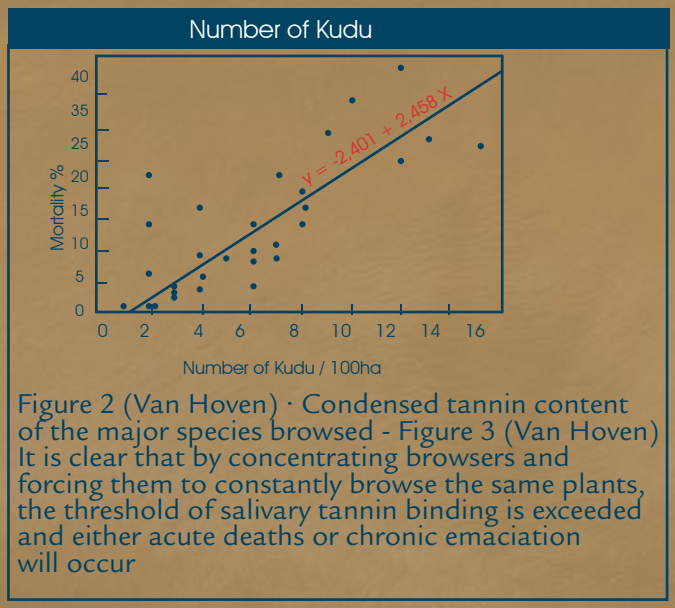
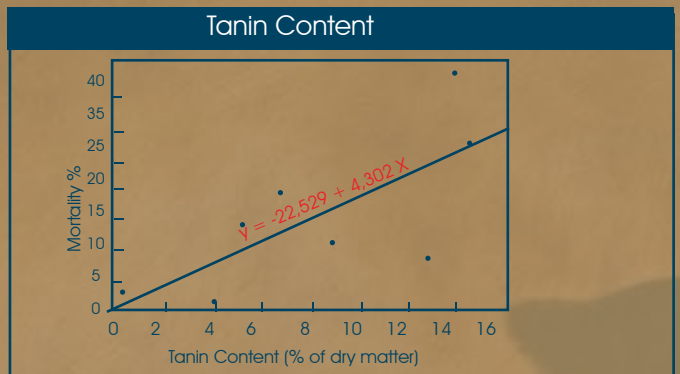


Figure 2 (Van Hoven) · Condensed tannin content of the major species browsed - Figure 3 (Van Hoven) It is clear that by concentrating browsers and forcing them to constantly browse the same plants, the threshold of salivary tannin binding is exceeded and either acute deaths or chronic emaciation will occur



(As game ranchers and consultants to game ranchers we must take into account that although browsers have adapted by secreting saliva rich in proteins able to bind tannins, selecting plants with lower tannin levels and by browsing on the move, by fencing in animals, we have artificially disturbed the balance.) There are basically only two practical ways of dealing with tannin related problems: - Decrease the stocking rate of browsers (within species and also among species) - Supply polyethylene glycol (Browse Plus) via drinking water, in order to bind tannins and prevent tannin related toxicity. For more information on the use of Browse Plus, contact Virbac RSA on 012 – 657 6000. Product: * Browse Plus® Reg. No: V11013 (Act 36/1947),
Polyethylene Glycol 930 g, Excipients 70 g, (Polyvinlpyrrolidone/Calcium Hydroxide/Dry powdered molasses stillate)

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12. Testimonials

12.1. Craig Fitzhenry

Indwe - Elliot District. February 2014
Lick that was used

3 kg Browes Plus
240 kg Maize
80 kg Molasses Meal
150 kg Oil Cake
150 kg Urea
200 kg Salt

500 g per cow per day
I put the lick 3 times out a week.
This was the 1st time I managed to pull cows through winter without giving them erogrostis bales.

12.2. Les Bowes

Queenstown Feb 2014

My Experience with Browse Plus

During last summer we were subjected to a very challenging drought. Those with rainfall records said that this was "the worst in ten years". This was a wake-up call for the younger farmers who had never really experienced severe drought and they realised the importance of sparing veld.

In the Queenstown area where we live, there is a good mix of sweet grass and bush. When the winter was at its worst and the previous year's grass was all consumed, things really became serious. The Virbac consultant for this area, Matthew Tawse, introduced us to Browse Plus. We had used Browse Plus long ago and he assured us that it had been reformulated and was an excellent product and it was certainly worth a try. The idea was to utilise the bush and trees as we have an abundance of these. We calculated our quantities and mixed Browse Plus into our winter lick and waited. Sure enough, after a few days, the cattle started eating the trees to such an extent that they stopped losing condition.

The Browse Plus only added an extra R1 000,00 per ton to the price of the lick which was a small price to pay considering all the extra fodder that became available. This eased the pressure and we did not have to purchase any additional hay.

The winter ended and on 18 November the rain fell, as always, just in time!!! "Another month and I would have been buggared" was the phrase on many farmers' lips.

It is very comforting to know that I can rely on Browse Plus next winter!!!

13. Summary

13.1. Improved digestion = efficient nutrient utilisation

- During unfavourable periods, the intake of dry roughage in the form of grass, bush or crop residue is important.
- Because the rumen microbe populations of ruminant livestock are reduced over this period - the ability of the digestive system to process dry roughage and extract nutrients is limited. Browse Plus enhances the digestive processes and results in more efficient nutrient utilisation.

13.2. Proven to be safe and environmentally friendly, **Browse Plus**:

- Encourages browsing of unpalatable plant material.
- Restores normal gastro-intestinal function.
- Restores rumen function and increases microbial populations which aids in the healthy digestion of normally unpalatable dry plant material and vital roughage.
- Neutralises the negative effects of tannins and terpenes, the natural defense mechanisms of plants that make it unpalatable and sometimes dangerous to eat.

13.3. The benefits of Browse Plus

- Save money by reducing the need for costly supplementation.
- Keep your livestock healthy by unlocking the nutritional potential of existing plant material.
- Preserves the environment and does not impact on other life forms, such as dung beetles.

13.4. Residues

- PEG and PVP not absorbed from intestinal tract of treated animals, therefore, no residues in meat, blood or milk.
- Ethylene concentrate – molasses related product – consists mainly of sugars, some proteins and other nutrients. Metabolized in the normal fashion.
- Calcium Hydroxide – not usually considered a nutrient as such, but may provide small amount of calcium which could be absorbed.

13.5. Administration and dosage

Browse Plus: can be administered in feed (licks or pellets) or the drinking water.

Recommended* 3 - 4 grams per livestock unit (cattle and game) per day.
Recommended* 1 - 2 grams per livestock unit (sheep and goats) per day.

* Varies according to nature of vegetation browsed or grazed per day.

PACK SIZES

1 kg
4 kg
10 kg

BROWSE PLUS®

Reg. No. V11013 (Act 36/1947), Namibia Reg. No. N-FF 0482

Virbac RSA (Pty) Ltd (Reg. No. 1990/003743/07)
Private Bag X115, Halfway House 1685
Tel: (012) 657-6000 · Fax: 086 565 7208
www.virbac.co.za

FOR ANIMAL USE ONLY

Class: Tannin Inhibitor Composition: Polyethylene Glycol 930 g, Excipients 70 g, (Polyvinlpyrrolidone/Calcium Hydroxide/Dry powdered molasses stillate)

Virbac

Shaping the future of animal health