

Kynoch



VOLUME 3 | 2019

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« Massive increase in
avocado production »

« KynoPrecise™
successfully used
on a sugarcane farm »

« Potatoes do well on a
clay loam soil »



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@KynochFertilizer

Enhanced efficiency through innovation.

» Foreword

Dear Food Producer, Customer, Friend

The 2018/19 production season was probably one of the most challenging seasons of the past few years. From the outset, predictions of how the season would play out were not very positive and at times even contradictory. In general, the year was characterised by late rainfall which led to the late planting of most crops in the summer rainfall area. The western production area in particular was characterised by late or virtually no rain during the planting season. This lack of rain resulted in a large number of hectares being planted too late. In the more eastern production area, rainfall was generally better, but severe hail caused some damage in places.

Because of the aforementioned factors, the National Crop Estimate Committee has predicted significantly lower yields for the most important summer grain crops compared to the previous season. According to the committee, the total hectares of maize – a staple food – is about the same, but production is expected to decrease by about 2 million tons compared to last season. As for summer grains as a whole, it is estimated that production will shrink by approximately 2,5 million tons compared to the previous season.

The sugar industry is facing a major crisis and it is feared that this R14 million/year industry may collapse, resulting in a loss of at least 350 000 jobs.

Of the wheat producing areas worth mentioning, only the Western Cape (51%) and the Free State (7%) produced more than the previous season. Yields in the rest of the production areas remained more or less the same or decreased slightly. Overall, the country's wheat crop increased by about 306 000 tons (20%) compared to the previous season, but the total harvest will meet less than 50% of the South African consumer demand, resulting in wheat imports.

By contrast, the subtropical crop industry is thriving. There is an overwhelming demand for land suitable for these crops and in some areas producers are lining up to acquire land. Even universities that do not traditionally offer courses in subtropical crop production, are now offering such courses. There has also been an increase in research capacity related to this field. The largest subtropical expansions have been experienced in the macadamia industry.

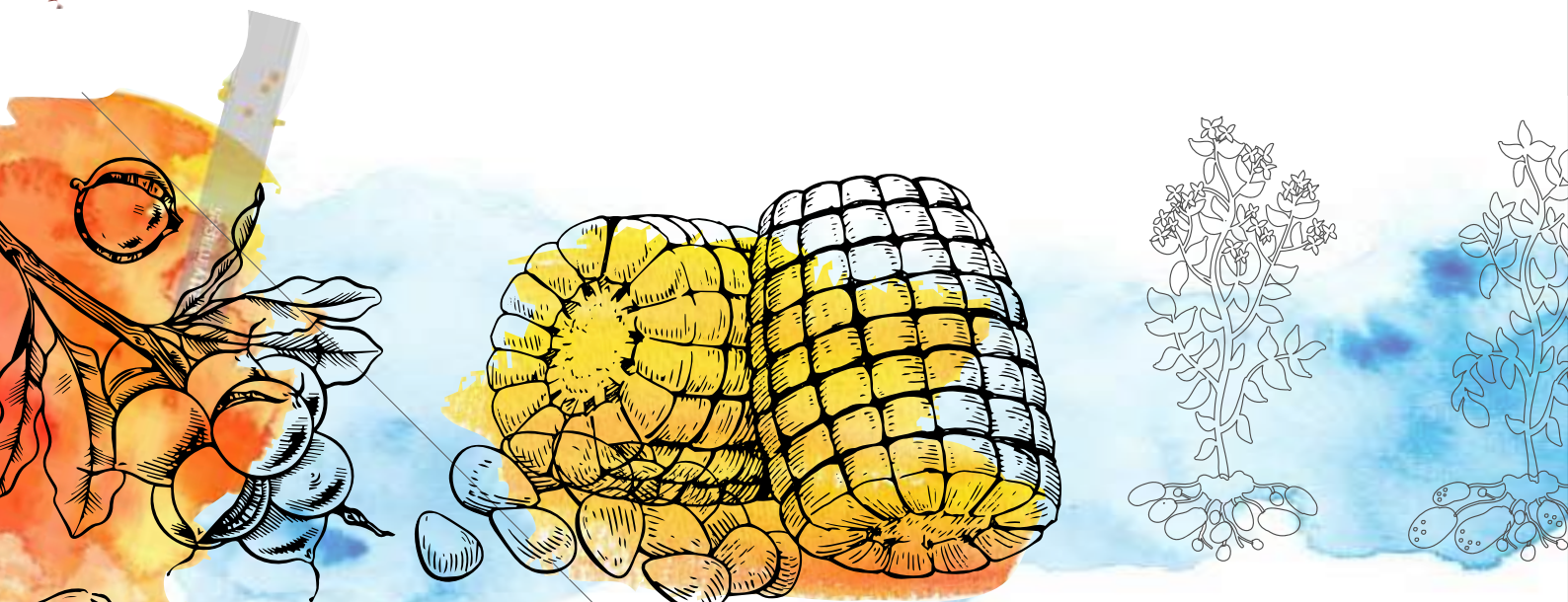
Despite the negative picture for some crops there are still producers out there achieving success.

At **Kynoch** we are aware that every piece of land has its own unique fertilisation requirements. To this end, **Kynoch** uses a crop, growth-stage and site specific approach to improve the efficiency of crops. In addition, **Kynoch** uses fertiliser products and services to increase producers' chances of achieving the maximum from a specific season and meet the ever-changing nutritional needs of crops throughout the season.

We trust that you will enjoy this issue of **Kynoch's Success stories** and will share in the joy and achievements of each and every producer. These successes are the result of dedication and **Kynoch's motto: Enhanced efficiency through innovation.**



Dr. Johan J. van Biljon,
General Manager: Enhanced Yield systems.



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» Massive increase in avocado production

Chris Burbidge and Cassie Dorfling, Levubu district, Limpopo Province

A non-bearing orchard was turned around to give a profit of approximately R250 000/ha and the current harvest will improve it even further!

During August 2017, an orchard visit was undertaken to an avocado producer in the Levubu district. This formed part of **Kynoch's "green tours"**. The aim of the visit was to investigate a specific orchard which had gone into a non-bearing cycle for the past few production seasons. **Kynoch agriculturists** approached the producer with a multidisciplinary focus and amongst others included soil profile pit investigation, chemical soil analysis, leaf analysis, irrigation type and efficiency as well as overall appearance of the orchard.

The orchard was a Fuerte block, seven years old at the time and with a tree population of 250 trees per hectare. The irrigation system was that of microspray and one microsprayer per tree. The cation exchange capacity (CEC) of the soil was between two and three. At the time, as mentioned before, there was no economical yield on the block even though good flowering was evident at the cauliflower stage. Most fruit set was then aborted soon thereafter.

Proposals

Most feedback received was related to irrigation efficiency or lack of irrigation scheduling. There were suggestions of using irrigation management tools like probes, tensiometers and soil augers.

There was a lot of consensus around the doubling of microjets (one on each side) to improve water distribution around the whole drip area of the tree, thus maximising the root surface area for uptake of plant nutrients. More frequent light irrigations were suggested with the focus on alleviation of water stress periods during flowering, pollination and fertilization, which is detrimental to good fruit set.

The present, single microjet, was also obstructed by the main stem (trunk) and low-lying branches and leaves. This resulted in concentrated areas near the microjets which could possibly leach out nutrients like boron. The "over-wetted" area could also be contributing to phytophthora.

The producer mentioned that he could not understand why the boron analysis in the leaves remained low despite several applications of different boron sources. It was also mentioned by the **Kynoch team** that the "silver bullet" approach by the producer in relation to boron, should be replaced by taking more production-limiting factors into account.

The next season (2018) the producer implemented most of the proposals made by the agriculturist team. He harvested a remarkable 25 tons per hectare and has since also been using **Kynoch granulars** like **GreenGold®** and **Brio®** from the **Miracle™ range** of products. The financial result with realistic assumptions, is that the 25 ton/ha yield will give a R250 000/ha profit after deducting costs compared to no income for a few seasons prior 2018.

Interesting was the increase of boron levels in the leaves from under 20 ppm in 2017 to 53 ppm in August 2018. The result of an increased root surface area and a more efficient factory, in combination with the right product at the right growth stage, means there is now a potential crop of about 60 tons/ha on the trees (**Figure 1**) which is naturally too heavy and some thinning out of fruit will be necessary. This incredible result indicates that a holistic approach is necessary to mitigate risks in producing crops economically and sustainably.



Figure 1: A photo of the orchard in December 2018 showing good fruit set.



» Looking after the small brings huge success

Dr. John Tolmay, Eastern Free State and Megan Lourens, Manager: Research and Development.

Kynoch serves a variety of clients, some big and others small. One of our smaller clients is Maluti Mini Tubers, a small potato seed producer who only buys a few bags of fertilizer per year.

This tiny production unit has been producing first generation seed potatoes for a few seasons and is at present still fine-tuning techniques and best practises to help increase production capacity of the unit. Producing various varieties that differ in nutritional needs in such a confined area, remains one of their biggest challenges.

Two seasons ago, the owner, who uses **Kynoch products** for various field crops including maize, dry beans and seed potatoes, approached **Kynoch** for assistance to improve production of the mini tubers in a specialised tunnel. This production unit consists of a tunnel (**Photo 1**) which produces one crop per season. They want to expand the business but before they can do that, yield must be increased.

The virus-free material is transplanted into a growth medium in “books” (slotted plastic containers), which is fertilised and watered through a computer-controlled irrigation system. Plant nutrition can be exactly controlled to provide precisely the correct nutrient at the right growth stage. Megan Lourens visited the facility in 2017 and developed the first nutritional programme.

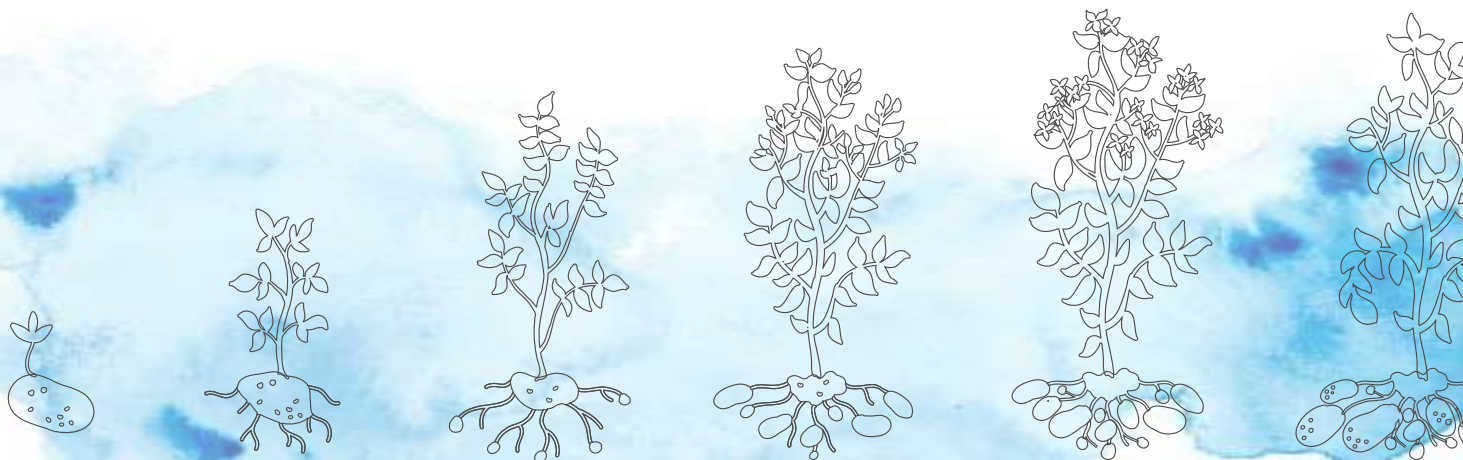
Maluti Mini Tubers has now completed two production cycles with the **Kynoch programme**. Although some minor adaptations had to be made during this time, the client is very pleased with the results especially the quantity and quality of the mini tubers which were produced. He is also particularly pleased with the programme resulting in a tunnel that is easier to keep disease free, hygienic and clean.

Although Maluti Mini Tubers is one of the smaller agricultural enterprises served by **Kynoch**, we are immensely proud of our role in assisting this enterprise with the development of their business.

The Kynoch programme did not only increase the yield and quality but also made it easier to keep the facility disease free.



Photo 1: Mini-tuber production



» KynoPrecise™ successfully used on a sugarcane farm

PJ Fryer, Chris Hall & Diddle Mahabir, KwaZulu-Natal



The sugar industry has traditionally not been able to use precision agriculture because of the steep slopes and small fields that dominate in large areas of the sugar growing area. However, things are changing, and new technologies are allowing sugarcane growers to move towards a more precision way of farming.

Umhlatuze Valley Sugar Company (UVS), is a company that **Kynoch** has been working with in KwaZulu-Natal (KZN). They have been adopting **KynoPrecise™** as a tool to help transform their agricultural practices towards a more precision style of farming. **KynoPrecise™** is **Kynoch's precision agriculture program** that is conditionally available free of charge to producers. Three replant fields were recently selected for grid samples and using the **KynoPrecise™** application the samples were taken at a 0.5 ha grid and sent for analysis.

It was suspected that the variation in most of the selected lands would not be very high, however, the range of results showed huge variation. In one land the potassium levels ranged from 96 mg/l to 547 mg/l (**Figure 1**) and phosphate levels ranged from 3 mg/l to 53 mg/l. This once again demonstrates the chemical heterogeneity of our lands, although we easily say it is the same! This heterogeneity resulted in under or over fertilization which not only

increased risk but cost us money both ways. Variable rate gypsum, potash chloride (KCl) and mono-ammonium phosphate (MAP) fertilizer applications were applied as corrections before the fields were planted. **Esprit®**, which is one of **Kynoch's Miracle™ range fertilizers**, was used in the furrow during planting. Our **Miracle™ range of products** contains calcium, magnesium, sulphur, zinc and silicon and sometimes some micro-nutrients are added along with nitrogen (N), phosphate (P) and potash (K) which is superior to normal NPK fertilizer. The crop will be top dressed using **GreenGold®** and **KynoPlus® Topstar + S. GreenGold®** is a product that contains **KynoPlus®** and nitrate nitrogen as well as boron. **KynoPlus®** is an enhanced fertilizer that contains **Agrotain®** to reduce volatilization losses and make it more efficient than some other nitrogen sources. **KynoPlus® Topstar + S** contains **KynoPlus®** as well as sulphur which is becoming more and more important in crop production because of a cleaner environment with less pollution.

How it works

With **KynoPrecise™** we have the ability to monitor the crop during the growing period.

KynoPrecise™ receives NDVI imagery (NDVI images give an index value for crop growth) from two different satellite sources to ensure more timeous images. Images are normally supplied every couple of days. However, it depends on cloud cover at the time the image was taken on whether or not the image can be used. NDVI imagery (**Figure 2**) will help us identify if there are any weak or stressed areas in the replant fields.

At the moment, these fields are looking very good. Just another example of precision agriculture adding value to the sugarcane industry.

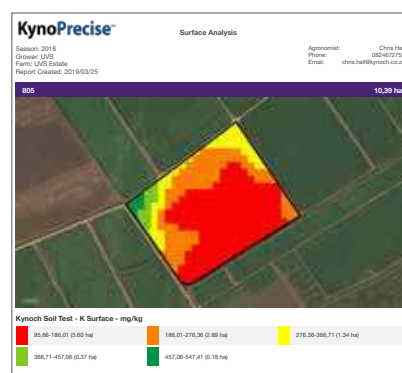


Figure 1: Chemical map showing difference in K content.

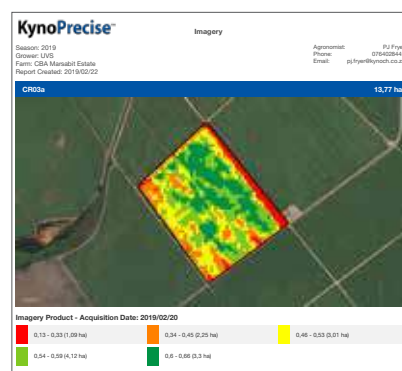


Figure 2: NDVI image showing differences in growth.

» Potatoes do well on a clay loam soil

Graham Peddie and Natie Labuschagne, Winterton/Bergville, KwaZulu-Natal

Imagine what a 38% yield increase of good quality potatoes can do to your bottom line!

In mid-2018 **Kynoch** was approached by a producer wanting to plant potatoes for the first time. The farm is situated in the picturesque foothills of the Drakensberg Mountains near the start of the scenic Oliviershoek Pass. The soils on the selected pivot-irrigated land are a deep Hutton form with a clay content in excess of 35%.

The producer requested a fertilizer programme for a target yield of 65 t/ha – quite a challenge in this area and clay soil. The programme was prepared according to the **Kynoch** approach of crop specific, growth-stage specific, and site specific. The full programme was then costed and presented to the producer. After approval, implementation could start. Planting was done with a **Kynoch blend** from the **Miracle™ range** (containing eight plant nutrients), while a **KynoPop®** solution was sprayed over the planting material. Our **Miracle™ range** of products contains

calcium, magnesium, sulphur, zinc and silicon and sometimes some micro-nutrients are added along with nitrogen (N), phosphate (P) and potash (K) which is superior to normal NPK fertilizer, while the **KynoPop®** helps with the number of stems and tuber initiation. Top dressing was done in three applications using three different products to supply the nutrients in the right quantities and balance at the right time as required by the plants. This included a dressing using a blend from the **Enhanced-Nitrogen KynoPlus®** range of products.

Foliar applications of nutrients were done using **Kynoch's Veggie Oemff® Starter, Veggie Oemff® Grow and Veggie Oemff® Fruit**. These products contain macro, secondary and micronutrients in the correct ratios for each of the growth stages and help the plants to better manage stress and can increase yield and tuber quality.

On an adjacent smaller pivot a different fertilizer programme was followed. This land was planted first and the **Kynoch** land a week later. Burn down and lifting was also a week apart, so the growth period for both lands was the same.

The question on everybody's lips was if we were able to get close to the target set by the producer on these clayish soils. The answer is a resounding YES! The yield (**Photo 1**) on the **Kynoch pivot** averaged at 65 ton/ha potatoes sold, while the other pivot only managed 40 tons/ha. This is a 25 tons/ha difference.

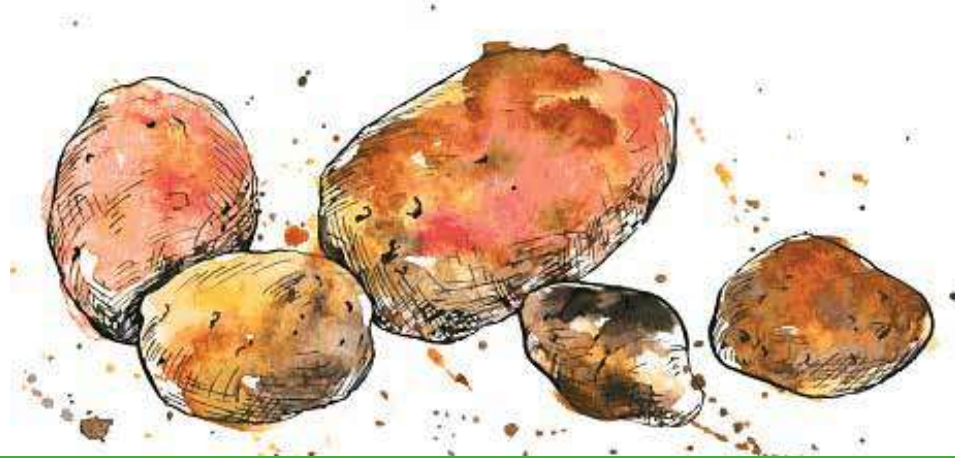
But what about the quality? The farmer was very happy with the quality: well-formed, clean, white tubers (**Photo 2**) that achieved top prices at the market. The size was also excellent with well over 50% of the potatoes in the large-medium and large classes.



Photo 1: Lifting a top yield in mid-December 2018.



Photo 2: Beautiful, well-sized, clean, white tubers



« Nutrient Scheduling™ aligned with plant development. »

« Maize OEMFF® L16

Nutritional support during pollen shedding, pollination and fertilisation.

KynoPlus® mixtures Foli-Grande® or Foli-Plus®

Nutritional support to enhance grain fill.

« KynoPop®

Rapid start and strong seedlings.

KynoPlus® - NPKS planter mixture

Support potential in the maize plant.

MAIZE

FLOWERING STAGE

MIDDLE VEGETATIVE
TOP DRESSING

EARLY VEGETATIVE
WITH PLANT

PRE-PLANT



KynoPlus® and KynoPlus® mixtures

Increased nutrition when the maize plant needs it the most.

Maize OEMFF®

A foliar feed to enhance the efficiency of the maize plant.



KynoPlus®

Increasing available nitrogen in the soil.

KynoPlus® mixtures

Add Nitrogen, phosphate and potassium.

Speak to us about how you can implement the **Nutrient Scheduling™** into your crop management programme.

With Kynoch's innovative and tailor-made products you can apply fertilizer according to the needs and growth stages of your maize plant. In this way, Kynoch ensures that your **maize plants are given what they need when they need it most.**

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» Recovery of maize despite hail damage comes as a big surprise

Lodewyk Bruwer and Hans-Jurie Vosloo, Chrissiesmeer, Mpumalanga

Danie Neethling and his son, Marlouw, farm with maize, soybeans and cattle in the Chrissiesmeer/Carolina district. The Neethlings are passionate about farming and weather and nature permitting are always trying to improve on the previous season's performance.

The Neethlings follow a farming practice where they over fertilize the maize to provide sufficient nutrients for the next season's soybeans. To this end, the nutrient removal figures for maize and soybeans are taken into account and this precision information is then used to inform final decisions. This precision information is also used regarding variable rate applications – a practice with unquestionable financial benefits.

By using the nutrient removal figures together with the precision information, the possibility of over or under fertilization

is virtually ruled out. This not only reduces production risk, but also increases the chance of fully utilising the season's potential and maximising profit.

The annual rainfall in the area of about 800 mm is relatively high compared to other production areas. The maize is planted at a population of 50 000 plants per hectare in loam soils with a clay percentage of about 15% in the top soil and 25% in the B horizon (sub soil).

Minimum tillage practice is followed and lime is worked in with a tine implement every third season. No further tillage, except planting, is carried out. The planter is equipped with a spike tooth to loosen the soil up to a depth of about 200 mm and fertilizer is applied at a depth of 100 – 200 mm. The planter band places the fertilizer once only. This single application with the planter should provide sufficient nutrients to the maize for the full growing season, as well as the next season's soybeans. The soybeans then utilise any fertilizer not used by the maize.

What stood out this season, was the capacity of the maize to recover after the hail damage. The maize was hit twice (**Photo 1**). The first time at the four leaf stage and again at the eight leaf stage. However, it was still surprising to witness the rapid recovery of the plants (**Photo 2**). This rapid recovery can be attributed to the preceding adjustments, as well as sufficient nutrition during the growing season. The yield potential looks promising and we are cautiously optimistic that we can once again look forward to a good harvest despite the hail damage.

Precision application of lime and fertilizer plus sufficient plant nutrition certainly mitigated the hail damage.



Photo 1: Maize after hail damage (2 December 2018)



Photo 2: Maize one week after hail (9 December 2018).



» Kynoch now also making a difference in the Southern Cape

Pierre Theron and Hanno Maritz, George, Southern Cape.

By doing the basics right and using new technology, Kynoch was able to make a difference in the Southern Cape from the word go.

Although **Kynoch** only recently entered the Southern Cape, we have already made a difference in the area. **Photo 1** shows **Kynoch agent** Hanno Maritz next to dryland maize in the George district. Unfortunately, there are no available yield data, but what is clear from the photograph is that these maize plants are looking exceptionally good compared to other maize plants in the area.

Marius Smit of Kristalfontein Farm's normal maize cultivation practices are aimed at chemically correcting the soil and also to ensure a clean seedbed.

Chemical soil correction includes the application of lime, phosphate and potassium based on reliable soil analyses. The Southern Cape is known for its zinc, copper and manganese deficient soils. However, these deficiencies are thoroughly taken into account in the fertilization programme and addressed at the various growth stages. On the fields where maize will be planted, weeds are chemically killed and disced in with the lime. As the calcium levels of some of the fields are not yet sufficient, it not only effects the availability of this nutrient in the soil, but can also impact negatively on soil structure and therefore soil aeration, in turn limiting root development. With this in mind, and also due to the fact that dairy cows will be grazing on the land for a reasonable period, the soils

are ripped at a depth of approximately 70 cm to counteract any physical limitations.

KynoPlus® 3:0:1 + S was broadcasted beforehand after which planting took place with 8:9:0 with micro elements. The **KynoPlus®** range of products contains **Agrotain®** - a urease inhibitor – which limits volatilization losses from urea. This technology further underlines **Kynoch's slogan** of “Enhanced efficiency through innovation”. **Maize Oemff®** was sprayed four weeks post emergence. **Maize Oemff®** is a foliar application specifically formulated to manage the physiology of the maize plant. The total amounts of nitrogen, phosphate and potassium applied to the maize, were 91 kg nitrogen plus 30 kg potassium broadcasted beforehand. Planting took place with 22 kg nitrogen and 25 kg phosphate. The **Maize Oemff®** sprayed at four weeks, is a product containing nitrogen, phosphate, potassium, magnesium, sulphur and specific chelated micro elements. This programme is the embodiment of the **Kynoch approach of crop, growth stage and site specific fertilization**.

The result of good management, planning and a quality range of plant nutrition products is maize that stands out from the rest of the maize in the area. **Kynoch** also gave Marius access to its **KynoPrecise™** precision farming program which should enhance his farming operation even further. The **KynoPrecise™** program enables the producer to take precision grid samples of the soil and to correct possible nutrient deficiencies in the soil prior to planting. Making use of satellite images enables the producers to identify problem areas post

emergence so that these can be corrected in good time. In the end, all of this contributes to enhancing the efficacy of the inputs and the efficiency of the crop.



Photo 1: Maize in the Southern Cape.



» KynoPrecise™: A most handy app for today's producer

Renier Bothma and JB Joubert, Kroonstad, Free State

Kynoch's KynoPrecise™ app is a program combining the gathering, processing and evaluation of data as well as the management of site-specific precision farming – all in one place. KynoPrecise™ can be used in the field or on a personal computer to evaluate soil chemistry, soil maps, satellite images, combine harvester maps and more.

Satellite images

Another handy function of the app is that it provides NDVI images at least every fortnight. NDVI stands for Normalized Difference Vegetation Index – an indication of the relative amount of green on a specific geographical site. These images enable us to identify differences in green/soil cover in a field. By using these images, it is possible to enhance your time management considerably as you can directly move to the appropriate sections of the field as indicated by the images.

Identification

The following scenario took place during a visit to a producer in the Kroonstad district and is a typical example of how these satellite images can be utilised in practice. On arrival, all the images were analysed to ensure that we stop at the appropriate places to determine why the maize plants in these specific areas differed from the rest of the field. One of the sections identified, was a block of maize showing strips (Figure 1) across the field.

It was quite significant that the strips were lying in the same direction as what the maize was planted. The field is situated on the other side of a large water pan, therefore, the affected area could not be reached. A few days later a drone was used to photograph the affected section.

Photo 1 clearly shows the yellow and green strips. At closer inspection, it was determined that liquid fertilizer was applied prior to planting and that the tractor operator completed some of the circuits without fertilizer in the tank to finish the process sooner.

Advantage

Without the app it would remain a mystery why a section of the field under performed in comparison to the rest of the field, as all plants would've been dead at harvest resulting in no colour differences. The yield loss between the affected section and the rest of the field was 2 ton/ha. If **KynoPrecise™** was used earlier, the problem could have been fixed with the necessary fertilizer application in an endeavour to prevent additional losses. Furthermore, the app also helped considerably in marketing the grain beforehand, as it was quite clear from the images which sections would potentially perform well and which not. **KynoPrecise™** – a valuable asset for any producer!

KynoPrecise™ not only helped to indicate problem sections, but it could also prevent a loss of income.

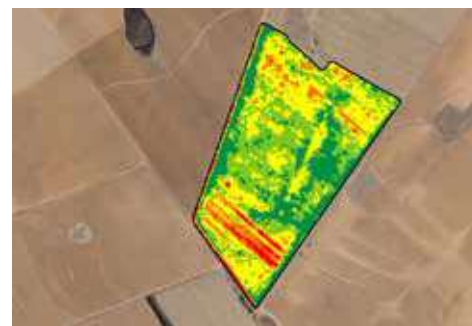


Figure 1: Strips (red) in the bottom section of the field (satellite).



Photo 1: Strips on the bottom section of the field (drone).



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Free access for
Kynoch customers.*

KynoPrecision™ making informed decisions.

Kynoch is at the heart of innovating new science and technology, supporting you in your quest for maximum profitability. With **KynoPrecision™** you have access to site-specific information empowering you to make the right choices for your farm.

Some of the **KynoPrecision™** software features include:



KynoRover™

- On your smartphone or tablet for excellent mobility for use in the field
- All the necessary e.g. navigation, sampling, scouting, reports, etc.



KynoEye™

- A webbrowser where you can look at all available information e.g. soil maps, satellite images, yield maps, etc. in one place.



KynoAnalytics™

- The ultimate in integration of data and multi-layering to analyse meaningful relationships between different factors on your farm.

KynoPrecision™ gives you site-specific insight while the cutting edge information puts an added edge in your hand, empowering you to make informed decisions.



* Currently available on Apple devices as well as desktop application. Terms and conditions apply.



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» Kynoch clients in the Northern Cape excel in competition.

Hentie Cilliers and Piet Hamman, Orania, Northern Cape.

“Every year, the CVO school in Orania (Photo 1) as part of their fundraising for their new sport fields, runs a competition for maize under irrigation.

Producers in the area can donate a 1 or ½ hectare block of maize to the school. Every block entered, is harvested and weighed separately to determine which block achieved the highest yield. Several prizes, donated by the various agricultural companies, are up for grabs. **Kynoch** is also one of the sponsors. As some of the organisers of the competition are also producers, they are excluded from the competition. However, these organisers have decided to compete against each other to see who walks away with the highest yield.

Two of **Kynoch's** clients excelled in the Maize project. The average maize yield for the area is approximately 15 – 16 t/ha. Zelih Straszacker came third in the 1 hectare division, with a yield of 17 t/ha, while Danie van Wyk achieved first place in the organisers' division with an excellent yield of 19 t/ha – the highest of all the entries.

One of the aspects that contributed to the success, is the fact that producers' soils are well cared for. To this end, producers have been using chemical grid samples for years. Care is also taken not to deplete the soil through under fertilisation.

Water management is another crucial aspect under irrigation and producers use probes to prevent over or under irrigation. Another important aspect is conducting regular field inspections – sometimes with the **Kynoch agent** present. **Kynoch** made recommendations regarding fertilisation and some of the products used were **KynoPlus® TopStar S**, **Maize Oemff® Early** and **Maize Oemff® L16**.

KynoPlus® Topstar S contains nitrogen, potassium and sulphur. The nitrogen source, **KynoPlus®**, is treated with the internationally known and proven product, **Agrotain®**. **KynoPlus®** reduces volatilization losses, can reduce fertilizer burn and is also cost-effective. **KynoPlus® Topstar S** is an ideal top-dressing product for maize and wheat.

Maize Oemff® Early is applied early in the season with the purpose to increase the photosynthesis rate of the plants, thereby stimulating sugar production and consequently, growth.

Maize Oemff® L16 is applied just before the tassel stage. The purpose of this product is to aid the plant during the pollination process and to reduce stress.

Kynoch's objective is to enhance the efficiency of the crop and its products through innovation. This is achieved by following a crop, site and growth-stage specific approach.

The Maize project was a great success and the results of the competition were outstanding showing high yields. The collaboration between the producers and **Kynoch** held great benefits for the school. However, the producers also benefitted as the winners achieved between 1 and 4 t/ha higher yields than the average for the area.

With the Kynoch approach of crop, growth-stage and site specific fertilisation it is a win-win situation - for the school as well as the producers!



Photo 1: CVO school, Orania.





» Success on citrus with KynoPlus® products

Chris Burbidge and Cassie Dorfling, Weipe, Limpopo Province

This Kynoch approach and products like Brio® and KynoPlus® delivered excellent quality and yield on high value permanent crops.

A citrus producer in northern Limpopo Province agreed to change his fertilizer programme from traditional, low-cost straights to **KynoPlus®** products. His motivation was largely striving for better quality as he exports his produce to a highly competitive international market.

His orchards, planted in 2009 at a population of 288 trees per hectare, are Deltas on rough lemon rootstock. A fertilizer proposal was drawn up according to the most recent soil and leaf analyses and the previous years' production history.

Kynoch follows a scientific approach to enhance better quality and yield. The following points were considered:

- Growth-stage specific - (**Photo 1**)
- Site specific -
- Crop and even cultivar specific application of plant nutrients.



Photo 1: Growth stages of citrus.

Results

The products that were applied were predominantly **Brio®**, from the **Miracle™ range** and **KynoPlus® Topstar + S**.

Photo 2 clearly shows that the **Kynoplus® programme** increased efficiency through the improvement of the size of the factory (bigger leaf area) and a more efficient factory (chlorophyll/greenness) to produce more sugars. The comparison (**Photo 2**) is between the previous flush and the flush after application of the **Kynoch products**.

Furthermore, from soil and leaf analyses it was evident that the soil was moderately to strongly alkaline and especially micro nutrients such as zinc and iron (**Photo 2**) were deficient in leaf samples.



Photo 2: Bigger and greener leaf area (increased sugar production), previous leaf flush compared to leaf flush after treatment.

The success of following a **Kynoch approach** including the **Miracle™ range** and **KynoPlus® products** vs LAN can be summarised as follows, keeping in mind the previously mentioned soil chemical properties:

- Zinc is involved in the production of growth regulators and chloroplast development, thus driving photosynthesis and carbohydrate production. The application of **Brio®** is an effective means of applying zinc, amongst others, especially during budbreak and flowering phenological stages.
- In addition, iron and zinc were sprayed as foliar application.
- The nitrogen source on the high alkaline

soils is also very important as the granular application can sometimes only be washed in by irrigation a day or two later than application. In this case **KynoPlus®** protects the nitrogen from volatilisation.

- In the case of LAN, it is well known that the ammonium nitrogen form is easily volatilised on high alkaline soils, unless irrigated swiftly after application. Also, the earlier applications, early spring, may be subjected to immediate nitrate leaching.
- The **KynoPlus®** nitrogen source is also beneficial under these circumstances in acidifying the solution and assisting with uptake of tied up micro nutrients.
- Our **Miracle™ range** of products have calcium, magnesium, sulphur, zinc, silicon and sometimes some micro nutrients added along with nitrogen (N), phosphate (P) and potash (K), which is superior to normal NPK fertilizer. The supply of all these nutrients in a specific form also contributed to the success.

Summary

The feedback from the grower emphasised the importance of a balanced nutritional approach with **Kynoch products** containing up to eight essential plant nutrients. He achieved excellent quality fruit on a very competitive international market while still maintaining good yields of 55 - 60 tons per hectare.



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efficient, effective **nitrogen** »

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NITROGEN
VOLATILISATION
LOSSES

SUPPORT A
CLEANER
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REDUCE
LEACHING

Support your crops, support the environment!

KynoPlus® – treated with **AGROTAIN®**, has been formulated to mitigate volatilisation losses typically associated with urea, as well as reducing potential leaching losses. This **N-enhanced-N™** efficient nitrogen fertilizer enables you to apply nitrogen without the added risk to the environment. When using **KynoPlus®**, you improve the efficiency and effectiveness of applied nitrogen, which can result in enhanced crop quality, yield and profit.

KynoPlus® is also available in a full range of **NPKS** blends.

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KynoPlus® is registered as fertilizer group 1 - K8024 (Act 36 of 1947)

» Macadamia tree fertilisation

William Gibson, Agriculturist, KwaZulu-Natal

Increasing numbers of producers in the coastal and subtropical areas of South Africa are diversifying out of certain crops and planting macadamia orchards. Current financial returns from macadamia farming are very favourable and the crop allows farmers to grow a high value export product. South Africa is currently the largest supplier of macadamia kernel in the world.

The industry

The South African macadamia industry has been steadily expanding since the middle 1990's with a sharp increase in plantings since 2008 when prices began to increase to record high levels. Despite a dramatic increase in production since 2008, macadamia prices have continued to increase steadily over the past 10 years. There is an upward trend in per capita macadamia consumption due to the health benefits of tree nuts being increasingly recognised. The future looks good for the South African macadamia industry.

Pre-plant planning

Macadamia farming is a long-term investment which requires a high initial capital outlay. It is imperative to plan a new planting thoroughly and well in advance. Macadamia trees cannot tolerate poor nutrition so it is important to follow a customised seasonal programme for fertilising your trees.

Identify if the soils and climate are suitable for macadamia production. Dig soil pits to identify any limiting factors. Either take standard top- and sub-soil samples and send them to a reputable soil lab for analysis, or preferably use **Kynoch's KynoPrecise™** app to take grid top- and sub-soil samples. Crop-specific soil correction maps will then be compiled by a **Kynoch agriculturist**. Correction zones can be identified in the orchard or soil corrections can be made using a variable rate applicator.

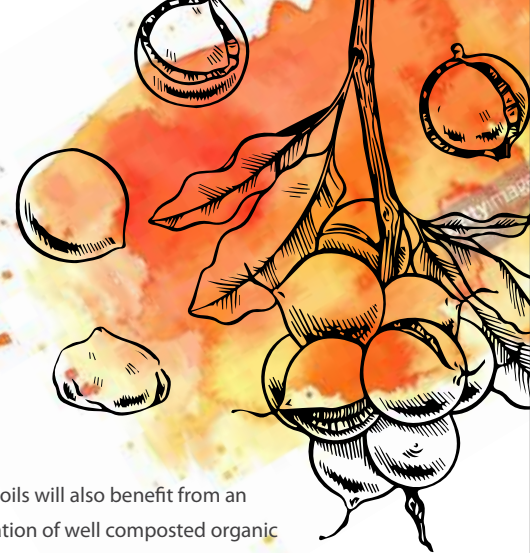
Soil preparation and planting

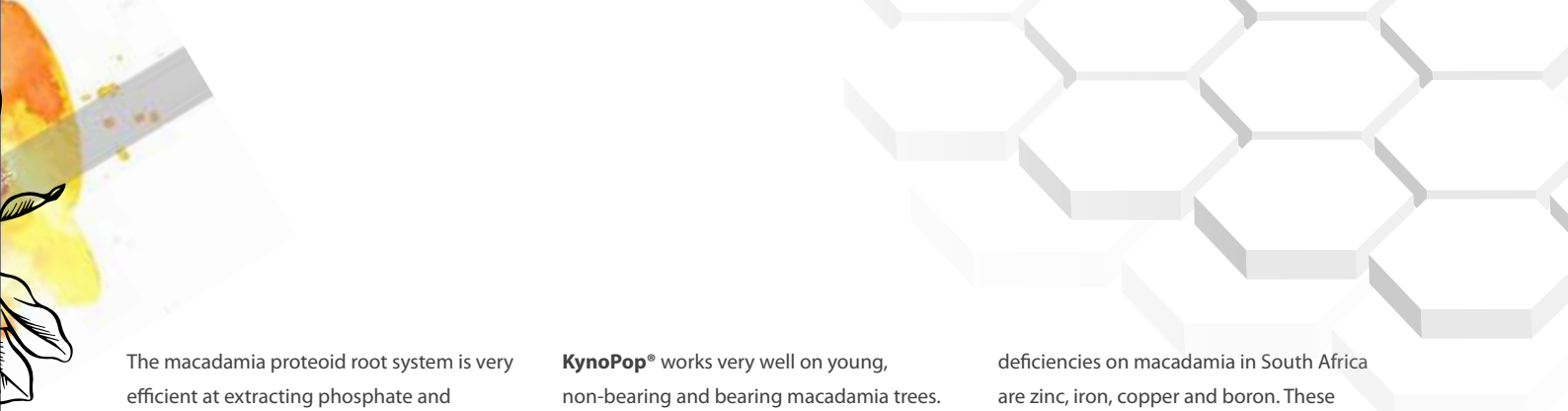
Apply the pre-plant corrective applications of lime, gypsum, phosphorous, potassium, calcium, magnesium and micronutrients. Broadcast and incorporate the various products. Deep ripping may also be required to eliminate compaction. It is imperative to correct any soil acidity problems before planting.

Many soils will also benefit from an application of well composted organic material. Preferably don't use a high phosphate content manure such as chicken litter, as this can lead to phosphorous induced iron and zinc deficiencies. If possible, plant a cover crop before planting macadamia trees. Ensure there is a plan in place to water newly planted trees. After planting, apply a mulch that has a high C:N ratio around the trees. Don't apply any granular fertiliser to newly planted trees during the first two to three months of growth.

Macadamia nutrition

The timing and quantity of nutrients applied are important. Macadamia trees have very specific nutrient requirements. The fertiliser programme varies according to the growth stage, tree age, whether the trees are bearing or non-bearing and the soil and leaf analyses results. The crop's phenological cycle is the main determinant of the application timing and specific nutrients that are applied on bearing trees. Leaf and soil samples are the best way of monitoring your crop. For producing trees take soil samples in July and leaf samples in October or November.





The macadamia proteoid root system is very efficient at extracting phosphate and

calcium from the soil. Iron, zinc and copper deficiencies can be induced or aggravated by high soil phosphate levels and also by high soil pH. Iron chlorosis in particular is commonly seen on macadamia trees.

Kynoch has a wide range of products that are ideally suited for macadamia fertilisation, including five specific blends that have been custom formulated for macadamias. These **KynoMac** blends all contain macro, secondary and micronutrients. This range also includes some blends that don't contain any phosphate.

Some products in the **Kynoch Miracle™ range** are widely and very successfully used in macadamia fertilisation programmes. These products include **Prelude™** and **Brio®**. These premium blends include macro, secondary and certain micronutrients in ratios ideally suited to macadamia trees.

KynoPop® works very well on young, non-bearing and bearing macadamia trees.

GreenGold® is an ideal nitrogen product for macadamia. **GreenGold®** contains various forms of nitrogen, including **KynoPlus®**, together with a highly plant available calcium source and 0.1% boron.

Kynoch also has a broad range of soil enhancers, foliar sprays and water-soluble products for fertigation of macadamia. Two new custom formulated, water-soluble foliar products are currently awaiting registration. Speak to your **Kynoch agent or agriculturist** and they can advise you on a complete crop nutrition programme for your unique farm conditions.

Management tip for young, non-bearing trees

As young trees have few reserves, regular applications of fertiliser and foliar sprays are required during the growing season to ensure optimum growth and a strong framework. The most common micronutrient

deficiencies on macadamia in South Africa are zinc, iron, copper and boron. These nutrients are present in our macadamia-specific foliar and granular products. General **Kynoch macadamia products** for young trees include **Prelude™**, **Brio®**, **KynoPop®**, **GreenGold®** and the **KynoMac macadamia specific blend range**.

Management tip for bearing trees

The focus moves away from vegetative growth towards reproductive growth. The timing of crop nutrition applications is closely linked to the phenological growth cycle of the tree. General **Kynoch products** for bearing trees include **Prelude™**, **KynoPop®**, **GreenGold®** and the **KynoMac crop-specific blend range**.



Kynoch's macadamia products are also driven by our slogan: Enhanced Efficiency through Innovation.

» Nitrogen fertilisation of pastures and animal health

Graham Peddie, Agriculturalist, KwaZuluNatal

Many livestock producers are intensifying their pasture systems in response to research input and increased financial constraints. With the intensification of grazing systems, adequate fertilization of the pastures is required to produce the dry matter yields required to maintain high levels of herbage and animal production.

In recent years there have been many reports of stock mortality, bloat, reduced animal growth rates and apparent lack of acceptability of intensive pastures. A number of these adverse effects may be due to the presence of high nitrogen levels in the herbage.

Nitrogen levels of the herbage

Research at the Cedara Agricultural Development Institute has suggested that nitrogen (N) fertiliser applications above 50 kg N/ha/application, at certain times of the year, may result in plant N levels of 4.0 to 5.4% (25 to 34% crude protein) and plant nitrate levels as high as 0.9 to 1.0% nitrate nitrogen ($\text{NO}_3\text{-N}$) in the herbage. These high levels of N in the herbage are not only in excess of plant requirement, but are in excess of animal requirement. Furthermore, the high levels of N in the herbage are potentially toxic to ruminants (Richard Eckard – University of Melbourne), or may induce nutritional imbalances.

Possible side effects

Grass tetany - Although opinions differ on the effects of nitrogen fertilisers on levels of magnesium in herbage, and the availability of this magnesium to ruminants, an association between a high concentration of total nitrogen ("crude protein") in spring pastures and incidence of hypomagnesaemic tetany ("grass tetany", "grass taggers") has been noted by several investigators (Molloy *et al* 1973). Thus an "over-fertilisation" of the pasture may cause an induced magnesium deficiency in the grazing animal resulting in "Staggers".

Ammonia-induced bloat (as opposed to frothy bloat) results from ruminants eating herbage containing high levels of rumen-degradable nitrogen. In the rumen, the ingested nitrogen is rapidly converted to ammonia, which is then converted into microbial protein and other forms of nitrogen. The ingestion of excessive quantities of such nitrogen may result in a build-up of ammonia gas in the rumen, as rumen micro-organisms, that convert ammonia to microbial protein, may be limited. In most grasses, the carbohydrate and nitrogen fractions are inversely related. Furthermore, the energy required to metabolise the excess nitrogen increases as the nitrogen content of the herbage increases. Under conditions of high nitrogen, without sufficient energy for microbial assimilation, a build-up of ammonia occurs in the rumen. This excess ammonia may lead to alkalosis and rumen stasis (paralysis of the rumen wall), thus preventing eructation (release of stomach gas via the mouth). Without the release of this ruminal (ammonia) gas, the animal bloats. (Richard Eckard – University of Melbourne)

Ammonia toxicity (also known as urea poisoning) in ruminants is usually caused by the ingestion of pure urea, i.e. urea fertiliser. Ammonia toxicity has, however,

been recorded on intensive pastures. This condition is usually related to, and associated with, ammonia bloat. It occurs when the affected animal has managed to eructate the ammonia gas, thus not succumbing to ammonia bloat. The excessive rumen ammonia is absorbed through the rumen wall into the blood stream, leading to paralysis of the muscles and brain. This condition is usually fatal. Animals tend to show extreme nervous symptoms. Blood samples show an alkaline pH under such conditions.

Nitrate toxicity in ruminants on intensive pastures has appeared to cause occasional stock losses in European countries. Researchers in the Netherlands, where nitrate toxicity is more common, regard nitrate toxicity as extremely rare in tropical or subtropical climates. Stock losses, attributed to nitrate toxicity, normally affect a large proportion of the herd and may therefore cause concern. In most high rainfall, subtropical climates only two pasture species, namely kikuyu and Italian ryegrass, are known to accumulate potentially toxic levels of nitrate given the predisposing conditions.

Reaction

Under normal conditions, nitrate ingested by ruminant livestock, like cattle, sheep and goats, is converted to ammonia and then bacterial protein in the rumen by bacteria. The steps of conversion in this process are as follows:

Nitrate (NO_3) → Nitrite (NO_2) → Ammonia (NH_3) → Amino Acid → Protein

Nitrate is converted to nitrite faster than nitrite is converted to ammonia. Consequently, when higher than normal amounts of nitrate are consumed, an accumulation of nitrite may occur in

the rumen. Nitrite then will be absorbed into the bloodstream and will convert hemoglobin to methemoglobin, which is unable to transport oxygen. Thus, when an animal dies from nitrate poisoning, it is due to a lack of oxygen. (Undersander *et al* Uwex)

The occurrence of nitrate poisoning is difficult to predict because nitrate levels can change rapidly in plants and the toxicity of nitrate varies greatly among livestock due to age, health status, and diets. However, concern should certainly be raised when plant growth has been less than half of normal or nitrogen application more than twice recommended. (Undersander *et al* Uwex)

Factors influencing build-up

Some important factors leading to a build-up of nitrate in the plant include continuous cloudy conditions for 4 to 5 days, high temperatures, low moisture, frost, high applications of nitrogen fertiliser (over 60 - 100 kg N/ha in one application), and the season of the year (first grazing in May, and during the spring growth period). These conditions, in isolation, may not lead to a significant rise in plant nitrate levels. If, however, several of these factors coincide and are sustained for a period of 4 to 5 days, then an appreciable rise in plant nitrate levels is likely (Eckhard, 1986, Eckhard, 1990).

Diagnostic symptoms

Evidence from experiments at the Cedara Development Institute, suggests that nitrate toxicity is unlikely to be the causative agent in most cases of suspected nitrate toxicity. Confirmed cases of nitrate toxicity are uncommon, as the true diagnostic symptoms are often masked by the time a post-mortem investigation is conducted. For example, nitrate toxicity causes anaemia, brown blood, and high non-protein nitrogen (NPN) levels in the blood and rumen digesta. All the above symptoms will be present in an animal that died of redwater or ammonia toxicity while grazing an intensive pasture. Many cases of suspected nitrate toxicity have turned out to be redwater, anaemia associated with mineral deficiencies, or ammonia toxicity/bloat.

Nitrate in the plant

The toxic level of nitrate in the plant was originally reported to be in the order of 0.22 % $\text{NO}_3\text{-N}$. Recent literature reports suggest these levels may be as high as 0.6 to 1.0% $\text{NO}_3\text{-N}$. Evidence from studies at the Cedara Agricultural Development Institute, South Africa, has shown that sheep can graze ryegrass, with a nitrate content more than 1.1% $\text{NO}_3\text{-N}$, with no apparent ill effect. This indicates the ability of ruminants, under correct management, to adapt to high nitrate or ammonia levels in pasture. However, these animals, although not succumbing to the high nitrogen levels, may be under a subclinical nitrogen toxicity stress.

Further evidence from nitrogen fertilisation studies, conducted in KwaZulu-Natal, South Africa, show a correlation between plant protein levels and nitrate content. Previous studies have shown that pasture protein levels above 22 to 25% are in excess of plant requirements, and are potentially toxic to the ruminant. As mentioned earlier, high protein levels may cause a non-frothy bloat, or at least, an appetite repression. From the relationship between nitrate and protein in the plant it appears that, under normal conditions, appetite repression due to high protein levels would occur before toxic quantities of nitrate could be ingested. Thus, the only way to induce nitrate toxicity in ruminants would be to starve the animals before grazing them on a potentially nitrate-toxic pasture. Even under such conditions the animals are still more likely to suffer from ammonia bloat/toxicity, with the situation being aggravated by subclinical nitrate toxicity.

The following two management practices, if followed, should prevent the above disorders from occurring:

1. Avoid over-fertilising pastures with nitrogen in autumn and early spring. Nitrogen applications should not exceed 50 kg N/ha/application for irrigated temperate (i.e. ryegrass) pastures and 75 kg N/ha/application for subtropical dryland pastures (i.e. kikuyu), during these periods.

2. Hungry, or unadapted animals should never be given unrestricted access to well-fertilised pastures.

Summary

Too high levels of nitrogen in the herbage are potentially toxic to ruminants or may induce nutritional imbalances. Under normal conditions, nitrate ingested by ruminant livestock, like cattle, sheep and goats, is converted to ammonia and then bacterial protein in the rumen by bacteria, but some factors can lead to a build-up of nitrate in the plant. Confirmed cases of nitrate toxicity are uncommon, as the true diagnostic symptoms are often masked by the time a post-mortem investigation is conducted. Nitrogen application on pastures must be managed but under correct management practices animals can adapt to high nitrate or ammonia levels in pasture.

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