PULA IMVULA

>> GROWING FOOD >> GROWING PEOPLE >> GROWING PROSPERITY >>

GRAIN SA
GRAAN SA

OCTOBER
2016

PANNAR®

PULA IMVULA

Editorial team

GRAIN SA: BLOEMFONTEIN
Suite 3, Private Bag X11, Brandhof, 9324
7 Collins Street, Arboretum
Bloemfontein
▸ 08600 47246 ◂
▸ Fax: 051 430 7574 ◂ www.grainsa.co.za

EDITOR IN CHIEF
Jane McPherson
▸ 082 854 7171 ◂ jane@grainsa.co.za

EDITOR AND DISTRIBUTION
Liana Stroebel
▸ 084 264 1422 ◂ liana@grainsa.co.za

DESIGN, LAYOUT AND PRINTING
Infoworks
▸ 018 468 2716 ◂ www.infoworks.biz

infoworks
your ideas can fly

PULA IMVULA IS AVAILABLE IN THE FOLLOWING LANGUAGES:
English,
Afrikaans, Tswana, Sesotho,
Sesotho sa Leboa, Zulu and Xhosa.

Grain SA Farmer Development Programme

DEVELOPMENT CO-ORDINATORS

Danie van den Berg
Free State (Bloemfontein)
▸ 071 675 5497 ◂ danie@grainsa.co.za

Johan Kriel
Free State (Ladybrand)
▸ 079 497 4294 ◂ johank@grainsa.co.za
▸ Office: 051 924 1099 ◂ Dimakatso Nyambose

Jerry Mthombothi
Mpumalanga (Nelspruit)
▸ 084 604 0549 ◂ jerry@grainsa.co.za
▸ Office: 013 755 4575 ◂ Nonhlanhla Sithole

Jurie Mentz
Mpumalanga/KwaZulu-Natal (Louwsburg)
▸ 082 354 5749 ◂ jurie@grainsa.co.za
▸ Office: 034 907 5040 ◂ Sydwell Nkosi

Graeme Engelbrecht
KwaZulu-Natal (Louwsburg)
▸ 084 582 1697 ◂ graeme@grainsa.co.za
▸ Office: 034 907 5040 ◂ Sydwell Nkosi

Ian Household
Eastern Cape (Kokstad)
▸ 078 791 1004 ◂ ian@grainsa.co.za
▸ Office: 039 727 5749 ◂ Luthando Diko

Liana Stroebel
Western Cape (Paarl)
▸ 084 264 1422 ◂ liana@grainsa.co.za
▸ Office: 012 816 8057 ◂ Hailey Ehrenreich

Du Toit van der Westhuizen
North West (Lichtenburg)
▸ 082 877 6749 ◂ dutoit@grainsa.co.za
▸ Office: 012 816 8038 ◂ Lebo Mogatlanyane

Julius Motsoeneng
North West (Taung)
▸ 076 182 7889 ◂ julius@grainsa.co.za

THIS PUBLICATION IS MADE POSSIBLE BY THE CONTRIBUTION OF THE MAIZE TRUST

IN THIS ISSUE...

We are delighted to be able to tell you that the Maize Trust has approved the funding for the Pula Imvula for the coming twelve months. We are very dependent on the Maize Trust for the major funding for the Pula and we are indeed grateful to them for the approval of twelve editions for this coming year. We would also like to thank the other sponsors of the Pula Imvula – the Winter Cereals Trust, the Oil and Protein Seed Development Trust. A further thanks to the commercial donors (Monsanto particularly) who bear the costs of the expanded English version.

During September we held our Day of Celebration in Bloemfontein. This is always a very joyous occasion where we celebrate success and progress. Congratulations to the winners of each category and thanks to the sponsors who make the day possible. The winner of the New Era Commercial Farmer of the Year competition will be announced in Johannesburg on 14 October – we believe that 'the best man will win'!

Our Jobs Fund project has expanded very well for this coming season. We have exceeded all expectations and overshot the targets in the project proposal. We really hope that this season will enable the farmers to harvest the fruits of their labour – last year was difficult because of the drought. We wish to express our thanks to the partners in this project – the Jobs Fund of the National Treasury, the Sasol Trust, the Department of Rural Development, Monsanto, Syngenta, Kynoch and SA Lime and Gypsum. Thanks also to the personnel in the programme who agree to doing more work each year so that farmers can be assisted. Well done and thank you to you all.

At the end of September, Danie van den Berg retired from service. Danie presented our first course in Bothaville on 20 June 2005. Danie has been with us since then and has made a huge contribution to our entire programme. Fortunately Danie will still assist with courses from time to time. Thank you Danie for the part you have played in our programme – you have touched the lives of many farmers throughout South Africa.

Be a WINNER in the war against weeds

Trying to get rid of weeds. *(Photo taken by Johan Kriel)*

A 'weed' is generally considered to be any unwanted plant, even though in itself, it could be a crop.

Weeds aggressively compete for the limited resources available in the soil – natural nutrients, applied fertiliser and water. Weeds can also restrict the essential amount of sunlight that is required by the planted crop – especially in early growth stages. In addition, some weeds act as hosts to other pests or produce toxic seeds dangerous to animals and humans.

When we plant our crops we go to great lengths to establish and apply the correct amount and type of fertiliser required to obtain an optimum yield. We carefully calibrate our planters to space the seeds for optimum growth – allowing the root system of each plant to develop optimally, without competing with each other. Obviously, any other unwanted plants growing and thriving in the midst of this carefully planned crop, will consume much of the nutrients and water intended for the crop, and in turn have a negative effect on the expected results (yield).

Crop farming in South Africa presents enormous, uncontrollable challenges – given the unpredictable climate, volatile markets and the difficulty accessing affordable comprehensive insurance. The only things we can control are our farming practices and discipline. **Weeds are problematic but they can be controlled**. All contracts for comprehensive insurance, production loans and grants have clauses that specifically require absolute adherence to effective weed control.

Don't be fooled by the 'height or size of the weed, compared to the height or size of the crop planted. A young maize plant might seem healthy and stand tall in comparison to the surrounding weeds, but if it has had to compete for food, the growth has certainly been compromised.

A simple analogy: A chicken broiler operation – a specific amount of food and water is supplied to the chicks daily, in order for them to attain a desired weight after six weeks. But, each night, an infestation of rats consume much of the rations. The chicks obviously do not get to eat all the food and will not reach their required weight (yield).

Ways that weeds affect your yield and profitability

There are other ways weeds can affect your yield and profitability. A few examples are:

- A maize plant can also be considered a weed in a cultivated maize land, when there is '*opslag*' – the random germination of maize seeds spilled during the previous harvest. The biggest nuisance is that the plant usually becomes the host for the first flight of moths (stalk borer) to lay their eggs. If not removed, it creates an exponential problem later in the season, when second generation moths hatch and infest the new crop planted. Worm infestation damages the plant as well as the cob. This not only translates to a lower yield, but also exposes the maize cob to viruses like 'diplodia' which results in a damaged, contaminated, lower grade pip.
- The *uintjie* seems a relatively harmless, thin plant. It is extremely competitive and destructive. Its roots excrete toxins that severely inhibit the growth of crop plants. *Olieboom* is a severe competitor for water and nutrients. The seeds are most poisonous to animals and humans and end up in the harvested crop, resulting in severe penalties at the silo. *Jongosgras* is the most common of grass weeds found in cultivated fields. The extensive and dense root system has a choking effect on the roots of crops. It will destroy any surrounding crop plant.

Most conflicts are caused by greed of man, and the lack of sustainable resources the earth provides for survival. It's the same with crops, weeds and the available resources in the soil. This is one war you must get involved in. Assist your crops with good discipline, implements… and chemicals. In this war, there could always be a winner – YOU.

Article submitted by Raymond Boardman, Farmer and Mentor at Buckingham, Ventersdorp, North West Province. For more information, send an email to rhboardman@gmail.com.

TWO-IN-ONE: Champion producer and superb financial manager

The business of being a farmer can be explained as being 'the efficient employment or combination of all resources, human and physical, to achieve the aims of the farming business'. In practical terms this means to manage your business properly.

When considering the aims of a farming business, one dare say that the overall or most important aim would be to make a sustainable profit. Please note we are not saying a maximum profit. Yes, there could be additional aims such as to improve the standard of your living, to have a happy workforce, and others. However, all additional aims can only eventually be achieved if a profit is made.

To be able to make a profit the farmer of today must produce products that are acceptable to consumers in terms of quantity, quality, taste, appearance, health, ethics, price and what consumers need. Thus, a successful farmer today must be a champion producer.

Not an easy task for a farm manager considering all factors beyond his/her control, influencing the business. But to continue to survive as a farmer it is necessary to be financially successful on a sustainable basis. Therefore you need to improve your business continuously form year to year.

Before 1994 under the controlled marketing system the emphasis for a farmer was to be a producer and as long as he had money in the bank it was fine. After 1994 things changed dramatically for farmers. Controlled markets were abolished and changed to free marketing. All of a sudden a farmer had to become a marketing manager in his/her own right. With this, to have money in the bank was not good enough anymore. Now the emphasis was on making a sustainable profit. This posed a major challenge and increased the emphasis on sound financial management.

In the primary production process farmers are price takers both in terms of income (price) and expenditures. Both income and expenditures increase over time, however at different levels. This causes the so-called cost-price squeeze. To be able to produce at a profit and overcome the cost-price squeeze a farmer must increase income and/or reduce or at least control all expenditures. To increase income you have to produce more by either expanding horizontally (farm bigger by buying more land) which is not always possible and/or expand vertically (produce more from a specific unit of production – more maize per hectare).

Of course another way of expanding horizontally is to become involved in value-adding to the basic product. In other words it could be better to become involved in the processing of your product/s than to produce more of the basic product. Again careful financial consideration is needed to evaluate the pros and cons of this step. Farmers are finding this to be profitable and are rather expanding their businesses horizontally than vertically. Thus now the modern farmer is becoming a business manager.

To address all these challenges it has now become very important to pay serious attention to the financial implications of addressing these challenges. To decide if you are going to be successful to increase your income in what way possible and to manage expenditures, you need sound financial information. You cannot make this decision by only considering production matters. You must know what the expansion or change is going to cost? Have you got enough money (capital) available to finance your new plans? If not where can I obtain capital to finance my plans? Thus in today's farming businesses financial matters plays a far greater role than in the past.

Bear in mind the four main activities of financial management is first of all to gather and re-work all financial information to compile the necessary financial statements. This will then enable one to determine the financial result (profit/loss), the financial position (solvent or insolvent) and the cash-flow position of the business.

> *"To face the challenges of the ever changing business environment the modern farmer, big or small, must be a champion producer but also a superb financial manager – therefore a skilled business manager.*

Secondly, to analyse the financial statements to determine the progress of your business.

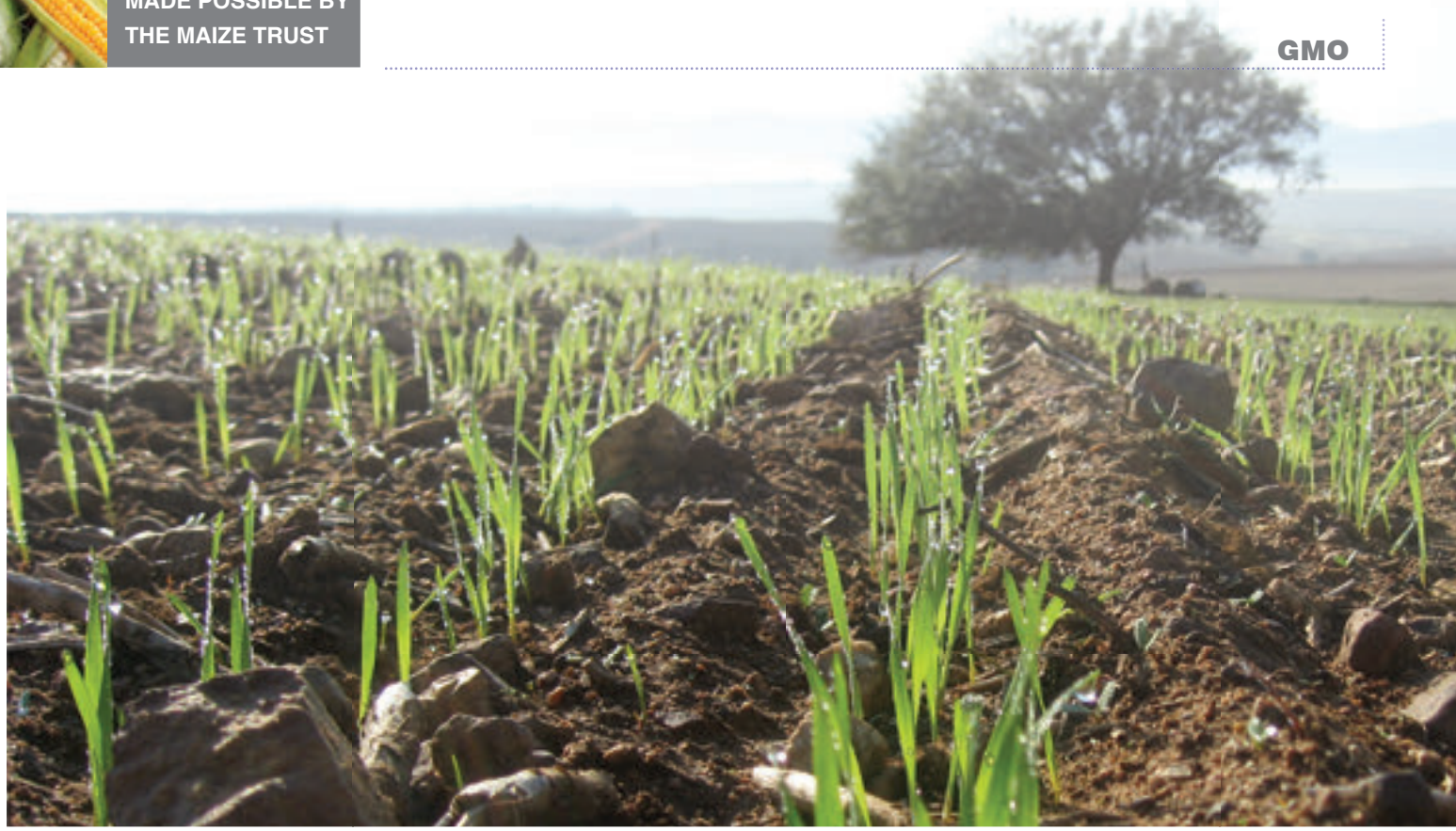
Thirdly, to pay attention to investment decisions. What will the profit be used for? To improve and/or expand your business? Or to include a new enterprise or to progress into value-adding.

Lastly, to pay attention to finance decisions – how will you finance your future plans. Will you be using your own funds (profits) or will you borrow money?

The business of farming has changed and will change progressively in the future with new challenges. The financial success of farming today is less dependent on you just being a good production manager, but more dependent on how good a financial manager you are also.

To face the challenges of the ever changing business environment the modern farmer, big or small, must be a champion producer but also a superb financial manager – therefore a skilled business manager. You will have to allow yourself time to become financially literate, it is of the utmost importance.

Article submitted by Marius Greyling, Pula Imvula contributor. For more information, send an email to mariusg@mcgacc.co.za.



What is a GMO?

South African citizens have been exposed to 20 years of reports, discussions and arguments about GMOs. Some of this has been about science, some about risks and much about pro- and con-arguments; altogether, often creating more heat and confusion than clear understanding. Despite this, adoption of GMOs continues to expand, here and globally.

In a nutshell, this topic is where science, nature, consumers, producers, and markets meet. To set the stage, we start with definitions.

Definitions

- An **organism** is a living entity which is able to produce biochemical products, grow, multiply and convey its genetic traits to its offspring.
- **Biology and Biotechnology** (a) deal with living things and scientific investigations on what they are and do, and how their genetic systems function; (b) the technology part refers to techniques to generate new knowledge and finding ways to employ such knowledge to the benefit of humans, animals and the environment.
- **Genetic modification (GM)** is one part of modern biotechnology that enables humans to make changes in an organism's genetics or to insert novel genes to generate more efficiency or new products 'in ways that do not occur through natural cross-breeding and traditional selection' for improving plants, animals or micro-organisms. These resultant GM organisms are known as genetically modified organisms or GMOs.
- The **Genome** is the sum total genetic composition of an organism. It covers genes that contain codes of the DNA hereditary chemical which determines traits, other genes that control expression of functional genes, and genes located in minute organs inside cells.

Nature and science interaction

For thousands of years farmers and households have selected better plants for domestication and for improved foods though they could not see, identify or apply genes. In nature, ongoing climate change and impacts from pests and diseases led to survival of organisms that had undergone genetic mutations, such as the navel orange that was a mutated plant of common orange, or recent mutation in Australian cotton bollworm that caused resistance of its larvae to the Bt gene, as well as cross-pollination between related species, that provided genetic tolerance to these stresses – a process known as 'genomic plasticity'.

Plant breeders still investigate wild ancestors for useful genes. Our present staple foods, animals and microbes all arose from ancient wild species. Duplicated and stacked genes used in breeding exist naturally in most plant species. Wild potato genes provide resistance to fungal disease in cultivated varieties. New knowledge, sophisticated diagnostic and computer software now enable us to better understand DNA systems, identify and isolate genes and transferring them from one plant species to another as DNA is common to all living organisms (except for some viruses that have RNA genetics).

> *"Farmers and the public should challenge parties that claim GM crops are risky and not useful for smallholder farmers to present scientific facts that old systems that caused famine due to low yields, pests, diseases and weed competition, are claimed to be best.*

This has become possible only after many decades of investigating how genetic systems work in nature.

How are genes moved between species?

- Conventional cross-breeding between species or varieties and selecting desired offspring that appear more robust under stress

or have better grain or fruit quality or yields in tests.

- For other cases transporting genes (transgenes) require finding and describing genes that determine traits by using molecular diagnostics that enable identification of the gene's specific code such as the Bt gene in a bacterium (Crystalline 1Ac gene for resistance to certain insects).
- Isolating the targeted gene by way of an enzyme that neatly cuts it out from the DNA code.
- Multiplying copies of the gene in automated laboratory equipment.
- The lengthy code of a gene has a short DNA code in front, called promoter, that activates the gene to be expressed in specific tissue and a short DNA code at the end that stops the expression.
- The transgene can be 'shot' into a plant embryo or plant cells by infiltration or by using a small circular piece of DNA that contains the transgene and let a harmless bacterium carry this DNA, called a construct, into plant cells.
- Some plant cells will now contain the construct with the transgene that can latch onto the plant's DNA where it may be expressed. Plant tissue or cells are then transferred to nutritious growing media in the lab to develop into plants.
- Greenhouse and field testing these plants for stability and performance follow.

Some GMO achievements

Hybrid maize with yield potential of up to 20 t/ha under irrigation, resistance to stalk borers and tolerance to herbicides, thanks to improved genetics. Oilseed crops with improved oil composition for human health and cotton resistant to bollworm. Herbicide tolerant soybeans now facilitates conservation agriculture with minimum or no tillage and more rapid crop rotation.

The drought of 1991 - 1992 caused maize yield to fall to 0,85 t/ha or 3,0 million t/crop from 3,5 million hectares. The catastrophic drought of 2015 - 2016 gave us 3,73 t/ha or 3,73 million tons from only 1,9 million hectares thanks to superior genetics and improved farming systems. Altogether a 4,4 times increased efficiency.

How safe is South African GM maize?

Scientific assessments are conducted by a ministerial appointed GMO Advisory Committee while regulatory decisions are made by the GMO Executive Council comprising representatives from seven departments. Safety assessments include food, feed and environment, allergens, toxins and socio-economic impacts. Since the year 2000 some 40 million tons of GM maize grain have been produced on 18 million hectares without any substantiated adverse impact on humans, animals or the environment.

Farmers and the public should challenge parties that claim GM crops are risky and not useful for smallholder farmers to present scientific facts that old systems that caused famine due to low yields, pests, diseases and weed competition, are claimed to be best.

> *"Genetic modification (GM) is one part of modern biotechnology that enables humans to make changes in an organism's genetics or to insert novel genes to generate more efficiency or new products 'in ways that do not occur through natural cross-breeding and traditional selection' for improving plants, animals or micro-organisms.*

Article submitted by Wynand van der Walt, Senior Partner, FoodNCropBio Consulting Services. For more information, send an email to wynandjvdw@telkomsa.net.

Pula Imvula's Quote of the Month

'Desire is the key to motivation, but it's determination and commitment to an unrelenting pursuit of your goal – a commitment to excellence – that will enable you to attain the success you seek.'

~Mario Andretti

What makes silage special?

When opening the silage to feed to animals it is exposed to unlimited oxygen resulting in rapid growth of aerobic micro-organisms that is detrimental to the quality in the long run. The aim should be to conserve the quality.

Maize silage is an important source of forage feed for the dairy and beef finishing industry. Several characteristics of maize silage make it attractive to many livestock farmers. It is palatable forage with relatively consistent quality and higher yields and energy content than most other forages.

Silage is the end product of fermenting a high moisture crop (40% - 80% water) and storing the product is called ensiling. Ensiling fodder has been around a long time and now contributes over 50% of the nutrients for beef and dairy cattle production.

Silage has several advantages over hay as a mechanically harvested product. Silage has more nutrients preserved per hectare because there is less field loss. Silage is also less affected by weather damage because the forage does not lie in the field drying.

The main objective of silage is to conserve the digestible fibre, protein and energy in the forage, and to maintain the protein in a form that can be utilised efficiently by the ruminant animal. As with haymaking, choosing when to harvest the forage plants directly influences the quality of the forage to be preserved as silage. Higher yields can be reaped when plants mature, but quality decreases, so balance the desired yield with harvesting the forage when the plants contain excellent feed value.

Good ensiling creates an oxygen-free environment to stimulate lactic acid bacteria growth and prevent growth of moulds and many types of yeast. Fermentation is bacterial growth without oxygen. Lactic acid bacteria use sugars within the plant to produce organic acids which lower the pH from 6,0 to 3,8 - 5,0, depending on the forage species. Lower pH measurements result in restricted cell growth and enzyme activity. So ensiling involves preserving forage, excluding oxygen, and reducing the pH quickly through bacterial fermentation. There are three main players at work within the silo. Plants are undergoing changes, microbes are busy at work, and chemicals are reacting. Plant processes include respiration for a while, cell breakdown (lysis), protein breakdown (proteolysis), and carbohydrate degradation to sugars. Microbial players include yeasts, moulds, acetic acid bacteria and bacilli with lactic acid bacteria and clostridia as the principal anaerobes.

Chemically, there are browning reactions and acid hydrolysis of hemicellulose. Forage crops are best preserved within an oxygen-free (anaerobic) environment with a low pH (5,5 - 6,0). The oxygen-free environment stops the growth of moulds and yeasts, prevents the respiration of plant material, and promotes the growth of lactic acid bacteria. The lactic acid is needed to ferment sugars in the crop which produce lactic, acetic and other acids. The acids lower the pH which prevents the growth of undesirable anaerobic bacteria and inhibits plant enzymes that break down proteins which is good for maintaining feed value.

The forage inside the silo goes through four stages: Pre-seal, active fermentation, stable phase and feedout. Pre-seal describes the filling of the silo when oxygen is available and actively affecting the plants. This is a period of heavy losses in nutritive value of the forage crop. So filling should be done quickly and air should be pushed out with compaction. Once the silo is filled, the remaining oxygen is quickly used up and active fermentation begins. This 1 - 4 week period sees growth of lactic acid bacteria and the lowering of pH. When the lactic acid bacteria use all the plant sugars, the stable (infiltration) phase begins. During this phase little biological activity occurs but some oxygen can creep into the silo and cause some yeast, mould, and anaerobic bacteria growth. When the silo is opened, at feedout, the silage at the opening is exposed to unlimited oxygen resulting in rapid growth of aerobic micro-organisms and a build-up of heat. Caution should be taken in opening a silo.

Many additives are available to promote fermentation and preservation or inhibit detrimental processes within the silo. Additives that promote lactic acid bacteria are stimulants. Inhibitors slow down undesirable activity.

Silage additives are added during wilting or storage. At first molasses were added, then urea to promote lactic acid bacteria growth. More recently bacterial inoculants are used to help natural lactic acid bacteria and lower pH. These additives work best when natural lactic acid bacteria is low as in grass and legume silage. Enzymes are also available to break down forage fibre. Ammonia and acid products are commonly used as well. Dry matter loss can be reduced with the addition of additives but many involve some danger to human health. A firm understanding of the ensiling process is needed for a producer to wisely decide on using additives.

Recognition is given to the National Forage and Grassland Curriculum, Oregon State University, 2008.

Article submitted by Grant Pringle, Agronomist, Pannar Seed. For more information, send an email to Grant.pringle@pannar.co.za.

Time and tide wait for no man – make sure you have a plan!

In farming we need to strive for perfection. Obviously we deal with the environment and the unpredictable natural world, and not everything always goes according to plan. But if we don't strive for excellence, it won't be achieved.

In agriculture there are many aspects to the planning process. Each season has its own set of tasks that need to be performed and they need to be planned well in advance so your time can be used productively. The old proverb says, '*If you don't have a plan for yourself, you will become part of someone else's*!' – And that is not where we want to end up! In this article I would like to specifically discuss the planning processes during the planting time and the weeks leading up to this time.

Make sure that your inputs are ordered well in advance, and are stored away safely ready to be used when the time comes. Be sure to perform all soil analysis soon after the completion of the previous season so that you have time to plan for the soils requirements. The soil is your most important resource; it is your factory to produce crops. It is essential that you understand your soil and what it needs. This is your first priority. If your soil requires lime to balance acidity, then make sure that you apply it. Do not cut corners in order to save a few rands as you will end up paying the price when it comes to harvest time. Be sure that your fertilisation is structured around the results of your soil analysis. You do soil sampling for a reason. It is wise to take the recommendations into account.

Once you have decided which crop you would like to plant, you should then take a closer look at your land in order to determine how best to prepare the soil to create the desired seed bed. Different crops prefer different growing conditions. One should also assess the implements that will be performing the task to make sure that all equipment is configured correctly. Let's say that you have decided on planting maize. Firstly, you should decide which cultivar you wish to plant. There is a wide variety of options today, so in order to make the correct selection I would suggest that you consult your local seed representative. He will be able to discuss past trial results under conditions which are similar to those in your land. One should then consider your target yield. You will do this by looking at historic yield averages in your area. The reason you do this is to assist you with calculating your fertiliser requirements.

Now that your inputs are ordered and stored away safely, you can take time to check over all the equipment and machinery that you will be using to perform the different jobs with. Firstly, your planter: This is the most important piece of machinery that needs to be working perfectly. Calibration should be done before the planter even enters the field. From your previous planning you should know what plant population you desire and what plant mix fertiliser application you decided was required. Now you need to set your planter up to plant at these desired rates. Be sure to do a double check once you start working in the field as a miss calculation can be a big cost once you reach the end of the field. Now your planter is ready.

Next we need to consider the seed bed preparation. This will depend on your specific farming practices. Perhaps you employ no-tillage practices. In that case you need not worry too much about a seed bed as your land will already have a good seed bed of fine mulch and old crop residues. But let us consider a conventional set up for the sake of this article. Firstly, one will need to break up the soil compaction with a disc or plough. Next you will need to break the clods and sods into a finer soil aggregate by using a soil harrow such as a Vibroflex. One should now be left with a good seed bed, free of big clods with a decent layer of soft loose soil. This is essential as the planter needs to be able to penetrate well in order for the seed to lodge nicely in loose damp soil. The pressure wheels running behind the seed colters will apply just enough force to firmly close the soil over the seed.

> *'If a man is called to be a street sweeper, he should sweep streets as Michelangelo painted, or Beethoven composed music or Shakespeare wrote poetry. He should sweep streets so well that all the hosts of heaven and earth will pause to say, Here lived a great street sweeper who did his job well.' – Martin Luther King*

If the seed bed is done well throughout the entire field and the planter has done a good job of planting the seed, we should see a nice uniform emergence of seedlings. If the follow up programs such as herbicide and pesticide application are done with the same care and attention to detail that the planting process was done, then we can expect excellent yields from our maize crop. As long as we strive for perfection and get out there to make it happen. I heard an old African Proverb that inspires me to get going: *'The lion that stays at home too long will start to feel like a cat!*

Article submitted by Gavin Mathews, Bachelor in Environmental Management. For more information, send an email to gavmat@gmail.com.

Sunflowers surprise in a dry season

We could not actually believe our eyes at the yields which returned off a field that was seriously drought affected this season. The struggling sunflower plants only grew to about one metre tall and their heads were so small…and then we had one good rainfall!

Wow! What a sight it was to see these little struggling plants respond after the watering and a few days of cool weather. The little pips began to fill, and fill…until we could not believe our eyes. From thinking we would have to just let the livestock eat what they could in that field, we instead harvested a decent 1 t/ha crop! For many farmers in the past two seasons of drought and extreme heat, it has been their sunflower crops which have been the light at the end of the tunnel. (You can read the article about this online: *http://www.grainsa.co.za/sunflowers-talk-of-the-town-at-50th-nampo).*

Sunflowers are an important field crop

No longer can sunflowers be tagged an 'orphan' crop as they were for some time. In the last two decades it has become increasingly more economically favourable to grow sunflowers with growing market opportunity as a useful oilseed used mainly by animal protein feed manufacturers and from the demand for sunflower oil. The crop also has great value in a crop rotation system.

In fact nowadays it is classed as the third most important field crop in South Africa after maize and wheat. By adding sunflower to an existing crop rotation, pest problems such as stalk borer and nematodes can be reduced. The shorter growing season also means the crop may be planted later and harvested earlier than other crops such as maize. A sunflower plant is particularly efficient at up-taking water from the soil profile especially in sandy loam soils which is why it tolerates drier conditions better than other crops and explains the astounding results experienced by farmers in the drought stricken regions this season.

Growth and development

The sunflower is a broadleaf plant which emerges four to five days after the seed has been planted about an inch deep in warm soil. This can take a few days longer in cooler soils or if the seed is planted deeper. The biggest problem, which has been highlighted in a number of previous articles, is the crusting which can form on the surface of the soil. Soil crusting makes it difficult for the sunflower seedlings to push out of the soil. It is very important that farmers manage this process with care. They grow best on well drained soils and perform well on sandy soils but they do not like very wet soils. Post emergence, sunflowers grow very quickly producing their large rough leaves and some cultivars can reach a height of up to six feet. There is nothing quite as beautiful as a field of sunflowers in full bloom! Unfortunately the fully seeded sunflower heads are also very appealing to birds and farmers are experiencing many challenges in dealing with these marauding birds particularly in fields close to built-up, urban areas.

Each sunflower head, the proper term is *inflorescence*, is actually made up of two different types of flowers. The yellow 'petals' around the edge of the head are in fact individual flowers called '*ray flowers'* while the 'face' of the sunflowers is made up of hundreds of tiny little '*disc flowers*' which form into the fruit (*achene*) which we call the sunflower seed.

Commercially grown sunflowers are generally self-pollinating which means they do not require a pollinating insect; but where a farmer is growing seed sunflower, you will notice that at a point in the growing season he will import many bee hives to facilitate the pollination taking place between the male and female plants. (There are some farmers who still believe that a higher bee population does boost the yield of their commercial sunflowers, so this is a good reason to look after our bee populations!)

Sunflower has conservative fertilisation needs but this is obviously dependent on soil analysis information. The crop does respond well to nitrogen applications. Another advantage of sunflower is that its own vigorous growth makes it highly competitive with most weeds. Weeds must be controlled pre-emergence or early post-emergence, with most farmers using a combination of herbicide and mechanical cultivation to achieve this. While you are nurturing your crop it is necessary to constantly monitor the markets in order to fix the best price possible.

The market place

The macro-economic factors that influence the price of sunflower in South Africa are primarily the Rand/Dollar exchange rate and Brent crude oil price per barrel. Other factors which influence price are the supply and demand which means we must consider the stock of sunflower in South Africa and cross-reference

> *By adding sunflower to an existing crop rotation, pest problems such as stalk borer and nematodes can be reduced.*

with the rainfall experienced especially in the North West Province, one of the main growing regions locally. Imports of vegetable oil into the country also affect the price of locally grown sunflower which is why farmers need to be alert to the sunflower import parity price. The high demands for oilcake/meal in protein feed rations also see large quantities imported. These imports explain why international commodity prices affect local prices so much.

The role of your producer organisation: Grain SA

As farmers we do not always have time to monitor and lobby for import tariffs which protect our local production. This is why we need the services of producer organisations like Grain SA. Agricultural economists and conservation farming specialists like those employed by Grain SA, have the focus, know-how and skills to monitor the macro-economic environment and lobby on our behalf. They are a constant source of information for farmers and a channel of information to policy makers and government departments on our behalf. Don't ever make the mistake of thinking that a producer organisation is not very necessary or able to make significant contribution to your on-farm sustainability. It is up to every farmer to talk to his consumer organisation and to know the personnel.

Find out how they can help you at farm level and tell them about the challenges you are facing. This is the heartbeat of our organisation, Grain SA. If they can't make a difference to you, it's because you have stopped talking to them about your needs!

Postscript

If you want more detail on sunflower production there is a useful Concise Sunflower Production Guide made available online for producers by the Department of Agriculture & Rural Development, KZN on this link: *http://www.kzndard.gov.za/images/Documents/RESOURCE_CENTRE/GUIDELINE_DOCUMENTS/PRODUCTION_GUIDELINES/Look-n-Do/Sunflower%20Production.pdf.*

Article submitted by Jenny Mathews, Pula Imvula contributor. For more information, send an email to jenjonmat@gmail.com.

Increasing soybean yield and nitrogen nutrition

Many relevant articles in the Pula Imvula covering various aspects of soybean production and correct techniques to ensure good nodulation have been published by this and other authors since 2012. It is a good idea to look at some of the back issues as a rich source of information.

This article will examine some of the critical aspects of production to increase yield and look at nitrogen use by the plant.

Increasing soybean yield

The period before the planning and planting of the soybean crop can be used to assess in detail what happened last year on your farm. Some farms suffered a very bad drought and yields from 0,3 t/ha to 0,5 t/ha if the farmer was lucky. One can then refer to the average yields from years prior to the 2016/2017 production year to benchmark yields on your deep and medium potential soils from the various cultivars used.

Many farmers will probably not include soybeans in their planned crop rotations due to past disappointments and the excellent performance of late planted sunflowers in one of the most difficult production years ever. Where do you stand?

> *"The world average soybean yield has increased by 60% over 30 years since 1980 from 1,6 t/ha to 2,6 t/ha.*

Soybean pods. *(Photo taken by Johan Kriel)*

The world average soybean yield has increased by 60% over 30 years since 1980 from 1,6 t/ha to 2,6 t/ha. Yields of 7,8 t/ha have been realised in Japan and the USA. Our national average was 1,56 t/ha in 2015 and 1,49 t/ha despite the drought this season.

There some excellent cultivars available in South Africa suited to the various microclimates, height above sea level soil, summer and seasonal heat units prevailing on your farm. By now you should have identified a minimum of three cultivars that work in your area and on your farm. Dry land production yields over 2 tons and more are quite possible with the cultivars available if your land preparation and good crop husbandry practices are used optimally.

Factors effecting soybean yield

The final seed yield components of soybean plants are a function of multiplying number of seeds per area and seed mass or weight. Seed number per area is calculated by the number of pods and the average number per pod. The number of pods is decided by the number of flowers and the seedpod formation rate. The number of flowers depends on the number of nods on a stem, the number of stems per plant

> *The final seed yield components of soybean plants are a function of multiplying number of seeds per area and seed mass or weight.*

and the planting density or number of emerged and growing plants per square meter or per hectare.

What can the farmer control?

Although the above factors might seem simplistic or logical it is extremely important to study each of these every planting season in each cultivar you use to enable you to increase yields over time.

The farmer can control planting density. Previous articles covered the general rule of thumb that 250 000 plants/ha is a good compromise for water utilisation and seed yield. Planting density is one of the most factors for soybean growth and seed yield. A final plant stand of between 220 000 and 250 000 would be acceptable for striking the target of over 2 t/ha. Remember that when planting density is too high the branching potential of each plant is depressed and the number of lateral stems decrease.

Under a too high planting density the competition for photosynthesis and nutrient absorption amongst plants becomes severe and plants will tend to grow tall and thin. These plants are also prone to lodging at pre-harvest and harvest time.

Your yield will depend mainly on the number of pods per hectare. Generally over 50% of soybean flowers will abort before the day length is optimum for seed set to take place. Seed mass is mostly affected by growing conditions in the late growth stages.

Soy seedlings. *(Photo taken by Johan Kriel)*

Soil health and planting conditions

As is continuously advised do soil tests and follow fertiliser recommendations or proved applications of nutrients. Soybean plants respond best to high inherit soil fertility built up over several seasons with different crop rotations.

It is essential that the lands be ripped or loosened to alleviate any soil compaction present from cattle running on the previous crop residues or tractor and implement traffic. Soybeans required well aerated soils with a loose profile to enhance nitrogen production by the rhizobia and allow for any excess rainfall to drain through the soil profile.

Sources of nitrogen (N)

From 25% to 75% of the nitrogen in mature plants is sourced and fixed from the symbiotic relationship of Bradyrhizobia japonicum and the soybean plant. This means that 75% to 25% of the nitrogen needed must come from the soil. Single cell nitrogen fixing organisms supply some of this within the soil matrix. The rest is held in the soil together with the humus, organic matter and other soil structures. If up to 15 kg/ha is used at planting together with the recommended amounts of phosphates and potassium and placed two inches below and to the side of inoculated seed nitrogen can be available to the plant within 10 days from germination. Nodules take up to 21 days to start supplying the plant with N. Low soil fertility cannot be corrected at the time of planting.

Conclusion

Take some time to study and know the important seed production factors and plan to plant on fertile loose soil to achieve your target of 2 t/ha yield in the coming season.

Article submitted by a retired farmer.

Did you know that lucerne, maize and sheep can also increase your profits?

It is common knowledge that no business should put all its eggs in one basket. The same applies to the grain producer. However, the question remains: where should the producer invest additionally and how much is the return going to be?

The inclusion of a sheep system is definitely a very good alternative that should be considered. However, this sheep system certainly has its own problems that need to be managed. Theft is definitely a major problem and containing it must form part of the farm's cost structure. There are various methods that can be used, which include the hiring of full-time guards and the use of dogs.

Combination of components

There is no single component that can be singled out to increase the profitability of the system. It is the combination of all the components within the system that leads to the beneficial effect and that increases profitability.

The fodder flow and the production of stock, combined with the fodder flow, is the cheapest way to accomplish sustainable stock production. It is no different in this lucerne, maize and sheep system.

If there are animals that produce, they must have access to sufficient food that supplies essential nutrients in order to produce sustainably, efficiently and effectively. Within this system both lucerne and maize meet this requirement – high-quality food that the animal can turn into money quite easily.

If animals do not produce, they must live on cheap animal feed that either maintains the condition or results in a little growth without any extra costs. The lucerne-maize crop rotation system meets these requirements very well.

The animals that are still growing can do so on lucerne grazing, and if the ewes do not produce, they can graze on cheap maize residues. Because lucerne grows on dry land in summer, it means that the ewes must lamb in spring and they must raise the lambs on lucerne. The lambs will then be sold from this lucerne grazing.

As soon as the lambs have been weaned, the ewes can be moved to natural veld, planted grazing or crop residues, and in winter the ewes can make use of crop residue or natural grazing.

Young established dryland lucerne lines. Inter-row cultivation has increased the capacity by 30%. *(Photo taken by Hendrik van Pletzen)*

Lucerne-maize crop rotation system

A substantial amount of research regarding the lucerne-maize crop rotation system has been done at the Nooitgedacht Agriculture Development Centre (ADC) outside Ermelo. Here a spring lamb system was used to transform the lucerne into money. At Wildebeesfontein OTK did similar work. The feed flow used at Nooitgedacht mainly followed these patterns:

- 15 October to 28 February: dryland lucerne grazing.
- 1 March to 15 May: dryland lucerne grazing supplemented with hay, maize or maize residues (soy crop residues can also fit in nicely here).
- 15 May to 30 July: maize residues.
- 1 August to 15 September: maize residues, protein lick and hay.
- 15 September to 15 October: protein lick, maize, hay until switching over to dryland lucerne grazing.

On the weaner production system, the ewes raise the lambs on the lucerne when they are weaned and then they are rounded off on lucerne before they are marketed. The ewes were serviced in the autumn and flush feed in the form of maize was supplied to increase conception. Teaser rams were used to synchronise the ewes so that they could lamb within a short period of time.

In order to effect good grazing on the lucerne, it was divided into smaller camps and

Table 1: Meat and wool production per hectare achieved at Nooitgedacht.

Class of animal	ADI* gram per day for 10 animals per hectare	Mass per hectare (kg)	Wool per hectare (kg)
Ewes – pre-weaning	700 g for 120 days	84 kg	40 kg
Ewes – post-weaning	1 100 g for 60 days	66 kg	
Suckling lamb	2 400 g for 120 days	288 kg	20 kg
Total		438 kg	60 kg

**ADI = average daily increase*

intensive grazing was used to increase the lucerne production. It is very important to allow the lucerne some rest to ensure that it keeps on producing, and therefore the camps were never grazed for longer than seven days.

Seeing as the lucerne was planted in rows, the sheep preferred to rather walk in the pathways, which limited wastage. Unfortunately, the pathways were compacted quite quickly and had to be loosened mechanically.

Lucerne is a crop that is known for its ability to produce. As soon as this crop is established in high potential soils, the yield can easily be one ton of dry material per 100 mm rain. It is possible to produce up to 12 tons of dry material in the Eastern Highveld. At Nooitgedacht the lucerne fields either have ten Merino ewes with lambs per hectare for approximately seven months, or approximately 17 small stock units (SSU) per hectare.

An excellent daily weight gain was achieved. The young lambs easily gained 215 grams/day over a period of 165 days. **Table 1** shows the amount of meat and wool per hectare produced on Nooitgedacht's lucerne.

It is an enormous income per hectare, given the current wool and meat prices. When all the sheep costs are taken into account, the gross margin of the sheep system is still positive and the sheep can pay back the establishment costs of the lucerne quite comfortably. The increase in the maize income also contributes considerably to the overall profitability of the system.

Problems

It is unfortunately true that no paradise exists without a snake. Lucerne also has definite problems that can affect the production dramatically. Once stock is raised in such an intensive system, the climate risk becomes very high. During drought years food can be quite scarce. The importance of a proper feed bank cannot be emphasised enough.

Bloating is definitely always a possibility. There are various methods to manage this risk. A few ways of managing this are the right lick, managing the animals and putting out good quality hay.

If the pastures are left to grow too big, a lot of it will be wasted. The animals will eat the lucerne very selectively and if they are forced to eat the stem, then the animal performance will drop drastically.

The animals should be moved regularly to restrict wastage of the crop. This causes the system to be labour intensive and it will definitely take up a lot of your time as manager. Your eyes and footprints have to be there.

The lifespan of lucerne is approximately five years and therefore a new portion should be established annually. It is common knowledge that the successful establishment of lucerne is not easy. Ensure therefore that establishment is done properly and that the crop is already growing before the old parts are removed.

The crop rotation effect of lucerne is actually the part in the system where the money is made. Maize production following the lucerne is usually better. At Nooitgedacht top dressing of the maize in the lucerne fields was not done and the yields were still better for the first three years than single-culture maize that was fully fertilised.

Results obtained from OTK's experimental farm, Wildebeesfontein, effected a yield increase of approximately 65% in year 1. For year 2 it was approximately 45% and for year 3 it was still approximately 16%. After that the yields were more or less level. Given these figures, it is already worthwhile implementing this system.

Animal health

In order for the animals to produce, it is very important for their health to be up to standard. Vaccinations should be done regularly. The internal and external parasites should be managed and the animals' general condition should be good. Attention should not be paid only to the ewes – the rams must also be able to work if it is expected of them.

The increase in and management of resistant parasites in any intensive system are always a big problem. Moving the animals regularly and perhaps keeping them away from a certain area for a period of time can be used to manage this problem. The lucerne-maize crop rotation practice is also a very good way of solving this problem.

The ewes should also be scanned timeously so that the ewes pregnant with more than one lamb can be managed separately from the ewes with one lamb. Everyone knows that only live lambs can be sold, so during lambing season everything possible should be done to keep mortalities low. Do everything in your power to protect these lambs.

Most of the information in this article is quoted from work that Dr A Moore, F Steynberg, K Odendaal, M Swart and various others did at Nooitgedacht ADC. Only a few of the most important aspects have been mentioned in this article.

Article submitted by Pietman Botha, SA Grain contributor for SA Graan/Grain October 2015. For more information, send an email to pietmanbotha@gmail.com.

Heat stress has a material effect

The condition of heat stress increases the toll that the environment demands for heat loss. Stress refers to all the exogenous (from the environment) and endogenous forces/factors that effect changes and/or adjustments locally or in general in the animal.

This helps to avoid physiological malfunctions and enables the animal to adjust better to the environment. The environment in which the animal lives, plays a major role in its production, reproduction and general health. The performance, welfare and physical health of the animal, and particularly of the dairy cow, are affected by external factors like the weather, soil type, animal care, production techniques, waste removal and pollution, as well as internal factors like genetic composition (breed and type) and breeding (pure or cross bred).

Climatologically speaking, heat stress plays the most important role in an animal's performance during the hot summer months, and the wind-chill factor during the cold months.

Comfort zone

The comfort or thermo-neutral zone for animals is a sensible zone of the ambient temperature that has an upper and lower critical temperature. If the general performance (production, reproduction and growth) and welfare of the animal are optimal at minimal effort for thermoregulation, and lacking other stress factors, its metabolic functions with respect to effective energy consumption levels within the indicated ambient temperature limits are virtually ideal.

The comfort zone comprises a cool, optimal and hot zone. The optimal zone represents a transition zone. The animal delivers optimal productivity, effectiveness and performance in the optimal zone of the comfort zone. The optimal zone of the comfort zone of a dairy cow lies between 0°C and 16°C. The comfort zone of Holstein Friesian cows for maximum milk production is between 5°C and 2°C.

If the ambient temperature rises to above the upper critical temperature, the animal's heat burden increases. Heat loss by the animal becomes more difficult, the heat burden increases, and the body temperature consequently increases. The animal compensates by sweating increasingly, losing heat by breathing more rapidly, slowing down its metabolism and changing its behaviour.

If the temperature and associated factors like relative humidity and air movement in the thermal environment exceed the capacity of thermoregulation of heat loss through evaporation, the body temperature increases enormously and deaths can occur. Veterinarians and agricultural engineers can apply the upper critical temperature values very usefully in designing and developing animal housing to limit the negative effects of the weather on animals.

This cow is experiencing severe heat stress. A typical sign of heat stress is exessive excretion of saliva.

Table 1 indicates the comfort zone of some food animals in terms of ambient temperature. **Table 2** sets out the upper critical temperature for food animals. Although the comfort zone provides sound guidelines for the performance of food animals, the stress index will provide more appropriate information.

Table 1: The comfort zone of some food animals expressed in terms of ambient temperature.

Food animal	Comfort zone (°C)
Cattle	
Cows	0 to 16
Calves	13 to 25
Sheep	
Ewes	-2 to 20
Lambs	29 to 30
Pigs	
Sows	0 to 15
Piglets	32 to 33
Goats	10 to 30

Stress index

The stress index indicates a level of stress that demonstrates the degree of physiological shift from the animal's neutral state. This physiological calculation is sometimes called a tension index, and is based on the supposition that the greater the physiological reaction, the closer the system is to collapse.

Stress and stress-causing factors

The establishment and maintenance of an animal's homeostasis depends on the general stress control system. Factors that disturb and stimulate the system's receptors to react are called stress-causing factors.

> *As a rule, heat stress is undesirable because it harms the animal's health, welfare and performance, and in extreme cases it can lead to deaths.*

What you should know…

Food animals, and dairy cattle in particular, in large parts of South Africa and Namibia are exposed to heat stress for long periods during the year, negatively affecting their yield. The negative effect of heat stress is usually related to an increase in the animal's body temperature (hyperthermia).

The economic loss in South Africa as a result of heat stress in the dairy industry is more than R500 million per annum.

Depending on the nature and extent of the stress-causing factors, the general control system of the body is stimulated, which activates the nervous system and accomplishes pituitary-adrenocortical-endocrinological and sympathetic-adrenomedullary secretions, which eventually assist in an effort to compensate for the disturbance.

The above reaction depends on the 'general adjustment syndrome'. The general adjustment syndrome is the combination of all the non-specific metabolic adjustments that are activated in order to normalise homeostasis where it has been disturbed locally as well as generally by stress-causing factors.

The aim of the general adjustment syndrome is to allow the animal to adjust better to and function better in a specific environment. If the extent and nature of the natural or artificial stress-causing factors are such that the general adjustment syndrome causes abnormal and extraordinary adjustments in the animal's physiology or behaviour pattern, the animal experiences a state of stress.

The implementation action of the general adjustment syndrome can cause stress where the animal has to make abnormal or excessive physiological or behavioural changes (according to non-specific as well as pure-bred phenotypical patterns) to deal with the anti-homeostatic condition of the environment and thus reduce its stress condition for itself.

Thermal conditions inside the comfort zone or acceptable temperature spectrum are not regarded as stress-causing factors. Thermal conditions outside the borders of the comfort zone or acceptable temperature spectrum are stress-causing factors that contribute directly or indirectly to metabolic adjustments through the general adjustment syndrome that causes different stress phenomena.

This discussion is about heat stress. Heat stress in the animal is associated with the following symptoms: increase in body temperature and breathing rate, decrease in feed intake, milk production, body mass, as well as external heat signs and an increase in skin surface evaporation. The nature and extent of the above symptoms, with their effect on the health condition, behaviour pattern, welfare, production and reproduction of the animal, differ depending on the duration and extent of the heat stress, as well as other additional stress factors in the environment.

As a rule, heat stress is undesirable because it harms the animal's health, welfare and performance, and in extreme cases it can lead to deaths.

Table 2: Upper critical temperature for food animals.

Food animal	Physiological condition	Upper critical temperature (°C)
Cattle		
Dairy cattle	Lactating	25*
Dairy cattle	Pregnant	23
Beef cows	Lactating Pregnant	27 29
Sheep		
Ewes	Full fleece	31
Lambs	Growing	25
Pigs		
Sows	Lactating	28
Piglets	Eight to 12 weeks old	34
Goats		
Zariaby	Lactating	25

** With respect to maximum milk production, dairy cattle already experience heat stress at 23,8°C. Holstein Friesian cows have an upper ambient temperature limit of 21°C.*

Heat stress has a material effect

These cows are lying in the mud spontaneously because they are experiencing heat stress.

Heat stress increases the oestrus cycle and shortens the oestrus period.

Temperature-humidity index for animals

The four most important environmental factors that affect the sensible and effective temperature are the dry-bulb temperature, relative humidity, radiation and wind.

The above factors can all be measured relatively easily with instruments. There is not yet a single index where all the relevant climate parameters can be expressed to present them in a stress index.

The temperature-humidity index (THI) is currently the best and most practical index for determining heat stress in cattle in a given area. The critical temperature-humidity index for milk production is 72 and for reproduction 65.

The temperature-humidity index is calculated as follows: THI = tdb + 0,36 tdp + 41,2, where the dry-bulb temperature is in °C (maximum temperature at 14:00), tdp is the dewpoint temperature in °C and 0,36 and 41,2 are constants.

The tdp is calculated by deducting the wet-bulb temperature at 14:00 form the dry-bulb temperature at 14:00. The answer is used in the hygrometric tables of the Weather Bureau in accordance with the correct atmospheric pressure in mb for determining the tdp.

Livestock weather safety index

Livestock weather safety index is based on the temperature-humidity index values and was established by the Livestock Conservation Institute as guideline for preventing and controlling heat stress in cattle that are exposed to warm weather conditions.

Interpretation of the livestock weather safety index categories for dairy cattle

Within the normal stress limit of values (livestock weather safety index) the animal performs optimally, experiences minimal or no heat stress and its handling has no negative consequences for it (**Table 3**).

Table 3: Classification of livestock weather safety index for dairy cattle (see Figure 1, Figure 2, Figure 3).

Temperature-humidity index value	Livestock weather safety index categories for dairy cattle	Colour code in Figure 1
	Normal	Blue
70 to 72	Warning to critical index level for milk production	Green
72 to 78	Warning to above critical index level for milk production	Orange
78 to 82	Dangerous	Red
83 and higher	Emergency	Not applicable

In the warning to critical category of values the animal already experiences a degree of heat stress, its performance with respect to production and reproduction is already harmed, handling is starting to have a negative effect on the animal's performance and cooling down of the animal is advised.

With respect to the category warning for above the critical index level for milk production the same applies as for the latter category, but milk production is severely impaired. In the dangerous category the animal experiences severe heat stress, its performance with respect to production and reproduction is severely impaired, handling should take place only in the early morning, and it is essential to cool the animals down with the necessary dietary adjustments (Table 3).

In the emergency category deaths occur easily, with all the other disadvantages of the dangerous category, and it is essential to cool down the animals.

There is no area in South Africa and Namibia where the monthly arithmetic mean temperature-humidity index values exceed 83 (emergency category), but some of the daily temperature-humidity index values do exceed this.

Discussion of Figure 1

There are only a few areas in South Africa and Namibia (see Figure 1, blue) where animals are not subject to heat stress during the five hottest months of the year (November to March).

Climatologically speaking, taking heat stress into account, it is wise to farm with dairy

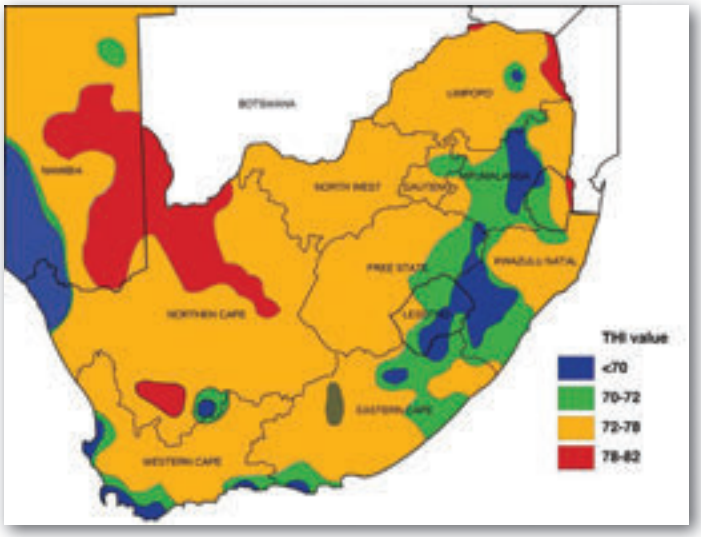


Figure 1: Mapping of South Africa and Namibia according to the livestock weather safety index for lactating dairy cattle for the five hottest months (November to March) of the year.

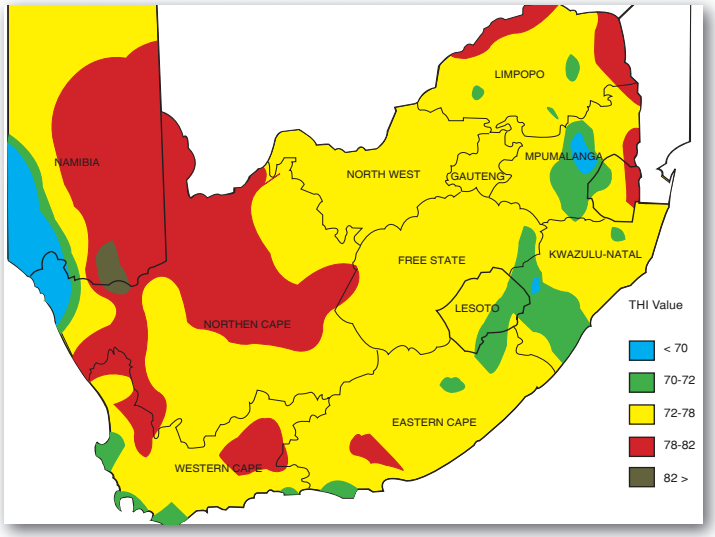


Figure 2: Mapping of South Africa and Namibia according to the livestock weather safety index or lactating dairy cattle for January.

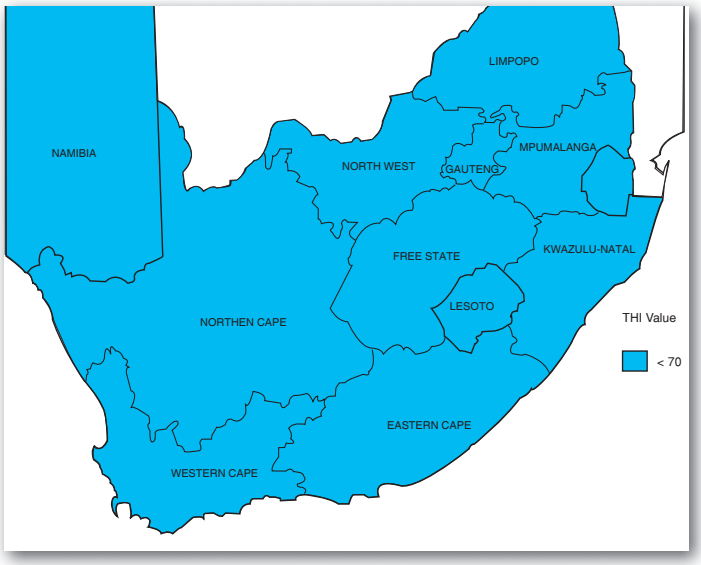


Figure 3: Mapping of South Africa and Namibia according to the livestock weather safety index for lactating dairy cattle for July.

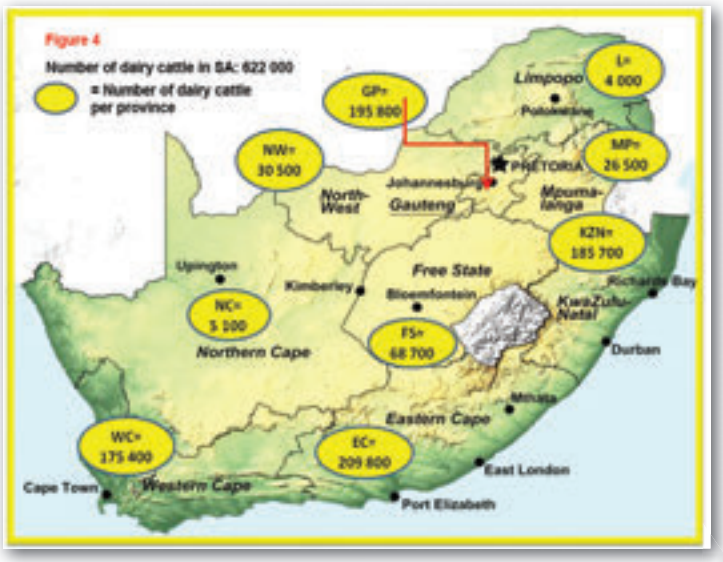


Figure 4: The number of dairy cattle changes constantly: Number of dairy cows in SA: 622 000 = number of dairy cows per province.

Heat stress has a material effect

Table 4: The minimum preventive measures that should be taken to protect or alleviate heat stress in dairy cattle (see Figure 1, Figure 2, Figure 3).

Temperature-humidity index value	Livestock weather safety index categories for dairy cattle	Minimum preventive measures
70 or lower	Normal (Figure 1, blue)	Natural or artificial shade
70 to 72	Warning to critical index level for milk production (Figure 1, green) Critical temperature-humidity index for milk production is 72 and for reproduction 65	The above, as well as assured ventilation in shady areas. Ad lib drinking water* that is in the shade
72 to 78	Warning to above critical level for milk production (Figure 1, orange)	The above, as well as sprinkling (wetting) and artificial air movement in the holding area of the dairy cattle before the milking portal; diet adjustments**; consideration of the dairy breed kept***; animal care and management changes
78 to 82	Dangerous (Figure 1, red)	The above, as well as shade provision and air movement at feed hoppers
82 and higher	Emergency	The above, consideration should be given to whether dairy farming should continue

**The provision of cold drinking water (± 20°C) is ideal.*

***The concentrate portion of the animal can be increased with a reduction in the roughage. The dairy cow seems to have a greater need for potassium under heat stress conditions. If possible, the animals should be fed during the cooler periods of the day. Provide fodder that has a lower heat increment. Fat has the lowest heat increment, followed by carbohydrates and proteins.*

****Jerseys tolerate higher sensible ambient temperatures better than Holsteins.*

Limit the handling of stressed animals during the hottest part of the day. Consider changing milking times. Dip and inoculate the dairy animals during the cooler times of the day, or perhaps at night.

cattle in these heat-stress-free areas or fatten feedlot cattle here during the five hottest months of the year.

In the biggest parts of South Africa and Namibia cattle experience heat stress during the five hottest months of the year. The temperature-humidity index values can be obtained from the writer, as it would take up too much room to publish the monthly, seasonal and five-monthly temperature-humidity index values for the 563 weather stations in South Africa and Namibia.

Comparing heat stress in people and animals

The formula for calculating the human discomfort index (HDI) is:

$$HDI = (2 \times T) + \frac{(RH \times T) + 24}{100}$$

Where T is die dry-bulb or air temperature in degrees Celsius (°C) and RH is the percentage of relative humidity.

According to the HDI:

- 80 - 90 = reasonable discomfort
- 90 - 100 = considerable discomfort
- 100 - 110 = extreme discomfort
- 110 and higher = dangerous to human health

If the data for calculating the temperature-humidity index for dairy cattle (animals) is inserted into the HDI formula for calculating discomfort, the data obtained reflects a great degree of agreement with the discomfort status of humans.

If people experience a sensible temperature that causes discomfort, it should be accepted for all practical purposes that animals also experience heat stress. This is also a practical way to determine whether the animals experience heat stress.

Homothermal animals

Cattle are homothermal animals that need to maintain a constant body temperature of as close to between 37,5°C and 38,5°C as possible. Cattle lower their body heat through evaporation, convection, radiation and conduction.

Cattle do not cool down as effectively through the evaporation of sweat as primates, because the apocrine sweat glands produce little sweat and maintain a poor thermoregulation function. This is further complicated by the poor water-regulating mechanism of cattle.

The requirements of dairy cattle are particularly great in hot weather conditions and when they are lactating. High-production dairy cattle require up to 150 litres of water per day in times of heat stress.

When the ambient temperature rises above the upper limit of the comfort zone for the optimum welfare of dairy cattle, their bodies will make certain adjustments to try and compensate and prevent their body temperature from rising. The blood vessels in the animal's skin will dilate, respiration rate (breathing) will increase, sweat glands in the skin will start secreting moisture, food intake declines, skin temperature can increase by 10% to 20%, water intake increases by 20% to 30% or more, milk production drops and the milk composition declines.

Disadvantages of heat stress in cattle

Udder health and milk production

The incidence of mastitis cases during the hot summer months increases the rate of new udder infections. The effectiveness of the udder's defence mechanism decreases.

Milk production declines by 10% to 40%. The composition of the milk changes: the butter fat declines by 20% to 40%, fat-free solids by 10% to 20% and total milk proteins by 10% to 20%, and the somatic cell count rises.

Necrobiosis (damage) of the udder tissue increases.

The higher the temperature-humidity index in an area, the higher the milk production loss is, and vice versa.

Reproduction

Heat stress extends the oestrus cycle and shortens the oestrus period, conception drops and embryo mortality increases, with corresponding placental malfunction and a drop in fertility.

Foetal (unborn calf) growth is retarded. The gestation period is shorter, with a corresponding lower birth mass and a lower survival rate among calves. The maximum sensible temperature on the day after insemination has the biggest effect on conception (fertilisation). The critical period for the survival of the embryo with respect to heat stress is between four and six days after conception.

Heat stress reduces the libido of the bull, the motility of the sperm and their concentration, and the percentage of abnormal sperm increases.

If the temperature-humidity index is available, the formula of CR = 388,3 - 4,62 THI can be used to calculate the conception rate (CR) for dairy cattle (Holsteins) in a specific area for a specific period of the year.

The higher the temperature-humidity index in an area is according to the above formula, the lower the conception rate is, and vice versa. The above formula can also be used as base for the conception rate in cattle in general. Significant losses are experienced in South Africa due to the reduced conception rate as a result of heat stress during the months with a high temperature-humidity index.

Nutrition

With heat stress the feed intake, especially roughage, is reduced. The reduction in roughage intake plays a role in reducing the butterfat percentage of the milk. The animal's heat increment rises with feeding where the ambient temperature is high. It seems as if the animals then have a greater need for potassium in their ration.

> *"Climatologically speaking, heat stress plays the most important role in an animal's performance during the hot summer months, and the wind-chill factor during the cold months.*

Growth

Heat stress limits the growth and mass increase of cattle, depending on the genotype and adaptability. Cattle kept in feedlots must be protected against heat stress for satisfactory mass increase. The provision of shade is the minimum protective measure that should be introduced for satisfactory performance in feedlot cattle that experience heat stress.

Behaviour and health, particularly in dairy cattle

The cattle experience a change in behaviour in an attempt to maintain homeostasis by adjusting their posture, wetting the skin surface where possible, lying down in wet places and reducing feeding times during peak temperatures. Latent viruses can be activated, which creates a favourable environment for secondary bacterial infections.

Mortality (deaths)

Mortality increases where the emergency category of the temperature-humidity index applies. It is not recommended that a dairy or a feedlot be started in an area where the temperature-humidity index values exceed 82.

Recommendations

Most animals in South Africa and Namibia experience heat stress in the five hot months of the year (November to March, see Figure 1), with all the harmful effects this holds for food animals and dairy cattle and their performance in particular.

During the cooler winter months (**Figure 3**) dairy cattle usually experience no heat stress.

Article submitted by Jan du Preez, Managing Director, Institute of Livestock Technology for SA Graan/Grain October 2015. For more information, send an email to drjanh.dupreez@gmail.com.

Grain SA interviews...
Edwin Thulo Mahlatzsi

Edwin Thulo Mahlatsi was born on a farm in the Bothaville district. Both his parents were farm workers. He was born on 2 August 1942 and is 74 years old. He attended a farm school and passed Grade 6. When the farm Edwin grew up on was purchased by Mr Frikkie Rautenbach, he stayed on as a farm worker. As he puts it: 'Ntate Rautenbach bought me with the farm'.

He has 40 years of working experience in agriculture and has the following experience: Cash crops, managing a beef herd and sheep production.

Mr Danie van den Berg, who evaluated this farmer, said the following about Edwin: 'He is a farmer by heart, and is probably one of the very few I have met that has the most farming experience across the spectrum. He has been involved in farming from a very young age and was coached and trained by a well-known farmer in the Bothaville district for a period that spans over 40 years'.

The farm Swartlaagte is 463 ha in size and has 208 ha of arable land and 255 ha of grazing. The farm was acquired in 2014 through the government's proactive land acquisition strategy of the PLAS scheme.

From 2012 to 2014 Edwin was given the opportunity to farm in partnership with his former employer. This came to an end when his former employer passed away. Unfortunately for Edwin all the implements, tractors and the pick-up van used during these years belonged to his former employer and had to handed back to the estate.

Edwin has been a member of the Grain SA Farmer Development Programme since 2012. He is an active member of the Bothaville Study Group. He has attended four training courses with Grain SA, which include: Introduction to Maize Production, Resource Assessment and Farm Planning, Farming for Profits and Business Ethics. His daughter, Doreen has attended an Introduction to Sorghum Production Course and Farming for Profits, as she is very interested in Agriculture.

He has planted 137 ha of maize this 2015/2016 season, but plans to plant 208 ha in the 2016/2017 season. Edwin has 35 beef cows, 3 bulls and 18 calves. He also has 118 ewes, 2 rams and 45 lambs.

Edwin was part of the 2015/2016 Recapitalisation Project managed in partnership with the Department of Rural Development and Land Reform, Grain SA and the farmer. This grant from the Government has enabled him to buy a tractor, planter, boom sprayer, ripper, disc and two trailers. He also bought input supplies to be able to plant 137 ha of maize. With the support from his mentor, Christiaan Bouwer, the work has gone well. He is one of the few farmers who have harvested a crop this year. This was his first year of planting on his own and he will at least become part of the Grain SA 250 Ton Club. He has suffered 41% hail damage but still managed to harvest 2,4 t/ha. He could have averaged 4 t/ha. The maize was insured for 4 t/ha at R4 000/ton.

'My success I attribute to the fact that agriculture is all I know. Grain SA has been there for me with training and support. They have helped me to become part of the Recap Project and blessed me with a mentor who is so good. My neighbours also help me a lot', says Edwin.

Edwin is motivated by the dream to be successful. He wants to be able to look after himself and not stand with his hat in his hands, looking for hand-outs.

'My strength is my knowledge, my good health, my children and my support system all over the agricultural sector. I wish I could work a computer and read and write better'.

In five years time Edwin hopes that his daughter can take over a sustainable farming operation and carry on and grow bigger and stronger. He further wishes that the government can manage to get the crime under control as someone recently stole and slaughtered 16 of his pregnant ewes.

Edwin's advice to young people is: 'They should be humble and respect the land and its resources. Money and big shiny cars are not the be all and end all. If your stomach is empty, you will die. Hard word, hard work, hard work. Listen, look, learn and then do – that is the way, and always thank God for what you have.

Article submitted by Johan Kriel, Development Co-ordinator of the Grain SA Farmer Development Programme. For more information, send an email to johank@grainsa.co.za.

The Corner Post

DANIEL MOGONEDIWA
First the teacher, now the learner

Daniel Mogonediwa (45) is a subsistence farmer from the North West Province. He farms on Holgat, 400 hectares of land which he leases from the Monamaladi CPA in the Bodenstein area near Coligny. On 130 hectares of land he plants sunflower and maize in a crop rotation system and also owns a mixed breed of 33 cattle. He achieves an average sunflower yield of 1,6 t/ha. Due to the severe drought conditions of the previous season he made the wise decision not to plant a lot of maize as he realised water would be a problem, but still managed a yield of 1,2 t/ha. With better weather conditions he usually achieves an average yield of 1,6 t/ha.

He received some of his equipment from the government and buys most of his other equipment second-hand, but is now the proud owner of a brand new tractor which he recently purchased. He supports other parties in the agricultural industry by purchasing seed from Pannar and Agricol. Omnia supports him with financial and technical assistance and he is also a member of the Omnia Farmer Development Scheme.

To Daniel the agricultural industry is synonymous with 'food, food, food'. 'The agricultural industry is all about feeding the nation,' he says and adds 'It is important to fight the problem of hunger which is facing the continent of Africa as a whole.' According to him farmers, seed companies, people who sell fertiliser to ensure healthy crops and the businesses who sell equipment needed to plant and harvest crops all form part of this large industry and therefore all contribute to food security. Although he sees the role he plays in the agricultural industry as small, he definitely feels part of the industry as he is contributing to food security in his own area and inevitably joining in the battle against hunger.

> *"Subsistence farmers need more financial support and guidance in the area of financial planning.*

According to Daniel subsistence farmers need more financial support and guidance in the area of financial planning. 'This is the one area that causes me headaches and sleepless nights,' he adds. A change he would like to see in the agricultural industry is in the area of the availability of land to emerging farmers. 'It is a big struggle for us to acquire our own land,' he mentions. He dreams of being a land owner and developing into a fully fledged commercial farmer.

Starting his career as a teacher teaching Mathematics and English second language he decided to follow in his grandfather's footsteps in 2005 and started farming on a part-time basis. As his farming business was growing and demanded his undivided attention he made the decision in 2015 to exchange the classroom for the farm permanently.

As an ex-teacher he knows the importance of learning and makes sure that he attends as many of the study group sessions and courses in his area. He mentions that he is very appreciative to Grain SA about the guidance they are offering to emerging farmers. They are following the wisdom shared in this saying: 'Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime'. Most of his farming know-how of the past eleven years is a result of the input of Grain SA and other farmers.

> *"It is important to fight the problem of hunger which is facing the continent of Africa as a whole.*

The most recent course which he attended is a planter clinic presented in Bothaville. He also recently attended a business development course sponsored by Syngenta and led by the Grain Academy at the University of the Free State. With his attendance of the official opening of a state-of-the-art training centre at the AGCO future farm (which coincided with the Massey Ferguson Agricultural Fair) in Lusaka, Zambia in April this year as well as the Vaal University of Technology's Soya Food Seminar held in Vanderbijlpark in June, he ensured that he formed part of the broader agricultural scene in South Africa.

This month's edition of The Corner Post was written by Louise Kunz, Pula Imvula contributor. For more information, send an email to louise@infoworks.biz.

FROM FARM TO TABLE, YOU FEED THE NATION.

OUR APPRECIATION!

PANNAR is proud to support farmers in their mission to keep our people nourished and well fed. It's more than a job. It's a lifelong commitment on our part and yours to ensure that together we make a valuable contribution to food security in Africa. We're committed to your success.

www.pannar.com | infoserve@pannar.co.za

PANNAR®

Together we farm for the future™

For more information contact:

Business Development Manager	Reggie Mchunu	082 098 5242
Ciskei/Eastern Cape	Mzwandile Radebe	082 886 5091
Mafikeng	Hendrik Mokoto	082 767 7333
Mpumalanga/Limpopo	Karabo Puswe	082 715 4878
Zululand	Welcome Zulu	082 973 6604