Pacific Seeds

Growing possibilities

SUMMER FORAGE AGRONOMY GUIDE

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FORAGE SORGHUM AGRONOMY

Early paddock selection and preparation is advisable to take advantage of and utilise sowing opportunities for forage sorghums. The final decision on which forage sorghum variety to plant can be made nearer to sowing time when anticipated needs can be better identified.

SOILS AND SOWING

Forage sorghum is comparatively easy to establish, although an investment in good seed beds and sowing techniques will result in superior plant establishment and higher productivity.

Seed soil contact

As with all seeds, forage sorghum seed requires good seed-soil contact to ensure thrifty and healthy seedling emergence. By ensuring that the tilth of the seedbed is not too coarse seed-soil contact will be maximised, giving seeds the best chance of accessing the required moisture and nutrients for successful germination.

Soil moisture

Perhaps an obvious factor in having a suitable seedbed for planting is the level of soil moisture present. Problems from planting when soil moisture is too dry are well known, with seeds failing to germinate completely or germinating and emerging but dying as moisture runs out. It is however also important to note potential negative impacts arising from planting when soil moisture is too great which often occurs when sowing begins too soon after a rainfall or flooding event.

Prepare the seed bed in a similar manner to winter cereal, grain sorghum or corn. In preference to broadcasting and working in, plant with a combine, air seeder, or precision planter. The use of press wheels or rollers to provide good seed/soil contact is also recommended.

Broadcasting and incorporating

This system is not ideal however it can provide good results. It should only be used when there is no alternative.

a) Prepare a seedbed as you would for conventional sowings.

b) Work the ground with the aim of covering the seed with 2-5cm of soil. With this system it is not possible to get all the seed to the desired 5cm depth.

c) Harrow and roll the ground to provide good seed/soil contact. This will also reduce the rate of drying of the surface soil, giving the shallow placed seed a better chance to establish.

Light rain or a quick irrigation after broadcasting is the best means of ensuring a good, uniform establishment, but only on non-crusting soils

SOIL TEMPERATURE

Knowing the temperature of the soil in the planting zone and planting at the correct time is vital to achieving the required plant stand.

The correct method of measuring soil temperature is by calculating the daily average soil temperature – that is, adding the maximum and minimum soil temperatures of the day and dividing by two.

As many don't have access to on farm, or nearby weather stations that regularly measure soil temperature, the more well known method of taking the 8am soil temperature with a soil thermometer is often carried out. As the soil is often at its coldest at this time of the day this is an acceptable method of measuring soil temperature as it will give an indication of the lowest soil temperature of the day.

It is important that soil temperatures are taken and recorded over an extended period in the lead up to planting to assess whether the temperature is trending higher or lower.

In order to make the decision that soil temperature requirements have been met, the recorded temperatures must be rising over the period of assessment and weather forecasts should suggest this is to continue.

TABLE 1 Effect of soil temperature on sorghum emergence.

Temp	Effect on Seed	Effect on Seedling Emergence	Exp. Time to Emergence
12˚C	Slow germination, providing time for soil borne pests and disease to attack	Poor emergence, couples with increase incidence of soil diseases (Pythium, Fusarium, etc.)	14 Days >
15˚C	Satisfactory Germination	50% emergence to be expected. Similar disease expectations as at 12˚C	7 - 12 Days
16˚C	Good Germination	Adequate for good emergence	
18˚C	Good Germination	Good, Quick emergence	5 - 7 Days
20˚C	Ideal	Ideal	

Planting depth

For obvious reasons, when planting it is important to place the seed into good levels of moisture.

Care must however be taken to ensure seed is placed neither too deep nor too shallow in the profile as both situations can have negative impacts on crop establishment.

Research has shown the ideal depth for planting forage sorghum is 2-5cm.

Planting the seed deeper than this can lead to problems such as slowing the rate of emergence which may result in an increased risk of insect and disease losses.

Additionally, placing the seed too deep may result in the coleoptiles being unable reach the soil surface.

Problems can also be encountered when planting the seed too shallow. These problems regularly appear when planting into good moisture profiles as often the thought is to just 'scratch' the seed in as the moisture is right at the surface.

When planting at levels shallower than 2-3cm, emergence can be dramatically affected by rapid seed bed drying from factors such as warm, windy weather and also by secondary roots forming above the soil surface causing poor plant stability, likely leading to lodging.

Row spacing

Forage sorghum will produce similar results on a varied range of spacing, from 15cm to 1m. For grazing purposes, it is suitable to use any spacing that is convenient for the planting machinery. For hay production purposes narrower row spacings are more popular. In drier regions wider row spacing can be more beneficial, as the subsoil moisture between the rows acts as a reserve to be tapped as the roots develop into it.

Sowing rates

The most common sowing rates are shown in Table 2 and Table 3.

TABLE 2

Sowing rates - sorghum x sudan hybrids and sweet sorghum hybrids

(e.g. Sweet Jumbo LPA and Sugargraze). Average seed count 30,000 seeds/kg.

Situation	Sown alone (kg/ha)	Sown with legume companion (kg/ha)
Marginal dryland	3 - 5	2 - 4
Favourable dryland	5 – 10	3 - 6
Irrigation/coastal	15 - 25	10 -15

The lower rates are only for good seed beds, ideal sowing times and when using planters with effective rollers or press wheels.

TABLE 3

Sowing Rates - sudan grass

(e.g. Superdan 2). Average seed count 70,000 seeds/kg. A good guide is 70% of the sorghum x sudan sowing rate.

Situation	Sown alone (kg/ha)	Sown with legume companion (kg/ha)
Marginal dryland	2 - 4	2
Favourable dryland	5 – 8	2 - 4
Irrigation/coastal	10 - 20	Uncommon

The lower rates are only for good seed beds, ideal sowing times and when using planters with effective rollers or press wheels.

WEED AND PEST CONTROL

Weed control

Keeping paddocks free from weeds helps to maximise soil moisture and reduce competition with both emerging seedlings and later in the season with established plants. Applications of products such as atrazine and metolachlor can be made to some varieties prior planting in the fallow period for residual control of grass and broadleaf weeds. A "top up" application of these products is sometimes applied together with glyphosate at planting (but prior to emergence) to help ensure a weed free start to the season.

Concep® treatment is available on a number of (but not all) forage sorghum varieties to enable the use of Dual® Gold® herbicide for residual grass weed control. If using Dual Gold with forage sorghum, ensure seed treated with Concep seed safer is used, as the consequences of not doing so can induce severe crop damage and death.

Insect pest management

Overall there are few insect pests of great concern in established forage crops. However, wireworm and cutworm can be very destructive in the early stages of germination and establishment.

Wireworm

There are several species of wireworms which can attack the seed and to a lesser extent the roots. The larvae feed on the seeds as soon as they are sown, thus destroying the seed. The symptoms of wireworm damage are bare areas of various sizes and a general thinning of the crop.

When wireworms are present or anticipated, some means of control should be considered. The use of seed treated with insecticide is highly recommended.

Cutworm

Cutworms can also be a problem as they chew through the young seedlings stems at, or slightly below the soil surface. Again, recommended and easiest form of control is the use of insecticide treated seed.

According to the New South Wales Department of Primary Industries (NSW DPI) (2011) true and false wireworms (Orondina spp.) feed on the seed, roots and seedling stems of emerging crops often severely impacting upon crop establishment.

OVERCOMING SOME COMMON ESTABLISHMENT PROBLEMS

Based on field experience, some common problems faced by growers and the suggested prevention measures have been listed below.

Problem (a): Patchy poor strike

Symptoms:

- Emergence is satisfactory in sections of the paddock, but poor in others.

Reasons and advice:

- Planting too shallow or too deep. Ensure seed is sown into moisture, this is generally about 5cm, it is not advisable to go much deeper than this. Check seed placement.

Check for insect damage to the seed or seedlings. Note any common factors between the areas of good and bad establishment. It is essential that early inspection is done to make identification, before the insects move into their next life cycle. Monitoring prior to planting and taking preventative measures is recommended.

Problem (b): Uniformly poor strike

Symptoms:

- Overall poor seedling establishment.

Reasons and advice:

- Poor seed/soil contact caused by planting into a rough or wet seed bed or not using press wheels or roller to provide adequate seed/soil contact.
- Planting too deep, particularly in softer soils where the planter sinks into the soil when planting. Check planting depth at regular intervals.
- Planting too early into cold soil. Know the risk by monitoring soil temperatures prior to planting.
- Heavy rain or irrigation following planting can cause crusting and compaction of the soil above the seed. A light harrowing before emergence may overcome crusting.
- Seed quality. Always retain a representative sample of seed to check germination if in doubt. This is very rarely the cause of poor establishment unless the seed is old or stored in conditions detrimental to seed quality.

Problem (c): Seedling death/slow development

Symptoms:

- Seedlings show very slow growth and/or death.

Reasons and advice:

- Insects or diseases attacking the seedling. Early investigation to isolate the cause is essential.
- Planting too early will slow plant growth until conditions improve and temperatures warm up.
- A hard pan or dry layer beneath the seed will impede proper root development and stunt seedling growth. Check the moisture in the whole profile before planting.

Problem (d): Poor growth

Symptoms:

- Seedlings are slow growing and/or an abnormal colour.

Reasons and advice:

- Poor nutrition, particularly phosphorus and/or nitrogen.
- Correcting any soil deficiencies by fertilising and using a starter nitrogen and phosphorus fertiliser to give the seedling a 'kick-start', is highly recommended.
- Soil type unsuitable for the crop planted. If the country has been recently flooded, the soil can be in an anaerobic condition and there is poor nutrient availability to the plant.

FERTILISER REQUIREMENTS

As with all crops, it is necessary to have a soil with well balanced fertility in order to achieve optimum growth and feed value. High levels of nitrogen, in particular, will ensure high protein, fast growth and quick recovery after grazing or cutting. Consequently a good nitrogen program is necessary, provided moisture and other nutrients are adequate.

Irrigation/coastal

As a rule of thumb, a fertiliser program similar to that used for grazing oats or a corn crop is a good guide. Split applications of the nitrogen fertiliser are recommended so that the forage production can be tailored to suit seasonal conditions and feed requirements. Prior to sowing apply 50kg of nitrogen/hectare (110kg of urea) and at sowing time use a starter fertiliser to supply phosphorus and other elements if required.

Top dressing of the crop after each cutting or grazing with an additional 50kg of nitrogen/hectare will maintain productivity and feed quality.

Inland/dryland

At or before sowing, apply the same fertiliser type and rate as would be used for an oat or grain sorghum crop.

Top dressings of nitrogen during the season will provide an increase in feed quality and quantity should seasonal conditions allow and additional feed be required.

Table 4 is a guide to the maximum amounts of nitrogen and phosphorus that can be applied with the seed. It also converts these into comparative amounts of some of the more common fertiliser products. If possible, it is preferable to place fertiliser to the side and below the seed.

For more specific recommendations refer to your local agent or agronomist.

tAblE 4 Amounts of fertiliser that can be applied at planting with forage sorghum seed

Row spacing (cm)	Nitrogen kg/ha	Phosphorus kg/ha	Maximum product (kg per ha)			
			Urea	Crop King 700	DAP Starter np	MAP Starter 12
18	24	50	54	74	130	200
35	12	25	27	37	65	100
45	10	20	23	31	54	66
70	7	12	13	18	32	50
90	5	10	11	15	26	40

Notes:

1) The rates given in Table 4 should be reduced by 50% for very sandy soils. The rates may be increased by 30% for heavy textured soils or where soil moisture conditions at planting are excellent.

2) The rates are for conventional seeding equipment. Minimum or zero till equipment with slit openers tend to increase the fertiliser concentration and the fertiliser rates in Table 4 should be reduced by 50%.

GRAZING MANAGEMENT OF FORAGE SORGHUMS

Many hundreds of thousands of hectares of forage sorghum have been grazed under a range of seasonal conditions throughout Australia over many years. There have been few reports of stock deaths due to prussic acid poisoning because graziers generally follow the golden rule of not introducing hungry stock onto young and/or drought affected forage sorghum.

GRAZING MANAGEMENT FOR SUPERDAN 2, BMR OCTANE, BMR ROCKET AND SWEET JUMBO LPA

These hybrids belong to the sorghum x sudan and sudan x sudan grass groups.

The ideal grazing height for this group is 1m which provides safe, high quality feed (in terms of protein and energy) as well as allowing for proper plant development. As forage gets taller, quality declines, although available bulk increases.

To achieve the best quality feed, rotational or strip grazing methods should be used. With intensive forage crops electric fencing is useful, provided wires are visible to stock. By grazing the forage at an early stage and then allowing regrowth, the best quality feed is obtained. For best regrowth, remove stock before the crop is grazed below 15cm.

Traditional quick flowering hybrids need to be intensively managed to prevent the crop going to head. Once the crop does go to head, feed quality will decline and a lot of feed will be trampled and wasted. If this does occur, slashing the uneaten stalks (to 20cm height) will promote better regrowth. This problem does not occur to the same extent with Sweet Jumbo LPA or Superdan 2 which have been developed to be later flowering.

However, even with the late flowering hybrids, it is not recommended that grazing be unnecessarily delayed. In other words, late flowering does not mean late grazing. For maximum stock productivity the aim should still be to commence grazing when the crop is approximately 1m tall. The main benefit of growing late flowering forage is that if grazing is delayed until several weeks after the optimum time, the crop will not have flowered and there will be better utilisation of feed.

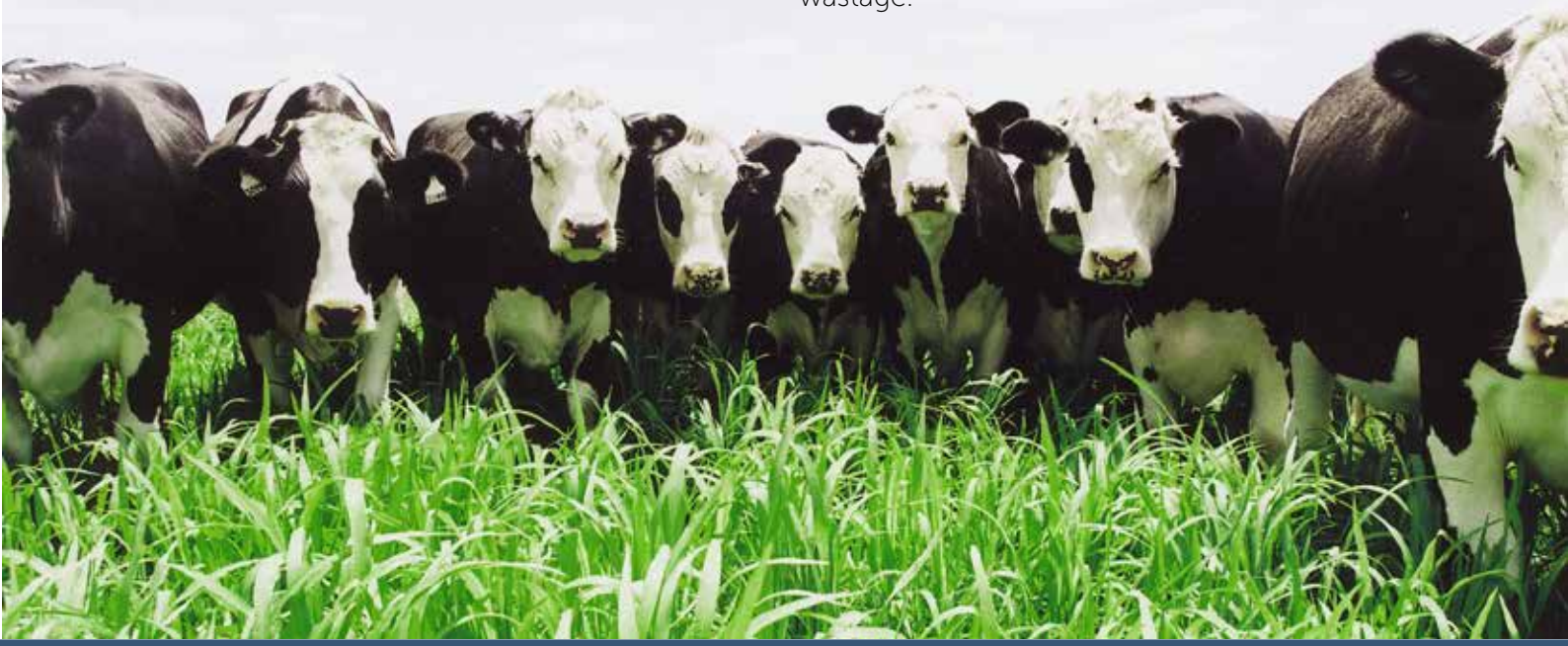
Therefore, under less intensive management systems where large areas are sown, or where greater flexibility is required Sweet Jumbo LPA and Superdan 2 should be the preferred choices.

GRAZING MANAGEMENT FOR SUGARGRAZE

This variety belongs to the sweet sorghum hybrid group. The characteristics and applications of Sugargraze vary significantly from the sudan and sorghum x sudan hybrids. If early grazing is required, Sugargraze can be grazed once it reaches 1.5m in height. It can also be left to grow and grazed later if feed is not needed until further in the season.

For best regrowth do not allow stock to graze the crop lower than 15cm. It should also be remembered that sweet sorghums do not regrow as quickly after grazing as the sorghum x sudan hybrids.

The real benefit of Sugargraze is its versatility, as it can provide useful feed at many stages of growth, from young growth right through to the post flowering stage and even after frost. As such, it can provide a 'standing haystack' for late autumn - early winter feed with the sweet stems ensuring minimal wastage.



WHAT IS PRUSSIC ACID?

Cyanogenic glucosides are a natural component of the plant which, when eaten by stock, are converted to hydrogen cyanide (HCN). In sufficient quantities this can lead to hydrogen cyanide poisoning or, as it is commonly referred to, prussic acid poisoning.

When animals consume forage sorghum containing cyanogenic glucosides, prussic acid is released and may be absorbed into the blood and carried to body tissue where it interferes with oxygen utilisation by the cells. Prussic acid poisoning is not a major problem provided sensible grazing management is adhered to.

Once stock have settled into a sorghum paddock, a portion of the forage they consume is high in prussic acid causing compounds (e.g. young growth, old stressed plants) but this has no effect because the toxic plants are only part of the diet and the animal is in a steady, rather than rapid intake, grazing pattern. However, environmental conditions can change which can result in a change in the level of these compounds in the plant, and this can in turn affect animal production.

Symptoms of prussic acid poisoning

Symptoms include muscle trembling, staggers, deep and rapid breathing, frothing at the mouth and gasping respiration. Collapse, coma and death may occur in extreme cases.

Factors which influence the level of prussic acid

1) Stress (the most important influence)

A plant which is under stress - particularly moisture stress - will have a higher level of prussic acid causing compounds than a plant not under stress, especially if the plant is in the young stage and less than 0.5m to 1m tall.

2) Stage of growth

The level of prussic acid decreases as the plant gets older and it is generally considered that once a healthy plant reaches 80cm to 1m tall the level of prussic acid is below a dangerous stage.

3) Sorghum type (genotype)

The sudan grasses, e.g. Superdan 2, are considered to be generally low in prussic acid whereas the sweet sorghum and grain sorghums are considered to be high.

There is a third group which comprises the majority of the forage sorghums and these are sorghum x sudan grass crosses which have a moderate level of prussic acid.

However, within each genotype or group there can be significant variations which have been identified by breeders and used in breeding programs. So, depending on individual parents, there is a difference in prussic acid levels between varieties.

Irrespective of varietal differences, caution should always be exercised, as even the varieties traditionally low in prussic acid can reach dangerous levels under severe stress.

4) Nutrient balance

High nitrogen levels in a plant can increase the prussic acid content, as can low soil phosphorus levels.

Recommended grazing management

1) Height

The plant should be healthy and preferably 80cm to 1m tall.

2) Stock condition

Starving stock should not be introduced to forage sorghum, particularly if the forage sorghum is young or showing any signs of stress.

3) Sulphur

Sulphur blocks are always highly recommended when grazing forage sorghums. When stock only have forage sorghum in their diet, they will become sulphur deficient, as forage sorghum is always low in sulphur. Therefore the significant effects of prussic acid in forage sorghum are not the infrequent fatal poisoning of animals, but the less obvious consequences. These include a depression in voluntary feed intake, sulphur deficiency and a decrease in growth rates.

The sulphur deficiency is increased when the forage has a high prussic acid level. This is because sulphur is used in a detoxification reaction within the animal which converts prussic acid to the nontoxic thiocyanate. Animals have this ability to break down the prussic acid as long as they have enough sulphur.

Sulphur deficiency causes a reduction in appetite which in turn leads to a decline in average daily weight gains or milk production.

As well as intake declining, there may be certain amino acids which become limiting factors to production. When this occurs, tissue synthesis and the ability to increase live weight in the animal decreases.

4) Salt

All forage sorghum varieties are low in salt and animals fed salt licks will show better performance.

Conserving forage sorghum high in prussic acid

1) Hay

Making hay from this material will decrease the prussic acid content to some extent, however as the moisture is reduced stock can consume the remaining dry matter (therefore prussic acid) more quickly, which increases the poisoning potential.

Standing forage that has a high prussic acid potential will also have a high prussic acid potential as hay.

2) Silage

It is widely reported that the silage process results in a decrease in the prussic acid content.

What to do with a stressed crop

When a crop is less than 1m tall and stressed, particularly drought stressed, there are two options:

a) The preferred option is to wait for rain to freshen up the crop to reduce the prussic acid, as it really is considered too risky to graze.

b) If the farmer is in a position where feed is extremely short and he wants to utilise the available sorghum, the following precautions should be taken:

1. If possible send samples of forage sorghum away for laboratory testing.

A reading in excess of 600ppm is considered unsafe and 1000ppm is lethal.

Hungry livestock are at high risk and can show symptoms within five minutes of eating plants with a high level of HCN (hydrogen cyanide), and may die within 15 minutes.

2. Give the stock a good feed of hay or straw etc so when they are introduced onto the sorghum paddock they are full and will commence grazing in a slow manner. When an animal consumes a large quantity of toxic forage rapidly, its body cannot neutralise the prussic acid at the rate of intake and poisoning occurs.

3. Introduce sulphur blocks to cattle well before they go into the sorghum paddock so they have sulphur in their system and have become familiar with their use.

4. Closely monitor the stock and if there is any indication of any toxic reaction occurring within the cattle, remove them immediately.

MILLET AND SORGHUM TYPES AND THEIR POTENTIAL CYANIDE ACCUMULATIONS

Millet or Sorghum types	Cyanide potential
Pearl and foxtail millet	very low
Sudangrass varieties	low to intermediate
Sorghum-sudangrass hybrids	intermediate to high
Sweet sorghums	intermediate to high
Johnson grass	high to very high
Grain sorghums	high to very high

TO PREVENT PRUSSIC ACID POISONING

- Do not graze any of the plants (sorghums) that have been subject to drought or injury, unless they are tested for hydrocyanic acid.
- If plants have been damaged by herbicides defer grazing until they are either well recovered from injury or cut for hay and the plants have been allowed to dry.
- Do not graze plants until they have reached a minimum of 0.8m in height for sudan grasses or 1m for sorghums.
- Graze re-growth sorghum with caution if growing conditions are poor.
- Remove all livestock from the feed source when an animal is found to have died suddenly after grazing forages under poor growing conditions.
- Prevent animals from grazing wilted plants or those with young tillers.
- After plants have grown rapidly, such as shortly after a rain or irrigation on previously drought stressed paddocks, wait at least two weeks after plants begin to grow before grazing.
- Provide sulphur supplement where possible to assist with the detoxification of prussic acid and toxins.

NITRATE POISONING

What is Nitrate Poisoning?

Although its incidence is low, nitrate poisoning can occur in a wide range of fodder crops including forage crop and pastures. Plants absorb nitrogen from soil in the form of nitrate, which is quickly converted into amino acids. This conversion process requires energy from sunlight, water and favourable weather conditions, particularly temperature. When plants are stressed, this conversion process is interrupted and nitrate will begin to accumulate in the plant. In general, the highest levels of nitrate will be in the lower one third of the stem.

Symptoms of Nitrate Poisoning

A typical symptom of stock suffering nitrate poisoning is an increase in respiration rate, which may progress to severe gasping, convulsions and death. The blood changes to a chocolate brown colour but within several hours, after death, will change again to a dark red colour.

Factors which influence the level of nitrate

Note: nitrate accumulation in plants generally occurs when several of the following occur together:

1. The crop is grown on fertile soil containing high levels of nitrogen
2. Drought, frost or any significant stress factor temporarily stops plant growth
3. Plants have their leaves removed or killed (i.e. grazing or severe hailstorm) while the stems and roots remain active
4. The growth of highly fertilised (particularly N) crops is suddenly halted due to an adverse weather change (e.g. cold and overcast weather).

Recommended grazing management

Stock can breakdown nitrate however there is a harmful by-product produced. In the process of turning nitrate into beneficial ammonia, ruminants produce the intermediate product, nitrate. This is usually no problem but when stock ingest nitrate faster than it can be broken down into ammonia, nitrate will form in the rumen. When this nitrate is absorbed into the bloodstream it reduces oxygen carrying capacity of the blood.

The tolerance of stock to nitrate does vary. Stressed animals, such as those that have been without feed, are sick, pregnant or lactating will be less tolerant to nitrate. Even mid-range levels of nitrate can be too high for them.

What level of nitrate is dangerous?

Forage suspected of containing high levels of nitrate should be tested prior to feeding. Nitrate can be expressed in two different ways – Nitrate nitrogen (NO_3N) and Nitrate (NO_3-).

Potentially toxic levels are as follows:

	% of dry mattter	ppm of dry matter
Nitrate nitrogen (NO_3N)	Over 0.21	2,100
Nitrate (NO_3-)	Over 0.93	9,300

Treating affected stock

Affected stock need immediate treatment by a veterinary officer and success will depend upon how soon treatment can be given. Avoid handling or moving stock to minimise their oxygen needs.

CAUTION - NITRATES CAN BE CUMULATIVE

The level of nitrate that causes toxicity in ruminants varies depending on rate of intake, diet, acclimation to nitrate and nutritional status. As a rule, forage containing less than 5,000 ppm NO_3 on a dry matter basis is safe. Forage containing 5,000 to 10,000 ppm NO_3 is considered potentially toxic when provided as the only feed. Forage containing over 10,000ppm NO_3 is considered dangerous but often can be fed safely after proper dilution with other feeds.

One thing to consider is that the effects of feed and water levels are additive. Consider both in avoiding or assessing nitrate problems. Common causes of high nitrate levels in water include shallow bores contaminated with surface water, water containing animal wastes, and surface runoff from heavy rain after fertilization with ammonium nitrate. Water containing more than 200ppm NO_3 is potentially toxic, especially when feed also contains an excessive level. You can use these formulas to convert nitrate to a common basis.

TO PREVENT NITRATE POISONING

- Never turn hungry animals into possibly high nitrate forages. During drought, producers sometimes "turn onto" temporary forages to help animals in poor condition. The combination of poor body condition, high nitrate levels in the forage and high consumption can be deadly.
- Turning one old cow into a paddock to observe is not an effective test for nitrates, because cattle tend to bite the tops of plants first, where the concentration is lowest. As cattle are forced to eat the lower plant parts, poisoning could occur later when it is not suspected.
- Have hay tested before feeding if you suspect that it is high in nitrate. Nitrate levels remain constant in hay.
- If hay is high in nitrate, feed carefully with an energy supplement or in combination with low protein forages, or other hay low in nitrates.
- Never feed high-nitrate hay.
- Ensile forages high in nitrate. When hay is properly fermented, nitrate levels are reduced by 40 to 60 per cent. However, be careful in enclosed areas. High-nitrate forages can produce nitrogen dioxide (silo gas), which is very poisonous to humans.
- Irrigation or rain renews plant growth, which will lower nitrate levels (however, this could lead to prussic acid poisoning in sorghums
- Green chopping is the most dangerous feeding method. Cattle can adapt to higher than normal levels of nitrates if the increase occurs slowly. Healthy animals are less likely to develop problems than weak or sickly. Also, if enough carbohydrates are supplied, the digestive system can convert the nitrogen into ammonia or proteins faster, making it less likely that dangerous levels of nitrite accumulate.

TO CALCULATE DIFFERENT NITRATE FORMULATIONS

Potassium nitrate	Nitrate	Nitrate nitrogen
= Nitrate x 1.6 = Nitrate nitrogen x 7.0	= Potassium nitrate x 0.6 = Nitrate nitrogen x 4.4	= Potassium nitrate x 0.14 = Nitrate x 0.23

COMPARISONS OF NITRATE AND PRUSSIC ACID

	Nitrate	Prussic Acid
Plant parts affected	Older Lower Leaves	Young growth or new regrowth
Grazing problems	Occur when animals eat lower plant parts	Occurs early in the grazing period
Death occurs	Usually within 4 hours of consumption	Within minutes of consumption
Affect of haying on concentration	None – concentration is stable	Dissipates when cured or placed in a silage pit

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