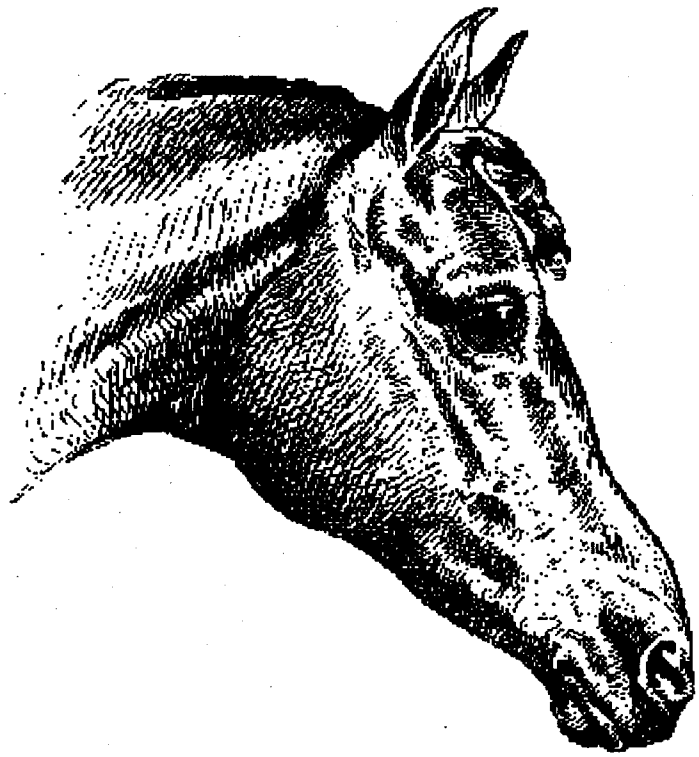
DROUGHT FEEDING & MANAGEMENT

For Horses



David Nash

Agriculture Victoria Rutherglen

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Researcher Contact Details
Angela Avery and David Nash
Department of Natural Resources and Environment
RMB 1145
Chiltern Valley Road
RUTHERGLEN VIC 3685

Phone: (02) 6030 4500
Fax: (02) 6030 4600
Email: davidgnash@nre.vic.gov.au

RIRDC Contact Details
Rural Industries Research and Development Corporation
Level 1, AMA House
42 Macquarie Street
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone: 02 6272 4539
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au.
Website: http://www.rirdc.gov.au

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Foreword

Droughts have always been part of Australian life and preparing for them is something that everyone in rural Australia must be ready to cope with. The Equine Research and Development Program of RIRDC has been looking strategically at the major area of horse nutrition for the past four years, commencing with a major workshop in early 1995. Funds have been invested in research on pasture nutrition, comparison of supplementary and pasture rearing and safe and effective grain feeding of horses. Additionally, major publications have been commissioned on pastures for horses, developmental orthopaedic disease of foals and a practical handbook on feeding horses in Australia.

This excellent booklet by David Nash will add to other outstanding material on horse nutrition published by RIRDC and will be of great assistance to horse owners and breeders that have to cope with drought conditions on their farms. The area of horse nutrition is one of eight major program areas for investment of research and development funds for the horse industry by RIRDC.

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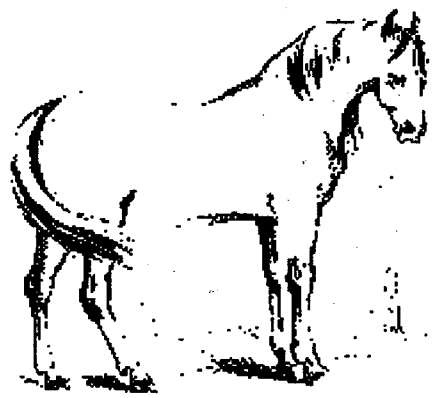

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INTRODUCTION

Unfortunately, droughts are very much part of the life of horse owners in Australia. They come at irregular intervals and owners should take a range of measures to prepare themselves for such events.

This booklet is a practical guide on horse feeding and management during drought to help owners break the daunting planning phase down into manageable steps, and then to see the plan realised as a successful way of combating drought.

As no two droughts are the same, this booklet cannot cover all situations. Rather, it aims to provide general recommendations, which can then be modified to fit the requirements of the individual. You are encouraged to contact your local office of the Department of Natural Resources and Environment or State Agricultural Department for assistance to develop a plan which will suit your situation including advice on conservation issues, feeding in confined areas and water quality.

I know that droughts can be a traumatic time for horse owners, especially breeders, so I hope you find this booklet a helpful guide to the best way to manage your stud in the event of a drought.

David Nash
Scientist Equine/Pasture
Department of Natural Resources and Environment
Agriculture Victoria - Rutherglen

PREPARING A DROUGHT ACTION PLAN

Introduction

Droughts are part of life for horse owners in Australia. Each drought brings its own set of difficulties. How well you survive drought will depend on the initial plan of action and the modifications undertaken to the strategy as the drought progresses.

Planning and decision making must be done as soon as you recognise the possibility that the poor season may progress to a drought. If you leave the decisions until the drought worsens, many of the management options available early may be closed to you. Prices for horses usually drop dramatically, agistment dries up and fodder prices generally soar.

The first step is to list the farm/stud's financial and physical resources so that the effects of various strategies, both short and long-term, can be calculated. Water is probably the first thing to consider, as if this resource is inadequate, then it will be difficult to retain large numbers of horses.

The next step in drought action planing, is to estimate when you think the drought will break. This will affect your calculations on how long you will be feeding horses, how much it will cost and whether you will decide to sell horses or not. It is best to over estimate the time you expect to hand feed your horses to be on the safe side. Figure 1 provides a list of questions you will need to address when deciding what to do in drought. Check to make sure your action plan addresses these questions.

- What is my current financial situation?
- Have I the time and equipment to feed horses?
- How long will I have to feed?
- Am I aiming at maintenance, growth or competition targets?
- What are the feeding needs of the various classes of horses (foal, lactating mare etc)?
- What fodder/grain will I use and what will they cost at various stages of the drought?
- Have I adequate water supplies to survive the drought?
- How widespread is the drought?
- Is suitable agistment available?
- What prices are horses now?
- What prices will horses be after the drought?
- What effect will reduced stock numbers have on my overall feeding costs?
- What effect will my strategy have on my pastures and soils?
- What effect will my action plan have on my long-term viability?

Figure 1. Important questions to ask when planning action.

Remember, allowing stock to starve is not an option as this is an offence under Australian Law.

The plan does not need to be implemented all at once and should be flexible to allow for changes in circumstances. For example you may only sell a certain class of horse or buy some fodder if conditions do not improve by a certain date.

You will find that having a plan of action will greatly reduce the amount of stress on you and other family members. Even though the plan may need continual modification as the drought progresses, each family member will be working towards specific aims, especially if you have discussed the plan with them before hand.

Environmental impact of your plan

You need to consider the long-term effect your plan will have on your pastures and soils. If your pastures are mostly annual species or your soil type is unstable, then you may need to lower the number of horses you intend to keep so that you minimise the long-term effects drought has on the environment. You should seriously consider confining at least some of your horses to a small part of the farm. This could mean stabling or yarding them for sometime. Stud managers have successfully undertaken this option in previous droughts with the stock, pastures and soils emerging from the drought with minimal impact.

If you were not on your farm/stud during a previous drought, talk to neighbours or relations about what happened to your district during that period. They may be able to suggest strategies that reduce the impact of the drought without significantly increasing your financial burden.

Management options

Toughing it out

It is your legal responsibility to ensure that horses do not starve to death or become distressed during a drought. Therefore, doing nothing is **not** an option.

You may be tempted to do nothing in the hope that a poor season will not turn into a drought. In the mean time, paddock feed diminishes, the condition and value of horses slip and feed prices increase. Once these changes occur many options are no longer available.

The key message is to plan early and set deadlines to activate specific actions. Remember, doing nothing is not an option.

Agistment

Agistment is sometimes more economical than feeding. The time saved from not feeding may be more usefully employed. Agistment reduces grazing pressure increasing feed for the horses remaining on the property. It may be appropriate to only to agist some horses. Foals, lactating mares and stallions should be kept on the stud, as they generally require a high level of maintenance. Dry mares and idle stock should be considered first for agistment.

Inquire in your own district for agistment first. This should be done early in the drought to find suitable paddocks, otherwise you may miss the opportunity to agist.

As drought becomes more widespread, agistment becomes harder to find and the cost rise rapidly. It may then be cheaper to feed stock at home. It may also be costly and impractical to supervise horses (especially foaling mares) at a distance.

The cost of transport, likelihood of disease and losses also have to be taken into account. The possibility of selling horses after the drought in the area of agistment should be considered, to minimise return transport costs.

Selling horses

Selling horses is one option where early planning and action is advantageous. Selling decisions should be made before horses have lost too much condition to ensure horses are saleable and before market prices start to drop.

When deciding what horses to sell and the timing, the following factors should be considered:

- Present value of horses
- Quality of horses
- Capacity to carry horses through the drought
- Impact on the studs breeding program
- Taxation
- Likely demand for horses at the end of the drought
- Likely length of the drought

In general, a sound policy is to sell some horses and feed the rest. Generally unproven or lower quality horses should be the first to go. Unproductive or geriatric horses should also be considered for sale.

For owners with small numbers of horses this information may not be as relevant as you will continue to stable and feed your horses. Careful planning however, can minimise costs, and ensure your horses have access to quality feed and water throughout the drought.

Feeding

Supplementary feeding is an expensive and time-consuming practice especially during drought. Horses will normally be fed rations just sufficient to maintain them in a condition score of at least 2 until the drought ends. In some cases, a short-term increase of rations may be required for particular stock such as lactating mares or weanlings being prepared for sale. Budgets need to be carefully calculated, as profit margins in drought are generally small for stud owners.

Previous experience shows that the quality of dry pastures, stubbles and failed crops is often much better than first anticipated. This can reduce the feeding levels needed to maintain liveweights and thus, the estimated cost of retaining stock. Horses should be weighed or condition scored regularly to ensured that feed is adequate or horses are not being overfed.

Information on nutritional requirements of various classes of horses, feeding rates and stock management is provided in the following section.

Humane destruction

If some classes of horses are unsaleable, and no other option is feasible, then these animals should be humanely destroyed. In past droughts, shires have made facilities available to dispose of carcases after destruction. Information on appropriate methods of destruction can be obtained from animal health staff from your local Government Department office, or your veterinarian.

For the average horse owner this seems a little drastic. Most horses are companion animals, not just livestock, and have a higher individual value than sheep or cattle. If you are a large breeder of horses, it may be the most humane way of dealing with some animals. Latter this manual will inform you how to calculate the cost to return a horse in poor condition back to an acceptable condition.

Other management decisions

Racing, competition, pregnancy and growth all increase the nutritional requirements of the horse herd.

Changes to breeding and weaning times can sometimes be used to reduce feed demands during the drought. The estimated cost of drought feeding a lactating mare for six months (including late pregnancy and lactation) is about 70% more than for a dry mare, so savings can be made by delaying breeding or by not breeding that season. However, the long-term effect of this action to your breeding program needs to be carefully considered.

Delaying the time of breeding for a late spring birth has the potential to greatly reduce supplementary feeding costs as during this time more pasture is normally available for horses to consume and thus less reliance on supplementary feeding.

A more drastic measure is not to breed that year. The most likely case is to select only your best mares to breed and leave maiden and lesser quality broodmares dry for the season or sell them.

Early weaning, if not already practised, can reduce feed costs and simplify management of both mares and foals. The mares can then be managed as dry stock and the foals given priority. The mares would then be suitable candidates for agistment, as they will be low maintenance. If you decide to wean early, the following factors should be considered:

- Foals should be at least 10 weeks old but preferably closer to 16 weeks
- Foals should have reached at least 140 kg liveweight for a horse maturing at 500 kg
- Foals should receive high quality rations

Chapter 2

FEEDING HORSES DURING A DROUGHT

When feeding horses in drought in Australia, it is important to have a clear understanding of what you desire from your horses and then you can set appropriate targets. In most situations you should attempt to maintain weight in idle horses and to meet the nutritional requirements of late pregnant and lactating mares. You should also allow for enough nutrition for growth of weaners and yearlings so that they do not suffer from severe checks in growth. Other targets can be selected for example, growth of yearlings for sale or a gradual weight loss of over conditioned horses. Feed levels can then be determined for these aims. Selecting the types and amounts of feeds to give horses during a drought involves six steps:

1. **Determining the weight and condition score of horses**
2. **Determining the nutritional requirements of various classes of horses**
3. **Understanding the nutritional value of different feeds**
4. **Determining how much feed a horse can consume**
5. **Calculating the total nutrient requirements and feed costs during a drought**
6. **Management considerations**

Step 1: Determining the weight and condition score of horses

To ensure feeding rations meet your targets, it is essential to know the nutritional needs of horses for maintenance, exercise, performance or growth. The first step is to know how much your horses weigh. Ideally, you would weigh the horse, however few people have access to scales to weigh horses. Table 1 provides a reliable method to estimate the weight of a horse.

Table 1. Estimating horse body weight from girth measurements.

Girth (cm)	Weight (kg)	Girth (cm)	Weight (kg)
101	45	159	346
108	77	165	380
114	104	171	414
120	132	178	453
127	164	184	486
133	192	190	520
140	234	199	570
146	252	203	593
152	307	206	611

(Avery 1996)

Once you have estimated your horse's weight you now have the basis on which to determine their nutrients requirements.

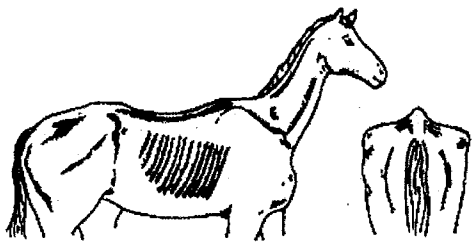
As weight, weight gain and weight loss can be difficult to determine a scoring system has been developed to monitor the condition of your horses. Condition scores are used throughout this book as benchmarks for horses in drought. Table 2 describes each condition score and Figure 2 provides a diagrammatic representation of the condition scores.

Table 2. Body condition score system.

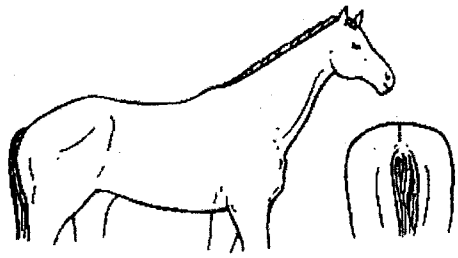
Score	Neck	Back and ribs	Pelvis
0 Very poor	Marked "ewe" neck. Narrow and slack at the base.	Skin tight over ribs. Spinous processes sharp and easily seen.	Angular pelvis- skin-tight. Deep cavity under tail and either side of croup.
1 Poor	"Ewe" neck. Narrow and slack at the base.	Ribs easily visible. Skin sunken either side of the backbone. Spinous processes well defined.	Rump sunken, but skin supple. Pelvis and croup defined. Deep depression under tail.
2 Moderate	Narrow but firm.	Ribs just visible. Backbone well covered. Spinous processes felt.	Rump flat either side of the backbone. Croup well defined, some fat. Slight cavity under tail.
3 Good	No crest (except stallions). Firm neck.	Ribs just covered -easily felt. No "gutter" along back. Spinous processes covered but can be felt.	Covered by fat and rounded. No "gutter". Pelvis easily felt.
4 Fat	Slight crest. Wide and firm.	Ribs well covered - need firm pressure to feel. "Gutter" along backbone.	"Gutter" to root of tail. Pelvis covered by soft fat - felt only with firm pressure.
5 Very fat	Marked crest. Very wide and firm. Folds of fat.	Ribs buried - cannot feel. Deep "gutter". Broad flat back.	Deep "gutter" to root of tail. Skin distended. Pelvis buried – cannot feel.

(Huntington 1992)

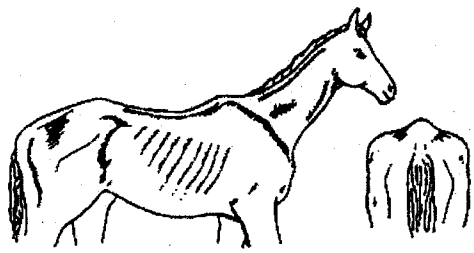
0.5 can adjust the pelvis score if it differs by 1 or more points from the back or neck scores to obtain the condition score.



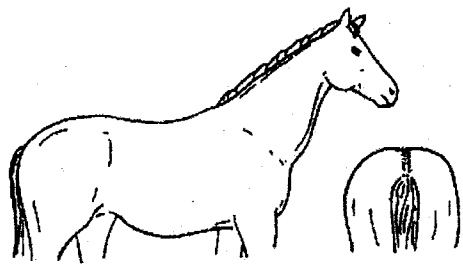
0. Very poor
* Very sunken rump
* Deep cavity under tail
* Skin tight over bones
* Very prominent backbone and pelvis
* Marked ewe neck



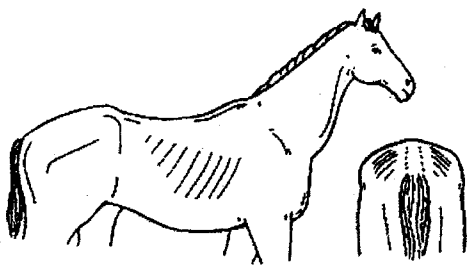
3. Good
* Rounded rump
* Ribs just covered but easily felt
* No crest, firm neck



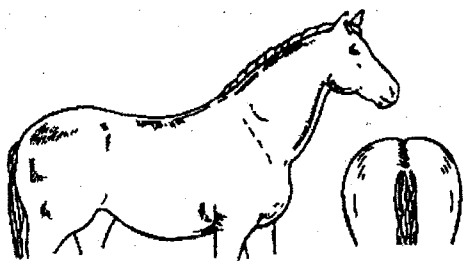
1. Poor
* Sunken rump
* Cavity under tail
* Ribs easily visible
* Prominent backbone and croup
* Ewe neck, narrow and slack



4. Fat
* Well-rounded rump
* Gutter along back
* Ribs and pelvis hard to feel
* Slight crest



2. Moderate
* Flat rump either side of backbone
* Ribs just visible
* Narrow but firm neck
* Backbone well covered



5. Very fat
* Very bulging rump
* Deep gutter along back
* Ribs buried
* Marked crest
* Folds and lumps of fat.

Huntington (1992)

Figure 2. Condition scores for horses.

Step 2: Determining the nutritional requirements of various classes of horses

When developing a ration for your horse, it is necessary to know their specific nutrient requirements. Once you have determined the horse's weight, you can now determine their nutrient requirements. Special consideration is needed when feeding different categories of horses.

Mares

The cost of full drought feeding a breeding mare for six months during late pregnancy and lactation is 70% more than for a dry mare. Considerable cost savings can be made by not breeding. When making decisions about breeding mares in a drought several points should be kept in mind:

- Condition score: chances of successful reproduction decline rapidly as condition score falls below 2. Also remember if mares are overweight the chances of conception diminish. If mares are below the critical condition score, it may be best not to breed them. Apart from the extra energy required to return them to a reasonable condition score, the mare's nutritional requirements will increase substantially during pregnancy. Severe under nutrition may result in an under grown foal or may result in some growth abnormalities such as DOD and OCD (refer to RIRDC publication Developmental Orthopaedic Disease in Horses by Janine Aldred).

- Roughage should be available to supplement a drought-fed grain ration during later stages of pregnancy and in early lactation to aid and maximise digestion of feed

- Weaning early will allow mares to run as dry mares, this will reduce feed requirements as mares will be managed as maintenance stock.

Stallions

During a breeding season stallions require more energy than other mature horses. Stallions are usually kept in small individual paddocks. A maintenance level of nutrition for stallion's will suffice during the non-breeding season.

Young stock

Young horses require between 90 and 120% of the energy required for the maintenance of a mature horse. Young stock can recover from a check in growth, but it is unadvisable to continue this for a prolonged period of time. The potential and quality of young stock should be evaluated and it may be best to sell horses that are of poor quality and lack potential.

Weaners

Early weaning can reduce feed costs and simplify management of both mares and foals. As previously discussed, the important factors when weaning are an absolute minimum of 10 weeks of age and a minimum liveweight of 140 kg (500 kg mature weight). The use of high quality rations and good management are also important. In a "normal" season, the growth target for weaners would be to achieve 75% of their mature (4-year-old) weight by 18 months of age. Some later compensatory growth is possible after a short check in growth. To enable

compensatory growth adequate nutrition must be provided. Severe under-nutrition of young stock can cause numerous growths and health disorders and must be avoided.

Yearlings

Yearlings if not being shown or prepared for yearling sales are usually produced under low input management systems. Generally, in a normal year quality pasture is sufficient for growth at acceptable rates. During drought pasture quality and quantity will rapidly decline. Frequent checks of the pasture and the condition of the yearlings should be made. If the condition score of the young stock falls below 2 supplementary feeding should take place.

Maintenance

This category generally involves idle horses that are doing little or no work. These horses should be frequently checked to observe their condition. If no pasture is available pasture hay should suffice. If horses fall below a condition score of 2, it will take about the same amount of energy to gain 1 kg of body weight as it does to maintain the horse for a day. In other words, it takes twice the amount of feed to gain 1 kg than for maintenance. Thus it is more economically viable to maintain a horse at condition score of 2 than to let it fall below this score.

Working horses

Working horses include racing, eventing, showjumping and show horses or any other type of horse that is performing at a medium or high level of energy requirements. These horses will require various levels of supplementary feeding from high energy rations for racehorses to low energy rations for show horses. Many of these horses have their nutritional requirements satisfied by supplementary feeding, therefore drought often does not result in a change in diet for these animals, unless certain feeds become too expensive or unavailable.

Diets that include pasture will require roughage as the pasture diminishes. During drought, it may be feasible and more economic to spell working horses and thereby reduce their nutrient requirements.

Ponies

Compared to large horses, ponies generally can survive on very little feed. Grass hay will provide ponies with adequate nutrition during drought conditions. Generally, the main cause of concern for ponies is laminitis (founder) when the drought breaks and they graze the new green pasture.

Total energy requirements

Feed energy is a major requirement and normally the first limitation during a drought. The energy derived from digested feed is used to maintain body functions, foetal growth, milk production or body weight increase. Energy is termed as Metabolisable Energy (ME). It is standard practice for ruminants (sheep and cattle) to describe energy value of feeds and energy requirements in units of ME (energy units). For horses, as they are not ruminants Digestible Energy (DE) is used. This is calculated by: DE = ME/ 0.82 and is expressed in Megajoules per Kilogram (MJ).

Table 3 is a summarised chart of nutrient requirements for horses developed by the NRC (Nutrient Requirements Council). NRC charts cater for all sizes and categories of horses. In the further reading section of this book, there are references for these charts so you can view the full range of nutritional requirements.

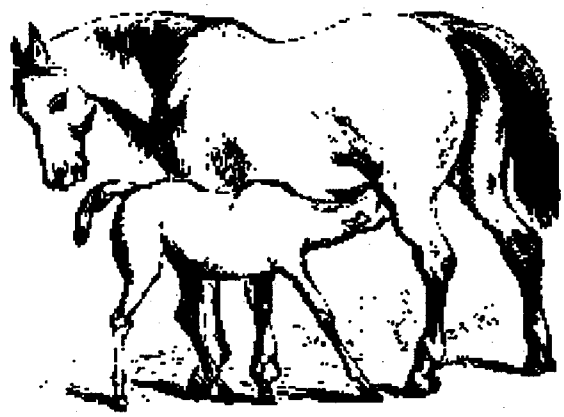


Table 3. Daily energy and protein requirements for different categories of horses.

Type of horse	Mature weight (kg)	Daily gain liveweight (kg/day)	Digestible energy (DE) (MJ)	Crude protein (g)
Weanling (4 months)	400	0.85	56.5	675
	500	0.85	60.2	720
	600	1.00	69.0	825
Weanling (6 months, moderate growth)	400	0.55	54.0	643
	500	0.65	62.8	750
	600	0.75	71.1	850
Weanling (6 months, rapid growth)	400	0.70	60.7	725
	500	0.85	72.0	860
	600	0.95	80.3	960
Yearling (12 months, moderate growth)	400	0.40	65.3	700
	500	0.50	71.9	851
	600	0.65	95.0	1023
Yearlings (12 months, rapid growth)	400	0.50	71.5	770
	500	0.65	89.1	956
	600	0.80	105.0	1127
18 months old	400	0.25	66.5	716
	500	0.35	82.8	893
	600	0.45	100.00	1077
2 years old	400	0.15	64.0	650
	500	0.20	78.7	800
	600	0.30	98.3	998
Maintenance	400		56.1	563
	500		68.6	656
	600		81.2	766
Pregnant (9 months)	400		62.3	654
	500		76.1	801
	600		90.0	947
Pregnant (10 months)	400		63.2	666
	500		77.4	815
	600		91.6	965
Pregnant (11 months)	400		67.4	708
	500		82.4	866
	600		97.5	1024
Lactating (foaling to 3 months)	400		95.8	1141
	500		118.4	1427
	600		141.0	1711
Lactating (3 months to weaning)	400		82.4	839
	500		101.7	1048
	600		120.9	1258

(NRC 1992)

Total protein requirements

In Australia, protein is generally not a limiting factor in drought rations, which supply adequate energy to meet the needs of horses. However horses with special requirements such as pregnant and young growing horses will need to have their protein requirements met.

Occasionally, protein concentrations in poor grass hay and oats are below 7%. Feeding low protein feed for a prolonged period may decrease horses appetites. This is due to the diet being unsuitable for intestinal micro-organisms, which break down feed in the hindgut. Poor micro-organism activity slows the rate of digestion and therefore feed intake of horses. In this situation, an increase in protein is required. To do this, you may have to consider the next cheapest feed or a proportion of the selected feed will have to be replaced by high quality oats, lupins or another high protein feed such as those found in your produce store.

It is clearly important to know the protein content of some feeds before they are used in the diet. This is particularly the case for grass hays and oats. The only reliable way to obtain this information is to have samples tested in a laboratory.

Adjustments to rations

During cold and windy weather conditions the energy requirements of horses increase. Horses will spend a lot of energy on maintaining body temperature, especially if there is a high wind chill factor. If cold conditions occur the ration should be increased by at least 20%. Hay is the safest feed for such a sudden increase in the ration, but it can be gradually replaced by grain if the increase has to be sustained. If grain alone is to be fed, then the frequency of feeding rather than the amount offered at each feed should be increased (dry pasture must then be available). Rugging horses or providing shelter will save energy and less feed will be required to maintain the horse's condition.

Other nutritional requirements

Roughage

At least 1% of the horses body weight is required in roughage to aid digestion. Therefore roughage should be approximately 50% of the ration. Roughage may come from pasture, crop residue, hay or chaff. If you rely on pasture to provide roughage, it will pay to buy or retain a small proportion of hay early in the drought so that you have some roughage in autumn when pasture or crop residue is scarce.

Minerals and vitamins

Generally, the two major minerals that need additional supplementation during drought are calcium and sodium. Calcium is can be deficient when diets consist mainly of cereal grain. To prevent calcium deficiency, add 2% (20 kg of limestone per tonne of grain) of finely ground agricultural limestone (calcium carbonate) to cereal grain. Do not use builders, burnt or slaked lime.

The calcium phosphorous ratio is important for horses. This ratio should be around 1:1.5. To overcome imbalances that arise from high grain rations, a feed high in calcium such as lucerne or clover should be included or alternatively add lime to balance the ration.

Sodium is deficient in most grains. Common salt can be provided at 0.5% if needed, but often water supplies have sufficient salt to alleviate the need to supplement.

Both salt and calcium can be provided in a salt lick. The percentage of each mineral can vary in salt licks. Calcium levels above 30% start to limit uptake. You can mix your own licks cheaply or buy commercial blocks. One difficulty with licks is that some horses in the herd do not partake and the intake of the others can be highly variable.

Two vitamins, A and E, can be deficient as a direct result of drought feeding. Vitamin A is stored in the liver and is obtained from green pasture, quality hay and yellow maize. Even small amounts of pasture will supply adequate quantities of Vitamin A. Young stock can experience deficiencies when they have been without green pasture, green hay or yellow maize for periods greater than six months.

An inter-relationship exists between Vitamin E and selenium. Grains and hays tend to be good sources of Vitamin E, although considerable variation does occur. If you suspect these or other vitamin deficiencies, seek veterinary advice for confirmation and dose rates instructions.

Water

Quality and quantity of water is often a major concern during a drought. Horses drink about 25 to 30 litres of water during hot weather but this can increase to 50 litres in extreme heat.

Often of greater concern during drought is the evaporation of water from dams. About 1,500 to 2,000 mm of depth is evaporated from a dam each year although this can vary with the depth and orientation of the dam. You should measure the depth of water in each dam early in the drought to make sure your supplies will last until at least next winter or preferably the one following. You may need to paddock horses together later in the drought when shallow dams dry up.

Problems can be experienced with algae and animal manure fouling the water, following heavy summer rains or strong winds

The most frequent water quality problem that occurs during drought is high levels of salt. Young horses have difficulty thriving on water supplies with higher than 5,000 ppm salt while adult stock can handle up to 6,500 ppm, especially once they get used to it. Levels above 6,500 ppm salt need to be treated with caution. You should not use water that contains more than 400 ppm magnesium salts. Other minerals (upper safe limits) are shown in Table 4.

Table 4. Safe levels for horses of elements in drinking water.

Element	Upper safe limit (ppm)
Cyanide	0.1ppm
Selenium	0.1ppm
Mercury	0.1ppm
Manganese	0.05 ppm
Cadmium	0.05 ppm
Silver	0.05 ppm
Lead	0.1 ppm
Iron	0.2 ppm
Arsenic	0.2 ppm

(Hungerford 1990)

If you feel that you may have a mineral problem it would be advisable to get your water tested.

Step 3: Understanding the nutritional value of different feeds

Feed Options

Feed values (energy and protein) of different feeds can be highly variable. Variations are due to district, variety, season and growing conditions. Table 5 shows the energy and protein ranges of common feed used in Australia. Your local district extension officer will have more information on feeds from your area. Having the feed tested by a registered laboratory is the best way of being confident about the quality of purchased or home grown feed.

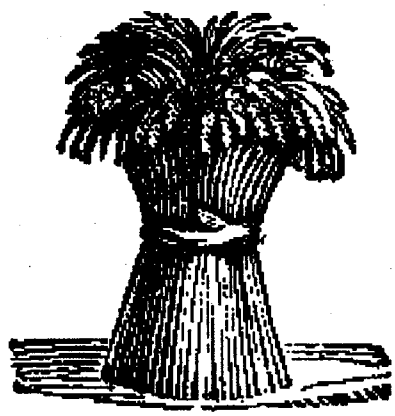


Table 5. Nutritive values of common feeds.

Feed type	Energy (MJ/kg)	MJ/kg as fed	Protein	% Crude protein
	Average	Common range	Average	Common range
Wheat	12	11.5-12.5	11	9-15
Triticale	12	11.5-12.5	11	9-15
Maize	12	11.5-12.5	11	9-15
Barley	12	11.5-12.5	10	8-14
Lupins	12	11.5-12.5	32	28-36
Peas	12	11.5-12.5	24	20-27
Oats	10	9-11	8	6-12
Horse pellets	10	9-11	12	8-20
Lucerne hay	8.5	7-9	20	16-25
Clover hay	8.5	7-9.5	18	15-20
Pasture hay	7	6-7	11	8-16
Oaten hay	7	6-8	8	5-10
Grass hay	6	5-7	8	5-10
Cereal straw	5	4-6	4	3-5
Perennial ryegrass (Summer)	9	8-10	10	7-13
Perennial ryegrass (Winter)	12	11-13	22	20-25
Phalaris (Summer)	9	8-12	10	7-13
Phalaris (Winter)	12	11-13	25	22-27
Annual pasture (Summer)	5	4-6	7	6-10
Annual pasture (Winter)	10	9-11	15	12-16

Drought may cause you to change the categories of horses on the stud. As a result, feed you normally store may be inappropriate. For example you may have purchased very high quality lucerne to feed pregnant mares. Due to drought, you may have decided not to breed this year. It therefore may be more appropriate to sell the high quality hay and replace it with pasture hay as this is all you will require to meet the needs of dry mares. Remember that feed costs rise as drought progresses, so do not be too anxious to sell off "surplus" feed, only to discover that it is needed later on.

Hay

Hay is extremely variable. There are three broad types of hay; cereal, pasture and lucerne. Cereal hay is made from grain crops such as oats. The nutritive value of cereal hay depends on the time of cutting and the proportion of grain in the hay. Late cut cereal hay with little grain closely resembles straw. Cereal hay attracts mice and is difficult to store for any length of time. Pasture hays range from 100% clover to almost 100% grass and the feed value is as variable. Generally the higher the clover the higher the protein. The species of grass in the hay is also important, for example silver grass is inferior to ryegrass.

Lucerne paddocks are often cut for hay several times and hay is sold as "first-cut" or "second-cut". First-cut lucerne hay is generally high in nutritional value if cut at the correct time. However, it can be weedy and weather damaged. Latter cuttings can have lower nutritive value, as fast growing plants produce more stem and fewer leaves.

The value of the hay will depend on the species cut, growth stage at cutting and harvesting practices. The earlier the pasture is cut the higher the quality. An ill-timed thunderstorm while the hay is drying can reduce leaf content, energy and protein by up to 15%, 34% and 25% respectively. If the hay is baled with too high a moisture content it can become mouldy which will increase the dust content of the hay, decrease protein utilisation, the hay will be less palatable and will generate heat which can eventually ignite.

Step 4: Determining how much feed a horse can consume

Horses are able to consume up to 3% of their body weight in feed per day. When formulating a ration for your horses consider the nutritional requirements of the horse and if it is possible for that horse to consume enough nutrients from their ration to fulfil their nutrient needs. For example, poor quality grass hay may not be able to satisfy a large lactating mare, as she would not physically be able to eat enough feed in a day to meet her nutritional needs. Table 6 provides a practical guide for expected intakes of different classes of horses. Knowledge of your horse's weight will help in your estimation of intake.

Table 6. Expected feed consumption of horses ((% Body Weight) Air-Dry Feed (About 90% DM)).

Class	Forage	Concentrate	Total
Mature horse			
Maintenance	1.5-2.0	0-0.5	1.5-2.0
Mare: late gestation	1.0-1.5	0.5-1.0	1.5-2.0
Mare: early lactation	1.0-2.0	1.0-2.0	2.0-3.0
Mare: late lactation	1.0-2.0	0.5-1.5	2.0-2.5
Working horse			
Light work	1.0-2.0	0.5-1.0	1.5-2.5
Moderate work	1.0-2.0	0.75-1.5	1.75-2.5
Intense work	0.75-1.5	1.0-2.0	2.0-3.0
Young horse			
Nursing foal: 3 months	0	1.0-2.0	2.5-3.5
Weanling foal: 6 months	0.5-1.0	1.5-3.0	2.0-3.5
Yearling foal: 12 months	1.0-1.5	1.0-2.0	2.0-3.0
Long yearling: 18 months	1.0-1.5	1.0-1.5	2.0-2.5
Two year old: 24 months	1.0-1.5	1.0-1.5	1.75-2.5

(NRC 1989)

An example of calculating intake

How much feed can a horse weighing 500 kg consume in a day?

Generally, most horses can consume around 2.5% of their body weight in feed a day, or 2.5 kg per 100 kg of the horse's weight. In this example the horse weighs 500 kg and can therefore consume up to 12.5 kg of 90% dry feed per day.

$$\frac{2.5 \text{ kg} \times 500 \text{ kg}}{100 \text{ kg}} = 12.5 \text{ kg}$$

Once you know how much your horse can consume each day, you can calculate wether or not specific feeds can be consumed in sufficient quantities to meet the nutritional requirements of your horse.

Step 5: Calculating the total nutrient requirements and feed costs during a drought

To determine a suitable ration for your horse you need to match their nutritional requirements with the nutrients supplied in feed taking into account the amount of feed horses can physically consume in one day. Remember that with drought feeding the first priority is normally energy.

In some cases you will have feed on-hand and you will want to use this as a basis for ration development, in other situations you may need to purchase feed. Understanding the nutrient requirements of your horses and the nutrients offered by different feeds will enable you to make sound decisions on allocating and purchasing feed.

An example of calculating a feed ration for one horse

What is ration will meet the nutritional needs of a 500 kg idle horse?

1. Look up Table 4 for horses nutrient requirements	= 68.6 MJ
2. Look up Table 5 for energy contents of feedstuffs	= Grass hay 6 MJ/kg
	= Oats 10 MJ/kg
3. Calculate horse intake (see previous example)	= 12.5 kg per day
4. Match horse energy needs to energy supplied by feed	= A Grass hay 11.4 kg/day or
	= B Oats 6.8 kg/day or
	= C Grass hay 5.7 + Oats 3.4 kg/day
5. Can the horse consume enough feed	= A Yes, B Yes, C Yes
6. Most suitable ration to feed	= C (50% grain 50% roughage)

It is relatively easy to calculate a full supplementary ration for a particular class and weight of horses. It is more difficult to calculate a ration to feed when horses have access to pasture. When this is the situation the simple answer is to start with approximately one third to a half of a full supplementary ration. The starting proportion will depend on what fodder is being fed, the condition of the horses, the aims of feeding and how much pasture is available. Monitor the horses for gain or loss of condition and alter the ration appropriately.

Calculating a feed budget for a drought

Once you have calculated the individual ration for a horse, you will need to apply the same procedure for the whole stud. This consists of all horses that you have on the stud, their individual nutrient demands and how long you believe the drought will last. It is best to over estimate the length of the drought.

For example: RIRDC Ranch currently has seven, 500 kg horses on maintenance rations, 2 yearlings that will mature to 500 kg and a 6 month old weanling. All mares are dry. All available pasture is negligible. Supplementary feeding will be the horse's sole source of feed.

No of horses	Type of horse	Individual needs (MJ/Day)	Time of expected drought (Days)	Total nutrients required (MJ)
7	Maintenance (500 kg)	68.6	200	96,040 MJ
2	Yearlings (500 kg)	71.9	200	28,760 MJ
1	Weanling (500kg)	62.8	200	12,560 MJ
TOTAL				137,360 MJ

From this example you can see that for a period of 200 days RIRDC Ranch will need a total of 137,360 MJ of energy to sustain their horses for the period of drought. If you refer back to Table 5 (nutrient values for drought feeds), you will see average energy values for different feeds; oats has an energy value of 10 MJ/kg (1 tonne would supply 10,000 MJ of energy), lucerne hay has an energy value of 8.5 MJ/kg (1 tonne would supply 8,500 MJ of energy) and grass hay has an energy value of 6 MJ/kg (1 tonne would supply 6,000 MJ of energy).

Remembering that maintenance horses can survive with mainly grass hay, a majority of your feed plan would consist of hay (grass and lucerne for growing horses) and oats. Your feed budget may be as follows: 15 tonnes of grass hay at 6000 MJ/t, 3 tonnes of lucerne hay at 8500 MJ/t and 3 tonnes of oats at 10000 MJ/t. This feed supply would provide about 139,500 MJ of energy and therefore met the RIRDC Ranch's energy needs for a 200 day drought. Drought feeds can vary, a feed analysis to determine the correct values would be advisable. This budget is only a guide to allow you to have the knowledge and information to design rations for your horses.

Calculating the cheapest source of energy

The amount of energy different feeds supply will vary as does the price. Most feed is sold by weight not energy. To ensure you get the best value you should compare feeds on the cost of energy.

Example: Calculating the cost of energy for different feeds

If you can buy triticale for $210/t at (12 MJ/kg), you are paying a unit energy cost of 1.8 cents/MJ.

$$\frac{\text{\$210 per tonne}}{\text{1000 kg x 12 MJ /t}} = \text{1.8 cents/MJ}$$

This would be the same value as oats costing $180/t at (10 MJ/kg), or lucerne hay at $150 at (8.5 MJ/kg). If oats or lucerne hay were selling for less than these prices, they would be better value on an energy basis.

Therefore for the total feeding cost for RIRDC Ranch for oats and grass hay would be:

Oats at $180 per tonne = 137,360 MJ x 1.8 cents per MJ= $2,472.50

Grass hay at $100 per tonne = 137,360 MJ x 1.6 cents per MJ= $2,197.00

In this example grass hay will be more economical (provided it is a suitable) than oats.

The cost of feeding horses is not just the feed purchase price. Freight costs, extra storage and handling costs, and the likely amount of wastage have all to be taken into account when calculating the relative costs of feed on your farm.

Step 6: Management aspects

Buying and storing feed

The introduction of weeds can be a problem with buying in feed and samples should be inspected carefully for weed seeds. It is not always possible to detect a potential problem or even to refuse a feed on these grounds during times of drought. One way to minimise a potential weed problem is to restrict feeding out of any suspect fodder to a limited number of paddocks.

During times of drought, grain prices tend not to rise significantly as compare to roughage. It is therefore advisable to store good quality roughage as this can save you a large amount of money and stress trying to find quality roughage for your horses when demand will be at its greatest. When storing feed it is always best to minimise wastage such as making storage areas vermin proof and store feed out of the weather. Grain can easily be stored in silos and this ensures grain is protected from vermin and the weather. Fodder is harder to protect from the elements and should be stored elevated from the ground and undercover. If this is not possible tarpaulins should be used to protect the fodder. There is likely to be some loss in fodder and this must be calculated into your feed budget.

Chapter 3

MANAGING HORSES DURING DROUGHT

When to start feeding

The commencement and cessation of feeding, the level of supplementation and the introduction strategy are all-important components in feeding during drought. Feeding too early or too long can waste feed while commencing too late or stopping too soon can result in increased costs in feeding to gain weight, illness or even death. Often the greatest problems occur after the drought has broken, especially if the weather turns cold.

It pays to remember that unlike fire or flood when horses may have to suddenly rely on hand feeding alone, the onset of a drought is usually gradual. Drought conditions rarely deteriorate to the stage where no grazing is available and horses have to rely solely on hand feeding.

Experience from previous droughts indicates that more paddock feed is available than would first appear. Horses can scavenge quite a bit of feed from sparse dry pasture. The presence of paddock feed early in a drought makes it easier to get horses accustomed to drought rations before they have to be fed close to full rations.

The presence of paddock feed can have its down sides, with the gradual onset of drought owners can miss a gradual loss in condition. These horses are frequently disadvantaged right through the drought.

Feeding should be started well before the horse drops condition. It may take some time before they become accustomed to hand-feeding and begin eating their entire ration. If horses have lost too much condition before feeding has begun or before they readily accept grain, it may be hard to raise their liveweight back to desirable levels. This is particularly applicable to weanlings that were not fed supplements when grazing with their mothers.

Table 7 provides target condition scores. Horses that are in excess of these condition scores can be allowed to lose some weight and condition at the start of a drought. This weight loss should be controlled. A drop in weight and condition over a number of weeks to the condition score target, will save feed. Horses can safely lose up to 5 kg on average a week for this period of weight loss. The period of controlled weight loss can coincide with the feeding of introductory rations.

Table 7. Suitable condition scores for horses during drought.

Category	Condition score
Maintenance	2
Weanling	2/3
Yearling	2
Pregnant mare	2/3
Lactating mare	2/3

Introducing horses to hand-feeding

Horses have to be introduced to hand-feeding gradually as a sudden change in diet can cause colic or founder. If possible, educating horses onto feed should be started while there is still reasonable paddock feed.

Train horses that have not been fed before by including previously fed horses in the herd to encourage the inexperienced horses to feed. Untrained horses are best educated in small paddocks. Whilst this may sound unfamiliar to most recreational horse owners, station horses or young horses on large studs may never have been supplementary fed before.

A new ration should be started at the rate of up to 2 kg per head per day for adult horses (1 kg for weanlings) and increased slowly to the full ration over a two-week period. Once the equivalent daily rate is reached the introduction period can stop.

If you witness some 'shy feeders' amongst your group. You should move them into another paddock so that they can obtain the same ration as the rest.

Monitoring

The management of horses during drought depends on knowing how the animals are faring. The best way to know how horses are going is to weigh them. In most cases this will be virtually impossible. The easiest way to monitor is to condition score using the scale as mentioned previously. Monitoring condition can prevent unnecessary feeding and ensure horses do not fall below a condition score of 1 before being fed as well as identify which horses are not getting enough to eat.

Breaking routine or changing feed

If a break in the normal feeding routine occurs through delay in the availability of supplies, do not resume feeding the full ration when supplies become available. Begin feeding again daily, on about half-rations, and build up to the full ration over a few days before returning to the normal routine.

In drought changes in feed are likely due to shortages and prices and this requires careful management. It is especially important to avoid sudden changes in the ration. Horses, which have become accustomed to one type of grain, cannot immediately adjust to another. Deaths can result from a sudden switch of feed. Even the same grain type obtained from a different source has caused problems. It is desirable to estimate early in the program how long supplies will last. This will allow time for planning of a gradual changeover from one feed to another. If it is necessary to use a different grain arrange the supplies early and mix the old grain with the new, gradually increasing the concentration over at least four days.

Deciding when to stop feeding

Using a rule of thumb based on condition score, stops feeding when stock remain at a condition score of 2 after the drought breaks. Feeding should be reduced gradually.

In previous droughts many studs have experienced their greatest problems/ losses during the period immediately following the drought-breaking rains. Prolonged periods of rain can induce horses to loose appetite and can cause health problems mentioned later in this manual. The emergence of new pasture growth can cause colic in horses.

Often people think the drought is over when the rain arrives, however it can take some time for pastures to recover. This time varies greatly depending upon the time the drought ends, and the severity of the drought. A very general indication for the time taken for pasture to recover would be about 2 months.

In most circumstances, horses should be kept confined to restricted feeding areas until adequate pasture is available. Allow increasing grazing time each day until full grazing is provided after 6 to 7 days. Allowing immediate full grazing will lead to digestive disorders.

Chapter 4

FEEDING IN HORSE CONTAINMENT AREAS

During a drought the risk increases of losing valuable soil as ground cover is reduced. If grass cover is reduced below 500 kg of dry matter per hectare or 1- 2cm, wind may start to blow soil particles away causing erosion and loss of valuable nutrients and topsoil. Bare areas will also be more prone to erosion and weed infestation once the break finally occurs.

Another potential loss is newly improved pastures, which may be vulnerable to overgrazing. Pastures that you have invested money and time in establishing can be lost if continuously overgrazed and should be among the first paddocks to be considered for de-stocking. Perennial based pastures should be de-stocked before annual based pastures

Feeding horses in containment areas provide an opportunity to take the pressure off susceptible parts of the farm/stud. Containment areas are yarded sections where horses are lot fed. For the horse industry lot feeding would consist of horses in smaller paddocks or in many cases 'day yards" with very limited access to pasture. This may already be normal practice for some small horse owners due to limited land availability. The main reasons for considering feeding horses in containment areas are:

- To protect areas vulnerable to erosion
- To protect vegetative cover of pastures
- Where weeds in bought feed are of concern
- Where stock are losing weight on full drought rations in paddocks
- To facilitate stock feeding, watering, monitoring and handling

Site

Location of the site is important and it should be set up as a permanent structure, like horse yards or a manage would be ideal. The site should have:

- A moderate slope and a well drained, stable soil such as a clay or clay loam
- Ready access to the house
- No important remnant vegetation
- Shade, shelter and good drainage
- Access to good quality water
- Minimal problems with noise and smell which will not cause concern to you or your neighbours
- Alternative areas for various categories of horses (stallions, lactating mares)

The stock containment area should be setback from watercourses and water storage's by 500 meters, to reduce the impact of nutrient run off if no other control methods are used.

Structure

Yards or smaller paddocks suitable for feeding are generally already present on most horse studs. Once a paddock is selected it will virtually be sacrificed with regards to its pasture. After the drought has broken, this area will certainly have to be renovated.

If there is no such structure on your property an area of 30 m by 60 m should suffice for 2- 4 horses. If possible a larger area should be used to allow horses to exercise. If this can not be provided ensure that the horses obtain some sort of exercise program.

Shade and shelter should be provided so the horses can escape from the elements. If there are trees in the area you propose to use protect these with guards as they will otherwise be ringbarked.

Water and feed supply

A good reliable water supply is extremely important in stock containment areas. Generally horses will be fed diets very low in water content and therefore must be supplied with water at all times. Allow enough trough space so that several horses can drink at any one time. Troughs need to be checked daily and cleaned regularly. For more detailed information on water refer to previous sections in this manual.

If possible allow one fed bin per horse. This is so 'shy feeders' don't miss out. For hay and roughage hay-feeders are great to use as they provide an area of containment and minimise wastage. Developing feed rations for horses in containment areas follows the same process as described earlier in the manual

Management

Mature horses are generally the easiest to manage. Common sense should prevail when assigning horses to containment areas. Stallions should have their own areas, young colts may be put together and if possible separate mares and geldings but this is not essential. If you find certain horses causing a disturbance within the group, it is easiest to remove the particular animals before an injury occurs.

Horses will spend a lot of energy trying to stay warm during cold periods. The best advice would be to rug your horses. This will save the amount of energy they use to stay warm and horses can utilise this energy to maintain or gain weight. This is particularly valuable with horses in containment areas, which will not have to room to exercise.

Containment areas will quickly develop into dusty or muddy areas. This is a major health concern. Common problems that could arise are mud fever and if dusty it would be advisable to check for cases of Rattles *(Streptococcus eqi.)* in young foals. This is a soil born bacteria and is more prevalent in areas of high stocking. To minimise the effects of dust water sprinklers can be used.

When health problems occur in containment areas effected horses should be quarantined as to avoid the spread of disease within the group.

Manure management and parasite controls are important when horses are contained. A regular parasite control program is required (referred to in the horse health section of this manual) and manure should be removed as frequently as possible.

Releasing horses back to pasture

When the drought breaks a change in feed can be quite sudden and may cause digestive problems. Therefore when you are considering releasing your horses from the containment area do it when your horse has a full stomach and continue to feed hay for a few days. Lactating mares may need the full ration for a few weeks. Calcium may also be limiting for mares released onto green pasture, so continue the limestone and salt mix.

General

The responses of studs who "lot fed" in previous droughts was that it was a very worthwhile exercise and is now part of their future drought management strategies. Managing a horse containment area involves a transition from a broad area manger to an intensive manager where you are in control. All the feed and water is supplied by you and sick horses ca not go off by themselves and sit in the shade. It therefore requires constant vigilance and good management. It also means you can have better control over weight loss and gain and come out of a drought with valuable land assets, horse numbers and their condition intact.

Chapter 5

PASTURE MANAGEMENT

Effects of drought on pasture

The effect of drought on pastures will depend on the management and grazing pressure, which the pasture has been subjected to relative to the rainfall received during the drought. Experience gained during previous droughts and the experience of pasture specialists throughout the country suggests that there are significant differences between species and their ability to withstand the combined effects of heavy grazing pressure and reduced rainfall.

Sub. clover

Paddocks with a history of high sub. clover content should have sufficient residual hard seed in the soil to produce a good sward after drought. Sub. clover regeneration in newly sown pastures is likely to be poor after a drought, particularly if seed set in spring has been effected. Overgrazing with sheep, during summer and autumn can result in a significant decline in seed reserves resulting in lower plant densities in the following pasture. Bare soil conditions and an early autumn breaks favour the germination of sub. clover, however if the drought breaks in winter sub. clover will produce little feed until early spring. It is not uncommon for sub. clover to return to a similar or greater percentage of the sward than prior to the drought.

Annual grasses

Often in drought annual grasses will have a reduced seed set. Low seed set, combined with heavy grazing, is likely to result in poor regeneration in autumn. In some cases such as paddocks dominated by silver grass and barley grass, this is a positive effect of drought. However with annual pastures that are based on annual ryegrass, a reduction in seed set could result in less available pasture the following winter and spring after the drought. Reduced surface ground cover in autumn can be unfavourable for the re-establishment of annual grasses. In most cases fewer annual grasses are found in pasture in the year after a drought than existed before or during the drought.

Annual weedy species

The annual weedy species that occur after drought will be dependent upon your location and previous management of the paddock. Common weeds that follow drought include capeweed, erodium, dock and thistles. These species are also the species likely to be introduced in feed that is brought onto the property during drought. The free standing broad leaved weeds tend to grow bigger with less competition. After a drought these species can dominate a pasture unless controlled. If horses are forced to graze pasture containing high quantities of weeds like capeweed there is a possibility of them being affected by nitrate poisoning or stringhalt. Like sub. clover, these species are favoured by bare ground at germination and reduced competition from other species. They also cope better with "false breaks" than other species and hence often recover from drought better than species like sub. clover. Winter grass and sorrel can increase in high rainfall districts.

Perennial species

Most perennial species are likely to suffer considerable reductions in plant numbers during a drought. This effect will be more severe the longer the drought continues. Perennial ryegrass is the least tolerant of drought, followed by cocksfoot/tall fescue and phalaris. Phalaris becomes dormant over summer and therefore normally has the greatest capacity of the perennial grasses for drought tolerance. The varieties of phalaris Australian and Holdfast are thought to persist drought better than the varieties Sirolan or Sirosa. Cocksfoot can persist through drought if grazing is significantly reduced. Paspalum is relatively drought tolerant and will increase dominance in under irrigated pastures. Paspalum has found to cause eye irritation in horses.

Lucerne has a large taproot and can survive drought provided it is given regular spells from grazing to allow it to recover. White clover survival is likely to be severely affected, particularly in marginal areas (which include irrigated areas where watering has been stopped). Critical for white clover survival is the maintenance of stolon (runner) density; therefore paddocks containing white clover should receive very lax grazing over drought periods.

Pasture management during drought

Droughts are a regular part of agriculture in Australia, however it is not always possible to adjust pasture management quickly and appropriately to unusually dry seasons. Attention to the needs of pastures as well as horses will provide the best chance of a safe and rapid recovery. Quick pasture recovery will reduce feed costs and good pasture management during drought will also minimise the need and costs of weed control and pasture re-sowing.

As plant growth during drought will be very limited to non-existent, plant survival is the main objective. Maintaining plant density will ensure rapid pasture growth and good weed competition on the return of favourable conditions. The maintenance of soil cover to minimise soil erosion is also important.

Moving to a rotational grazing system is good practice in the first stages of a drought. Rotational grazing (movement of horses into new paddocks based on time and/or pasture availability) allows you to see more clearly the amount of feed you have in front of you and you are better able to ration the diet of horses. Rotational grazing may necessitate amalgamating horses into larger groups were appropriate and perhaps temporary sub-division of paddocks.

If the dry conditions prevail it may be necessary to de-stock paddocks. The order of priority for de-stocking paddocks should be; (1) newly sown perennial pastures, (2) older perennial pastures (perennial ryegrass, followed by tall fescue/cocksfoot and then phalaris), (3) improved annual pastures and finally (4) unimproved annual pastures. Soil conditions and the likelihood of erosion should also be considered in de-stocking decisions. Your ability to de-stock paddocks will also be influenced by water supply and horse husbandry. Associated with de-stocking are small "sacrificial" paddocks or yards (previously discussed in the manual). From a pasture protection perspective feeding horses in yards is a sound practice in drought.

Estimating pasture survival

It is an advantage to determine how far pasture has deteriorated and what recovery might be expected when rain falls so that early action can be taken. Examination of paddocks may give an indication of the amount of seed left and the density of living (versus dead) perennial plants.

A simple procedure to confirm these observations is to water with a watering can a square meter in several places in the paddock and see what grows. In previous droughts the results of this procedure has shown a close relationship to what subsequently germinates. If horses are in the paddock it may be necessary to put a small fence around the watered area. To avoid runoff, build a bank about 10 cm high around the are to be watered. Apply the water in March if the autumn break has not occurred. Do not water in the summer months because the normal summer dormancy of seed and plants may not have broken. Sub. clover plant densities should be greater than 100 plants/m^2, where as species such as phalaris should have at least 15 live plants/m^2. You will also be able to predict weed populations and plan appropriate control strategies.

Management after drought

Pasture management

After the drought breaks you will be tempted to quickly return to normal grazing practices. However it is advisable to delay the grazing of paddocks for both pasture recovery and horse health.

The extent to which pasture recovers from drought depends largely on when the drought breaking rains are received. If the drought breaks in autumn break, the pasture should recover quickly provided there are adequate numbers of viable seed or perennial plants. Sufficient follow-up rain is needed to keep pasture growing. A delayed in the break, or lower than usual rainfall in autumn, will progressively limit the recovery rate of your pasture. The effect of drought on irrigated pastures will depend on the availability and frequency of watering.

After the drought breaks there will be very little paddock feed remaining; horses will graze every bit of new green pasture as it appears. Heavy grazing at this time can greatly reduce subsequent pasture production. Perennial ryegrass and cocksfoot are also susceptible to being pull out of the ground during this period. If possible delay grazing the majority of your pastures until they are 8 cm in height (around 1750 kg DM/ha) as this will optimise pasture growth. Given a "normal" autumn break this should take about 6 to 8 weeks. A late autumn or early winter break will reduce feed supply for a longer period and would result in feed shortages throughout winter.

The amounts and types of nutrients that are required for pasture growth in the post drought period should not be any different from a normal season. There may be a larger than usual residual effect of fertiliser that was applied before the start of the drought because of reduced leaching of nutrients in the dry conditions. The granules that can sometimes still be seen on the ground during a drought from top dressing are calcium sulphate (gypsum) and are unlikely to contain any phosphorous. In circumstances of reduced stock numbers and tight finances it is quite feasible for farmers/managers to defer, reduce or even omit fertilisers for the year. However, the strategic use of fertilisers, including nitrogen fertilisers, can be used as a way of increasing the rate of pasture recovery. Control of insect pests, during this early

period is most desirable as they can consume large amounts of pasture. Insects most likely to cause damage are lucerne fleas and red legged earth mites.

Horses management

Regardless of the grazing management policy adopted, it is prudent to introduce horses gradually to green pasture. After a prolonged period on dry feed, horses will likely experience severe digestive upsets (colic) associated with a complete and sudden change of diet. This warning applies particularly where the pasture contains perennial ryegrass, as there could be an increase in the incidence of ryegrass staggers, if any perennial ryegrass has survived the drought. There may also be health problems if the pasture is infested with particular weeds (eg stringhalt on capeweed or flatweed infested pastures). It would be wise to graze weed infested areas with a small number of cattle or sheep before introducing your horses to the pasture.

Opportunity to improve pastures

Pasture productivity may not necessarily fall drastically after a drought, even though some species will have declined. A "wait and see policy" is often advisable for up to two years as this will give sufficient time to gauge the actual effects of drought and allow some species (eg perennial ryegrasses) to thicken in the post drought year. In some cases the impact of drought will severe enough to warrant immediate pasture renovation or in others you may not wish to wait and take up the opportunity to improve pasture.

There are various techniques for improving pasture, these include weed control, adding new seed into existing swards (sod seeding) and re-sowing.

As previously indicated, weeds may form a substantial proportion of a post-drought pasture. Any decision to control them should be carefully considered, because they can make a contribution to the feed pool in the drought recovery period, provided they are edible and not harmful to horses. However, there is an opportunity to control weeds, and there may be long-term benefits for the pasture in doing so. Combinations of cultivation, grazing and spraying methods could be considered.

The spraygraze technique, where applicable, is often most effective in controlling some broad-leaf weeds with little pasture damage or reduction in feed supply. Spraygrazing involves the application of low rates of a phenoxy herbicide (MCPA or 2,4D-amine) followed by grazing (preferably not by horses) to reduce broadleaf weeds in winter.

Steps to spray grazing:

* Graze the paddock in late winter and early spring to encourage even seedhead emergence
* Remove stock 2-3 weeks prior to flowering to allow for even regrowth
* Apply recommended herbicide at the recommended rate to pastures from early head emergence to flowering. Timing will depend on target grasses. Some will seed early such as barley grass and silver grass and others will seed later such as annual ryegrass
* Observe herbicide withholding periods and then resume grazing
* Grazing is important to gain maximum benefits

In some situations you may need only to control weeds in isolated areas on your property. Target areas would be where horses have been fed during the drought period or containment and sacrifice areas.

If the pasture has significantly deteriorated re-sowing may be necessary. A good indicator for re-sowing a perennial pasture is if the perennial grass makes up less than 15% of the pasture. With annual pasture if there is greater than 50% weed and less than 10% sub. clover you should also consider pasture renovation.

Pasture re-sowing is expensive and should be used when the pasture is unlikely to improve through other techniques. The bare ground situation, reduced sward density and lowered stock numbers (in some grazing areas) can provide an ideal opportunity for you to sow improved pasture species or to thicken up a sward where plant numbers have been reduced by drought. Minimal seedbed preparation should be needed and even sod seeding can be successful. Weed control is important, even when sowing into what appears to be bare ground. It is advisable to wait up to six weeks after the autumn break for any surviving weed seeds to germinate then to control them by cultivation or a herbicide before sowing the new pasture.

Techniques for sowing include, cultivation, direct drilling, aerial seeding, undersowing, over sowing, sod seeding and broadcasting. Cultivation and direct drilling are the most effective technique for establishing pasture (Table 8).

There are also a number of disincentives to re-sowing pastures after a drought.

- Finance for re-sowing pastures (or any other purpose) is likely to be limited as a result of extra supplementary feeding expenses during a drought
- With reduced stocking rates, in some grazing areas there will be no urgency to increase pasture productivity immediately
- Availability of locally produced pasture seed may be limited. However, there should be adequate seed available from other states or overseas. The price of seed is likely to rise and supply/demand generally will keep prices higher for some time after the drought.

Table 8. Pasture sowing techniques.

Technique	Success rating	Comments
Direct drilling	*****	Pasture is sown without cultivation Weeds controlled using chemicals prior to sowing Reduced soil disturbance can decrease weed germination
Cultivation	****	Pasture seed is sown into a prepared level seedbed Soil is cultivated before sowing
Oversowing	* Not recommended	Seed is drilled/broadcast in without disturbing existing pasture Phalaris will not compete with established pasture
Undersowing	**	**Pasture is sown under a crop** **Use winter active cultivars** Alternate row most successful Phalaris may not compete well with establishing crop
Aerial	***	Pasture seed is spread by air onto steep inaccessible country Weed control with a knockdown herbicide is necessary

* Not recommended, **** Good success, ** Limited success, ***** Recommended technique

Note: Seed can be broadcast however, it is not recommended for phalaris pastures

Fodder crops

Fodders crops can be sown on badly eroded annual grass paddocks where pasture seed reserves have blown away. In some circumstances, it is useful to grow a fodder crop to boost feed supplies after the drought, but in most cases there is no need to do so particularly if there is a good early break, or if water is available to irrigate the pasture.

If you have the land available, a crop of barley, oats, short-lived ryegrass, clovers, or mixtures of these are suitable for fodder crops. Oats have the advantage of being able to be sown dry before the break and will often provide more winter-feed than pasture.

Areas best suited for fodder crops are those damaged by drought to the extent that the pasture can not supply sufficient feed to meet the horse's requirements. Cultivation in preparation for a fodder crop will help control weeds prior to re-sowing pasture. If feed is needed urgently following the drought, re-sowing permanent pastures can be deferred and a dense fodder crop sown.

MANAGEMENT OF HORSE HEALTH

Horse health

Past experience indicates that if horses remain in good condition during a drought then they will experience very little disease; - in fact less than in a normal season. However, if horses are stressed, diseases are much more likely to occur.

Regardless of the care you take, there are a number of conditions that may occur in drought-feeding situations, especially when horses are congregated onto small areas for feeding The type of disease likely to occur will change as the drought progresses. You should contact your animal health adviser or veterinarian about recommendations for prevention and control if you have any concerns.

If you witness your horse showing symptoms of ill health of injury, remove it and quarantine it from the herd, to protect itself from further injury or to protect the rest of your horses from infection.

Several horse health disorders are mentioned briefly, if you are in doubt contact your veterinarian immediately for advice and consultation.

Botulism

Botulism is mainly found in mouldy foodstuffs. If you are entering a drought it would be wise to plan ahead and buy or store some quality feed. Botulism is caused by the bacteria *Clostridium botulinum.* Cases have been noted in every state in Australia. A delay usually occurs between the consumption of the toxin to the first signs of symptoms of no less than 5 days. Symptoms include paralysis of the mouth, tongue and throat muscles. Horses will not be able to eat or drink and could die from dehydration. Staggers will also occur and once the horse is down it may make running or paddling motions and rotate around in circles. The horse will often die 12 – 48 hours later.

It is extremely important that if you experience these symptoms to immediately stop the feed that you are using as it may be the cause and contact your veterinarian immediately. If botulism is detected vaccinate all other horses on your premises. Treatment for botulism is usually futile but if paralysis has not set in there is an antitoxin if available which has a 30-40% success rate.

Colic

Colic is generally termed as any abdominal pain experienced in a horse. The term colic can apply to literally dozens of disorders, also many other diseases cause abdominal pain. Some are only mild and temporary whilst others can be very serious and may result in death if not treated rapidly. It is vital for you to recognise colic or any disturbances early and veterinary advice is received as soon as possible. Incidences of colic may increase as a prolonged dry period continues, because of changes in feeding, due to when feed becomes scarce, the reduced amount of vegetation resulting in a lot of bare ground and when the break arrives colic's such as sanding may occur.

Symptoms: Whatever the type or cause of the colic the symptoms are generally similar, especially in its initial stages. The horse will become very restless it will paw at the ground, stamp and kicks at its belly, frequently laying down only to rise almost immediately. In some

cases the first sign of colic may be failure to eat, lethargy, depression and sweating with the pain. A horse with abdominal pain will look or bite at its flanks, roll, and may lie down on its back in order to try and escape the pain. It may lay down carefully, 'slumping' at the last bit, and will be very slow to rise. It may also assume unusual postures such as sitting like a dog or stretch out its hind legs like a 'rocking horse'.

The heart rate may increase with severity of the colic. If a horse is over 62 beats per minute, a veterinarian will usually operate on the horse as it usually suggests a serious type of colic. In acute cases the mucous membranes of the gums become dark and congested. There is usually an absence of droppings however in some instances there may be an increase in manure.

The pain and associated signs of colic is often intermittent, especially in the early stages. These bouts of pain may last for up to 10 minutes or more. In the most severe cases the pain is continuous, and signs of shock may appear in addition to profuse sweating, laboured breathing and violent uncontrolled movements which can cause the horse severe injury.

Causes of colic: As mentioned previously there are literally dozens of variations of colic. Some of the causes of colic are:

- **Faulty intake of food, water and other materials:** Grain engorgement, coarse or poor roughage, lush green feed, sand, cold water, chemical poisons, mouldy products, unsuitable foodstuffs or poisonous plants.
- **Animal faults of function or of health:** Bad teeth, intestinal accidents such as volvulus, strangulation and intussusception, exhaustion and debility (nervous indigestion, spasmodic colic)
- **Environmental causes:** Thunderstorms, excitement and autonomic nervous system colic (scouring).
- **Parasitic causes:** Verminous mesenteric arteritis and parasitic infestations of the gut.
- **Microbial causes:** Bacterial, fungal infection, viral infection and peritonitis

Treatment of colic: Treatments used by veterinarians may vary markedly depending on the type of colic. Treatment used may use drugs and or mineral oil drenches to surgery in severe cases of blockage and intestinal disorders. If a horse requires surgery the sooner you get your horse to a surgery the better chance it will have of survival.

Prevention of colic: Poor worm control is the most common cause of colic. During drought horses can be grouped together and reinfestation may occur. Regular parasitic treatment and a program to reduce worm intake will minimise the problem. Your veterinarian can advise you on an worm control program. In a period of drought, many of your horses will be in a small containment area, if you worm one, worm all your horses. Also, if horses are in a containment area, remove manure as quickly as possible, (every 2 days).

Care of your horses teeth to prevent them from becoming too sharp or worn will ensure that they can properly chew dry feed; this will reduce the likelihood of large masses of roughage building up in the intestinal tract.

Ensure that there are no foreign objects in the horses feed. Avoid giving horses a large feed or drink immediately after strenuous exercise as this could bring on a mild case of spasmodic colic. Change feed gradually over 7– 14 days and do not let your horse gorge on grain. This is extremely relevant in a time of drought. If you have to change your horses diet, do it slowly and ensure your horse is getting enough quality roughage.

When the break in the drought occurs and there is likely to be a lot of new 'green pasture' and your horses may be at risk from sand colic. This is because horses are grazing low to the ground and the young plants root system is not developed so the roots as well as some dirt is consumed by the horse.

Chronic copper poisoning

This is caused by long-term excessive intake of copper in the diet, which may be caused by grazing Paterson's Curse or Heliotrope. Liver damage can be associated with copper build up. The disease is brought on by some form of stress (for example, nutritional or lactation stress).

Founder (laminitis)

The risks of founder will greatly increase when supplementary feeding has to take place. This is very common in ponies as they require a lot less nutrient for maintenance than large horses. This problem is usually evident in autumn and spring with the flush of pasture growth occurs. In a period of drought, the break will be time when you will have to watch your horse carefully.

Signs of a horse with laminitis are a reluctance to move and stiffness in movement. It will also have warm to hot feet. Laminitis is a serious condition and medical treatment should be sort immediately. Again the earlier you treat the animal the greater the chance of recovery. In severe cases, the pedal bone or coffin bone rotates or pushes through the sole, resulting in the horse having to be destroyed or its movement and future condition will be seriously impaired.

Photosensitization

This is caused by sensitisation of un-pigmented skin to sunlight after consuming plants such as clover, medic, St John's Wort and other plants mentioned in poisonous plants section of this manual. Chronic liver disease can also lead to photosensitization.

White skin areas are affected, especially the muzzle, back and legs. The effected skin exudes serum, latter cracking to leave raw bleeding areas. The areas are often covered by scabs and can be confused with rain scald/ mud fever or greasy heel. Treat your horse by confining your horse to a dry stable and apply an antibiotic/ corticosteroid cream to the effected areas.

Pneumonia

Pneumonia is caused by bacterial infections aggravated by dry dusty conditions. It is more common with foals being fed on dry, dusty feeds in troughs, especially finely hammer milled hay. Symptoms are nasal discharge, coughing, illthrift and sudden death. To lower the risk of this condition, avoid feeding dry and dusty feeds. This may require some damping down of the feed in troughs.

Rain scald, mud fever, greasy heel

Rain scald is a skin infection caused by bacteria *Dermatophilus congolensis*. The disease is characterised by matting of the hair with a formation of a scab under the hair mat, commonly along the midline of the neck and back, the face, muzzle, legs and either side of the rib cage.

After the scab falls off the skin underneath is moist and grey to pink in colour. This condition is also called greasy heel and mud fever.

Large areas of skin may be affected. The skin infection usually occurs in prolonged wet conditions. These conditions will be evident at the end of the drought as there is no grass to hold the soil together and mud will prevail. The distribution of scabs follows the pattern of wetting from rainwater, pasture and mud. Rain scald spreads rapidly between horses. In appearances it can resemble sunburn, photosensitization or ring worm.

Mud fever occurs behind the pastern, when horses are standing or walking in wet grass or mud. It is more common for horses with white legs. The mud can cause cracking of the skin, which can be painful. In most cases the disease is self-limiting and will regress after 3-4 weeks. Any horse that is severely affected should be moved out of the rain and onto dry land or into a dry stable. The affected area can be bathed in an iodine solution and injectable antibiotics.

Respiratory infections

An increase of the amount of dust occurring in small containment area such as yards will result in an increase in dust related respiratory diseases. Once again if you witness a condition in one of your horses, quarantine it and seek advice. A way of minimising the risk of dust is to water the yards regularly. A point to watch is rattles. This effects foals and is a result of a soil borne bacteria. Dusty yards are a great breeding environment to spread this disease. If you have had cases of this disease before, the onset of drought may increase the chance of incidence of this disease. Be extremely watchful for any symptoms in your foals.

Ryegrass staggers

Horse owners should note that when the break occurs there is a lot of new pasture growth. A great majority of the new growth could be perennial ryegrass, if it survived the drought. Ryegrass staggers can occur under these conditions. The fungus, *endophyte* emits a toxin called *lolitrems* which is the cause of ryegrass staggers. Symptoms include a loss of coordination, standing out stretched, convulsions and in extreme cases, death. During drought conditions immediately after the break, juvenile perennial ryegrass will be prevalent. Horses will immediately graze the grass close to the ground. Endophytes exist in the stem of the grass, so grazing low will increase the chances of infection.

If horses are showing symptoms of staggers, remove them from the pasture immediately and seek veterinary advice. The best prevention is when renovating pasture is to ensure an endophyte low or free perennial ryegrasses are sown.

Salmonellosis

Faecal contamination of feed and water supplied with Salmonella organisms can cause an outbreak in stressed horses. It is more likely to be a problem when the area becomes wet or muddy following heavy rain or from overflowing water troughs. Symptoms are fever, scouring and sudden death. Treatment requires antibiotic treatment and advice should be sought from your veterinarian. Reduce the risk by feeding in clean bins.

Worm infestations and control

There are over 60 types of worms that exist that horses are susceptible too. In Australia the main types of worms that effect horses are, large and small strongyles and round worms.

Normally worms are not a problem during hot dry conditions. However, horses that are stressed for any reason can lose their immunity and may show the effects of worm infestation. Clinical signs are ill-thrift, anaemia and scouring (scouring may not be caused by worms), pale gums, tail rubbing, poor coats and colic

When worms are confirmed by either a worm-test or at worst post mortem, drench remaining horses with an effective drench. Worm burdens should be regularly monitored through the use of faecal egg counts and drenching should be undertaken when deemed necessary.

Horses can be infested with worms by grazing infected pasture, eating contaminated feed or manure and licking infested horses coats During a drought period when horses are contained in a smaller area of your stud, the risk of reinfection of worms is great. To avoid this, remove manure as frequently as possible. If horses are in larger areas, harrowing your paddocks in the middle of summer will reduce larvae. If a new horse enters your stud, drench it upon arrival and quarantine it for at least 36 hours, so as not to contaminate your stud.

Regular worming programs, using a quality drench should be implemented. Drenching should occur regularly and records of which, when, how much drench and what drench were administered should be maintained.

Note: If you drench one horse, drench them all.

Animal welfare

All owners must realise that animal welfare is an issue at all times, but especially during a drought. It is unacceptable to let horses die or suffer during drought. Those horses that cannot be cared for should be humanely destroyed. As this is often a distressing task, seek advice from your local Government Department. The Victorian Government has a list of notifiable equine disease. Most other State Governments will have similar lists. If your horse contracts one of these diseases, you are obligated to notify the authorities.

Plants poisonous to horses

Fortunately horses are fussy eaters and therefore cases of plant poisoning are not common unless horses are hungry. Occurrence of this will increase dramatically in times of drought, where the only source of nutrition may be plants, which are toxic to horses. Owners should be aware of the possibility and at least be able to identify the most common poisonous plants. Do not be alarmed at the length of the list of potential poisonous as most horses will not be exposed to these plants or consume them. Nearly all of these plants have restricted distributions, which further reduces the risk to your horse.

It is not always easy to identify which plants may cause poisoning or disorders in horses. Without botanical knowledge of plants it is impossible to distinguish between a poisonous plant and a harmless plant. There are no characteristics of taste, smell or appearance which tells us which is which, and no simple method of identifying which plants may be poisonous or when poisoning is likely to occur.

When a horse's condition indicates that plant poisoning may have occurred it is important to check:

- What signs of illness the horse is showing
- What plants the horse has been grazing on
- What plants are available in the grazing area
- Whether the horse can reach native or ornamental plants over a garden, roadside or windbreak fence
- Whether these plants and their toxic properties can be identified

Seek professional veterinary advice immediately and provide the veterinarian with as many answers as possible to the above questions.

Most horses will avoid eating poisonous plants but during drought when they are hungry the chances of them doing so will be dramatically increased. The plants described in Table 9 have caused cases of poisoning of horses in Australia, or have been known to be poisonous, even though cases may not have been reported.

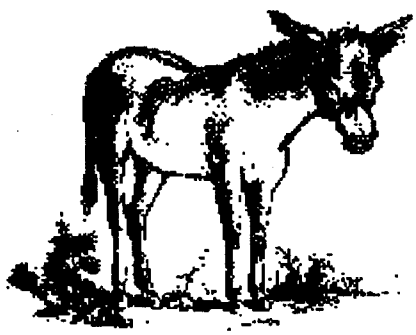


Table 9. Plants poisonous to horses

Plant	Group	Clinical Signs
Aconite (Monkshood)	B	Staggers, trembling
Alsoke clover	C,D	Liver disease, photosensitization
Avocado	G	Dullness, colic, heart failure
Birdsfoot trefoil	A	Rapid Breathing, collapse, death
Birdsville indigo	B	Nervous signs, behavioural changes
		Death
Black night shade	A	Depression, colic, death
Braken fern	B	Nervous signs, staggers
Buck wheat	C, D	Liver disease, photosensitization
Burr medic	C, D	Liver disease, photosensitization
Corn gromwell (White iron weed)	B	Staggers
Castor oil plant	B	Nervous signs, colic, death
Croften weed	G	Breathing difficulties, coughing
Darling pea	B	Weight loss, staggers, mood changes
Ergot of paspalum	B, H	Temmors, staggers, colic
Fireweed	D, B	Liver and nervous disease
Hemlock	A	Depression, shock, death
Laburnum	A	Excitement, sudden death
Leucaena	F	Hair loss, hoof rings
Linseed	A	Rapid breathing, shock, death
Lupina	B, D	Staggers, convulsions
Marshmallow	B	Staggers, rapid breathing
Monkshood	B	Staggers, trembling
Oak	E	Colic, bloody urine, depression
Oleaner	A	Diarrhoea, colic, death
Patterson's curse	D,B	Liver damage, behaviour changes
Poppies	B, F	Staggers, trembling, dermatitis
Ragwort	B	Nervous signs, staggers
Rattlepods	B	Behavioural changes, staggers
Rubber vine	H	Intestinal damage, death
Russian knapweed	B	Chewing disorders
Ryegrass – Perennial	B	Staggers
Annual	B	Staggers, convulsions, death
Salvation Jane (Patterson's curse)	D, B	Liver damage, behaviour changes
Selenosis	F	Loss of hair, gait changes
Sorghum	A	Rapid breathing, collapse, death
Soursob	E	Weakness, incoordination, collapse
St Barnaby's thistle	B	Chewing disorders
St John's wort	C, D	Liver disease, photosensitization
Storksbill	C, D	Liver disease, photosensitization
White iron weed	B	Staggers
Wolfsbane	B	staggers, trembling
Yellow burr weed	B	Staggers, nervous signs
Yew	A	Excitement, sudden death

Group A - Sudden death or death within a few days, Group B - Nervous diseases eg staggers, dummy syndrome
Group C - Photosensitization Group D - Liver damage
Group E - Kidney damage Group F - Skin disorders
Group G - Heart and lung disorders Group H - Intestinal disorders

THE FEED VALUE OF UNUSUAL FEEDSTUFFS

There is a wide range of unusual feedstuffs that may be safely and effectively fed to horses. They should only be used when traditional feeds are not available and extreme care should be when using them in drought. Apart from these unusual feedstuffs generally being of poor nutritional value, they can also be contaminated with high levels of residue producing chemicals. Potentially all supplementary feeds may contain chemical contaminants, but unusual feedstuffs, not normally used for feeding livestock, pose a much greater risk.

Agricultural chemicals used on fruit and vegetable crops are typically designed to be eliminated from the edible parts of the plant at harvesting, however some residues may still be present in the waste plant material after processing. It is when this waste plant material is fed to stock that problems can occur.

Agricultural chemicals are not designed to be ingested by livestock and so, in many instances, little is known about the effect of these chemicals on horses.

For this reason, the best policy is to not feed unusual feedstuffs to horses without first establishing that the material is suitable. Producers should ask the supplier of unusual feedstuffs to certify that the material they are supplying is suitable for the purpose for which it will be used.

Ideally, unusual feedstuffs should be tested for chemical contamination by an accredited testing laboratory before being used as drought feed, although this in itself may not provide a satisfactory guarantee of suitability as analytical tests typically only screen for a narrow range of chemicals. It should also be noted that the chemical content of unusual feedstuffs may vary from batch to batch.

It should also be realised that the composition of many feedstuffs varies widely because of differences in climate, soil conditions, maturity, variety, management and processing factors.

Therefore, the information presented in this chapter should be considered as a guide rather than a precise statement of nutrient composition. Before finalising plans to feed any by-product or unusual feedstuff to livestock, it is advisable to have a sample analysed by a feed analysis service.

Most by-products and unusual feedstuffs should be used with caution and introduced into rations gradually, even when low prices favour their use. Factors to consider about unusual feedstuffs are: their nutritive value, palatability, possible toxicity or contamination with pesticides or heavy metals and the effects upon digestion and utilisation of the total ration.

High moisture content feeds

Horses can eat up to 3% of their liveweight per day when the feed is in a dry form, such as hay or grain, but they cannot eat as much dry matter if the feed has a high moisture content. Therefore horses may not be able to consume enough to meet their nutritional requirements.

Fresh, high-moisture feeds are often quite palatable to livestock but most such feeds will ferment and sour quickly unless they are dried or ensiled. Silage has been fed to horses in the past, but it is not recommended.

Types of feeds

Horse feed is usually categorised as either concentrates (high in energy) or roughage (higher in crude fibre, but lower in energy). Concentrates can be high in either energy or protein content. Protein concentrates generally contain more than 20% crude protein.

Before you use any unusual feedstuff you must consult a nutritionist or veterinarian as to its suitability to feed to horses.

Bakery waste

Large amounts of unsold bread; doughnuts, cakes and other pastries are available in some areas and are energy sources for rations.

They are usually high in fat and low in crude fibre. Protein levels (on a dry-matter basis) in the range of 10-12% are typical. Up to about 10% may be included in rations when supplies and economics are favourable. Supplies should be fed quickly because toxic moulds can develop during storage.

Brewers' grains

Brewer's grains have 20-25% crude protein (on a dry matter basis), making them a good protein source in addition to their energy value.

The brewing process makes this protein less soluble than that from many protein supplements.

Brewers' grains are fed both wet and dried. In the dry form they have about 80% of the energy value of barley (the energy value varies depending on the brewery and additives used in the brewing process). They are not as palatable in the dried form as the original grain.

By-product protein concentrates

Many crops grown for oil production also produce by-products high in protein. These by-products are the primary source of supplemental protein in livestock rations. These include coconut meal, corn gluten meal, cotton-seed meal, linseed meal, safflower meal, soybean meal and sunflower meal.

Coconut meal

Coconut meal, popularly known as copra, is one of the most palatable feeds available for livestock. It is high in energy and contains about 20% protein. Rancidity can be a problem during storage of the meal as it is high in fat. High-fat copra contains considerably more energy than copra produced by the solvent process.

Cottonseed meal

Cottonseed meal is a by-product of the production of cotton lint and cottonseed oil. It contains about 40% protein. The amount of oil left in the meal affects its energy value (amounts vary according to the method of processing). However, energy levels are somewhat

lower than those found in some other protein supplements such as coconut meal, soybean meal and linseed meal.

Fat

Fats and oils have an energy value about 2.25 times that of carbohydrates. Fats are also used to settle the dust and as a lubricant for feed processing. Two to 5% fat is an acceptable level in commercial rations. Care must be taken to ensure the fats and oils are not contaminated with extraneous chemical during collection, storage and use. Horses are able to digest fat more readily and exercise can supply more accessible energy for performance.

Grain screenings

Grain screenings result from the cleaning of small grains before they are milled for human consumption. The best grade of screenings consists primarily of broken and shrunken kernels of grain, wild oats and other palatable weed seeds. When ground, good screenings approach grain in feeding value and have been used as 25% or more of concentrate mixed and 15-20% in feed rations. However, light, chaffy screenings are much higher in fibre and resemble straw more than grain in feeding value. Such screenings should be restricted to 10% of the feed ration.

Kelp

Kelp represents the most common type of seaweed that might be available for feeding. The dry matter of kelp contain about 30% minerals (compared to 5 to 6% in hay, pasture, etc). Kelp contains 0.15 to 0.2% iodine. Seaweed is sometimes used as a mineral source for livestock. The composition of dried kelp is: dry matter 91%, crude protein 6%, crude fibre 7%, minerals (ash content) 30%; ME value is about 5 MJ per kg DM.

The rich mineral content of seaweed, especially salt, can make the material quite palatable to livestock. As seaweed is high in iodine, it would be strongly advised not to feed too much seaweed meal to your horses.

Linseed meal

Linseed meal, the by-product of the extraction of linseed oil from flaxseed, is an excellent protein supplement for livestock. Protein content varies from about 30 to 38% depending on the processing method. When reasonably priced, it can be used as the only protein supplement in livestock rations because it is very palatable.

Molasses

All types of molasses are good energy sources but are low in protein. The energy value of cane molasses decreases rapidly when it is increased from 10 to 30% of the total ration. In rations, up to 15% is an acceptable level.

Rice bran

Rice bran results from the processing of rice grain for human consumption. Besides the bran itself, it contains the germ from the grain and fragments of the hull not removed in milling.

Rice hay

Rice hay is generally a good, palatable roughage of equivalent feed value to cereal hays. Rice hay is known to contain significant levels of silica and oxalate, both of which may cause problems to livestock. High dietary silica levels can predispose animals to urinary calculi.

If rice hay is fed as the roughage in a hay and grain diet, it is suggested that 1.5% limestone and 0.5% salt be fed to correct the calcium:phosphorus balance and levels in the ration. Rice hay can contain a range of weeds, such as umbrella sedge, barnyard grass, starfruit and wild millet. It is recommended that rice hay not be feed to young horses or pregnant mares as oxalates in the hay can inhibit calcium uptake, which is essential for growth.

Rice hulls

Rice hulls have practically no feed value but can be useful as bedding material for livestock. They are very high in crude fibre and silica and the fibre is largely indigestible.

Safflower meal

Safflower meal has increased in availability and importance as a protein supplement in recent years because of the popularity of safflower oil in human diets. Safflower meal from unhulled seeds has about 20% protein, is high in fibre and is relatively low in energy. Meal made from well-hulled seeds has about 40% protein and is much higher in energy.

However, safflower meal from either sources is not as palatable to livestock as the more common protein supplements.

Soybean meal

Soybean meal contains from 40 to 50% protein, is high in energy and is highly palatable to livestock. High fat soybean meal can go rancid. Rancidity may be a problem if not stored correctly.

Sunflower meal

Protein levels vary from 20 to 25%, depending on the processing method and whether the seed is hulled or not. It is roughly equivalent to cottonseed meal as a protein supplement for livestock.

Wheat bran and other wheat by-products

Wheat bran consists of the coarse outer coatings of wheat kernels. It is a bulky feed, which is relatively high in protein and phosphorus. It is highly palatable to livestock and is utilised efficiently when included up to 25% of the concentrate mix. The bulky nature of wheat bran and its high phosphorus content make it a popular by-product fed for livestock. Horse

owners should note that if they feed wheat products, they should supplement the ration with a high calcium supplement such lucerne clover or lime.

Table 10 is a list of unusual feedstuffs is only for reference. **Before you use any unusual feedstuff you must consult a nutritionist or veterinarian as to its suitability to feed to horses as many of these products have not been fed to horses before.**

Table 10. Energy and protein compositions of unusual feedstuffs.

Feed	Approx. dry matter (DM)%	Metabolisable energy (ME) (MJ/kg DM)	Crude protein % dry matter
Acorns	70	7	5
Almond hulls, 15% CF	90	8	2
Almond hulls and shells, 20% CF	90	7	2
Apple pomace, dried	89	10	5
Apple pulp silage	21	11	8
Apples	17	10	3
Apricots, dried	90	12	6
Bakery waste, dried	92	13	11
Banana skins, dried, ground	88	9	8
Bananas	24	13	4
Bread, dried	92	13	13
Brewers dried g rains	92	9	22
Brewers dried grains, 25% protein	92	10	25
Brewers grains, wet	21	10	25
Broccoli	11	10	33
Brussel sprouts	15	11	33
Buckwheat	87	11	12
Cabbage	9	13	25
Cabbage leaves	15	10	14
Carrot pulp	14	9	6
Carrots	13	12	10
Cauliflower	9	10	30
Citrus pulp	18	12	7
Corn cobs, ground	90	7	3
Cottonseed meal, 41% protein mech-extd	93	3	44
Cottonseed meal, 41% protein, solv-extd	91	11	46
Cottonseed, whole	92	14	23
Eggs without shells, dried	96	15	49
Fat	99	16	0
Feather meal	90	9	87
Fish meal	92	11	67
Grape pomace, dried	91	5	13
Grape pomace, without steams dried	91	9	14
Grape/pear/apple pomace, dried	92	6	7
Grapefruit	14	13	8
Kelp, dried	91	5	7
Lemon pulp, dried	93	12	7
Lettuce	5	8	22
Linseed meal, 36% protein, solv-extd	90	12	38
Linseed meal, 37% protein, mech-extd	91	12	38
Melons	4	11	11

Milk, cattle, skim, dried	94	13	36
Milk, cattle, whole, dried	94	15	27
Milk, colostrum	25	15	46
Molasses, cane	75	11	6
Oat hulls	93	5	4
Oat straw	92	7	4
Oats, sprouted 5 days	13	10	18
Onions	91	9	13
Orange pulp, dried	88	12	8
Orange pulp, wet	25	12	9
Oranges	13	12	7
Pea hay	88	9	14
Peaches	10	12	9
Peanut meal, mech-extd	93	12	52
Peanut meal, solv-extd	92	12	52
Peanut skins	94	10	17
Pears	17	13	6
Pineapples	15	12	3
Potato meal, dried	91	12	11
Potatoes	23	12	9
Pumpkins	9	13	16
Raisin pulp, dried	89	8	11
Raisins, cull	85	7	4
Rice bran, solv-extd	90	9	16
Rice hulls	92	2	3
Rice straw	91	6	4
Rye bran	91	9	17
Safflower hulls	90	12	4
Safflower meal, 20% protein, mech-extd	91	9	22
Safflower meal, 20% protein, solv-extd	92	9	25
Safflower seeds	94	13	17
Soybean meal, 44% protein, solv-extd	89	13	50
Sunflower meal, mech-extd	93	11	45
Sunflower meal, solv-extd	93	10	50
Sunflower seeds	94	12	18
Tomato pomace, dried	92	9	23
Tomato pomace, silage	29	10	19
Tomatoes	6	10	16
Turnips	9	13	14
Wheat bran	89	10	18
Wheat straw	89	7	4
Whey, dried	93	12	14
Whey, liquid	7	12	14
Yeast, brewers, dried	93	12	47

Mech-extd - mechanically extracted. Solv-extd - solvent extracted.

Further reading

The information provided within this manual, is only a brief guide to the management of horses under drought conditions. To gain further insight into the management of horses during drought the following texts are recommended.

Avery, A. (1996). Pasture for Horses- A winning resource. Rural Industries Research and Development Corporation, Canberra, ACT and Dept Natural Resources and Environment, Vic, Australia.

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