

## EFFECT OF DROUGHT ON GRAIN NUTRIENTS ©

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Plant nutrient composition varies widely due to botanical composition, season, and fertiliser history and soil type. The density, moisture, nutrient and fibre content of grains vary widely between different crops. For example, the same volume of oats can vary in weight by up to 30%, depending on soil fertility, variety and growing conditions. Over time, oats have been measured in lbs per bushel – a bushel being 35.24 litres. Ideally a bushel of oats should weigh 40lbs, but can be anything from 27lbs to 52lbs. The lower weight grains have less energy per unit of volume. Thus a horse could receive almost twice as much by weight if

**Weight Range (grams) in 2 Litre Dipper of Grain**



heavier oats are used.

Ordinarily, because the weight per unit volume varies both between feeds and for the same feed, feeding by weight is more precise than feeding by volume. This avoids sudden fluctuations in the levels of nutrients, particularly energy, that is being fed each day.

However drought conditions change this. Both yield and the nutrient levels are affected by drought conditions and it cannot be assumed that what a horse eats one day will be the same as the next – even though there has been no change in the amount or type of feed given. In addition, volume and weight vary with the dipper used. Because of the effects of drought on grains, the weight of feed can vary – even though volume does not, due to are variations in weight per bushel between and within grains.

Lower weight grains have less energy per unit of volume. Feeding by weight then is important because the weight per dipper determines the energy density of the feed. However, during prolonged and severe drought, grain protein composition

changes. The result of these sources of variation is that although it is assumed that there has been no change in feeding, there can in fact be considerable variation in the amount fed to an individual horse from one day to the next. This is often overlooked in the evaluation of the potential role of nutrition in the etiology of certain conditions, such as changes in form, laminitis, colic, gastric ulcers, osteochondrosis and tying up.

Each horse must be fed to their individual requirements according to their metabolic rate and workload. The daily feed intake of a 500 kg horse in full work is commonly assumed to match the average requirement of 138MJ, as given by the National Research Council in Nutrient requirement of Horses (NRC, 1989). Because of normal variation between horses, the range would be 120-190MJ. What this means from a practical point of view, is that out of 40 horses one will require 120 MJ and one, 190MJ, with the remainder falling somewhere in between. This range introduces huge errors into calculations of the ration (amount of daily intake) and the diet (composition of daily intake), and is further complicated by the effect of drought on nutrient levels.

An important nutrient in grains is protein – not for its value to the horse for body building, but because they improve digestibility. Grains contain enzymes which are necessary for starch digestion. These enzymes are made of protein and when grown under drought conditions, the amount and activity of the enzymes is reduced – reducing the digestibility of the grain starch. Recognising the variations in grains and the effects of varying nutrient levels and changes in digestibility on the well being of the racing standardbred, MITAVITE has recently included PROTEXIN and equine-specific enzymes into racing feeds. These combine to improve digestibility, reduce the uncertainty of feeding and protect gut function.

The term 'processed feed' often evokes images of 'fast food' and is perceived as a negative. The term 'prepared feed' is more appropriate because cooking in fact prepares feed for digestion – improving the bioavailability, release and uptake of nutrients. Horsemen and women have boiled, flaked, steamed, cracked and crushed grains for centuries to improve digestibility. The most recent advances in cooking feeds for horses have produced steam-extrusion and micronization. These advanced methods of feed preparation increase the digestibility and availability of energy and protein, so that a lower weight of feed is required and the risk of gut upsets is reduced.

Drought conditions also affect the ability of cereal crops to extract minerals from the soil. Both the absolute amount of each mineral and its ratio to other minerals are important. It is well known that the ratio of calcium to phosphorus is a great importance in the formation of sound bone and joint structure. One of the greatest pitfalls when thinking about nutrition is the ever-present tendency to assume more is better. There is also a strong tendency to oversimplify things. For example, you need calcium to build strong bones – true. However, extra calcium does not mean extra strong bones. There is an optimal amount balance

between vitamins and minerals that is at least as important as the actual amount of each in the body. Bones need other minerals to be strong too - phosphorus, magnesium and trace minerals are critical.

Recent research has revealed valuable information on how micromanagement of mineral ratios affects muscle function, tying up, behaviour, anti-oxidant production, hormone function, work capacity and performance. Important ratios include: calcium to phosphorus – 1.5:2.1; calcium to magnesium – 1.5:2.1; zinc to manganese – 0.7:1.1; zinc to copper – 2.7:3.1; iron to copper – 4:1. Stress and high intensity exercise increase the requirement for selenium, iodine and chromium. However, many minerals have a low safety margin and, for iodine and selenium, the signs of excess are difficult to distinguish clinically from the signs of deficiency. The higher the desired level of performance, the lower the margin for error.

Research in California into heavy metal concentrations in injured racehorses has shown that excessive iron is detrimental to ligament, tendon, bone and joint health and strength. In a study published in the Journal of Veterinary and Human Toxicology in 1996 the records of fatal injuries at Californian racetracks were studied for 16 months. Kidney iron concentrations were significantly higher in horses with ligament ruptures and in horses with fractured sesamoid, knee and cannon bones.

Attempting to address individual mineral deficiencies with different supplements ignores the important ratios between minerals and because many supplements contain several minerals, the risk of overlap, excesses, deficiencies and imbalances increases. Grains, chaff, hay and pasture are all deficient in vitamins, minerals and trace elements. These deficiencies are further influenced by dry growing conditions and it is necessary to supplement most pasture and traditional diets. However, the balance must be correct. Balancing mineral intakes by using carefully formulated concentrates and prepared feeds is safer and takes the guess work out of feeding.

Correctly formulated feeds contain protected vitamins and chelated minerals. 'Chelated' minerals are 'attached' to protein or carbohydrate - preventing interactions and improving uptake compared to natural inorganic minerals. Naturally occurring forms of vitamins are often chemically unstable and can degrade during processing or storage, but research and ongoing refinement has resulted in protected forms, which are much more available and stable than naturally occurring forms. A cross-linking reaction between gelatin and carbohydrate has improved vitamin A stability. Vitamin E (alpha tocopherol) is protected by formation of an ester. After 3 months storage, the stability of alpha-tocopherol falls from 50% to 35% if trace minerals are present. If copper is also present, the alpha-tocopherol is completely lost within 15 days. However, when the vitamin E is present as tocopheryl acetate, retention is 95%. Using the available technology and keeping abreast of developments in vitamin biochemistry, MITAVITE feeds are formulated with known and predictable levels of vitamins.

By understanding the stress factors that affect vitamin activity, it is possible to more precisely formulate ingredients and control processing conditions to

circumvent vitamin damage. Vitamin stability in complete feeds correlates to some extent with vitamin stability in trace mineral premixes and supplements. However, vitamins tend to be more stable in complete feeds than in premixes because the trace elements and macro minerals are more diluted and the extruded nut itself constitutes a barrier to stress factors (Coelho, 1991). Stress factors include cooking temperature and pressure, moisture, friction, conditioning time, light and the composition of the feed. The magnitude of these stresses varies with feed type and processing method, for example, vitamins are subject to more friction during pelleting and dry-extrusion than they are during steam-extrusion. Processing of feed by steam-extrusion also increases digestion in the small intestine from around 30 to over 90% - releasing essential amino acids and increasing mineral absorption.

Vitamins differ in their susceptibility to chemical reactions and an awareness of these differences has allowed losses to be minimised during preparation of MITAVITE feeds. The vitamin stability at each stage of processing as well as during storage are calculated. In addition, feed samples are kept in an environmentally controlled humidity-cabinet and subjected to extremes of temperature and humidity to determine losses and shelf life. By knowing the specific conditions and individual vitamin stability, retention times and forms of vitamins, vitamin supplementation rates can be adjusted to offset losses. In addition, post-cooking application can be used. Continual monitoring of moisture, protein and nutrient levels in raw grains and regular analysis of final feed formulations removes variability in MITAVITE feeds, ensuring that nutrient intakes remain stable and published feed composition can be relied upon – regardless of environmental conditions.

For further information on Mitavite feeds or feeding horses, contact Mitavite on 1800 025 487  
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