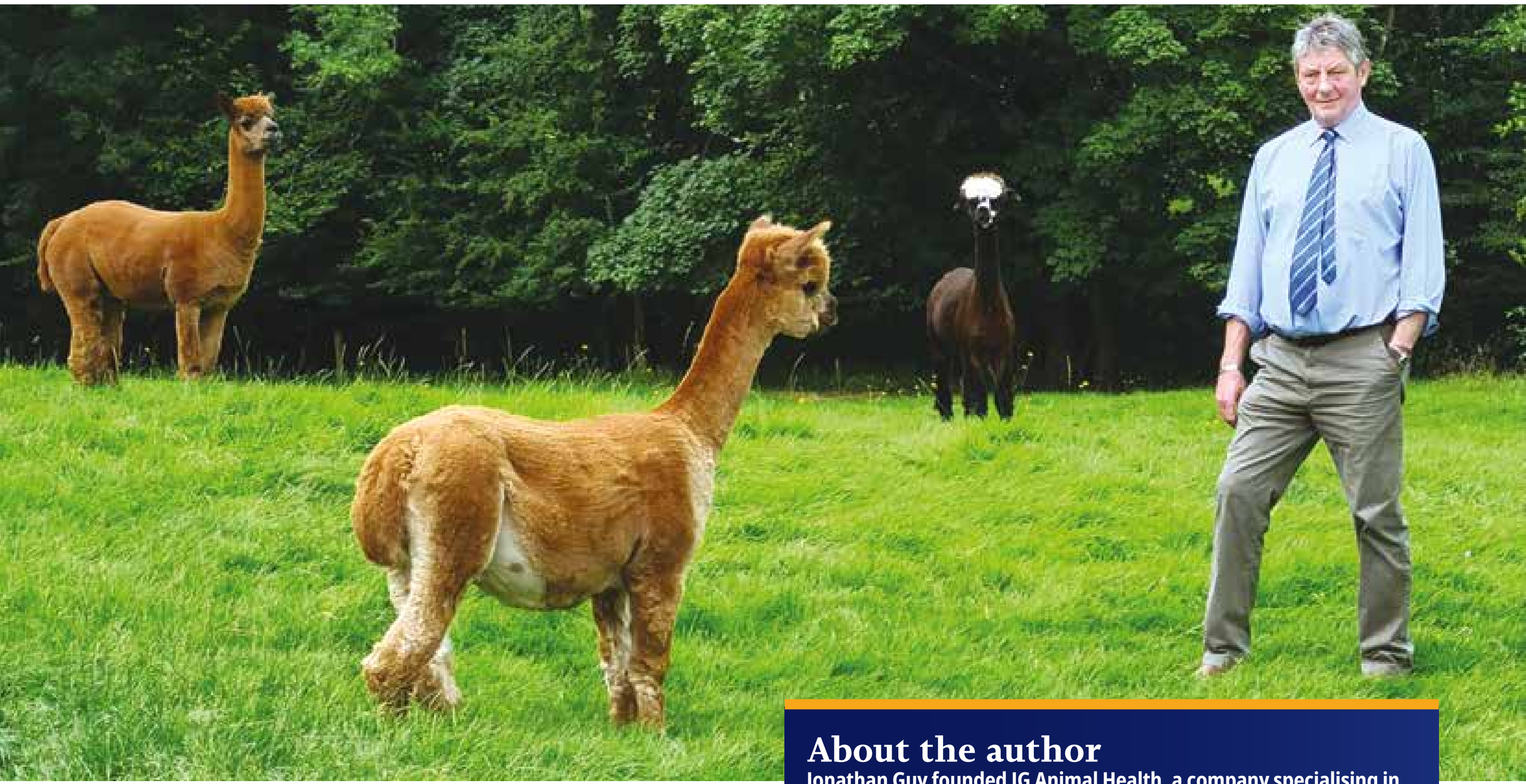
NUTRITION AND FLEECE QUALITY

Jonathan Guy, JG Animal Health, takes a look at the role of vitamins and minerals on fleece growth and quality. Achieving the right balance of vitamins and minerals in the diet will not make a great fleece from poor breeding, but could make a fantastic fleece from good breeding.



Alpacas are naturally browsing animals in their native environment. They often choose coarse woody material and herbage, being selective in the elements and minerals, that each plant contains and consider the tastiest bits of forage. However, when they are brought into a domestic paddock, where they will consume up to 1kg of grass every day, they become grazers. In this environment, in an effort to provide essential minerals and vitamins, a supplementary feed is generally given.

The density of the fleece will severely reduce the amount of skin absorption of vitamin D3, while the colour can impact on trace element requirements – often darker fleeced animals will have a higher requirement for certain elements over white and fawn.

There are 92 naturally occurring elements found in soils, however only 27 of these are classified as essential minerals, which are required for maintenance and growth, reproduction and health. These elements are divided into two groups dependent on their concentration in the body, namely the major, or macro elements and the micro, or trace elements. Without mineral elements, the nutrients of protein, carbohydrate and fat, which provide the animal with energy for growth, would be worthless. The reason for this is that mineral elements:

- contribute to the oxygenation of blood,
- maintain health and immunity,
- repair cells and tissue
- promote development of digestion micro-organisms.

About the author

Jonathan Guy founded JG Animal Health, a company specialising in mineral and vitamin nutritional supplements in 2004. After more than 25 years working within the supplement industry, and having looked at the available products on the market he wanted to launch a range of supplements specifically designed to meet the needs of the livestock industry.

Nutritional needs

Generally, fibre traits are highly heritable, however what mostly influences the value is weight (up to 4kg), fibre diameter and length of staple. The term wool (or fibre) is usually restricted to describing the fibrous protein derived from the specialised skin cells called follicles. The maximum number of follicles that can develop is determined genetically, but the actual percentage of the wool-bearing follicles depends on nutrition.

The nutritional needs vary according to the different production stages. Secondary follicles (that determine fine wool production) develop during the third trimester of pregnancy. In this trimester the foetus's nutritional needs also increase while the pregnant females stomach capacity is at its lowest.

Wool is a protein fibre, composed of more than 20 amino acids. These amino acids form protein polymers containing small amounts of fat, calcium and sodium therefore nutrition plays an important role in fibre growth in alpacas.

Soil and pasture

The main reason for different trace element deficiencies throughout the world is variable geology and soils, weather and climate. When the soil cannot supply sufficient trace elements to the plants that animals are eating, a deficiency will occur. This is more likely to show up where the ration is mainly grazed grass or conserved forage.

Re-seeding can reduce trace element intake by reducing the diversity of plants and herbs present. Rapidly growing, lush pasture following fertiliser application will also have lower trace element (TE) content. The TE content of plants can vary widely even in the same soil. Soil derived from acid rocks such as granite and light sandy soils contain less TE's than clay soils, however poorly drained soils showing soil compaction are far more likely to lead to the risk of induced copper deficiency due to the antagonist molybdenum. It should also be noted that excessive liming will reduce herbage cobalt levels but increase the amount of molybdenum present.

Animals may adjust to a suboptimal mineral intake by reducing the concentration of mineral in tissues. Thus, the tensile strength of wool fibres may be reduced in order to conserve minerals for more essential functions like growth, fertility and lactation.

Carbohydrates, fat, and excess protein in the diet all contribute towards fulfilling the energy requirements. With restricted energy consumption, wool growth slows, fibre diameter is reduced, and weak spots (breaks) develop in the wool fibre.

Understanding nutrient requirements

Although wool growth is determined by feed intake, understanding the true nutrient requirements of wool production is far more complex. Microbial protein synthesis in the stomach and its availability for digestion and absorption in the intestine is more closely related to the intake of digestible energy by the animal than to the protein content of the diet.

Although wool growth increased with increasing digestible organic matter intake, its affect is consistent with its probable effect on microbial protein synthesis. Thus, it would appear that the apparent response in wool growth to an increase in organic matter or energy intake is to the increased supply of microbial amino acids reaching the lower gastro intestinal tract.

The wool fibre is primarily protein, this wool protein contains a high proportion of the high-sulphur amino acids cysteine, (10% in wool) and it has been shown that variation in the availability of the sulphur containing amino acids to the follicle can affect both fibre growth rate and fibre composition (Corbett, 1979).

Clean wool is composed of complex protein keratin which contains about 20 amino acids in many polypeptides and has a sulphur content varying from 2.7% to 5.4% of the fibre weight. Most of the Sulphur is present as cysteine and methionine. Infusion of 2.0g cysteine or 2.46g methionine per day increased wool production by 35% to 130% and the S content by 24% to 35% (Reis and Schinckel, 1963).

Copper plays a very important role in maintaining quality of wool fibre. A deficiency of copper, either in the ration or induced by high levels of iron and molybdenum in the diet, caused by low activity of the copper containing enzyme tyrosinase, results in de-pigmentation of the wool, a lack of crimp and low mechanical strength.

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> A well nourished Suri fleece ©Art Of Fibre

< Copper is one of many enzyme systems in the body that have a vital role in the development of the proteins – collagen and keratin – essential in bone, skin and wool growth and resulting in the loss of crimp and pigment.

Zinc deficiency on the other hand results in a marked reduction in wool growth, over and above that associated with the reduced feed intake induced by the deficiency. Some fibres are shed, and the fibres that are produced lack crimp and are brittle.

Vitamin deficiency slows fibre growth

Vitamins play an important role in wool production. Fat soluble vitamins namely Vitamin A, D and E are required in alpacas. Vitamins A and D3 probably have direct effects on follicle function, as both have specific receptors in various parts of the follicle. Vitamin K is essential for blood clotting. The levels of B group vitamins are essential to help ensure adequate utilization and absorption of amino acids, carbohydrates and fats.

A deficiency of a vitamin may reduce or completely inhibit wool fibre growth, by reducing the feed intake of the animal thereby impairing the supply of substrate to the follicle, by inhibiting the activity of enzymes involved in protein or energy metabolism and reducing the production of nucleic acids required in the follicle for cell division.

Thiamine (vitamin B1) is essential for carbohydrate absorption and energy production. Pyridoxine (vitamin B6) is required for amino acid metabolism in general and in the transsulphuration reaction in which methionine is converted to cysteine. Biotin (vitamin H) may be involved in follicle function because it is required for nucleic acid synthesis which affects DNA of the cells.

Folic acid (vitamin B9) is essential for the conversion of glycine and histidine to other amino acids, purines and thymidine, there by contributing to cell division and protein synthesis. Vitamin BI2 is a cofactor in methionine synthesis, for a range of molecules, it is also essential for the activity of methyl malonyl coenzyme A (CoA) isomerase, a key enzyme in the production of glucose from propionate.

The only direct demonstration of a vitamin deficiency affecting wool growth occurred in pre-ruminant lambs supplied with diets deficient in Folic acid (Chapman and Black, 1981). The wool lacked crimp and in several cases fibre growth ceased completely, despite the fact that the animals were gaining weight. Provision of folic acid alleviated the condition, supporting the notion that this vitamin is essential for wool growth. While microbial synthesis of the B group vitamins in the rumen means that adults are unlikely to suffer deficiencies of these vitamins, their effect on rumen function may reduce microbial supply.

> ***Forage mineral report by Albion Laboratory Services:*** *"Over the last 12 months we collated grass samples throughout the UK. Most major elements are in the green column, while the trace elements are more varied. However the antagonists of Iron, Aluminium and Molybdenum are all likely to influence the availability of many of those elements, in particular Copper," says Jonathan.*

SAMPLE TYPE	**Grass**	FARMER	**Grass Average '20-'21**
SAMPLE REF	**85960**	FIELD ID	**380 Samples**
DISTRIBUTOR	**J G Animal Health**	POST CODE	**UK**
DISTRIBUTOR'S REF		DATE	**21/06/20 - 18/08/21**

Dry Matter 18.9%

MINERAL ELEMENT (DM BASIS)			ASSAY	VERY LOW	LOW	MEAN	HIGH	VERY HIGH
Calcium	Ca	%	0.61	0.3	0.5	0.6	0.7	0.9
Phosphorus	P	%	0.43	0.2	0.3	0.35	0.4	0.55
Magnesium	Mg	%	0.19	0.1	0.15	0.2	0.25	0.4
Potassium	K	%	3.17	0.5	1.5	2	2.5	5
Sodium	Na	%	0.17	0.1	0.2	0.25	0.3	0.4
Chloride	Cl	%	1.20	0.3	0.6	1	1.4	2
Sulphur	S	%	0.29	0.1	0.15	0.2	0.25	0.4
Cation-Anion Balance		meq/kg	365	50	100	200	300	500
Manganese	Mn	mg/kg	152	50	75	100	125	200
Copper	Cu	mg/kg	8.4	5	8	10	12	15
Zinc	Zn	mg/kg	31.8	25	40	60	80	130
Cobalt	Co	mg/kg	0.24	0.1	0.2	0.25	0.3	0.4
Iodine	I	mg/kg	0.34	0.25	0.5	1	1.5	2
Selenium	Se	mg/kg	0.19	0.05	0.1	0.15	0.2	0.25
Boron	B	mg/kg	6.2	1	2	4	6	10
Iron	Fe	mg/kg	340	50	100	150	200	350
Aluminium	Al	mg/kg	161	25	50	100	150	300
Molybdenum	Mo	mg/kg	2.81	0.1	0.35	0.8	1.25	2
Lead	Pb	mg/kg	0.89	1	2	2.5	3	10
Relative Copper Antagonism								
Soil Contamination Index								

The right balance

Getting the balance right will not make a great fleece from poor breeding, but could make a fantastic fleece from good breeding

As we see, mineral and vitamin supplementation is all about harmony and balance, while a deficiency may manifest itself as an issue, an excess, particularly of copper, can cause serious issues of toxicity and can be fatal, so care must be taken!

The levels of minerals can vary hugely in British pasture. As a business we are able to advise and supply a wide range of supplements for either individual or herd performance as well as being able to analyse all forage to identify what might be happening on your farm. Should you be on a private water supply this should also be checked for mineral inbalance.

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