



The following article was written by Soiltech
Soil Scientist, Dave McKie MAgSc (Hons)

IS UREA AGRICULTURES “SILVER BULLET?”

The application of nitrogen in the form of urea has become the trendy way to farm in recent years. The logic behind this fad can be simplified to the following:

- 1) To lift production (& economic return?) more dry matter must be grown.
- 2) The way to grow more dry matter is to apply nitrogen fertiliser.

This approach reduces the complex holistic system we call “farming” to little more than a simple mathematical calculation i.e. to grow “x” extra kilograms of dry matter, how much extra N must be applied?

If farming is that simple and nitrogen fertiliser is indeed the agricultural “silver bullet” so many farmers seek, it would have been discovered long before now. Nitrogen is obviously an essential driver of productivity but its use needs to be considered alongside many other factors.

Let’s examine some of these factors. Firstly, plant physiology and climatic conditions. Pastoral farming depends on the growth of grasses and legumes. As a general rule, grasses do not grow below 6 degrees Celcius and legumes stop growing a degree or two above that temperature. Therefore, applying urea to boost pasture growth when the soil temperature is too low and/or the soil is saturated with water is about as effective as spreading \$1 coins on your paddocks! When the plants are not growing nitrogen fertiliser will not “kick start” them and cause them to suddenly start growing! Worse, in damp conditions, perhaps a third of the nitrogen applied will be converted to ammonia gas and lost (to the atmosphere) while the rest will either leach past the dormant plant roots down the soil profile and/or be carried away to adjacent water courses, potentially to cause environmental pollution. At least if you’d applied \$1 coins, you could recover them but not so nitrogen applied when it is too cold or wet.

Secondly, pasture composition and soil biology. NZ farming is the beneficiary of large amounts of nitrogen supplied free to the farmer by soil bacteria. The economic benefit resulting from this situation is enormous. When nitrogen fertiliser is applied, it suppresses this free supply of nitrogen by roughly 50% i.e. if 100kg/ha of N fertiliser is applied, nitrogen fixation can be reduced by about 50kg/ha. Thus, the economics of urea application are not just about the benefits of growing extra grass but also about the loss of nitrogen from biological fixation. In addition, most of the nutrients the plant takes up from the soil are provided by the organisms living in the soil. Providing conditions that favour the latter facilitates the supply of nutrients to the plant roots. Conversely, applying high levels of an acidic fertiliser such as urea, will kill off or disadvantage these soil organisms. This is tantamount to “cutting off the hand that feeds you.” The soil biological life is one of the farmer’s greatest assets – when conditions are right, these creatures work tirelessly night and day, without pay and without complaint. They need to be encouraged, not wiped out!

Thirdly, plant and animal nutrition. Animals require a balanced diet of carbohydrates, protein etc to be healthy. Carbohydrates, which are derived by the plant from the sun's energy and air and water, provide most of the animal's energy requirements. Protein is distinct in that in addition to the dominant carbon, hydrogen and oxygen components, it also requires nitrogen and often sulphur as well. When nitrogen fertiliser is applied, it is usually assumed that this will boost plant protein levels, and thus growth and productivity as well. This point of view is reinforced by the way crude protein levels are usually determined i.e. plant nitrogen levels multiplied by 6.25 or milk nitrogen levels multiplied by 6.38. The reality is actually quite different and often, when excessive nitrogen is applied, large amounts of non-protein nitrogen or nitrates build up in the plant, often associated with mineral imbalances (high potassium, low calcium, magnesium and trace elements). The nutrient balance in the plant is compromised, which causes the feed to be unpalatable or undesirable to the grazing animals, which prefer not to eat it. When stock are forced to eat such feed, the result is often rumen digestion problems and a host of animal health/veterinary issues.

Good pasture generally results from good soil. When the nutrient balance is right in the soil, nutrient and mineral levels in the plant will be in balance and the feed will be of good quality i.e. the right balance of carbohydrate, protein etc providing the grazing animal and ruminant microbes with optimal energy and nutrition. When excessive nitrogen is applied, feed quality is compromised. The nitrogen "silver bullet" may produce lush green pastures and increased quantities of dry matter, leading to the farmer having "peace of mind" in terms of his feed supply but other factors must also be considered. Strategic applications of nitrogen fertiliser have a place but good productivity and economic return is not just about "painting the landscape green," it is first and foremost about producing well balanced, good quality feed. Only with the latter can the farmer expect to generate an improved economic bottom line.