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The sandplain lupin: its nutritional value and grazing management

By Peter Morcombe, Veterinary Officer, Division of Animal Health, South Perth

The sandplain lupin or Western Australian blue lupin (Lupinus cosentinii) was introduced to the West Midlands at the turn of the last century. Since that time it has been used as a self-regenerating summer forage for sheep and cattle. Being deep rooted, it has adapted well to the sandy soils from Perth to Northampton, and plantings now cover more than 100,000 ha.

As few other improved pasture species will persist on these deep sands the sandplain lupin provides an important source of summer feed for grazing livestock. A stand can be grazed throughout summer at stocking rates of 10 to 15 sheep/ha as long as lupinosis is avoided by correct management. The cultivation of the sandplain lupin as a cash crop is restricted by its high alkaloid level in the seeds and shattering pods.

Nutritional quality

The seed of the sandplain lupin is high in protein (34 per cent) and digestibility (80 per cent), and its fibrous coat makes it ideal for ruminant animals. Its high alkaloid content (0.5 to 2.0 per cent) gives it a bitter taste.

If ruminants eat large amounts of seed they may become uncoordinated and stagger excitedly. This is usually short-lived, however occasionally it can be fatal. Pigs and poultry (monogastrics) are very sensitive to the effects of the alkaloids and they can die after eating small amounts of sandplain lupin seed.

The protein levels of the pods (5 per cent) and stems (6 per cent) are higher than that of the volunteer grasses which grow between the lupins plants. These grasses - spear grass, silver grass and annual veldt grass - while low in protein have higher digestibility (50 per cent) than the lupin pods (40 per cent) and stems (30 per cent). Sandplain lupin stems are thick and woody and generally are not eaten by sheep unless they are softened by rain, the plant material on the ground is wet, or there is a shortage of other feed.

The lupin leaf material, which is eaten along with the seed and dried grass, has 13 per cent crude protein and 60 per cent digestibility.

Animal growth rates

Sheep choose the more nutritious fraction of the lupin-grass mixture and growth rates can range from 100 to 150 g/day.

Sheep with no previous experience of grazing sandplain lupins may take some time to develop a taste for the seed. During this time they will eat more of the poorer quality plant material including some small stems which are low in digestibility and which contain the fungus Phomopsis leptostromiformis that causes lupinosis. It pays to run a small number of experienced 'teacher' sheep with the mob to help the novices learn how to select the safer, more nutritious feed.

Weaner sheep generally do not grow as well on sandplain lupins as adults because they eat less seed. They also need a high quality, nutritious feed. In one trial at Badgingarra weaners gained 7 g/day for three months, and in another trial they apparently wouldn't eat any seed and lost weight from the start.

Cattle, on the other hand, are less selective for the seed and their growth rates are more moderate, at 200 to 300 g/day. Cattle use less digestible roughage better than sheep so the provision of small amounts of an energy
supplement, for example 2 kg of oats per day, can boost growth rates up to 600 g/day.

Animal growth will only be sustained while there is enough lupin and grass in the paddock. At high stocking rates or after prolonged grazing, stock will lose weight. The amount of plant material produced in a sandplain lupin stand depends on the finish to the growing period. It can range from 3 to 8 t/ha, so that stocking rates will need to be adjusted accordingly. Six to 12 wethers per hectare or one to two steers per hectare will comfortably graze a stand for three months. They will gain weight during the first 60 days and maintain that weight for the final 30 days.

Grazing management

Autumn and early winter

At the break of the season, a lupin stand may have 50 to 100 plants per square metre. Such a stand should be grazed with 10 to 15 sheep per hectare for six weeks to thin it out to two or three plants per square metre. If the start of the season is delayed or there are frosts at germination the stocking rate will need to be lowered to prevent too many plants being eaten.

Thinning of the stand will encourage the growth of volunteer grasses and the stems of the lupin plants will be thicker, and less palatable, to sheep. Sheep grazing a thin stand will eat proportionally less lupin stem and more grass and therefore will be less likely to suffer from lupinosis. Thinning also helps small sheep graze between the plants and find their way to and from water.

If the stand is too dense swathes should be mowed through it, either leaving the cut lupins on the ground or baling them for hay.

Leave the lupin stand ungrazed during late winter and spring to allow maximum plant growth for summer.

Summer and autumn

The stand can be grazed once the pods have shattered, in late October or early November. This period coincides with the decline in the digestibility of other pastures on the farm. Stock can also suffer alkaloid poisoning at this time because they are eating whole pods. Deaths can usually be prevented if the stock are not disturbed.

To avoid lupinosis, sheep must be taken off the lupins after 10 mm of rain and two to three days of humid, cloudy weather. They can be reintroduced after two weeks of hot weather has dried out the lupin stems. This will prevent the sheep eating the toxic stems and will limit the development of lupinosis.

How to grow them

Three methods are used to establish sandplain lupins on old land.

- Buy graded seed and sow it through a combine near the break of the season.
- Buy seed and spread it with a superphosphate spreader near the break of the season, using a chain to bury the seed.
- Harvest a stand of sandplain lupins, auger straight into a superphosphate spreader and spread the seed immediately.

The germination percentage of bought seed should be tested to establish the seeding rate. There should be at least 20 per cent soft seed, the balance being hard seed. The 20 to 30 per cent of soft seed will germinate in the first year and the hard seed will germinate in subsequent years.

The seeding rate of 20 to 100 kg/ha will depend on the density of stand wanted in the first year. At 20 kg/ha, the first-year stand will be thin, but the second-year stand will be as thick as is needed. At 100 kg/ha, the first year stand will be thick enough to provide a full canopy and help suppress weeds.

Depending on the rotation, a healthy sandplain lupin stand will out-grow weeds.

The soil should be tested for its phosphorus level before planting. If it contains more than eight parts per million phosphorus, then superphosphate at 100 kg/ha/year is a usual rate.

Sandplain lupins may respond to applied potassium, but assess the cost before applying it. If worthwhile, apply a potassium fertilizer four to six weeks after germination.

Cattle are less susceptible to the fungal toxins. Even though steers grazing sandplain lupins can suffer some liver damage, clinical symptoms are rarely seen.

Late pregnant or lactating ewes and cows should not graze lupins because even a small amount of fungal toxin will depress their appetites and cause pregnancy toxaemia in sheep or fatty liver in cattle.

Deficiencies of selenium, copper and cobalt must be prevented in stock grazing lupins grown on sandy soils. Selenium and cobalt deficiency can be corrected by administering.
Why grow them?
Sandplain lupins have many good characteristics. They:

• have deep roots and can use rainfall and fertilizer efficiently on sandplain soils.
• are legumes that produce a high-protein feed capable of carrying 5 to 10 sheep per hectare over summer compared with 2 to 5 sheep per hectare on the usual sandplain pasture.
• stop wind erosion.
• recycle nutrients from deep subsoils. Potassium levels have been noted to increase in the topsoil after several years of sandplain lupin stands.
• increase soil nitrogen levels.
• are a good pioneer species on poor land. Clover can be established after several years of blue lupins, except on 'deep sands' and sandplain soils with gravel or clay at greater than 50 cm.
• have potential to increase overall farm stocking rates.

Lupin hay
If the lupin hay is cut early and dried quickly there will be less fungus present and it will be less toxic than on the uncut lupin plants. This hay is of better quality than the lupin stand, being 10 to 20 per cent above the digestibility of the uncut material.

Livestock, however, will eat more stem material from the hay and even though this is less toxic, lupinosis can still be a problem.

The timing of the hay-making operation is critical to the successful reduction in fungal infection. Hay should be cut between pod formation and leaf drop, and then conditioned. This is not always effective because lupin plants do not mature at the same rate.

Growth rates of cattle fed lupin hay will be greater than those grazing standing lupins. However, cutting the lupins at the right time for fungus control reduces the total amount of plant material by 30 to 50 per cent so there will be fewer grazing days from the hay.

Further reading

intra-ruminal pellets. The application of a fertilizer containing copper will overcome copper deficiency of grazing stock. Stock should not be given copper supplements because sheep with some liver damage from grazing toxic lupin stubbles could develop copper poisoning.

Barbers pole worms and the scour worms are common in the higher rainfall areas of the south-west coastal strip. Sheep should be given a suitable drench before they graze the lupin stand in late October or early November to provide good worm control throughout summer.

The alkaloids in lupin seeds have been implicated in the birth of lambs with leg defects. There have been reports from the West Midlands of between 0.1 and 5 per cent lambs affected. In one case 10 per cent of lambs were affected when sandplain lupin seed was fed to ewes as a supplement during mating.