Pulses as Stockfeed

Demand for pulses for stockfeed both locally and in export markets is likely to have a major influence on prices. Pulses are valuable stockfeeds because of their high protein levels and palatability. They can be used as part of intensive livestock rations or as supplements for paddock reared stock.

In Australia lupins are generally the preferred pulse for sheep and cattle because of their higher protein, higher fibre and lower starch levels, but peas and faba beans are also useful and are commonly used overseas.

INTENSIVE FEEDING

Pig and poultry

In intensive rations pulses are used to complement other feedstuffs to produce nutritionally balanced rations. Pulse's strong points are their high protein content compared to cereal grains, particularly proteins which can be digested easily by the animal for high production rates.

Stockfeeds make up over 75 percent of the cost of intensive animal production so most intensive animal producers and stockfeed manufacturers compare and select between ingredients to use the cheapest combination of ingredients for each particular stock diet.

This means that pulse use (and all other ingredients) depends on nutritional value, cost and local availability.

In the eastern states soybean meal and peas are the most widely used vegetable protein source in stockfeeds, in Western Australia lupins predominate while in South Australia peas and beans are most commonly used.

Pulses are used in intensive rations to provide energy and essential amino acids for growth. Table 10:A shows the nutrient value of the various pulses. Lysine, threonine, methionine, cysteine, isoleucine and trytophan are all amino acids essential for muscle (lean meat) production. As the table shows different animals (pigs and poultry) differ in their ability to absorb the different nutrients. Animals also have different amino acid energy requirements at different stages of growth.

The amount a producer or stockfeed manufacturer will be willing to pay for a particular ingredient will depend on its various nutritional components and the availability of substitutes with equivalent or better nutritional values.

TABLE 10 : A

NUTRIENT LEVELS OF PULSES PER KILOGRAM

NUTRIENT	FABA BEANS	LUPINS (NARROW LEAF)	PEAS	SOYBEAN MEAL
Digestibility energy, pigs (DE, MJ/kg)	13.7	14.0	14.2	14.5
Metabolisable energy' poultry (ME)	11.1	8.8	11.5	10.7
Total lysine (g/kg)	14.4	14.2	17.0	28.0
Available lysine, pigs	13.4	10.6	15.3	25.2
Available lysine, poultry	13.4	12.1	15.3	25.2
Total threonine	8.1	9.2	8.5	15.3
Total methionine	1.8	1.7	2.2	6.0
Total cystine	3.3	4.7	3.0	6.5
Total isoleucine	8.8	10.6	9.5	19.7
Total tryptophan	1.5	2.0	2.0	5.2
Total phosphorus	4.7	4.2	3.9	7.0

TABLE 10:B

Weed seed limits in stockfeed as legislated in one or more Australian states

WEED SEED (that may affect livestock health)	TOLERANCE Seeds / 0.5 litre
Amsinckia *(Amsinckia spp.)*	50
Black bindweed *(Polygonum convulvulus)*	750
Broom rape *(Orobanche crenata)*	0
Caltrop, Bullshead, Catshead *(Tribulus terrestis)*	2.5
Cape Tulip *(Homeria spp.)*	2.5
Castor oil *(Ricinus communis)*	0
Common heliotrope *(Heliotropium europaeum)*	10
Darling Pea *(Swansonia spp.)*	0
Darnal *(Lolium temulentum)*	25
Hexham scent *(Melilotus indicus)*	25
Jute *(Chorchorus olitorlus)*	5 or 10
Mexican poppy *(Argemone orchroleuca)*	10
Mintweed *(Salvia reflexa)*	25
Mustard *(Sisymbrium spp.)*	10,000
Noogoora or Bathurst Burr *(Xanthium pungens, X. spinosum)*	2.5 or 1 burr
Nightshades *(Solanum spp.)*	25
Parthenium Weed *(Parthenium hysterophorus)*	25
Paterson's curse or Salvation Jane *(Echium plantagineum)*	50
Pheasant's eye *(Adonis microcarpa)*	0
Rattle pod *(Crotalaria spp.)*	0
Saltbush *(Atriplex muelleri)*	1000
Sesbania pea *(Sesbania benthamiana)*	100
Thornapple *(Datura spp.)*	2.5
Three cornered jack or Double gee *(Emex spp.)*	10
Turnip *(Brassica tournefortii)*	2000
Wild Turnip *(Rapistrum rugosum)*	3000
Commercial vetch and Tares *(Vicia spp.)*	5
Wild or crow garlic *(Allium vineale)*	2.5
Yellow Burrweed *(Amsinckia spp)*	50

Note: There are variations between these State legislated standards and the standards used by Pulse Australia www.pulseaus.com.au

The value of various stockfeed ingredients will also depend on their quality. Stockfeed mixers are unlikely to be concerned about the level of splits, small and mixed varieties. However they are likely to downgrade or reject grain with high levels of soil or stone, pea weevils, snails, more than 2 percent pods and more than 5 percent cereals. Weed seeds, particularly those which may inhibit the animal's use of nutrients or feed palatability, will affect the value of grain. Some weed seeds cannot be traded under state laws. See Table 10:B.

State laws control the allowable level of most weed seeds in stockfeeds. It is advisable to check these state laws. See also Table 9:F page 9:18 for Australian pulse receival standards.

Health problems

Pulses, particularly lupins, tend to be safer feed sources than barley or wheat but grain poisoning is possible if the introduction is too rapid or too much grain is fed at the one time.

There is a risk that sheep and cattle grazing lupin stubble after rain may be affected by lupinosis if the crop is infected with the phomopsis fungus *(See Page 7 : 13)*. Grain from crops severely infected with phomopsis may also cause lupinosis (severe liver damage).

Sheep introduced to lupin stubbles should be inspected daily for the first week, and then at least three times a week. It is not essential to remove the flock after rain but daily inspections should be made for the next seven days. As soon as the earliest signs of lupinosis are recognised, (loss of appetite, a 'tail' developing in the flock, and in severe cases yellowing around the mouth and eyes) the stock should be removed from the paddock.

TABLE 10 : C

NUTRIENT COMPOSITION OF PULSES, PER KILOGRAM OF DRY MATTER

(CEREAL GRAIN IS INCLUDED FOR COMPARISON)

	ME* (MJ)	RDP** (g)	UDP*** (g)	FIBRE (g)	CALCIUM (g)	PHOSPHORUS (g)	SODIUM (g)
PULSE							
Chickpea grain	13.3	120	50	100	1.7	3.7	–
Faba bean grain	12.8	130	65	100	1.5	6.3	0.6
stubble	7.4	20	6	500	–	–	–
Lentil grain	10.9	150	65	50	0.9	4.2	–
Lupin grain	13.2	142	152	140	2.2	3.9	0.6
stubble	5.0	24	3	550	4.0	0.3	6.7
Pea grain	13.4	129	46	80	0.9	4.0	0.6
hay	8.8	74	25	360	13.9	2.8	–
stubble	6.5	26	3	410	9.9	1.1	4.1
VETCH							
grain	12.6	147	96	76	1.2	5.8	–
stubble	11.8	91	36	420	12.6	3.2	–
CEREAL							
Barley grain	13.7	106	21	53	0.8	3.7	0.1
Oat grain	11.5	58	20	140	0.7	3.9	0.5
Wheat grain	14.0	87	16	26	0.4	3.6	0.3

*ME = metabolisable energy.

Protein is made up of three main parts:

**RDP = Rumen degradable protein.
This is the most important part of the protein makeup as it is used by the rumen bacteria to digest the food and provide the animal with its energy and protein.

***UDP = Undegraded dietary protein.
This protein is only important for high production animals, pregnant or lactating animals. eg fast growing animals.

$\frac{RDP + UDP}{10}$ = Digestible protein percentage. e.g. chickpea $\frac{120 + 50}{10}$ = 17%

The rest of the protein making up the total crude protein content is unavailable to the animal and passes straight through unused. i.e. undigestible protein.

Cattle generally are not at risk but late pregnant or recently calved cows may be severely affected and will die if not removed from the stubble immediately. The Phomopsis fungus which causes lupinosis does not affect peas, beans, chickpeas, lentils or vetches so these crops are completely safe.

Plant breeders have released varieties of phomopsis resistant lupins *(See Table 2 : I)*. These varieties should be planted wherever lupin stubble is likely to be grazed.

Sheep grazing faba beans or peas have occasionally shown a break in the wool, particularly young sheep introduced suddenly to stubbles. The break may be prevented by giving sheep access to alternative feed until they are used to eating beans or peas. Do not put hungry sheep or sheep from poor feed directly into bean or pea stubble. It is best to put them into a good cereal stubble first.

Feeds listed in decreasing levels of risk in relation to acidosis:

Least risk	lupins
	oats
	beans
	peas
	barley
	triticale
Greatest risk	wheat

Need to process grains

The need to process lupin grain appears to depend on the type of cattle. It is recommended that pulses be hammermilled before feeding to dairy cattle because studies have shown that between 24 to 36 percent of whole lupins fed to dairy cows pass through intact. There appears to be little difference in production of beef cattle when fed hammermilled, rolled or untreated grain.

Sheep and lambs are very efficient at digesting whole grain, therefore processing grain is not required. Processed grain can be digested too quickly and may upset normal rumen function.

TABLE 10 : D

APPROXIMATE AMOUNT OF PULSE TO FEED TO STOCK WITH DIFFERENT PRODUCTION LEVELS

(BASED ON FABA BEAN, LUPIN, PEA OR MIXTURES WITH CEREAL GRAIN FED AT 70% OF ANIMAL INTAKE)

SHEEP (LIVEWEIGHT/CLASS)	MAINTENANCE (kg/day)	MEDIUM PRODUCTION (kg/day)	HIGH PRODUCTION (kg/day)
20kg ewe/wether lamb	0.22	0.35	0.51
30kg ewe/wether hoggett	0.28	0.46	0.67
ram hoggett	0.32	0.48	0.68
50kg ewe/wether	0.40	0.68	0.97
ram	0.44	0.69	0.99
75kg ram	0.61	0.96	1.40
CATTLE (LIVEWEIGHT/CLASS			
100kg steer	1.0	1.5	2.2
250kg steer	1.9	2.7	3.7
400kg steer	2.7	3.7	5.1
600kg bullock	3.6	4.9	6.7
400kg dairy cow	2.9	4.7	6.6
600kg dairy cow	3.7	5.5	7.4

Exact estimates of the amount of pulse required depends on the quality and quantity of other feeds available

Lupins

Lupins have many advantages over cereal grains when fed to stock grazing dry pasture or stubbles. As mentioned before, they are a better source of protein. This stimulates microbial activity in the rumen, which assists stubble breakdown.

The low levels of starch in lupins mean that the rumen pH does not drop as much as it does with cereal grains and this also has a positive effect on the rumen's ability to break down roughage.

Lupin seeds are large and highly palatable so farmers can broadcast lupins into the thickest areas of stubble, and sheep, once trained, will eat almost all the grain. This encourages stubble breakdown as sheep forage for seed and can discourage sheep from grazing bare areas. This even works on sandy soil as long as the sheep are used to eating lupins. Scattering the grain amongst the stubble helps reduce shy feeders and curb greedy sheep.

There is little risk of grain poisoning with lupins because of the low level of starch and the high fibre levels *(See Table 10 : C)*. This means that sheep do not have to be introduced to the grain gradually and they adapt to grain quickly. However, watch out for lupinosis fungus on the grain *(See Page 7 : 13)* *(See Plate 7:36)*.

As lupins are not likely to cause grain poisoning the frequency of broadcasting can be reduced saving labour and encourage maximum stubble consumption. Weaners can be fed as little as once a month although it is recommended that all classes of sheep be fed fortnightly. Broadcasting minimises behavioural and mis-mothering effects.

Lupins to increase lambing

Feeding ewes lupins at the rate of 3.5kg per head per week for two weeks before and 17 days after joining begins can significantly increase lamb marking percentages. The lupins must be fed at least three times a week. The biggest increases in lamb marking percentages occur when mating is carried out on dry, low protein feeds.

A similar result may be achieved by putting the ewes onto lupin stubble as long as the stubble contains 20kg to 25kg of lupin grain per head, and lupinosis does not occur.

The biggest increase in lamb markings is achieved in mature ewes which have had teasers run with them for 14 days before joining.

With merino ewes a 15 percent increase in lambing may be achieved while crossbred ewes may show up to 35 percent improvement. These results however may be variable.

Lupins to increase serving capacity

Feeding lupins to rams at the rate of 3.5kg per head per week for eight weeks before joining will ensure adequate testicle size and condition and encourage maximum fertility. By increasing the serving capacity of each ram, lupins may allow farmers to use the minimum number of rams. This will allow the farmer to either save money on ram purchases or purchase higher priced rams.

Peas and faba beans

Peas and beans have high energy and protein levels and therefore correct the deficiencies in cereal stubbles or dry feed better than cereal grains. However, they are not as low in starch or as high in fibre as lupins so they must be introduced gradually and fed once a week to avoid grain poisoning.

Sheep may take a little longer to adapt to peas and beans than lupins and may not eat as much roughage as when fed on lupins. In practice these differences are fairly minor and it is usually price which determines the grain to feed.

In recent years the vetch breeding program has conducted feeding trials with lambs and pigs.

Vetch grain from common vetch varieties (Morava, Blanchfleur, Languedoc and Cummins) can be used to feed ruminants without limit in the feeding ration or as a pure grain. Common vetch grain can also comprise up to 10% of the dietary ration of pigs. No information exists for feeding vetch to chickens.

Grain from purple or woolly vetch (Popany, Namoi, Haymaker, Capello) should never be used for any feed for pigs or poultry.

All Vetch hay/silage is a very valuable fodder source for dairy cows, beef cattle, sheep and other stock, with high levels of protein, digestibility and metabolisable energy.

SUPPLEMENTARY FEEDING

Sheep and cattle

In recent years pulses have been recognised as a valuable source of forage supplements for livestock *(See Tables 10:C and 10:D)*. They are particularly useful helping sheep make the best use of cereal stubbles.

Stubbles are low in digestibility and low in protein so once grain on the ground and weeds have been eaten, stock grazing stubble usually lose weight. The high levels of protein and energy in pulses can be used to supplement stubble and maintain stock condition.

Studies by a farmer group at Cummins on South Australia's Eyre Peninsula have shown that alternatives such as stock blocks or stubble treatments are more expensive and often less effective than pulse supplements.

> Pulses are more effective supplements to stubble than traditional grains such as barley and oats because they can correct the protein imbalance in the animals diet.

At times sheep eating oat or barley grain decrease their consumption of stubble by the amount of grain fed. In these situations supplements of cereal grains have little effect on animal performance and a negative effect on stubble breakdown. In contrast pulses will sustain the roughage intake and hence animal performance and stubble breakdown.

Pulses for weaner animals

Pulses in early weaning rations allow artificially reared calves to be successfully weaned at about six weeks of age if the calf is eating about 0.5kg of grain each day. Pulses may also be fed to weaned calves in paddock situations to ensure they achieve good growth rates.

Under intensive feeding regimes young lambs require a high balanced energy and protein diet. As lambs become larger the protein requirement decreases and the rotions should be adjusted accordingly.

Feedlot and supplementary rations

The high protein content of pulses can be combined with cereals, hays and mineral supplements to achieve balanced rations for most livestock.

In feedlot situations store lambs and cattle perform much better on a mixture of cereal hay and grain (e.g. 30 percent hay, 70 percent grain), where the grain portion consists of a mixture of pulses and cereals (e.g. ratio 1 : 3).

However it should be recommended that stock fed lupins, or rations containing lupins, usually adapt quickly to a high level of grain feeding otherwise it would take between two to five weeks to adapt to a higher level of grain feeding. Therefore the use of lupins in preference to other pulses may be crucial to the economics of the exercise.

When formulating rations it is useful to have all ingredients tested to know their exact chemical composition. A balanced "least cost ration" will enhance the viability of any feedlot enterprise.

Feed test kits can be obtained from

FEEDTEST, Agriculture Victoria
Mount Napier Road
Private Bag 105
Hamilton VIC. 3300
Telephone: 1300 655 474

Primary Industries and Resources SA has developed a computer programme called "Ready Rations Pro" which will help formulate least cost rations for sheep and cattle under a range of production conditions including:

- feedlotting
- drought feeding
- supplementing ewes pre-lambing
- finishing on pasture or stubbles.

Roughage

When ruminants such as cattle and sheep are fed a high grain diet they also require roughage. Roughage aids the digestive system to efficiently function and maintain rumen pH.

Legume hay such as vetch can be a valuable ingredient in intensive rations, apart from providing roughage, high quality legume hay can be high in protein and energy. Pulse stubbles can also be used as a roughage source but tends to be lower in energy, protein and generally less palatable.

Source p48 & 49
PIRSA "TAKE-AWAY" Software Manual 1995

Chemical residue awareness in grain and stubbles

The use of various fungicides and insecticides on pulses is now common. Growers need to be aware of the withholding periods for both harvest and the grazing of stubbles of each product used. MLA Livestock Vendor Declarations now ask graziers to list the chemicals used, date of application and withholding period for any chemical applied to the grain, crop or residues they have fed or grazed. Currently 60 days prior to sale and 60 days prior to harvest or grazing are the periods in question. Pulse growers must therefore record and be aware of the label, current NRA permit and export requirement withholding periods. These can all differ, and may even be nil grazing for some products. Quality Assurance programs also require such details to be recorded and adhered to.

Grazing pulse stubbles

The pulse stubbles left after a crop are also very nutritious livestock fodder. Sheep and beef cattle tend to do better on pulse stubbles than they do on cereal stubbles because of the high energy value and protein content of the remaining grain and the digestibility of the straw.

Comparisons between pulse crops have shown beans and lupins produce the best weight gains in young Merino sheep. Field peas also produce good results. Sheep production off lentil stubbles can be less due to the small seed size. Summer rains may germinate the leftover grain and reduce their food value.

Although the stems and pods of pulses are more valuable than barley straw or ryegrass stubble, the grain remaining on the ground has the greatest influence on the paddock's carrying capacity. *(See Plate 2, Section 1).*

This means the grain on the ground should be measured to make the best use of the stubbles.

Calculating grain residues

The amount of grain remaining on the ground can be measured by making a square with 50cm sides out of fence wire. The square should be taken out into the paddock and placed on the ground and the grain lying inside the square collected.

This should be done at 30 places across the paddock. Bulk all the grain collected and weigh it. The result (in grams) from the 30 samples should be multiplied by 1.33 to give the number of kilograms per hectare of grain.

One hectare with 0.5t/ha on the ground should be able to carry five weaners or store lambs for around three months. If there are still reasonable quantities of grain remaining on the ground older sheep can be used to clean up the area.

Even young lambs can make good use of pulse stubbles. In trials Dorset-Merino cross lambs ranging from 6kg to 23kg liveweight (three to eight weeks old) grew well (180gm/day) on bean and lupin stubbles containing about 1.0 t/ha of fallen grain.