Harvesting

Early harvest of pulses is critical because delays can result in significant yield losses due to lodging, shattering and pod loss. Grain quality can also suffer. Moisture levels at harvest affect the quality of the grain in storage.

Delaying harvest will allow grain to become more brittle and so susceptible to cracking and splitting. Also, moulds and diseases such as black spot on peas can increase on the pods and seeds. Seed damage from pests such as pea weevil is reduced by early harvest and fumigation.

If harvesting grain for seed, germination rates are improved if grain is harvested at 12 to 14% and then stored in mesh silos, aerated or immediately graded and bagged. Crop topping with herbicides prior to crop maturity may reduce grain quality and seed germination.

Harvesting settings

Pulses are easily threshed, so concave clearances should be opened and the drum speed reduced.

If there are a lot of summer weeds the drum speed may have to be increased to ensure that weeds do not block the machine. Pulses are larger than wheat so a concave with many wires or blanked-off sections can stop grain separation. To get the best performance alternate wires and blanking off plates will have to be removed. Maximum wind settings and barley sieves should ensure a good sample.

An alternative to the barley sieve is to make a mesh sieve using 18mm tubing for the frame and one square to the centimetre, 14 gauge wire mesh. This screen increases capacity because the whole area is able to sieve. This screen will also eliminate pods from lupin and pea samples.

If there are summer weeds, the rake at the back of the sieves should be blanked-off to stop them entering the returns. Summer weeds may cause walkers and sieves to block completely, causing high grain losses.

Take extra care, when harvesting pulses for seed, to reduce grain cracking even if this means making a poor sample. Gentle harvesting will give the best seed quality. Rotary harvesters are more gentle on the crop and will generally cause less grain damage than conventional harvesters.

CHICKPEAS

Chickpeas should be harvested as soon as they mature as pods will fall if harvest is delayed.

The crop varies in height from 15 to 80cm with pods held up in the canopy so direct heading without crop lifters is possible with open front and closed front machines. Some fingers may have to be removed when using closed-front machines. Chickpeas thresh easily but are prone to cracking, particularly kabuli types, so adjust thresher speed (400 to 600rpm) and concave (10 to 30mm) to suit. Removing alternate wires and blank-off plates from the concave will help reduce cracking. If possible cover the rasp bars with plate.

Harvesting grain at high moisture levels up to 14 percent should minimise cracking.

Early harvesting, before summer weeds become a problem, will reduce clogging and sample contamination. Desiccating the crop will kill summer weeds and ensure even crop ripening.

As chickpeas are destined for human consumption a good sample off the header is usually required.

Table 9 : A

Harvester settings for pulses

	CHICKPEAS	FABA BEANS	LENTILS (GREEN)	LENTILS (RED)	LUPINS	PEAS	VETCH
Reel Speed	Medium	Slow	Slow	Slow	Slow	Medium	Slow
Spiral Clearance	High	High	Low	Low	High	Standard	Low
Thresher Speed	400-600	400-600	350-450	350-450	400-600	400-600	400-600
Concave Clearance	10-30mm	15-35mm	20-30mm	10-20mm	10-30mm	10-30mm	10-30mm
Fan Speed	High	High	High	High	High	High	Medium
Top Sieve	32mm	32-38mm	32mm	16mm	32mm	25mm	25mm
Bottom Sieve	16mm	16-19mm	8-16mm	3-10mm	16mm	16mm	10-16mm
Rotor Speed *	700-900	700-900	350-450	350-450	700-900	700-900	Slow

*Rotary machines only.

FABA BEANS

Late sown or droughted crops may carry pods very close to the ground, especially if seeding rates were low. Draper fronts or open-front machines, ideally fitted with a flexi-front, are best for harvesting beans. Beans thresh easily so drum speeds should be adjusted (400 - 600rpm) and concave settings altered to 15mm to 35mm clearance to reduce grain damage. Blanking plates and alternate wires should be removed from the concave so the large seed is not cracked and grain separation can occur at the concave. *(See Plate 130)*

Double acting cutterbars should reduce losses caused by cutterbar vibrations. Four finger guards will also reduce vibrations but they can limit intake capacity of open fronts in heavy crops.

Vibra-mats will improve the flow of cut material from the knife to the table auger, especially in light crops (only on open fronts).

When harvesting, try to cut the stem below the lowest pod with the reel following the top of the crop. Often this means cutting height is very close to ground level so rolling after sowing, to level and firm the soil and depress obstacles, is worthwhile.

LENTILS

Harvest lentils as soon as possible to avoid losses, otherwise pods will shatter or fall and the crop will lodge further. Delays also increase the risk of rain damage which will decrease yield and grain quality. Wind can also cause significant losses. All except the shortest crops (15cm) will lodge at maturity, so this means that small crop lifters may be necessary. Rolled paddocks greatly assist harvest by firming soil and pressing down rocks, sticks and other contaminants in the paddock, hence reducing harvester damage and ensuring a cleaner sample. Firmed soil reduces soil and other contaminants in the harvested sample.

Harvest across the lay of lodged crops if necessary to reduce harvest losses. A closed front is best, ideally fitted with a flexi-front, slim crop lifters and air assistance. Double density knife guards may help reduce losses *(see also the Lupin section following)*. Some fingers may have to be removed if using a closed front machine.

The ease of threshing and the amount of seed splitting varies between varieties so experimentation may be required to find ideal thresher speeds and concave clearances.

Harvesting on cool days or at night, on rolled ground, may decrease shattering losses if harvest is delayed, but more pods may appear in the grain sample. *(See harvesting in high humidity Page 9:4)*

Desiccation or crop topping or perhaps windrowing can assist in earlier and more even lentil ripening to make harvesting easier, and may be necessary to kill late weed infestations or prevent weed seed set. Harvesting short lentil crops can be improved by windrowing directly in front of the harvester. Windrows must be bulky, and rolled or harvested immediately as part of the operation to prevent losses with winds.

A good sample off-header, free of soil contamination, insect damage and weed infestation, is required for lentils because they are sold for human consumption.

LUPINS

Lupins should be harvested as soon as they are ripe. If lupins are not harvested within three weeks of maturity shedding may cause significant yield losses.

Losses of between 5 to 40 percent can occur as pods shatter entering the header. Vibration due to cutterbar action, plant on plant, reel on crop impact and poor removal of cut material by the auger all cause shattering and grain loss.

Grain loss can be reduced by harvesting in high humidity, at night if necessary, to minimise pod shattering. Avoid reaping in extreme heat.

Finger reels are less aggressive than bat reels and cause fewer pod losses.

Double acting cutterbars reduce cutterbar vibration losses. Four finger guards with open second fingers also reduce vibrations. *(See diagram)*

A lupin breaker is a cheap and simple device which will increase harvesting capacity to reduce grain loss. It is a small serrated plate which attaches to the front spiral and creates an aggressive, positive feed action to clear cut material from the front of the knife.

There are other options available to improve lupin harvesting:

Aussie-Air

Directs an air blast through reel fingers, in either heavy and light crops.

The manufacturer claims an extra 15h.p. is required to drive an Aussie-Air but there is also less horse power. requirement because of wider concave clearances. The actual h.p. required should be no more than for a heavy cereal crop.

Harvestaire

Replaces reel with a manifold that directs a blast of air into the front.

The manifold causes some interference with the incoming crop; correct orientation of air blast is very important; an optional secondary fan to increase the air blast is worthwhile; the device is more effective in light crops.

Vibra-mat

A vinyl mat that vibrates with the knife, stops bunching at the knife of open front headers and helps the table auger to clear cut materials; its chief advantage is that this device is very cheap. It is more effective in light crops.

It is important to match ground speed to table auger capacity and crop density - too slow and the plants will not have enough momentum to carry to the front, too fast and the cut crop will not be cleared from behind the knife.

Extension fingers

Plastic extension fingers, approximately 30cm long, which fit over existing fingers can save significant losses, for little financial outlay, at the knife. Pods which would have fallen in front of the knife are caught on the fingers and pushed into the comb by the incoming crop.

Extended fronts

Extended fronts are now available for some headers and reduce losses at the knife by increasing the distance between the knife and auger to a maximum of 760mm. This helps stop losses from material bunching in front of the auger, where pods can fall over the knife and be lost.

Platform sweeps®

Platform sweeps® are used in conjunction with extended fronts and consist of fingers which rake material towards the auger to help eliminate bunching. They can also be used on conventional fronts.

Draper fronts

Draper fronts such as MacDon® and Honeybee® have large clearances behind the knife and carry the crop to the elevator. The front can also be used for cereals without modification.

NB. Cost benefits must be assessed as a small area of lupins may not justify the cost of some of the above modifications.

PEAS

Field peas can be harvested with minor adjustments and modifications. Open-front or pick-up fronts are best suited to the job. *(See Plates 118-120).*

Harvesting peas can be costly if stones, sticks or too much dirt are picked up with the peas. Machinery damage can be reduced by a variety of practices.

Early harvest

Early harvesting can solve many problems. Losses are reduced because the pods are tougher and less prone to shatter. The crop is also easier to gather because it stands more erect, allowing the harvester front to operate at a greater height, reducing the dirt, rock and sticks entering the harvester.

Early harvesting also means there are fewer summer weeds to clog the harvester.

Early harvesting also plays a role in disease control and crop establishment in the following crop. Early harvested grain is of better quality due to less disease , principally black spot infection of seed. *(See Tables 9 : B and 9 : C)*

Table 9 : B

Effects of harvest date on ascochyta (black spot) levels in seed.

Harvest Date	Ascochyta infected seed %
November	4.5
December	8.0
January	12.9
February	24.7

Table 9 : C

Effects of seed-borne ascochyta (black spot) on crop emergence.

Ascochyta infected seed %	Emergence	
	Average	Range
0	83	74-94
10	76	68-88
40	61	55-64
50	45	32-54

Semi-leafless peas

The harvesting of semi-leafless, erect peas with the sugar pod (non-shattering) trait may need header adjustments to be made compared with the conventional pea types. Plucker and Draper fronts will require modifications to create downward pressure onto the harvested pea material or to force it into the broad elevator. There are generally fewer problems with conventional and flex fronts. Also a slower harvesting speed will reduce intake problems.

For these semi-leafless, non shattering pea types like Kaspa or Moonlight, harvest under warmer conditions than with conventional peas. The concave setting may need to be closer than normal and threshing time longer. A straw chopper may be essential to chop up the more ropey pea vine produced. It may be possible to remove the crop lifters if the crop is upright.

Set the finger tyne reel to force the pea material down onto the front. Moving the broad elevator auger forward can improve the feeding of light pea material. Fitting a raised cross auger, ideally with paddles on the middle section, is essential on draper fronts. A backing plate or cross wires at the back of the table may help all set-ups. Lupin breakers are a useful addition to cross or table augers to increase their aggressiveness on all set-ups, but particularly on plucker fronts. Flexible fingers above the plucker are a useful addition. Crop dividing coulters will assist all set-ups. For more detail see Seymour *et al* (2005) "Successfully harvesting semi-leafless field peas" Department of Agriculture WA bulletin 14/2005.

Rolling

Harvester damage may be reduced by rolling paddocks after sowing to flatten and firm soil and depress obstacles like stumps and stones. *(See Section 3)*

Perforated screens

Perforated screens fitted on the bottom of the broad elevator, cross augers, grain and seconds elevators, all reduce the amount of dirt in the sample.

The perforated screen at the broad elevator is large and removes the dirt before it enters the main working mechanism of the harvester.

Harvester speed

Excessive harvester speeds will cause large grain losses and force more dirt into the harvester. Generally speeds greater than 8 km/hour are not recommended, irrespective of the type of harvester front used.

Harvesting in high humidity

Harvesting in humid conditions, when pods are less prone to shatter can reduce grain losses, however more unthreshed pods may appear in the grain sample. It is unwise to harvest peas at night unless using a pick-up front or some positive height control which will stop the front from digging into the dirt. Some farmers have fitted wheels on the outer end of their fronts, as a depth stop. Others have bought ultra sonic automatic depth controls to control header height.

Pick-up fronts *(See Plates 119, 120 and 121)*

Pick-up fronts, the same as, or similar to those used for picking up windrows can be used to harvest peas. The rotating fingers pull the vine from the ground, leaving the weeds behind, which ensures a clean sample. The pick-up fronts greatly reduce the amount of dirt entering the harvester and make harvesting easier because harvesting height is not as critical as with a front fitted with pea lifters. This allows harvesting at night. The fingers on the pick-ups are closely spaced and will gather all the crop, so crop losses are reduced.

There are different types of pick-ups. Some have fingers attached to rotating belts (draper pick-ups) and others have fingers attached to rotating drums (peg roller pick-ups). The peg roller types are similar and cheap but tend to shatter pods and cause slightly higher grain losses than the draper type. The draper types are more expensive but will reduce losses if harvesting late.

Flexible cutterbar fronts (flexi-fronts)

Developed for soybean crops, the cutterbars of these fronts are hinged in short sections, allowing the whole front to flex and closely follow the ground contour. They use skid plates and are particularly good for short crops like lentils and peas, but can also be used on cereals by locking the hinged sections together.

SNAILS

Snails can be a major problem at harvest time in some areas. They can clog up and damage harvesting machinery causing delays while snail pulp is removed from sieves etc.

Both white and conical snails can cause problems by climbing plants and entering headers with the grain.

There is no quick and easy way to control snails, but the combination of a number of strategies and modifications to harvesting equipment can help.

Before harvest

- Baiting snails *(See Page 1 : 20)*. Complete all baiting by end of August to avoid the risk of bait entering grain samples at harvest, particularly with peas.
- Harvest crops early - the later they are left, the more difficult they will be to harvest.
- Leave badly infected areas until cool or damp weather when snails are more likely to be down off the plants.

At harvest

- Minimise the entry of dirt into the header by using a grate in the bottom of the front elevator.
- Use a smaller top sieve, or 10mm punch hole or octagonal top sieve.
- Weld a lip onto the front of the top sieve to stop snails falling off.
- Add removable panels to the header to allow easy cleaning.
- Add a steel slat in the elevator to keep the elevator clean.
- Slow down the speed of the grain elevators.
- Harvest with the repeat door open, but monitor losses.

After harvest

- Burning stubbles in autumn is effective if a complete burn of the paddock is achieved.
- Control grass along fence lines where snails can remain undisturbed.
- Roll, slash, cable or trash harrow stubbles so snails cannot get above 5cm off the ground. Beware of erosion.

Fire safety

Pulse dust is flammable and likely to cause fires. Be wary of slipping belts and collapsed bearings that could ignite the dust. To reduce the fire risk, remove the build-up of dust and clean the engine daily.

Drag an earthing chain to reduce static eletricity on the header.

Keep a water tank nearby during harvest and carry a knapsack that works, just in case a fire does start.

WINDROWING

The major advantages of windrowing are earlier harvest, reduced seed damage and less grain loss, particularly if harvest is delayed. Pod loss and shatter is reduced because windrowers allow unhindered passage onto the canvas due to the absence of platform augers. Lower harvesting heights may also be possible.

Windrowing also helps to dry out green broadleaf weeds, such as radish, which can cause major problems at harvest.

Windrowing also reduces damage to headers. Headers working in rougher country can damage knife fingers and sections, retractable fingers and other components on sticks and stones. Pick-up fronts leave most of these on the ground.

Windrowing of lupins should begin when the average moisture content of all the seed is 65 percent. At this stage leaves are beginning to fall and the cotyledons (inner part of seed) of the seeds in the primary pods are turning from green to yellow.

Windrowing faba beans should begin when the hilum (scar-like area where the seed attaches to the pod) is turning black on the seeds in the upper most pods *(See Figure 9 : A)*. At this stage the upper pods are still bright green, but the lowest pods are starting to turn black and have seeds with completely black hilums. If windrowing is delayed beyond this stage, it needs to be in cold and moist conditions otherwise pod loss becomes unacceptable.

If windrowing is premature, some cotyledons may stay green and affect marketability.

Windrowing of lentils is less advisable as the windrows can be blown away in strong winds.

The cutting height for windrowing should be just below the bottom pods with the reel following the top of the crop. The reel speed should be quite slow. The delivery opening in the windrower should

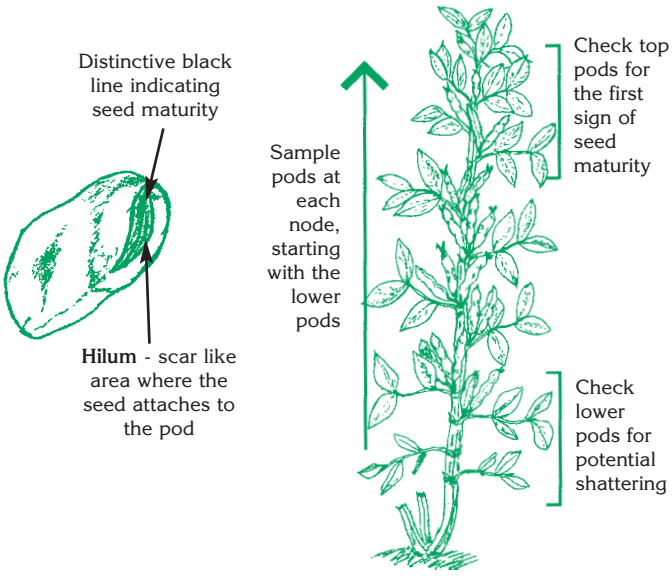
be large enough to prevent blockages or there will be lumps in the windrow. Windrows should be dense and tightly knit for best results.

Curing will usually take about 10 hot days. However heavy infestations of radish could delay drying to 14 days or longer.

Pick-up fronts are the most common type used for harvesting windrows, however crop lifters used close together on open fronts have been used with some success.

FIGURE 9 : A

Checking beans for maturity to enable windrowing



DESICCATION *(See Page 5 : 4 also)*

Pulses can be desiccated pre-harvest to enable earlier harvest and to dry out green weeds. It is becoming common practice, particularly in peas and lentils. Timing is based on crop stage, and is similar to or later than that for windrowing.

The danger of premature desiccation is in having excessive green cotyledons in the sample, staining of the seed coat or small seed all of which create marketability problems.

In field peas, desiccation can occur once pea seeds have reached maturity, usually at 30% moisture when the lower 75% of pods are brown, seeds are firm and shells thin and leathery. This equates to 20 days after the end of flowering. Harvest 5 to 10 days after desiccation.

In lentils, desiccation can occur when the crop has reached full maturity as indicated when seeds in the top pods are turning from yellow to orange and seeds in the top pods are firm. The tips of the plant and upper pods are still green, and about 50% of the crop has started to yellow at this stage. Harvest the desiccated lentils before they become brittle.

In chickpeas, desiccation can occur when less than 20% of pods are green and 90% of seed is changing from a green color.

CROP-TOPPING *(See Page 5 : 4 also)*

Crop topping is timed to prevent weed seed set, not the crop growth stage. It can coincide with desiccation times in peas, lentils and with windrowing times in some lupins and beans. Chickpeas are too late maturing to crop top.

Beware of grain quality effects if crop-topping earlier than the crop desiccation/windrowing stage.

Discolored cotyledons (kernel) and seed coats can arise with crop topping too early.

BULK HANDLING

Pulses are damaged each time they are moved, so farm operations should be planned to minimise grain movement. Tubulators or grain belt conveyors cause less damage than augers. When using augers, run them slowly but full. Adding a trickle of water will also help with peas as it tends to lubricate the flighting, casing and peas.

Augers with large clearances between flighting and casing tend not to crush the grain as much as those with close fitting flightings.

Combine loaders which throw or sling, rather than carry the grain, can cause severe reductions in germination rates.

Approximate weights of grain stored in a cubic metre of silo is shown in Table 9 : D below. The actual figures can vary as much as 6 to 7% in wheat and barley and 15% in oats. In pulses the variation is likely to be less (3 to 4%), and will vary with the grain size, variety and season.

Table 9 : D

Calculating silo capacities

Volume of a cylinder:

volume = area of base (diameter squared X 0.7854) X height

Volume of a cone:

volume = 1/3 (area of base X height)

Grain	Cubic Metres	Kilos	3-Bushel Bags
Peas	1	750	9.2
Faba Beans	1	750	9.2
Broad Beans	1	645	9.2
Lupins	1	750	9.2
Chickpeas	1	750	9.2
Lentils	1	800	9.2
Vetch	1	750	9.2
Wheat	1	750	9.2
Barley	1	625	9.2
Oats	1	500	9.2
Example . . . Silo of Peas	67.4	50,617	620

GRAIN CLEANING

Recleaning of samples after harvest is sometimes necessary.

Cereals can be cleaned from most pulses (not lentils) with a 3 or 4 mm rotary screen. The 3.75mm slotted screen is popular and will help screen out split grain. The paddles or agitators in rotary screens should be either new or sufficiently worn so that the grain being harvested cannot jam between the outside of the paddle and the rotary screen.

Screens or paddles can be damaged beyond repair if the grain jams. Fitting the screens with a spacer will provide additional clearance and so avoid the problem.

Milk thistle buds can be difficult to separate if they contaminate the sample because they are similar in size and weight to peas. However, if desiccated or given time to dry, the buds disintegrate when put through an auger and can be easily separated.

Dirt and most small weed seeds can be separated in rotary screens, however the dirt will increase component wear.

Grain Quality

It is extremely important to monitor the quality of grain before and during harvest. Seed coat and kernel (cotyledon) can be discolored by crop topping or premature desiccation in parts of the paddock if ripening is uneven. Pulse samples showing no header damage will always be more acceptable to a buyer, particularly if the product is for human consumption; eg. chickpeas, broad beans, lentils.

Staining of seed caused by green plants in the crop or admixture of splits, weeds, stones, etc., will only reduce the value of your grain and can lead to dockages.

Remember, harvesting is the last stage in producing a quality product for the market - do not be complacent in pre-harvest crop management or in setting up the header correctly.

Calculating grain losses

Grain losses on the ground can be estimated by counting the seed per m^2 and calculating the weight per hectare, using the 100 seed weights from the seeding rates in section 3.

Eg. Lupins 100 seed wt ..... 20 grams

seed on the ground ..... $80/m^2$

$$\text{seed loss} = \frac{\text{No. of seed/m}^2 \text{ X 100 seed wt.}}{10}$$

$$= \frac{80 \text{ X } 20}{10}$$

$$= 160 \text{ kg/ha}$$

A number of samples should be taken to cover both the losses at the comb and over the sieves.

Storage

Pulse grain placed in storage with high germination and vigour will remain viable for at least 3 years providing the moisture content of the grain does not exceed 11%. Storage life of pulses is determined by temperature, insects and diseases.

Moisture

Pulses harvested at 14% moisture or higher must be dried before going into storage to preserve seed germination and viability. As a general rule every 1% rise in moisture content above 11% will reduce the storage life of pulse seed by one third.

Temperature

High temperatures in storage will cause deterioration in grain viability. Temperatures of stored pulse grain should not exceed an average of 25°C and preferable the average temperature should be below 20°C. In general each 4°C rise in average stored temperature will halve the storage life of the grain.

One practical way of reducing temperatures is to paint the silo white as dark colored silos will absorb more heat.

Grain in large silos (over 75 tonnes) will remain cooler as grain is a poor conductor of heat and day - night temperature fluctuations rarely reach 15cm beyond the silo wall. Small silos (less than 20 tonnes) and field bins will have larger temperature fluctuations and can cause deterioration in grain quality.

Fumigation

For fumigation product information, hazardous substance database and protective equipment see www.draeger.com.au

Controlling pea weevil in storage

Pea weevil control programmes should principally aim to control insects in the flowering crop. However, if some insects escape, as they inevitably do in broadacre cropping situations, there are methods which will control infestations in stored grain.

Provided the correct methods are used, fumigation will penetrate the grain and destroy all stages of insects, adults, eggs, larvae and pupae in the treated grain at the time of fumigation.

However, successful fumigation requires a sealed storage area. *(See Page 9 : 10 Sealing silos.)*

To be effective fumigants must be held in the storage area at a given concentration for a certain period of time, this is only possible in sealed storage areas.

Effective fumigation with phosphine for example needs a concentration of 100 ppm (a chemical to air ratio) of phosphine to be maintained for at least 100 hours. An unsealed silo will not hold this concentration for more than a few minutes, even using a high dosage rate of five or more phosphine tablets for each cubic metre of silo space.

Sealed silos are available for a slightly higher cost, or alternatively, existing farm silos may be sealed to the required levels *(See Page 9:10 for details on sealing silos)*.

Treating stored peas

Fumigation should be carried out as soon as the silo is filled to ensure that the feeding stage (larvae) and the non-feeding stages (pupae and adult) are eliminated before any further grain damage or weight loss occurs.

Early harvesting and immediate fumigation will reduce the number of adults which could emerge from the peas to infest pea crops in the next growing season.

Phosphine fumigation

Caution should always be used when dealing with phosphine gas, it is not only toxic but also highly explosive. Observe all withholding periods for handling and grain use.

Phosphine released from aluminium phosphide tablets, pellets or sachets has a characteristic smell which can usually be detected at concentrations within the safe level.

Unless fumigating in a well ventilated situation gas respirators suitable for protection against phosphine should be worn.

Masks should fit properly for protection – this may be difficult for those with bearded faces – but is essential to avoid poisoning. Proper mask maintenance is also essential. For safety reasons it is best not to work alone when applying phosphine tablets or in a structures that have been fumigated.

Warning signs should be clearly displayed during fumigation.

Always open containers of phosphine preparations in the open air or near open windows. If possible use the contents of a tin in one operation. If any is left over the tin lid should be replaced and sealed with PVC tape.

First aid

If anyone is gassed they should immediately be removed into the open air and given oxygen treatment if possible. If the victim does not appear to be breathing check the pulse and begin mouth to mouth breathing and cardio-pulmonary resuscitation.

If the victim is breathing place them in a flat position and make sure he or she rests. They should be kept warm or they may succumb to shock.

As soon as possible transport the victim to hospital.

If someone swallows phosphine tablets, try to induce vomiting as soon as possible. Do not give them milk, butter, oils (castor oil) or alcohol.

Accidents are always possible so an emergency plan should be prepared in advance. Make sure

everyone involved knows the first aid treatment for phosphine poisoning and display diagrams for heart-lung massage as well as emergency phone numbers.

Using phosphine

Use only sealed storage.

Phosphine is slightly heavier than air and spreads rapidly. As grains do not absorb phosphine well it circulates through the stack effectively.

Suspend phosphine tablets in a tray or belts in the silo headspace. Do not mix with the grain. This makes it easy to remove residues when fumigation is completed.

Dosage rates

Phosphine application rates are based on the total silo capacity (internal volume of the structure) that is to be fumigated whether or not the silo or shed is full, partly filled or empty. The rates are the same for all crops.

Consult your local advisor or your supplier for details of different aluminium phosphide products available.

The recommended rates are shown in Table 9 : E.

TABLE 9 : E

RECOMMENDED RATES OF PHOSPHINE

Sealed Silo

CUBIC METRES	BUSHELS	TONNES	NUMBER OF TABLETS
18	500	14	28
37	1000	28	56
56	1500	42	84
74	2000	56	111
92	2500	70	138

The fumigation period varies from 7 to 20 days depending on temperature and product used.

It is important to follow concentration and exposure instruction carefully, as overdosing may reduce the fumigant's effectiveness.

Do not use phosphine when the grain temperature is below 15°C or when grain moisture is below 9%.

Ventilation after fumigation

If there is only natural air-flow over the grain there should be a minimum five days ventilation period to allow the phosphine concentrations to drop to safe levels below 0.3 ppm time weighted average (twa).

The concentration of phosphine can be measured with a multigas detector pump fitted with a Draeger testing tube for phosphine. This equipment can detect levels of phosphine as low as 0.01 ppm in the air. The detector is available from Draeger Australia, 9 Crittenden Road, Findon, SA 5023, telephone (08) 8244 3603.
See www.draeger.com.au

Disposal

Tablet residues and expended sachets should be buried at least 30 cm below the soil surface. The expended tablets should not be piled in a heap because there is a risk that they will catch fire.

Methyl bromide fumigation

The Australian Government has phased out most uses of methyl bromide from January 1st 2005. Methyl bromide may only be used on pulses for an approved quarantine or pre-shipment use. Further information can be from the Department of Environment and Heritage, ph 02 6274 1111.

The storage area (silo) has to be sealed for methyl bromide fumigation and an air circulation system is needed to distribute the methyl bromide through the silo effectively. The treatment area is only safe to enter when indicated by an appropriate measuring device.

Carbon dioxide fumigation

If the silo meets test levels, carbon dioxide can be added under pressure from a cylinder to give a rapid initial purge and quickly achieve high carbon dioxide levels.

For thorough protection a carbon dioxide concentration of 34 % or more must be maintained for 10 days.

Sealing silos

Growers may choose to seal existing farm silos rather than buying new silos.

However the sealing must be carried out with care and attention if good results are desired. A "slap happy" job will cost many hours as leaks will take time to locate and repair.

Silos which are inadequately sealed lose gas through small holes, preventing the fumigant

reaching and maintaining concentrations necessary for an effective insect kill. *(See Plate 122)*.

The figures below show why gas is lost from inadequately sealed silos, through the effects of wind and sun.

FIGURE 9 : B

GAS LOSS THROUGH HEAT EFFECTS

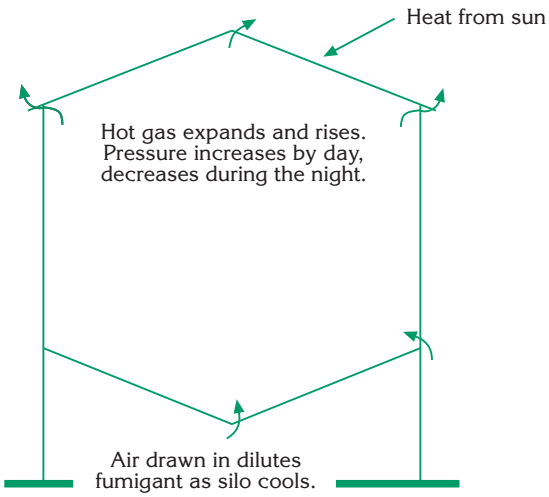
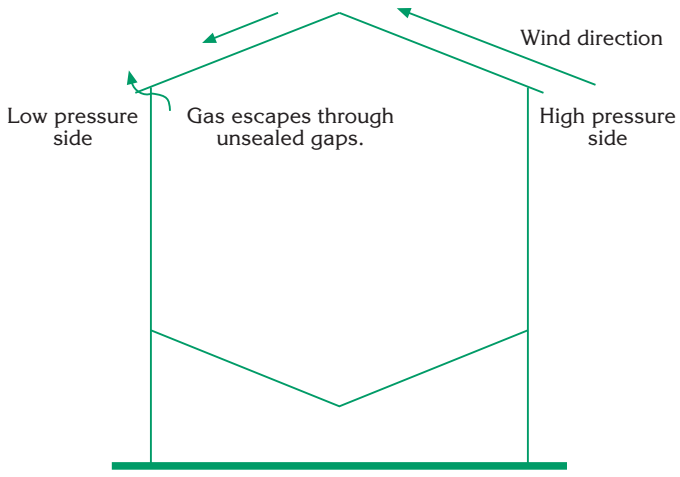


FIGURE 9 : C

GAS LOSS THROUGH WIND EFFECTS



Techniques have been developed which allow farm silos to be sealed to gas tightness for effective fumigation. Internal sealing is preferred, but external is possible.

Achieving a good seal

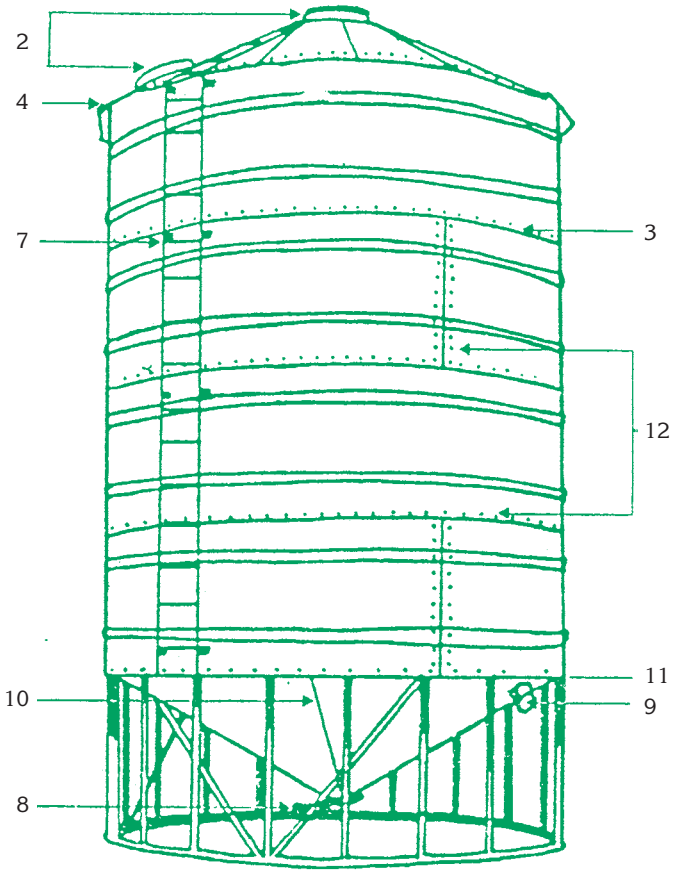
Correct surface preparation is one of the most critical aspects of achieving a good seal.

1. Remove all loose scale, rust, paint, grease, dirt and dust to give a good clean surface.
2. Modify or replace the roof and outloading hatches so they are self sealing when closed *(See Figures 9 : F to 9 : I)*. Alternatively they can be temporarily sealed using heavy duty plastic sheeting 0.25 mm thick, taped to the silo.
3. It may be necessary to strengthen areas to restrict movements at joints between metal sheets and other components.
4. If the rivets holding the roof wall join are spaced more than 10 cm (four inches) apart additional riveting, no more than 10 cm apart, will be necessary to restrict joint movement.
5. Concrete bases must be sealed with specially prepared cement sealers to stop gas leaks and to ensure moisture does not enter the silo from this area.
6. Large gaps between panels can be covered by filling with foam or cloth tape before applying the sealant.
7. The ladder mounts should be sealed using suitable sealants.
8. The auger boot should be modified or replaced with a resealable unit and should be fully welded to the silo body.
9. The bagging out chute should be removed completely if not required or alternatively should be modified to be a resealable unit.
10. Check that the weld joints in the cone area are continuous, if not weld fully.
11. The wall cone join should be sealed with suitable sealant.
12. All the rivet heads should be covered with sealant.
13. An approved relief valve should be fitted to the silo wall, preferably at eye level and on the shaded side of the silo *(See Plate 123)*.
14. A tubeless tyre valve should be fitted to the silo wall or cone.

15. If possible paint the external walls and roof surfaces of the silo with white reflective paint. This will reduce internal temperatures and reduce gas and air expansion inside the silo. As a consequence less gas will forced out of the relief valve.

FIGURE 9 : D

SEALING STEPS *(refer to numbers)*



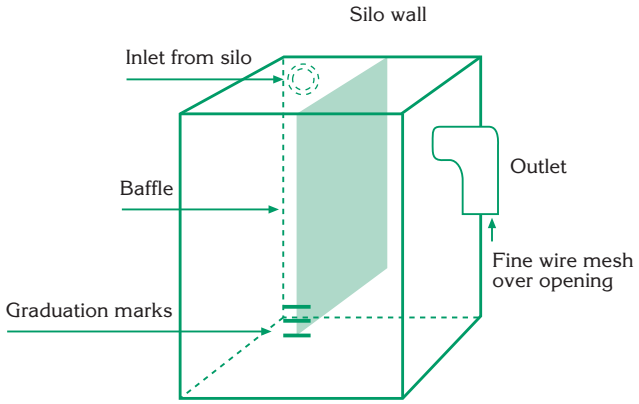
Testing the seal

A relief valve fitted to sealed silos can also be used as a gauge for pressure testing. This allows for easy and regular seal tests. The relief valve should be filled to the second line *(See Figure 9 : E)* with light engine oil (such as Shell Vitrea 68). Don't use water as it will evaporate. Vegetable oil is also unsuitable as it may react with the phosphine.

Relief valves are available from Acrifab Products 15 Davis Road, Attadale, W.A. telephone (08) 9470 2366 and Dominion Plastics, McGill St., Shepparton Victoria, telephone (03) 5821 1477, or Sherwell Holdings, 10 Cheviot Road, Salisbury, South Australia, telephone (08) 8258 8188.

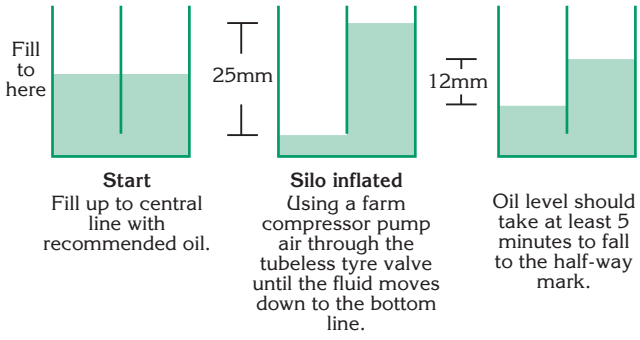
FIGURE 9 : E

PRESSURE RELIEF VALVE



TESTING SILOS FOR SEAL

Test the silo for gas tightness using the pressure relief valve.



Start
Fill up to central line with recommended oil.

Silo inflated
Using a farm compressor pump air through the tubeless tyre valve until the fluid moves down to the bottom line.

Oil level should take at least 5 minutes to fall to the half-way mark.

Method

Using a tubeless tyre valve fitted to the silo wall pressurise the silo using an air compressor until a 25mm difference in the heights of the fluid columns (or 250 pascals) is seen; this should only take a few minutes.

Time the pressure fall to 12 mm (125 pascals); it shouldn't be less than five minutes.

This test should only be conducted when weather conditions are stable, as fluctuations in the temperature, strength of sunlight, or windy conditions can affect the readings. The best times are at night after cooling or early morning before heating.

If the difference in fluid levels falls to 12 mm in less than five minutes it indicates an air leak which will need to be found and sealed before fumigation can be effective. First check all hatches to see that they are sealing properly. Leaks in other parts of the silo can be located by applying a soapy solution to suspect areas – bubbles will indicate an air leak.

Alternatively a boat flare may be released inside the silo *(See Plate 122)*. Ensure silo is free of grain dust as it is explosive.

When pressurising the silo take care not to exceed a difference of 30mm in fluid levels as this high level of relief valve operation could damage the structure.

Check the silo with the above method each time sealing is carried out.

When a sealed silo is not being used for fumigation leave a hatch slightly open or leave fluid out of the relief valve to allow air flow.

Suitable sealants

Water based sealants have an advantage because of their safety, ease of application and cleaning but they can take considerable time to cure, especially in cold or humid conditions.

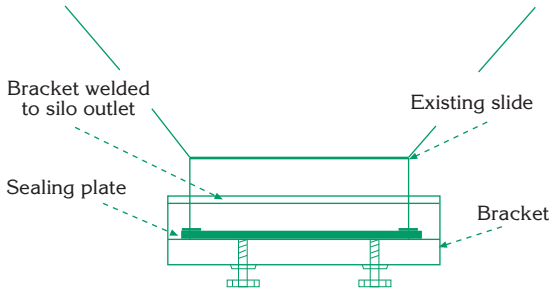
A solvent based product cures almost instantly, but there are problems with dangerous and inflammable fumes, especially, when these products are used in areas with limited ventilation, such as a workshop or inside of a silo.

Aluminium tape (3M or Scotch) could also be used to seal joints.

Modifying inloading and outloading ports

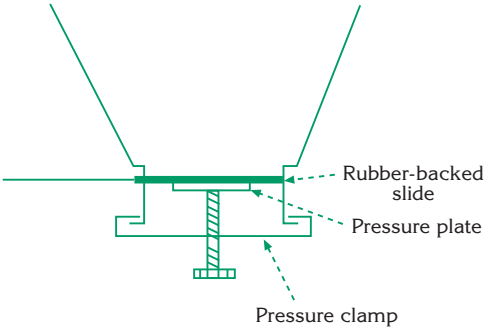
Below are are a few suggestions on how to modify the roof and cone ports.

FIGURE 9 : F



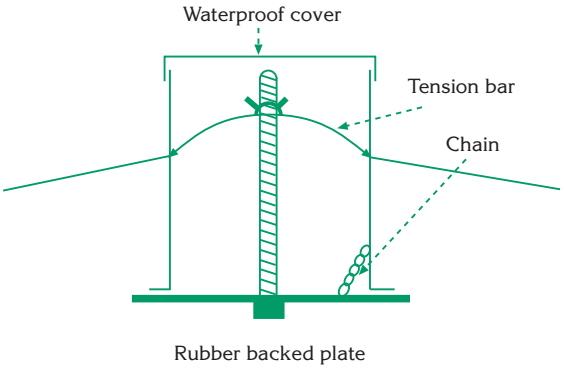
The auger boot, slide handles and bagging-out chute handles are removable through the use of quick-release pins and bolts. It is then a simple operation to slide in rubber-backed plates and seal them by tightening two hand screws.

FIGURE 9 : G



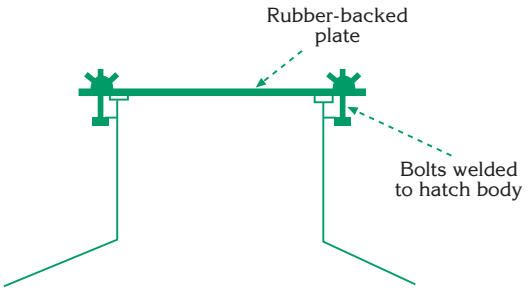
A loose-fitting rubber-backed slide which is sealed by applying upward pressure to the slide by means of a clamp.

FIGURE 9 : H



A rubber-backed plate is pulled up hard against the inside lip of the frame by means of a bar and screw.

FIGURE 9 : I



A rubber-backed plate bolted onto the existing frame. The plate is completely removed when using this type of resealable cover. A flat ring is welded to the existing frame so that the rubber-backed plate has a wider sealing surface.

National Pulse Standards

National Pulse standards are set by Pulse Australia and are reviewed annually. Changes are made or new standards introduced only as need arises, but after consultation with the pulse industry. Copies of the full standards are available on the Pulse Australia web site www.pulseaus.com.au and from the National Agricultural Commodities Marketing Association (NACMA). Summary tables of selected receival and export standards are presented, as well as examples of full descriptions used in the standards.

Note:
1. **For specific details the tables should be used in conjunction with the full standards and appendices for the standard involved.**
2. **These standards are the minimum required, and may change. It is advisable to check with the buyer for any changes in the standards before contracting or making a delivery.**
3. **The Grain Legume Handbook Committee compiled the following information and tables from the latest (March 2006) standards available from Pulse Australia (www.pulseaus.com.au).**

Nil acceptance - all pulses

All pulses shall be free from animal excreta, rodents, live insect pests and any chemical not registered for use on stored pulses or in excess of legal tolerances. There shall be nil tolerances on pickling compounds / seed dressings or any fungicide added to the pulse as a seed dressing and any tainting agents and / or other contaminants imparting an odour not normally associated with that particular pulse.

There shall be nil acceptance on toxic and / or noxious weed seeds which are prohibited by state laws against inclusion in stockfeeds.

Seed contaminants – weed seeds

Weed seed tolerance tables from the standards are listed in Table 9:F Page 9:18 and apply to pulses traded under the standards as specified. Note however, that the weed seed tolerances may differ from those applied in each State and Territory under the respective legislation. All persons trading pulses are advised to refer to the relevant legislation for appropriate standards to be complied with.

Soil contaminantion

It is the responsibility of all individuals involved in the trade of pulses to confirm for themselves prior to shipment, that soil levels in any consignment conform with the specifications of their contract and/or the legal requirements of the importing country and will pass the Australian Quarantine and Inspection Service (AQIS) inspection process.

MINIMUM RECEIVAL STANDARD SUMMARY: FIELD PEAS No 1 GRADE FIELD – FARMER DRESSED (CSP-10.1.1)

PARAMETER	REQUIREMENTS	COMMENTS / VARIATIONS
Physical Characteristics	The peas shall be hard and well filled.	
Purity	97% Min by weight	Whole Field Peas, defective Field Peas and seed coats.
Moisture	14% Max	
Defective Seeds	3% Max by weight	Field Peas not of the specified variety. Field Pea kernels that are broken, heat damaged, hail damaged, insect damaged, frosted, shrivelled, split, chipped, sprouted, caked, bin burnt, affected by mould (field or storage). Includes pods that contain Field Peas, whether broken or unbroken, loose seed coat and screenings.
Screen Size	3.75mm slot screen	Field Pea seed material is defective if falls through. Use "Forty Shakes" screening method.*
Poor Color	1% Max by weight	Seed coat or kernel that is distinctly off color from the characteristic color of the predominating class.
Foreign Material	3% Max by weight One clover burr in a 200g sample	Unmillable material and all vegetable matter other than Field Pea seed material.
Unmillable Material	0.5% Max by weight (of which Max 0.3% soil)	Soil, stones, metals and non-vegetable matter. Soil is defined as clumps of 2 mm diameter or greater. Please read important note re soil contamination.*
Snails	Max one (1)	Dead or alive or a substantial part thereof (more than half) including bodies per 200g sample.
Field Insects	Fifteen (15) Max	Dead or alive per 200g sample.
Foreign Seeds		See Appendix (Table 9:F page 9:18)*
Objectionable Material	Nil Tolerance	See Appendix*
Ryegrass Ergot	Two (2) cms Max	Pieces laid end to end per 200g sample.

NOTE: Not less than 70% by weight of the whole sample shall be prime peas, that is, field peas that will not pass through a 6.35mm round hole screen.

** Further details see Australian Pulse Trading Standards, www.pulseaus.com.au*

MINIMUM RECEIVAL STANDARD: FABA BEANS No 1 GRADE - FARMER DRESSED (CSP-5.2.1)

PARAMETER	REQUIREMENTS	COMMENTS / VARIATIONS
Physical Characteristics	The Faba Beans shall be sound, dry and fresh and light to medium brown or pale green in color.	
Purity	97% Min by weight	Whole Faba Beans, defective Faba Beans and seed coats.
Moisture	14% Max	
Defective Seeds	Total 6% Max by weight including 3% Max poor color 3% Max brokens, damaged etc	Faba Beans not of the specified variety. Faba Bean kernel that are broken, heat damaged, hail damaged, insect damaged, frosted, shrivelled, split, chipped, caked, bin burnt, sprouted and/or affected by mould (field or storage). Includes pods that contain Faba Beans, whether broken or unbroken loose seed coat and screenings.
Poor Color	3% Max by weight	Faba Beans with excessive discoloration of the seed coat as per the Pulse Australia Faba Bean Photographic Charts. Includes Ascochtya lesions.
Screen Size	3.75 mm slotted	Faba Bean seed material defective if passes through this screen. Use “Forty Shakes” screening method.*
Foreign Material	3% Max by weight	Includes unmillable material and all vegetable matter other than Faba Bean seed material. This includes stalks and plant material that may be connected with the plant.
Unmillable Material	0.5% Max by weight (of which Max 0.3% soil)	Soil, stones, metals and non-vegetable matter. Soil is defined as clumps of 2 mm diameter or greater. Please read important note re soil contamination.*
Snails	Max one (1)	Dead or alive or a substantial part thereof (more than half) including bodies per 200g sample.
Field Insects	Fifteen (15) Max	Dead or alive per 200g sample.
Foreign Seeds		See Appendix (Table 9:F page 9:18)*
Objectionable Material	Nil Tolerance	See Appendix*
Ryegrass Ergot	Two (2) cms Max	Pieces laid end to end per 200g sample.

** Further details see Australian Pulse Trading Standards, www.pulseaus.com.au*

MINIMUM EXPORT STANDARD: DESI TYPE CHICKPEA - FARMER DRESSED (CSP-4.1.2)

PARAMETER	REQUIREMENTS	COMMENTS / VARIATIONS
Physical Characteristics	The Desi type Chickpeas should be sound, dry, fresh and light to medium brown in color (a greenish tinge is allowed). Black is excluded as the predominate class.	
Purity	97% Min by weight	Whole Desi type Chickpeas, defective Desi type Chickpeas and seed coats.
Moisture	14% Max	
Defective Chickpeas	Container: 8% Max by weight Bulk: 10% Max by weight Outturn: 8% Max by weight including poor color	Desi type chickpea kernel that are split, chipped, broken, shrivelled, insect damaged, hail damaged, heat damaged, frosted, caked, bin burnt, sprouted, fully green and / or affected by mould (field or storage). Includes pods that contain Desi type chickpeas, whether broken or unbroken, loose seed coat and screenings.
Screen Size	3.97 mm slotted hole	Chickpea material defective if passing through. Use "Forty Shakes" screening method.*
Poor Color	2% Max by weight	Kernel is distinctly blemished and/or off color from the characteristic yellow color of the predominating class. Must comply with physical characteristics detailed above, and the 1% visible ascochyta listed below.
Ascochyta (disease mould)	1% Max by weight	Visible Ascochyta means that an ascochyta lesion is visible on the kernel. Classifiers are required to break the seed coat if they are not confident that the lesion has penetrated to the seed.
Foreign Material	3% Max by weight	Unmillable material and all vegetable matter other than Desi type Chickpea seed material including not more than 2% Field Peas.
Unmillable Material	0.5% Max by weight (of which Max 0.3% soil)	Soil, stones, metals and non-vegetable matter. Soil is defined as clumps of 2 mm diameter or greater. Please read important note re soil contamination.*
Snails	Max one (1)	Dead or alive or a substantial part thereof (more than half) including bodies per 200g sample.
Field Insects	Fifteen (15) Max	Dead per 200g sample.
Foreign Seeds		See Appendix (Table 9:F page 9:18)
Objectionable Material	Nil Tolerance	See Appendix*
Ryegrass Ergot	Two (2) cms Max	Pieces laid end to end per 200g sample.

Please note that these export standards are in addition to the specific quarantine requirements of particular countries, as governed by AQIS.

** Further details see Australian Pulse Trading Standards, www.pulseaus.com.au*

MINIMUM EXPORT STANDARD: WHOLE RED LENTILS No. 1 - MACHINE DRESSED (CSP-7.2.3)

PARAMETER	REQUIREMENTS	COMMENTS / VARIATIONS
Physical Characteristics	The Lentils shall be hard and well filled.	
Purity	99% Min by weight	Whole Lentils, defective Lentils and seed coats
Moisture	14% Max	
Defective Seeds	Container: 3% Max by weight Bulk ship: 5% Max by weight including poor color.	Lentils not of the specified variety. Lentil kernels that are broken, heat damaged, hail damaged, insect damaged, frosted, shrivelled, split, chipped, caked, bin burnt, sprouted, affected by mould (field or storage). Includes pods that contain Lentils, whether broken or unbroken, loose seed coat and screenings. Refer to the Pulse Australia Lentil Photographic Charts.
Varietal Restriction	1% Max by weight	Not of the specified variety.
Screen Size	Aldinga - 2.2 mm slotted hole All other varieties – 2 mm slotted hole	If whole lentils fall through then classed defective. All material that passes through screen is part of defective or foreign material as applicable. Use “Forty Shakes” screening method.*
Poor Seed Coat Color	1% Max by weight	Discolored Lentils have excessive discoloration of the seed coat as per the Pulse Australia Lentil Photographic Charts. Includes any disease, frost and water staining.
Poor Kernel Color	1% Max by weight	Discolored Lentils have excessive discoloration of the kernel as per the Pulse Australia Lentil Photographic Charts. Includes any disease, frost and water staining, and green, brown, black, yellow, bleached and chalky white kernels.
Foreign Material	1% Max by weight	Unmillable material and all vegetable matter other than Lentil seed material.
Unmillable Material	0.1% Max by weight	Soil, stones, metals and non-vegetable matter. Please read important note re soil contamination.*
Snails	Nil	
Field Insects	One (1) Max	Dead per 200g sample.
Foreign Seeds	2 cereal seeds Max	Cereal seeds exception only. See Appendix (Table 9:F page 9:18).*
Objectionable Material	Nil Tolerance	See Appendix.*
Ryegrass Ergot	Two (2) cms Max	Pieces laid end to end per 200g sample.

Please note that these export standards are in addition to the specific quarantine requirements of particular countries, as governed by AQIS.

** Further details see Australian Pulse Trading Standards, www.pulseaus.com.au*

TABLE 9:F

Grain Legume Handbook summary of Pulse Australia Receival Standards Appendix 1

Tolerances for foreign weed seeds (March 2006). Note disclaimers

Type	Tolerance	Foreign weed seed
1	4 seeds per 200g individual seeds basis	Parthenium weed *(Parthenium hysterophorus)*, Mexican poppy *(Aregemone spp)*, Jute *(Corchorus olitorius)*, Colocynth *(Citrullus coloycynthis)*, Long Headed Poppy *(Papaver dubium)*, New Zealand Spinach *(Tetragonia tetragonioides)*, Field Poppy *(Papaver rhoeas)*, Horned Poppy *(Glaucium flavum)*, Wild poppy *(Papaver hybridum)*, Three Corner Jack or Doublegee or Spiny Emex *(Emex australis)*.
2	Nil per 200g	Castor oil plant *(Ricinus communis)*, Crow or Wild garlic *(Allium vineale)*, Darling pea *(Swainsona spp)*, Opium poppy *(Papavar somniferum)*, Ragweed *(Ambrosia spp)*, Rattlepod *(Crotalaria spp)*, Starburr *(Acanthospermum hispidum)*, St John's wort *(Hypericum perforatum var, angustifolium)* and Coriander *(Coriandum sativum)*.
3 (a)	One (1) seeds in total per 200g	Cape tulip *(Homeria spp)*, Dodder *(Cuscuta spp)*, Thornapple *(Datura spp)*, Bathurst and Noogoora Burr *(Xanthium spp)*, Cotton seed *(Gossypium spp)*, Bulls Head or Caltrop or Catshead *(Tribulus terrestris)*.
3 (b)	2 seeds in total per 200g	Vetch - commercial and tares *(Vicia sativa)* & *(Vicia spp)*.
3 (c)	4 seeds in total per 200g	Blue heliotrope *(Heliotropium amplexicoule)*, Common Heliotrope *(Heliotropium europaeum)*.
4 (a)	10 seeds in total per 200g	Cutleaf mignonette *(Reseda lutea)*, Darnel *(Lolium temulentum)*, Hexham scent *(Melilotus indica)*, Mintweed *(Salvia reflexa)*, Nightshades *(Solanum spp)*, Skeleton weed *(Chondrilla juncea)*, Variegated thistle *(Silybum marianum)*, Field Bindweed *(Convolvulus arvensis)*, Paddy Melon *(Cucumis myriocarpus)*, Hoary Cress *(Cardaria draba)*. Hexham scent may only be accepted if there is no discernible tainting odour imparted to the pulse.
5	20 seeds in total per 200g	Creeping or Russian knapweed *(Acroptilon repens)*, Patterson's curse or Salvation Jane *(Echium plantagineum)*, Sesbania Pea *(Sesbania cannabina)*.
6	5 seeds/pod in total per 200g	Saffron thistle *(Carthamus lanatus)*, Colombus grass *(Sorghum almum)*, Johnson Grass (Sorghum halapense) Lucerne and Medic pods (Medicago spp), Trefoil pods *(Medicago spp)*, Marshmallow or mallow pods *(Malva parviflora)*, Muskweed pods *(Myagrum perfoliatum)*, Wild Radish pods *(Raphanus raphanistrum)*, Clover pods *(Trifolium spp)*. Pod refers to whole or part thereof.
7 (a)	10 seeds in total per 200g (excluding grain being sampled)	Chickpeas *(Cicer arietinum)*, Corn or Maize *(Zea mays)*, Cowpea *(Vigna unguiculata)*, Faba beans *(Vicia faba)*, Lentils *(Lens culunaris)*, Lupins *(Lupinus spp)*, Field peas *(Pisum sativum)*, Soybean *(Glycine max)*.
7 (b)	10 seeds in total per 200g sample	Two Row Barley *(Hordeum distichon)*, Six Row Barley *(Hordeum vulgare)*, Australian Bindweed *(Convolvulus erubescens)*, Black Bindweed *(Polygonum convolvulus)*, Durum *(Triticum durum)*, Black or Wild Oats *(Avena fatua)*, Sand Oats *(Avena strigosa)*, Common Oats *(Avena sativa)*, Rye *(Secale cereale)*, Turnip Weed *(Rapisturm rugosum)*, Wheat (Triticum aestivum), Sorghum grain *(Sorghum bicolor)*, Triticale, Rice *(Oryza sativa)*. Any other seed contaminant not specified (other than small foreign seeds).
7 (c)	1 seed in total per 200g	Safflower *(Carthanus tinctorius)*, Sunflower *(Helianthus annuus)*.
8	100 seeds per 200g	Bellvine *(Ipomoea plebera)*.
9	Small foreign seed 1% by weight or volume	Charlock *(Sinapis arvensis)*, Ball clover *(Trifolium glomeratum)*, Fat hen *(Chenopodium album)*, Fescue *(Festuca spp)*, Hares Ear *(Conringia orientalis)*, Hedge mustard *(Sisymbrium officinale)*, Horehound *(Marrubium vulgare)*, Knotweed *(Polygonum aviculare)*, Lesser Canary grass *(Phalaris minor)*, lettuce *(Latuca spp)*, Lucerne seeds *(Medicago sativa)*, Maltese Cockspur *(Centaurea melitensis)*, Medic seeds *(Medicago spp)*, Milk thistle seeds *(Sonchus oleaceus)*, Amsinckia *(Amsinckia spp)*, Australian Phalaris *(Phalaris aquatica)*, Bladder Soapwort *(Vaccaria hispanica)*, Yellow Burr Weed *(Amsinckia spp)*, Wild Canary Grass *(Phalaris canariensis)*, Canola or rapeseed *(Brassica rapa)*, Slender Celery *(Apium leptophyllum)*, Dock *(Rumex spp)*, Mustard *(Sisymbrium spp)*, Indian Hedge Mustard *(Sisymbrium orientale)*, Paradoxa Grass seed *(Phalaris paradoxa)*, Pepper Cress *(Lepidium spp)*, Ryegrass *(Lolium spp)*, Wild Sage *(Salvia verbenaca)*, Salt Bush *(Atriplex muelleri)*, Sorrell *(Rumex acetosella)*, Sow Thistle *(Sonchus spp)*, Mediterranean or Wild turnip *(Brassica tournefortii)*, Urochloa Grass *(Urochloa panicoides)*, Verbena *(Verbena spp)*, Wild Radish seeds *(Raphanus raphanistrum)*, Wire Weed *(Polygonom aviculare)*, Sheep Weed (or white ironweed or corn gromwell or stone weed) seeds *(Lithospernum arvensis)*, Marshmallow or mallow seeds *(Malva parviflora)*, Muskweed seeds *(Myagrum perfoliatum)*.

Note: *Receivers of grain should check for compliance of this table with the individual State Stock Feed and Medicine and or Weed Acts. See also Table 10:B page 10:1.*

TABLE 9:G

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

Commodity Standard Pulse Reference Number		Moisture content max. (aerate if 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g. max	Additional comments
FIELD PEAS Receival CSP-10.1.1	No 1 grade Farmer dressed	14%	97%	3%	3.75 mm Slot	1%	3% max. 1 clover burr per 200g	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	> 70% not pass through 6.35mm round screen
Receival CSP-10.2.1	No 2 grade Farmer dressed	14%	97%	7%	-	no limit	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	
Export CSP-10.1.2	No 1 grade Farmer dressed	14%	97%	5% container 7% bulk ship	3.75 mm	1%	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	> 70% not pass through 6.35mm round screen
Export CSP-10.1.3	No 1 grade machine dressed	14%	99%	2% container 5% bulk ship	3.75 mm slot	1%	1%	0.1%	-	-	-	-	Nil	1 dead	> 70% not pass through 6.35mm round screen
Export CSP-10.2.2	No 2 grade Farmer dressed	14%	97%	9% container 11% bulk ship	-	no limit	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	
Export CSP-10.3	Yellow split	14%	99.5%	3%	3.97 mm Round	1% and 3%[1]	0.5%	0.1% 1 stone per kg	3%	2%	4%	0.1%	Nil	Nil	[1] = 1% max dark green peas, 3% max. green tinge
BROAD BEANS Receival CSP-2.1.1	Farmer dressed	14%	97%	7% Grub eaten max. 1.5%	6.0mm Slotted	3% ascochyta max. 3% (>4mm)	3%	0.5% max. 0.3% soil	-	-	5%	-	1 per 200g	15	Mechanical damage 6% max. Evergreen max. 2%
Export CSP-2.1.2	Machine dressed	14%	99.5%	7% container. 10% bulk ship. Grub eaten max. 1.5%	6.0mm Slotted	3% ascochyta 3% max. (>4mm)	0.5%	0.1%	-	-	1%	-	Nil	1 dead	Mechanical damage 3% max. kernel, 5% max. skin, 90% retention on specified screen
Export CSP-2.2	No 1 grade split	14%	99%	7%	7.0mm Round	3% immature beans	1%	0.1% 1 stone per kg max.	1%	-	4%	0.1%	Nil	Nil	

TABLE 9:H

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

Commodity Standard Pulse Reference Number		Moisture content max. (aerate if over 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g	Additional comments
FABA BEANS Receival CSP-5.1.1	Canning grade Farmer dressed	14%	97%	2%	3.75mm Slotted	1%	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	90% retention above 8mm round screen
Receival CSP-5.2.1	No 1 grade Farmer dressed	14%	97%	6%	3.75mm Slotted	3%	3%	0.5% max. 0.3% soil	-	-	3%	-	1 per 200g	15	defective max. includes poor color & broken maximums
Receival CSP-5.3.1	No 2 grade Farmer dressed	14%	97%	10% including poor color	3.75mm Slotted	7%	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	defective max. includes poor color
Receival CSP-5.4.1	No 3 grade Farmer dressed	14%	97%	20% of which 7% max. heat, mould or sprouted	-	no limit	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	
Export CSP-5.1.2	Canning grade Machine dressed	14%	99.5%	1.5% including poor color	3.75mm Slotted	1.0%	0.5%	0.1%	-	-	-	-	Nil	1 dead	90% retention above 8mm round
Export CSP-5.2.2	No 1 grade Farmer dressed	14%	97%	8% container 10% bulk ship	3.75mm Slotted	3%	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	outturn max. 8% by weight including poor color
Export CSP-5.2.3	No 1 grade machine dressed	14%	99%	6% container 10% bulk ship	3.75mm Slotted	3%	1%	0.1%	-	-	-	-	Nil	1 dead	defective max. includes poor color
Export CSP-5.3.2	No 2 grade Farmer dressed	14%	97%	12% container 14% bulk ship	3.75mm Slotted	7%	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	outturn max. 12% by weight including poor color
Export CSP-5.5	No. 1 split grade	14%	99.5%	3%	6mm Round	2%	0.5%	0.1% max 1 stone per kg	2% caps whole unshelled	-	4%	0.1%	Nil	Nil	

TABLE 9:I

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

Commodity Standard Pulse Reference Number		Moisture content max. (aerate if over 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g	Additional comments
DESI CSP-4.1.1 CHICKPEA Receival	Farmer dressed	14%	97%	6% max. including max. 1% ascochyta stained	3.97mm Slotted	2% max. 1% ascochyta	3% max. including 2% field peas max.	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	max. 2% field peas. Defective includes poor color
Export CSP-4.1.2	Farmer dressed	14%	97%	8% container 10% bulk ship	3.97mm Slotted	2% ascochyta max. 1%	3% 2% field peas max.	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	max. 2% field peas. Defective includes poor color. Outturn 8% max. by weight including poor color
Export CSP-4.1.3	machine dressed	14%	99%	3% container 7% bulk ship	3.97mm Slotted	2% ascochyta max. 1%	1%	0.1%	-	-	-	-	Nil	1 dead	defective includes poor color
Export CSP-4.2	Split - chana dhal	14%	99%	-	3.57mm Round	2% ascochyta max. 1%	1%[2] including caps	0.1%	1%[2]	2% whole skinless	4%	0.1%	Nil	Nil	[2] = Caps plus foreign material max. 1%
KABULI CSP-4.3.1 CHICKPEA Receival	Farmer dressed	14%	97%	3%	6.00mm Round	2% ascochyta max. 1%	3% max. 0.3% soil	0.5%	-	-	-	-	1 per 200g	15	defective includes poor color
Export CSP-4.3.2	Machine dressed	14%	99.5%	2%[1]	6.00mm Round	2% ascochyta max. 1%	0.5%	0.1%	-	-	-	-	Nil	Nil	[1] = defective includes poor color. 92% must have retention on specified screen for size category

TABLE 9:J

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

Commodity Standard Pulse Reference Number			Moisture content max. (aerate if over 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g	Additional comments
LENTILS Receival	**CSP-7.1.1**	whole green No. 1 grade Farmer dressed	14%	97%	4% Variety restriction 1%	2mm slotted	1% seed coat and 1% max. kernel	3% Max. 2 cereal seeds	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	max. 3% defectives other than poor color
Receival	**CSP-7.2.1**	whole red No. 1 grade Farmer dressed	14%	97%	4% Variety restriction 1% 4% including poor color	2.0mm slotted except Aldinga 2.2mm slotted	1% max. seed coat and 1% max. kernel	3% Max. 2 cereal seeds	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	max. 3% defectives other than poor color
Export	**CSP-7.1.2**	whole green No. 1 grade Machine dressed	14%	99%	4% Variety restriction 1%	2.0mm slotted	1% max. seed coat and 1% max. kernel	1% Max. 2 cereal seeds	0.1%	-	-	-	-	1 per 200g	1 dead	max. 3% defectives other than poor color
Export	**CSP-7.2.2**	whole red No. 1 grade Farmer dressed	14%	97%	5% container 10% bulk ship. Variety restriction 1%	2.0mm slotted except Aldinga 2.2mm slotted	1% max. seed coat and 1% max. kernel	3% Max. 2 cereal seeds	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	
Export	**CSP-7.2.3**	whole red No. 1 Machine dressed	14%	99%	3% container 5% bulk ship. Variety restriction 1%	2.0mm slotted except Aldinga 2.2mm slotted	1% max. seed coat and 1% max. kernel	1% Max. 2 cereal seeds	0.1%	-	-	-	-	Nil	1 dead	
Export	**CSP-7.3.1**	red split No. 1 grade	14%	99.75%	-	3.0mm round except Northfield 2.78mm round	0.25% kernels	0.25% Max. 2 cereal seeds	-	0.25% caps	5%	5%	-	Nil	Nil	0.25% max. chalkywhite
Export	**CSP-7.3.2**	red split No. 2 grade	14%	99.5%	-	3.0mm round except Northfield 2.78mm round	0.25% kernels	0.5% Max. 0.3% soil Max. 2 cereal seeds	-	0.5% caps	5%	5%	-	Nil	Nil	0.25% max. chalkywhite
Export	**CSP-7.3.3**	red split No. 3 grade	14%	99.0%	-	3.0mm round except Northfield 2.78mm round	2% yellow kernel 0.25% other colors	1% Max. 2 cereal seeds	-	2%	5%	5%	-	Nil	Nil	0.25% max. chalkywhite

TABLE 9:K

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

Commodity Standard Pulse Reference Number		Moisture content max. (aerate if over 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g	Additional comments
NARROW LEAFED LUPINS Receival **CSP-8.1.1**	Narrow leafed (angustifolius) lupins Farmer dressed	14%	97%	7%[3]	-	36 per 200g[3]	3% max. 2% wild	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	[3] = defectives include 2 bitter/ dark seeded per 200g max. 17 phomopsis affected per 200g
Export **CSP-8.1.3**	Narrow leafed (angustifolius) lupins Farmer dressed	14%	97%	5%[4] container max. 9% bulk ship 11% max. including poor color[4]	-	36 per 200g[4]	3% max. 2% wild radish	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	[4] = defectives include 2 bitter/ dark seeded per 200g max. 17 phomopsis affected per 200
ALBUS LUPINS Receival **CSP-8.2.1**	Albus lupins No 1 grade Farmer dressed	14%	97%	5%[5]	6.75mm round	1%[5]	3% max. 2% wild radish	0.5% Max. 0.3% soil	-	-	-	-	1 per 200g	15	[5] = defectives include 2 bitter/ dark seeded per 200g max. 17 per 200g phomopsis affected seed
Receival **CSP-8.3.1**	Albus lupins No 2 grade Farmer dressed	14%	97%	7%[8]	6.75mm round	2%[8]	3% max. 2% wild radish	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	[8] = defectives include 2 bitter/ dark seeded per 200g max. 17 per 200g phomopsis affected seed
Export **CSP-8.2.2**	Albus lupins No 1 grade Farmer dressed	14%	97%	5%[6]	6.75mm round	1%[6]	3% max. 2% wild radish	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15 dead	[6] = defectives include 2 bitter/ dark seeded per 200g max. 17 per 200g phomopsis affected seed
Export **CSP-8.2.3**	Albus lupins No 1 grade Machine dressed	14%	99.5%	2%[7]	6.75mm round	1%[7]	0.5%	0.1%	-	-	-	-	Nil	1 dead	[7] = defectives include 2 bitter/ dark seeded per 200g max. 17 per 200g phomopsis affected seed

TABLE 9:L

SUMMARY OF PULSE AUSTRALIA WINTER PULSE STANDARDS

as compiled by Grain Legume Handbook March 2006

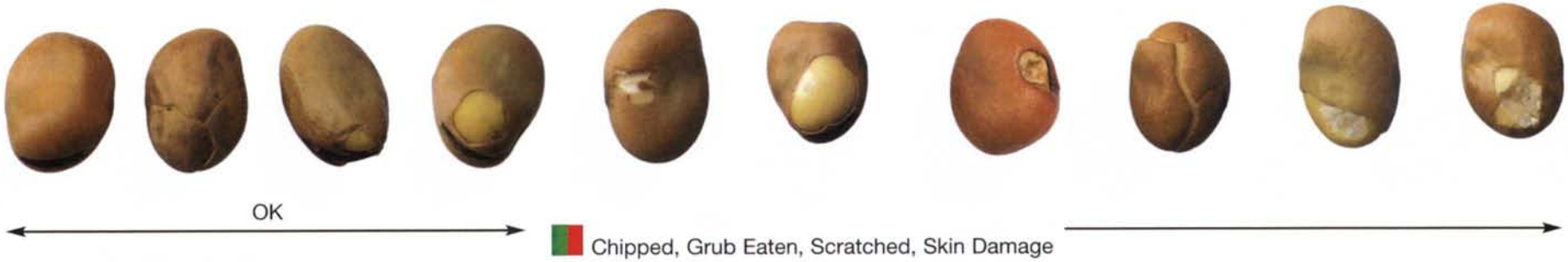
Commodity Standard Pulse Reference Number		Moisture content max. (aerate if 12%)	Purity min.	Defective max.	Screen size for defective or kibble	Poor color max.	Foreign material max.	Unmill-able material max.	Caps max.	Dehulled wholes max.	Broken knibbled or screening max.	Detached tached seed coats max.	Snails max.	Field insects per 200g	Additional comments
VETCH CSP-12.1 Receival	Farmer dressed	14%	97%	5%	-	1%	3% max. including 2% cereal grain	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	
Export CSP-12.2	Machine dressed	14%	99.5%	2%	-	1%	0.5%	0.1%	-	-	-	-	Nil	1 dead	
FENUGREEK Receival CSP-6.1	whole No. 1 grade farmer dressed	12%	97%	3% variety restriction 1%	-	1% seed coat or kernel	3%	0.5% max. 0.3% soil	-	-	-	-	1 per 200g	15	
Export CSP-6.2	whole No. 1 grade machine dressed	12%	99%	2% variety restriction 1%	-	1% seed coat or kernel	1%	0.1%	-	-	-	-	Nil	1 dead	

PULSE
AUSTRALIA

Faba Beans

Damaged and Defective

Skin Damage, Chipped, Scratched, Grub Eaten Kernels



Poor Colour

Ascochyta and Weather Damage

Sponsored by GRDC

Update 2002

Update 2002

PULSE AUSTRALIA

Broad Bean Colour Chart

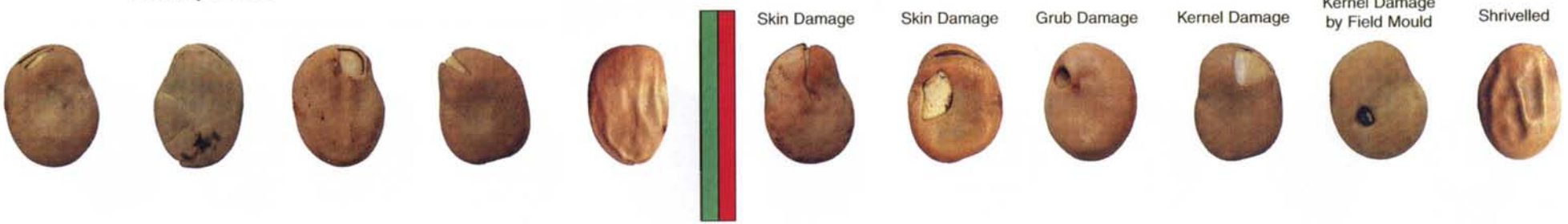
Receival Standard

Damaged & Defective

Skin Damage, Chipped, Split, Kernel Damage, Grub Eaten, Shrivelled

Acceptable

Not Acceptable

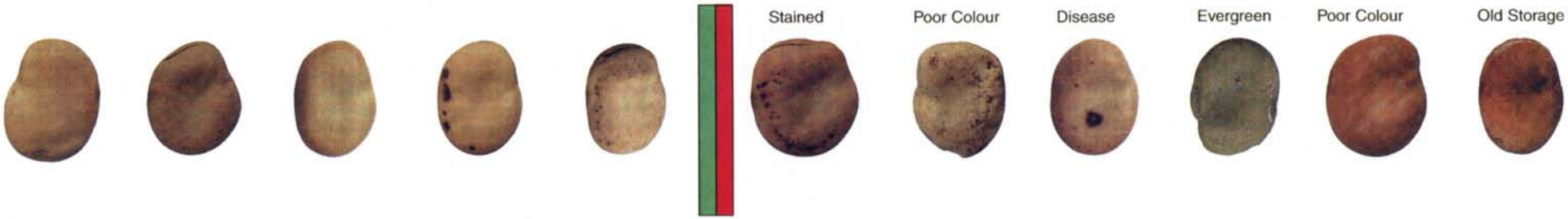


Poor Colour

Weather damage, Storage, Evergreens, Disease, Staining

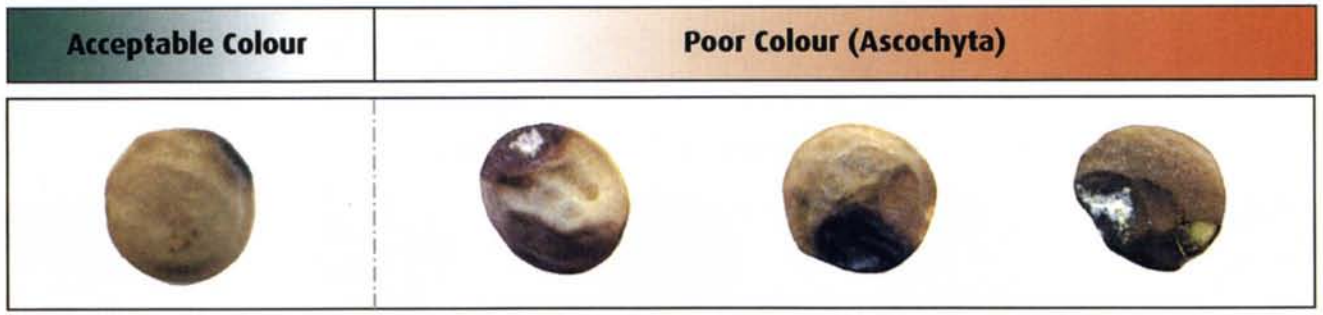
Acceptable

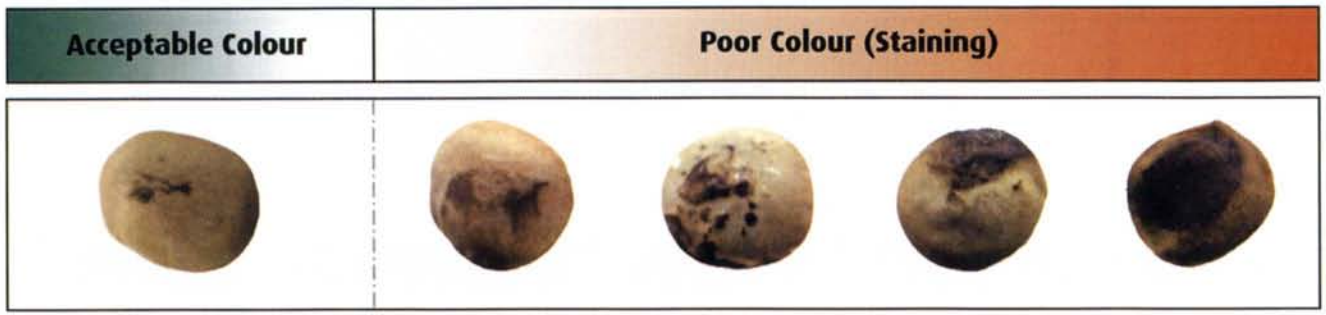
Not Acceptable



Sponsored by GRDC

Lentils (Digger, Cassab, Nugget) - Poor Colour



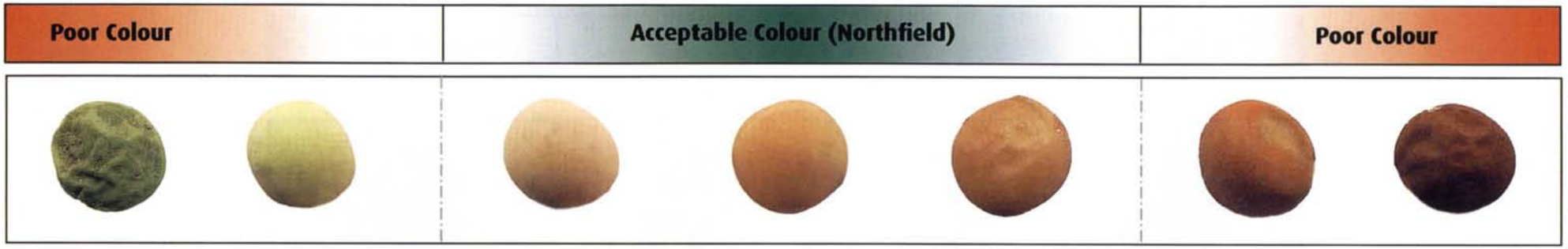


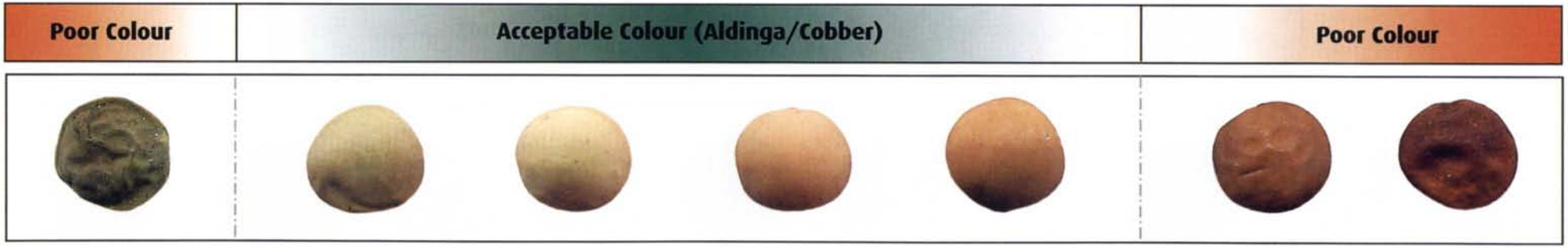
Sponsored by GRDC

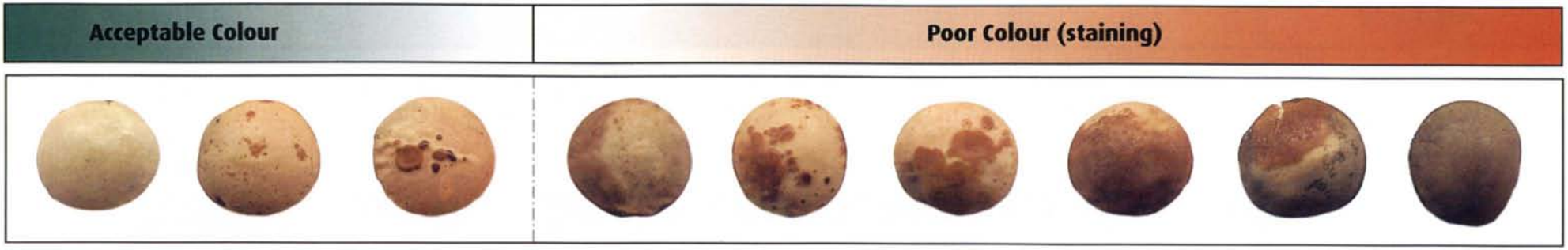
Update 2002

PULSE AUSTRALIA

Lentils (Northfield, Aldinga, Cobber) - Poor Colour

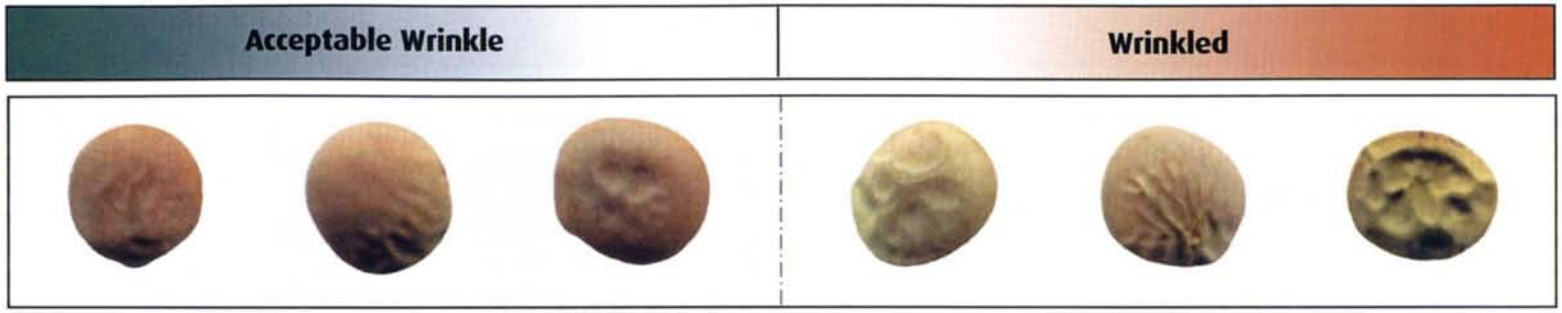


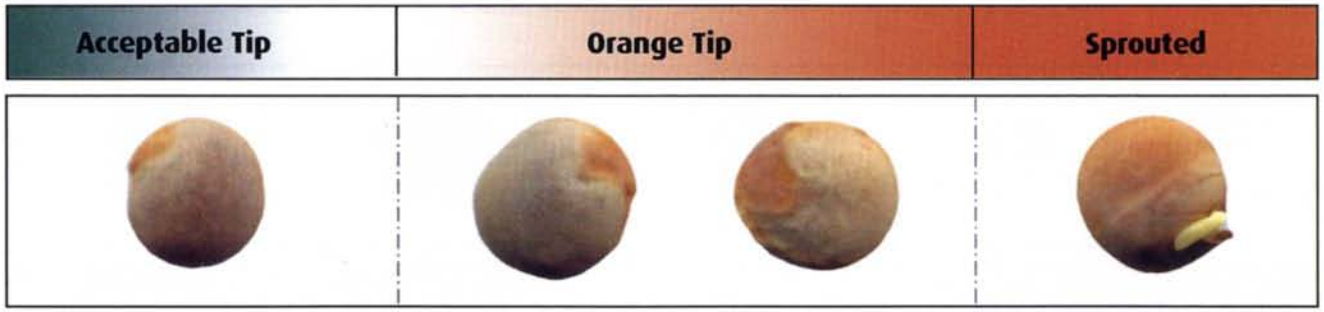




PULSE AUSTRALIA

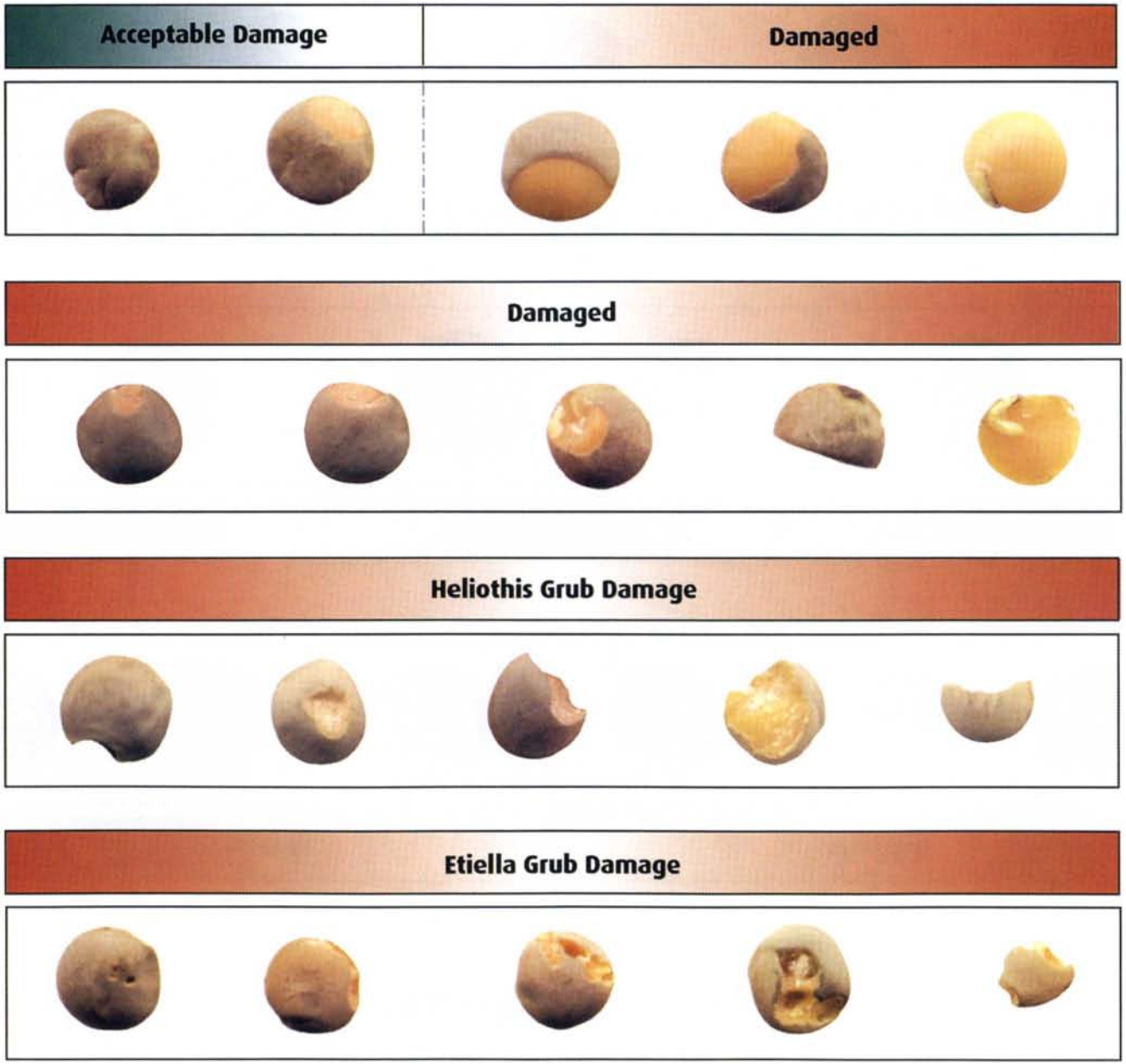
Lentils - Defective





PULSE AUSTRALIA

Lentils - Defective

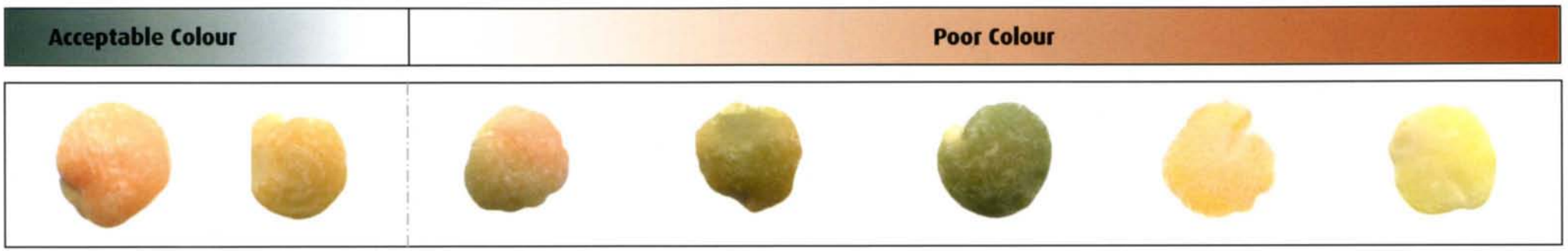


Sponsored by GRDC

Update 2002

Lentil Kernel (Red and Green) - Poor Colour

Red Lentil Kernel - Poor Colour



Green Lentil Kernel - Poor Colour

Plate 9.1
Donald Lentil Reel: simple construction; forces material back to table and auger; restricts visibility of knife.

Plate 9.2
Donald Lentil Reel.

Plate 9.3
Donald Steel Lentil Lifter: with hard shoe welded on front.

Plate 9.4
Lentil Lifter: 100mm of 6mm round steel welded on to knife guard.

Plate 9.5
Crary Air Reel.

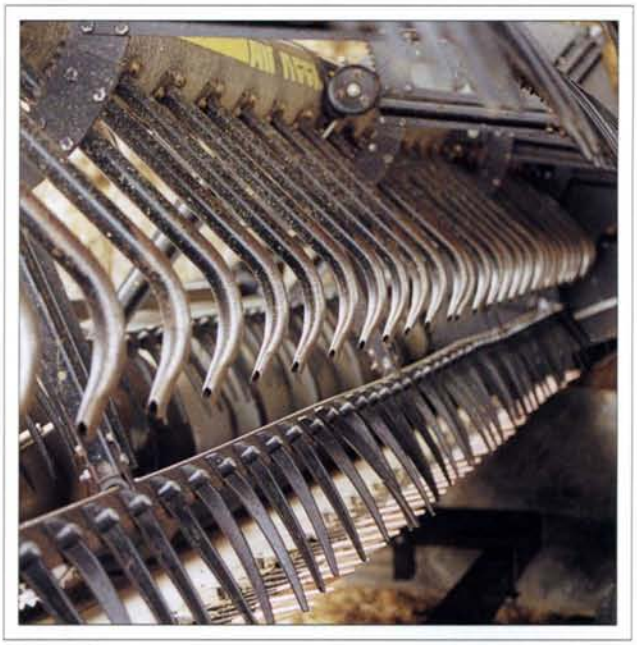


Plate 9.6
Crary Air Tyne Reel: tyne reel to drag back heavy material, air reel to blow back short material. One reel for all crop conditions.

Plate 9.7
Kelly Pea Pick-up

Plate 118

Conventionally peas are harvested with the aid of vine lifter, which need smooth, stone free ground to operate efficiently.

Plate 119

A range of pickup fronts are now available which pull the crop in to the harvester without the use of a cutter bar. A Sund pickup shown here.

Plate 120

Victory pickup front.

Plate 121

After harvesting with a pickup front. Note thistles etc. remain behind and stones or clods are not a problem.

Plate 122

Sealing silos. The effectiveness of the seal can be checked by releasing a boat flare in the silo. Obviously this silo is not sealed!!!

Plate 123

A gas lock on sealed silos gives a quick means of checking the seal of the silo.

Good quality samples of . . .

Plate 124
PEAS . . .
1 . . . Dinkum (White)
2 . . . Alma (Dun Type)
3 . . . Blue Boiler Type

Plate 125
CHICKPEAS . . .
1 . . . Macarena (Kabuli Type)
2 . . . Semsen (Desi Type)
3 . . . Kaniva (Kabuli Type)
4 . . . Tyson (Desi Type)

Plate 126
LUPINS . . . narrow leaf type . . .
1 . . . Warrah
2 . . . Gungurru

Plate 127
. . . faba beans.

Plate 128
Faba broad beans . . .

Plate 129
Faba broad beans . . . insect damaged.

Plate 130
. . . header damaged.