Pulses

## Export demands

# Harvest timing critical for chickpea quality

**CSIRO Stored Grain Research Laboratory scientist Julie Cassells explains why the timing of harvest plays an important role in chickpea quality and will help exporters and growers to meet market demands.**

Harvesting chickpeas early can improve yield and seed quality, allowing grain growers to maximise crop returns and meet the increasing export demand for premium quality pulses.

Delays in harvesting after the crop has reached harvest maturity can result in yield losses through pod drop and shattering, while seed quality also deteriorates.

In Australia, pulses are typically late harvested, following harvesting of cereal crops. But a change in harvest management of pulses, from late to early harvesting, is gaining momentum.

Recent collaborative research by the CSIRO Stored Grain Research Laboratory and New South Wales Agriculture has determined yield losses and changes in seed quality resulting from different times of chickpea harvest. This research shows the timing of harvest can significantly influence yield and seed quality of desi-type chickpeas.

CSIRO Stored Grain Laboratory

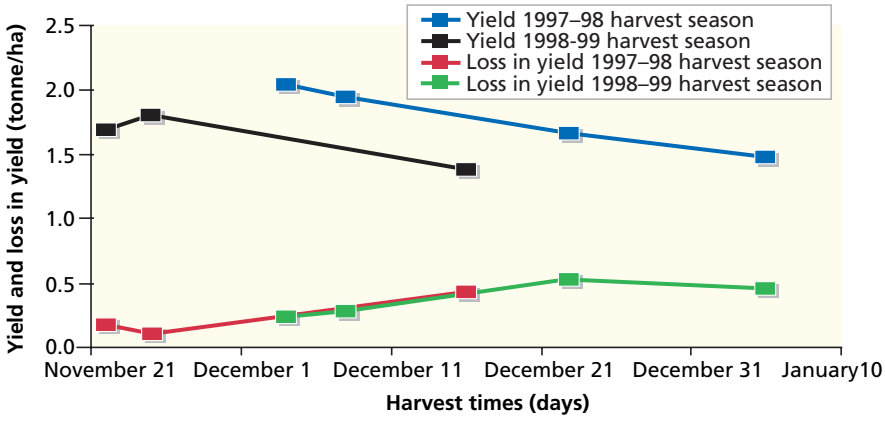
*Early harvesting of chickpeas can prevent yield losses and improve seed quality. Good quality Amethyst seed from the 1997–1998 trial harvest is pictured left. Pictured right is severely weather damaged Amethyst seed with darker seed colour and increased levels of split and broken seeds.*

## Export demand

Australia's grain export markets are becoming more discerning and product specifications are dictating terms of trade. In this environment, the variability and general poor quality of Australian chickpeas can potentially disadvantage growers' competitiveness in some of their key markets in Asia, the Indian sub continent and sub Sahara-Africa.

There needs to be a major incentive for growers to adopt changes in harvest management such as the use of driers and

**FIGURE 1 Influence of harvest time on seed yield and loss**




Source: CSIRO Stored Grain Research Laboratory.

aeration including in-bin drying, to reduce the cost of yield and quality losses.

Chickpeas destined for the human consumption market need to be of high quality and visually appealing. Colour has a strong influence on how acceptable the seed is to people as a food. Seed size and uniformity are more important where seed is processed into dhal (splits). The presence of split or broken seed, or impurities are also important factors which affect visual quality.

Weather conditions are the major factor influencing deterioration of seed quality while on the plant.

When harvesting is delayed, seeds darken and colour fades, resulting in reduced seed viability and increased split and damaged seed at harvest. Seeds which readily break during handling pose a problem for storers, resulting in high levels of defective seed at out-turn.

## Paddock trials

The influence of harvest time on yield and seed quality of the desi chickpea variety Amethyst was assessed during the 1997–1998 and 1998–1999 seasons at NSW Agriculture's research field centres at Tamworth and Wagga Wagga, NSW. The chickpea crop was harvested 'early' (the earliest time the header could thresh the seed), 'on-time' (about a week after the early harvest) and 'late' (two weeks after the on-time harvest).

Yield loss due to pod drop and shattering was determined before and after harvest by counting seeds on the ground. The amount of unthreshed pods in the harvested sample was also assessed.

The 1997–1998 and 1998–1999 harvests provided extremely variable conditions for crop development and seed maturation. The 1997–1998 harvest at Wagga Wagga was hot and dry, with the ripe seed drying rapidly in the standing crop from 20 per cent to 11% moisture content. In contrast, the 1998–1999 harvest was wet and cool at both field sites, which resulted in continual plant growth and poor uniformity of crop development.

## Timing of harvest

The timing of early harvest depends on weather conditions. For example, during the 1997–1998 season, early-harvesting of the chickpea crop began during mid-November. During the 1998–1999 season, early-harvesting began during December

Late harvest of desi type chickpea crops resulted in excessive yield losses due to pod drop and shattering (see Figure 1).

The amount of yield loss increased when mature, desiccated pods were exposed to a cycle of wetting and drying during the harvest period. Yield losses due to pod drop and shattering of up to 15% can be expected in late-harvested crops.

The laying down of late-harvested, lodged crops also contributed to an increase in losses due to shattering when plants were mechanically harvested.

Early harvesting of chickpea crops requires a uniform rate of crop maturation. In this study chickpea seed varied in maturity within and between plants, especially where

**in brief**

- Timing of harvest can play an important role in helping chickpea growers and marketers meet export demands.
- Chickpeas destined for human consumption need to be of high quality and visually appealing.
  Seed colour and size drive export sales.
- Recent CSIRO research shows early harvesting of chickpeas can prevent yield losses due to pod drop and shattering and improve seed quality.
- The benefits of harvesting early can depend largely on weather conditions.

# Export demands...

wet weather was experienced during seed ripening.

Immature seed at the apex of the plant increased the percentage of green seeds in early harvested samples. This problem was accentuated during wet weather

During fine, warm weather, when there is rapid, uniform drying of the crop, start harvesting when the late-maturing seed in the apical pods dries to a moisture level of 15%. This will reduce the level of green seeds and unthreshed pods in the harvested sample.

A maximum 1% by weight of seeds of poor colour (including green seeds) is allowable in export quality, machine-dressed desi chickpeas.

Re-wetting of mature pods is likely to increase yield loss due to less efficient threshing of seed.

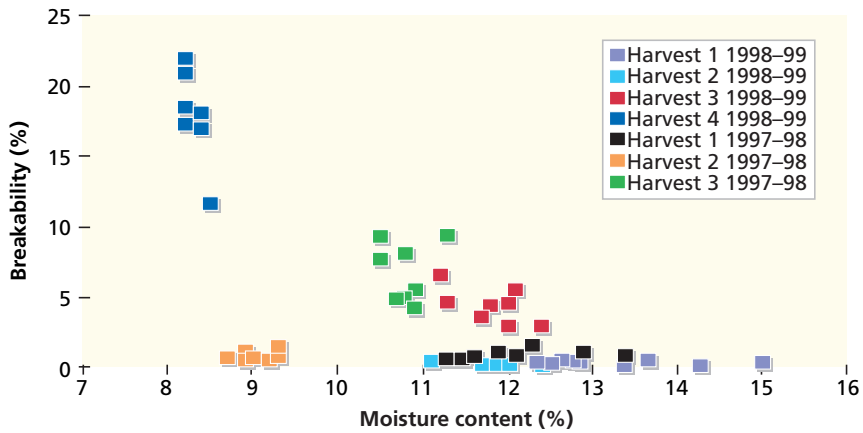
Following rainfall, allow enough time to enable pods and seed to dry to moisture levels where seed is readily threshed.

## Quality

Seed quality was enhanced through early harvesting. In early-harvested seed, germination was high, seed size large and uniform, seed coat colour intense and mould levels and post-harvest breakage low.

Late-harvested, weathered seed was more prone to fracture during harvest and subsequent handling.

**FIGURE 2 Post-harvest breakage of chickpea seed harvested at different times**




Source: CSIRO Stored Grain Research Laboratory.

It is well recognised the structure of large legume seeds makes them susceptible to damage during harvest, threshing and handling, especially when seed moisture content is less than about 11%–12%. But the study showed earlier harvested seed was more resilient to breakage during harvesting and subsequent handling, even at low moisture contents (see Figure 2).

In comparison, late-harvested, dry seed (less than 10% dry basis) was extremely friable with up to 20% of seed breaking in tests simulating handling after harvest.

## Seed colour

Seed coat colour drives export sales. Most of Australia's export customers prefer a light to medium brown seed coat colour.

Darkening and loss of colour from the seed coat results in a less marketable product. Darkening of the seed coat is thought to be due to oxidation of polyphenol compounds, a chemical process that occurs in other pulses. In the collaborative study, the seed coat colour of Amethyst varied between location and season.

Humidity and temperature after seed ripening can accelerate seed coat darkening and colour loss. The hot, dry 1997–1998 harvest at Wagga Wagga produced Amethyst seed with light yellow to brown seed coat colour.

The cool, humid conditions at both study sites during the 1998–1999 harvest, resulted in early harvested seed that was darker and browner.

Consumer preference is for the seed cotyledons, referred to as dhal or splits, to be golden yellow in colour. The colour of the cotyledons was generally lighter and less yellow for late-harvested seed. Similarly, the colour of flour, referred to as besan, was lighter and substantially less yellow.

## Viability of seed

Seed viability provides a good indication of initial seed condition and storability. Seed coat quality and physiological age of seeds can influence germination. Harvesting the ripe chickpea crop as early as practical is recommended to minimise seed coat damage and ageing.

Adverse climatic conditions during the post-maturation, pre-harvest period can reduce the storage potential of seeds.

Seed harvested and placed into storage with high germination will show a slower rate of loss of viability over time than seed which has already lost germination pre-harvest.

## Moulds

Frequent rainfall during seed development and ripening during the 1998–1999 season resulted in heavy fungal infection of plants and pods with the fungus diseases ascochyta blight *(Ascochyta rabiei)*, and to a lesser degree, botrytis grey mould *(Botrytis cinerea)*.

Fungal infection will have a detrimental impact on seed viability. Germination levels of heavily infected seed were reduced by up to 30% in late-harvested seed. High mould levels also caused discoloration of the seed coat.

Humid conditions increased infection by field type fungi, including *Alternaria, Aspergillus, Cladosporium,* and *Penicillium* species.

## Early harvest advantages

Harvesting desi-type chickpeas as early as possible can provide growers with increased yields and premium quality seed.

Delays in harvesting will result in yield losses due to pod drop and shattering. Late-harvesting of chickpeas will also reduce seed quality. But early-harvested seed may require cooling or drying to meet industry and marketing moisture content standards. The costs of this conditioning process would need to be weighed against the benefits of reduced harvest losses and better quality seed.

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