# Lupin yield loss from delayed harvesting

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## Key messages

- Lupins should be harvested as soon as they are mature to minimise significant yield loss
- Yield loss of lupin was 6% from delaying harvest by 2 weeks after maturity and 15% by delaying by 6 weeks
- There was no evidence to suggest PBA Jurien has higher harvest losses than other varieties

## Aim

To see if new lupin varieties have higher harvest losses than old varieties.

## Background

It is well known that delaying harvest after seed maturation can increase harvest losses and affect seed quality. Anecdotal evidence indicates that there are varietal differences in regard to the amount of seed that sheds or falls from the plant as whole pods. In particular Mandelup has a reputation for losing more seed prior to and at harvest than other varieties and this lead to the release of PBA Gunyidi.

## Method

Lupin varieties PBA Leeman, PBA Jurien,PBA Barlock, PBA Gunyidi, Mandelup and Gungurru were sown at Eradu on April 28 using a plot cone seeder. Plots were 10 metres long by 1.54 metres wide with buffers enabling complete randomisation of harvest timing. All plots were harvested with a Kingaroy plot header from the same direction.

Treatments were factorial 6 varieties by 3 times of harvest. This included a harvest timing control for each variety; harvested as soon as they were mature to minimise any seed or pod drop pre-harvest or during the harvest operation. The second time of harvest was 2 weeks after the first and the third 4 weeks after that.

Harvest timing differed depending on variety development and time of maturation. Early maturing varieties Mandelup, PBA Jurien and PBA Gunyidi were harvested on October 23, November 13 and December 11. Later maturing varieties PBA Leeman, PBA Barlock and Gungurru were harvested on October 27, November 17 and December 15.

As a means of accentuating variety responses overhead irrigation was applied to the plots that were harvested on the third harvest time. Ten millimetres of simulated rainfall was applied on two occasions, November 20 and November 27. This represents a decile 8 November rainfall for this site.

Gutter trays 1.5 metres long and 0.22 metres wide were placed between the middle rows of each plot. Trays had gutter guard mesh placed in them to hold seed off the ground and allow any rainfall to drain. Prior to harvest trays were emptied and all loose seed and whole pods counted and total seed loss calculated. The trays were replaced into the same positions and seed and pods again counted immediately after harvested. Quadrat counts were taken after harvest to assess yield loss after harvest.

## Results

### *Seasonal conditions*

Rainfall at the site was 282mm annual and 199mm from sowing to final harvest (Table 1). This compares to a long term yearly average for Eradu of 370mm annual and 302mm May to November inclusive.

**Table 1. 2017 monthly rainfall (mm) from BOM Eradu station (8200).**

| Site | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual | GS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Eradu** | 43 | 28 | 3 | 0 | 17 | 20 | 36 | 78 | 31 | 7 | 8 | 11 | 282 | 199 |

*Establishment and Growth*

The trial was sown into dry soil on April 28. Plants established after rain in the third week of May, however establishment was slow due to marginal soil moisture. Follow-up rain did not come until a month later in the third week of June on which all plants established. Plant population was good, slightly higher than the target of 45 plants per square metre. There was some variation amongst the varieties but this was not significant. There was also variation between harvest timings with harvest 2 plots establishing an average density of 46 plants/m² compared to 51 plants/m² for harvest 1 and 3 blocks. Lupin varieties produced similar dry matter at maturity of 5.4 t/ha.

*Yield*

Overall yield was 2.5 t/ha, which was exceptional given the late emergence and low rainfall. Variety yields differed ($P$ <0.001) and averaged across harvest times PBA Jurien yielded more than all the other varieties (Figure 1). Generally the later released varieties yielded more than the older ones, e.g. PBA Jurien yielded 588 kg/ha or 26% more than Gungurru. It was interesting to note that harvest index differed significantly between varieties ($P$ <0.05) with PBA Jurien and PBA Gunyidi having a higher HI than several of the other varieties (Table 2). There was no significant difference in yield from the late October and Mid-November harvest dates; with only a 41 kg/ha reduction in yield from the 2 week delay in harvest. There was a significant reduction in yield at time of harvest 3, 384 kg/ha less than harvest time one, or 15%. There were different variety responses to harvest date; some varieties yielded less at harvest time 3 while others did not (Figure 1).

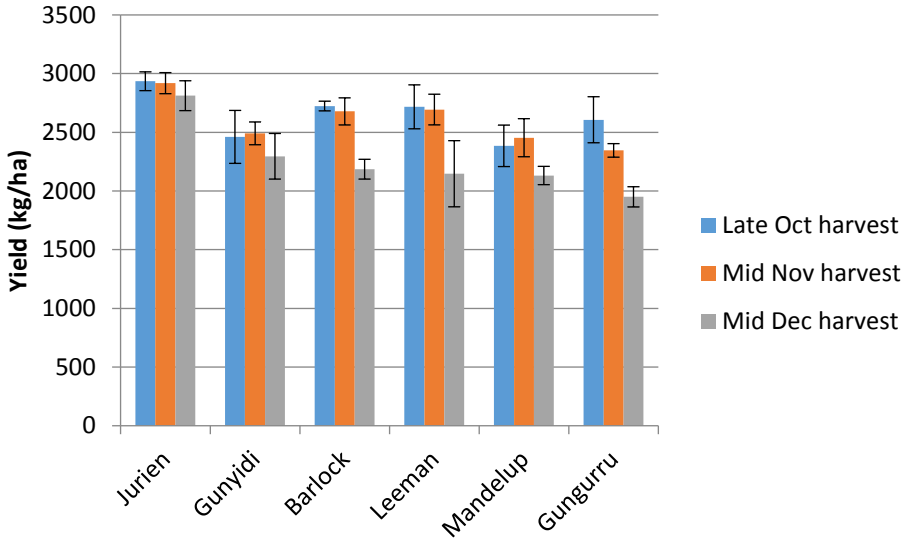


**Figure 1. Yield of lupin varieties at three different harvest dates at Eradu in 2017.**

*Yield loss*

Yield loss was assessed using two methods. The gutter tray method was useful for determining what proportion of the yield loss occurred prior to harvest or after harvest however, the total seed captured in trays did not correlate well to yield losses observed in machine harvested yield. The tray data indicated that pre-harvest yield loss accounted for only 1, 6 and 14% of the total yield lost for harvest times 1, 2 and 3 respectively. Hence the majority of yield loss occurred during the harvest operation. Quadrat counts after harvest showed that most of the yield loss was from seed contained in whole pods rather than threshed seed on the ground, particularly for harvest times 2 and 3 (data not presented). The number of whole pods on the ground increased with each time of harvest ($P$ <0.001) (Table 2). There was variation amongst the varieties which corresponded to previous observations e.g. PBA Gunyidi low and Mandelup high, but this was not significant (Table 2).

**Table 2. Pods on ground after harvest (pods/m$^2$), harvest index (HI)**

| | Harvest time | | | Av | |
|---|---|---|---|---|---|
| **Variety** | 1 | 2 | 3 | | HI |
| **PBA Barlock** | 7 | 12 | 62 | 27 | 45 |
| **Gungurru** | 11 | 11 | 60 | 27 | 45 |
| **PBA Gunyidi** | 7 | 24 | 46 | 26 | 48 |
| **PBA Jurien** | 10 | 20 | 43 | 24 | 48 |
| **Mandelup** | 13 | 30 | 61 | 35 | 46 |
| **PBA Leeman** | 16 | 22 | 50 | 29 | 45 |
| **Av** | 11 | 20 | 54 | 28 | |
| **P value variety** | | | | NS | < 0.05 |
| **Lsd variety** | | | | | 3 |
| **P value Harv time** | | | | <0.001 | |
| **Lsd Harv time** | | | | 5 | |
| **P value interaction** | | | | NS | |
| **Lsd interaction** | | | | | |

Total yield loss measured in quadrats ranged from 178 to 500 kg/ha or 7 to 24% of machine harvested yield (Table 3). Yield losses were greater with each delay in harvest (*P* <0.001) and reached 20% at time of harvest 3, averaged across varieties. The varieties all averaged 12 to 16% yield loss across the harvest times however the varieties responded differently to harvest time (*P* <0.001). Jurien and Gunyidi had the lowest yield loss at harvest time three but these were still substantial losses at 14 and 16% of yield. It should be noted if new varieties lose the same per cent of seed at harvest there will be a greater amount of seed on the ground due to higher overall plant yield e.g. averaged over the harvest times the quadrat counts indicated that Gungurru lost 14% of yield or 292 kg/ha while Jurien lost 13% of yield or 367 kg/ha (Table 3).

**Table 3. Yield loss after harvest (kg/ha) - numbers in parenthesis are % of machine harvested yield.**

| | Harvest time | | | Av |
|---|---|---|---|---|
| **Variety** | 1 | 2 | 3 | |
| **PBA Barlock** | 240 (9) | 202 (8) | 452 (21) | 299 (12) |
| **Gungurru** | 209 (8) | 208 (9) | 458 (24) | 292 (14) |
| **PBA Gunyidi** | 211 (8) | 381 (15) | 366 (16) | 320 (13) |
| **PBA Jurien** | 290 (10) | 421 (14) | 388 (14) | 367 (13) |
| **Mandelup** | 178 (7) | 459 (19) | 453 (21) | 364 (16) |
| **PBA Leeman** | 261 (10) | 272 (10) | 500 (23) | 345 (14) |
| **Av** | 232 (9) | 324 (13) | 437 (20) | 331 (14) |
| **P value variety** | | | | 0.05 |
| **Lsd variety** | | | | 60 |
| **P value Harv time** | | | | <0.001 |
| **Lsd Harv time** | | | | 42 |
| **P value interaction** | | | | <0.001 |
| **Lsd interaction** | | | | 104 |

## Conclusions

This trial highlights the advance in lupin breeding made over the past 20 years. Newer varieties had a higher harvest index and out-yielded older varieties. In particular PBA Jurien yielded significantly more than all other varieties.

Machine harvested yield was reduced by 15% when harvest was delayed from late October to Mid-December. This corresponded reasonably well to quadrat counts which showed average yield loss of 20% from December harvest.

For all varieties there will be substantial harvest losses if harvest is delayed for a long period after plant maturity. There was no evidence in this trial to suggest that PBA Jurien was less resilient to delayed harvest than other varieties.

The key message is that lupins should be harvested as soon as possible after maturity to minimise harvest losses.

## Key words

Lupin, harvest, variety

## Acknowledgments

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