The impact of different management practices on the control of powdery mildew in mungbeans

Duncan Weir[1], Lisa Kelly[1], Adam Sparks[2]
[1]Department of Agriculture and Fisheries
[2]University of Southern Queensland, Centre for Crop Health

Research Question: *Does active ingredient, row spacing or plant population impact the effectiveness of fungicides on powdery mildew control in mungbeans?*

Key findings

1. All fungicide active ingredients used provided equivalent powdery mildew control.
2. Row spacing did not impact fungicide efficacy.

Background

Powdery mildew in mungbeans is caused by the fungus *Podosphaera xanthii* and is found wherever the crop is grown in Australia. The fungus requires a living host and is unable to survive on plant residues. Although there are several confirmed hosts which can carry over the disease from one season to another, infection can also originate from spores traveling long distances in the wind, given the right conditions. The disease is favoured by moderate temperatures (22-26 °C) with high relative humidity and tends to appear in late-planted summer crops maturing into cooler conditions.

Infected plants have a greyish-white powdery growth on the surface of leaves, stems and pods. Infection can appear at any growth stage, depending on weather conditions.

Yield losses due to powdery mildew vary from year to year but can be significant if disease development occurs before or at flowering. Yield losses most commonly range between 10 and 15%, however they can be as high as 46% depending on the variety, growth stage at infection and rate of disease development.

Plant resistance and foliar fungicides are the only two viable options available for the management of powdery mildew in mungbeans. Most varieties are rated 'susceptible', except for Green Diamond$^{\Phi}$ and Jade-AU$^{\Phi}$, which have a slightly higher rating of 'moderately susceptible'.

Previous research trials have demonstrated that the control of powdery mildew using fungicides is both financially viable and highly effective. Past trials indicate that best results are achieved when the first fungicide spray application is applied at the first sign of powdery mildew, normally found on the lower leaves of a vegetative crop, followed by a second spray two weeks later.

Plant row spacing has been shown to be very important in optimising crop yield. Recent research in agronomy practises has indicated that yield is optimised when row spacing is between 25 and 50 cm. However, there has been only limited research on the effect narrower row spacings have on the development of powdery mildew in the crop and how it impacts on control methods.

What was done

The trial was established at Wellcamp Research Station on 13 February 2018. A randomised block design was used consisting of three factorials (row spacing, fungicide treatment and plant population) and three replications. Plot size was two metres wide x 10 metres long, row spacing treatments were 0.25 m, 0.5 m and 1 m, and plant populations of 200 000 and 400 000 plants per hectare were targeted. Plots were planted with Jade-AU$^{\Phi}$ mungbean, the variety with the highest level of resistance and currently considered the industry standard. Spreader rows were planted with mungbean var. Berken (rated very susceptible to powdery mildew).

The trial was planted on 13 February 2018 and harvested on 31 May 2018. Powdery mildew was first observed on 21 March 2018 and developed rapidly in the crop. The first fungicide spray was applied on 28 March 2018 and the second application on 16 April 2018.

Fungicides applied were:

- Folicur SC® (430 g/L tebuconazole) at 145 mL/ha,
- Group 3 fungicide at 250 mL/ha
- Veritas® (200 g/l tebuconazole + 102 g/l azoxystrobin) at 300 mL/ha.

The Folicur SC® and Veritas® fungicides were used under the Australian Pesticides and Veterinary Medicines Authority (APVMA) permit numbers PER13979 and PER82104, respectively. Fungicide treatments were applied at the first sign of disease and then again 14 days later using a pressurised hand-held two metre boom sprayer delivering 134 L/ha at 5 km/h.

Treatment plots were regularly monitored and assessed for powdery mildew against incidence and severity (Tables 1 and 2). Plots were harvested and grain yield per hectare calculated.

Plots were rated on a whole plot basis on 23 March (31 days after emergence (DAE)), 5 April (44 DAE), 11 April (50 DAE), 18 April (57 DAE), 26 April (65 DAE) and 2 May (71 DAE).

Note: Products in this field experiment were tested FOR RESEARCH PURPOSES ONLY. Not all products used were registered for the purposes we tested. Always read the label prior to use and only apply fungicides as approved in the label.

Table 1. Powdery mildew incidence rating (IR) scale (developed by Sue Thompson USQ).

IR	Infection description
1	No powdery mildew colonies observed on any plants
2	Small colonies in lower 1/3 of canopy, up to 75% of plants affected
3	Colonies in the lower 1/2 canopy, >75% of plants affected
4	Colonies in the lower 2/3 of canopy, up to 75% of plants affected
5	Colonies in the lower 2/3 of canopy, >75% of plant affected
6	Colonies in the lower 2/3 of canopy, 100% of plants affected
7	Colonies in the lower 2/3 of canopy, 100% of plants affected, some plants with colonies in the top 1/3 of canopy
8	Colonies to top of plant with >75% of plants affected
9	Colonies to top of plant with 100% of plants affected and heavy leaf drop

Table 2. Powdery mildew severity rating (SR).

SR	Infection description
1	No powdery mildew colonies observed
2	Small colonies covering up to 10% of leaf area
3	Larger colonies covering up to 25% of leaf area
4	Heavy infection covering up to 75% of the leaf area
5	Severe infection covering more than 75% of leaf area

Powdery mildew mungbean trial showing different disease development between treatments and differences between row spacing treatments. Image taken 26 April 2018, 65 DAE.

Results

Powdery mildew developed rapidly in the crop reaching an average incidence level of 5, 44 DAE for all treatments. At the same time severity rating averaged 2.29. There was no significant difference between all treatments at this stage. At 57 DAE the control treatment had an incidence rating of 7.2 and a severity rating of 3.44 which was significantly different from the other three treatments. At 71 DAE the incidence rating for the control was 8.2 (Figure 1) and a severity rating of 4.88 (Figure 2), significantly different from all other treatments.

A significant difference in yield was recorded between the control (1275 kg/ha) and the other fungicide treatments (Group 3 yielded 1469 kg/ha, Veritas® yielded 1442 kg/ha, Folicur SC® yielded 1439 kg/ha) (Figure 3). There wasn't any significant difference in yield between the fungicide treatments. There was a significant difference in yield between row spacings with the 0.25 m row (1538 kg/ha) and 0.5 m row (1523 kg/ha) being significantly higher than the 1 m (1157 kg/ha) row spacing. There was also a significant difference in yield between plant populations with the 400K plants/ha (1464 kg/ha) being higher than the 200K plants/ha (1348 kg/ha).

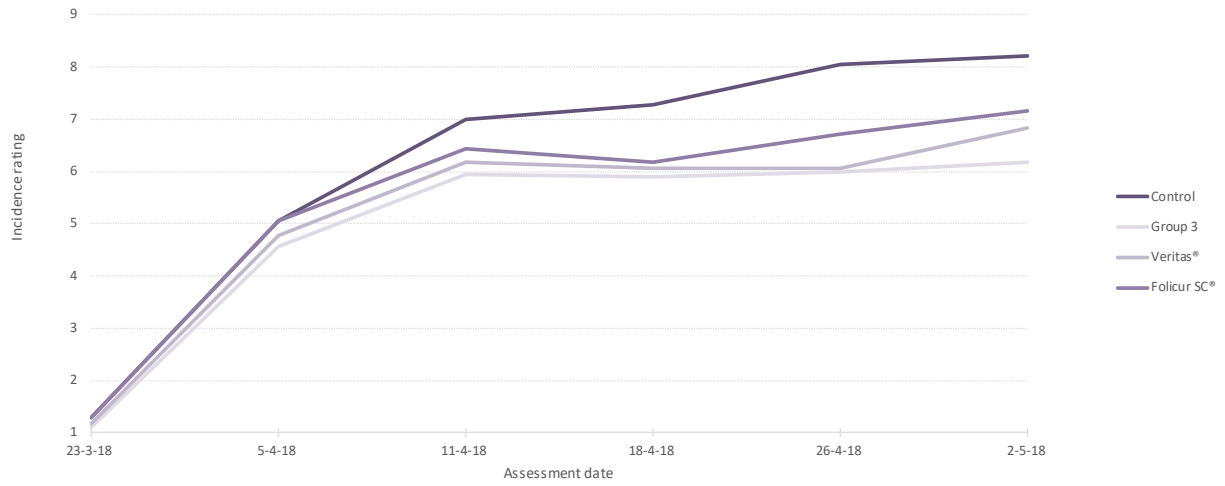

Figure 1. Incidence rating of powdery mildew in mungbeans at Wellcamp Research Station 2018. Points represent the mean of four replications at each respective assessment date.

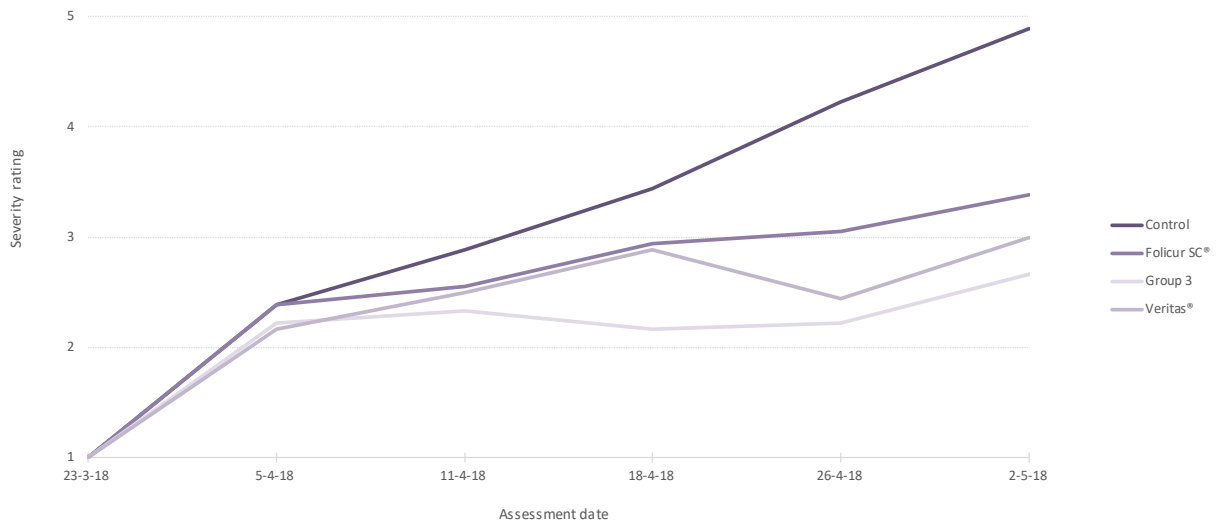

Figure 2. Severity rating of powdery mildew in mungbeans at Wellcamp Research Station 2018. Points represent the mean of four replications at each respective assessment date.

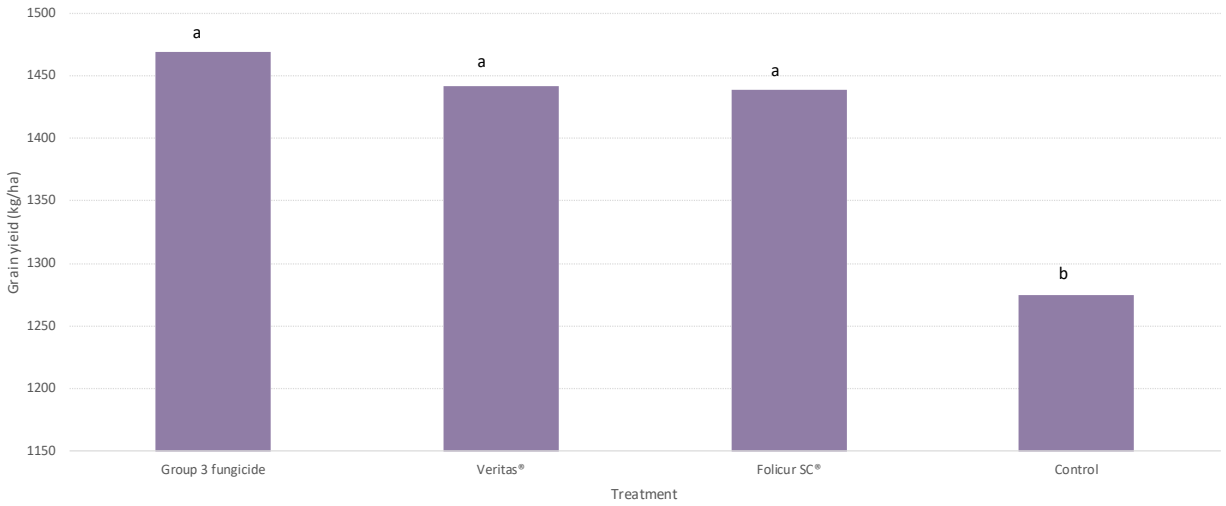

Figure 3. Average grain yield for treatments at Wellcamp 2018 (lsd = 136). Bars represent the mean of the four replications for each treatment.

No significant difference was measured for either disease severity or incidence between fungicide treatments from either the row spacing or plant population variables.

Implications for growers

Powdery mildew has been shown to cause significant yield reduction and economic impact when environmental conditions are suitable for the development of the disease in the crop. Well timed fungicide application is an effective, economic management practice in the control of this disease. Previous trial results indicate that best fungicide application efficacy is achieved when the first spray is applied at first sign of the disease followed by a second spray 14 days later. However, the first spray can be effectively applied up to 1/3 plant disease infection as long as it is followed by a second spray 14 days later. Timing of the first fungicide application appears to be more critical than the fungicide used. Results indicate that there is no difference in efficacy between the three fungicides trialled.

Row spacing configuration does not appear to impact on recommended powdery mildew management practices however row spacing has had significant impact on yield. Results confirm narrow row configurations (0.25 m to 0.5 m) can yield significantly more than wider rows (1 m), supporting the research from the Pulse Agronomy project (UQ000067).

Acknowledgements

This research is supported by the University of Southern Queensland (as lead agency), the Grains Research and Development Corporation (DAQ00186) and the Department of Agriculture and Fisheries).

The DAF biometry team and SAGI (co-funded by GRDC) have provided statistical analysis of the data presented.

Trial details

Location:	Wellcamp Research Station
Crop:	Mungbean
Soil type:	Black Vertosol
Fertiliser:	Granulock® Z 40 kg/ha