Can increasing row spacing reduce the disease incidence of *Sclerotinia sclerotiorum* stem rot in canola? (2018)

Bec Swift, Jean Galloway, Ravjit Khangura, Glen Reithmuller Department of Primary Industries and Regional Development**; Frank Panizza,** Grower

Key messages

- Sclerotinia disease ratings were low in this trial as is expected in a season with a dry and late start (Bennett et al. 2018) but there was more disease in the Hyola 404 at the higher plant density than the other treatments.
- Pioneer® 43Y23 had significantly more branching than the Hyola 404 and a reduced length to the first branch. There was no significant difference in plant height between the two varieties but stem diameter was narrower in Hyola 404 than Pioneer® 43Y23
- Overall, the plant architecture dimensions or row spacing trial did not indicate a mechanism for increased or reduced disease control
- Grain yields decreased with increasing row spacing and reducing plant density.
- This trial demonstrates that refining the agronomic package for wide row spacing in canola could lead to reduced up front and in season input cost.

Aim

Investigate the effect of row spacing up to 66cm in two hybrid varieties at two different seeding rates to determine if row spacing or plant density can ameliorate the effect of sclerotinia stem rot, with or without fungicide application.

Background

Sclerotinia stem rot is emerging as a serious problem in canola in the grain growing regions of Western Australia. The disease is caused by the fungus *Sclerotinia sclerotiorum* and prolonged humid conditions during flowering are needed for infection to develop. Since sclerotinia is a disease with air-borne spores, it is difficult to avoid, but there are some options to reduce the risk of infection like controlling weeds and avoiding close rotation with susceptible crops. Additionally, the mycelium produced by the fungus can directly infect stems and it is thought that this may be a source of infection in varieties of canola with a highly branching growth habit.

For instance, disease assessments of two hybrid varieties of canola were conducted in 2017 in adjacent paddocks at a grower's property at Toodyay. Hyola 404 is a highly branching hybrid (RR) variety and in this paddock 70% of plants were infected and only 15% of these plants were infected on the main stem. Most of the infection was observed in secondary branches. In contrast**,** Pioneer® 43Y23 (RR) has an upright growth habit and only 15% of plants in this paddock were infected and an average of 46% of these plants were infected on the main stem.

Investigations by Harries and Seymour (2015) indicated that in high rainfall zones, row spacing as wide as 60cm and lower seeding rates have no adverse impact on yield but may reduce seed costs. Additionally, wider row spacing may increase penetration of fungicides through the canopy, providing better protection for canola when the spores are airborne. Wider row spacing may also improve ventilation through the canopy making conditions less conducive for disease development. Additionally, wider row spacing may also reduce plant contact between rows, minimising direct infection.

Khangura et al (2016, 2017) have investigated the effect of row spacing on disease development in canola. In 2016, seasonal conditions triggered basal infection and row spacing had no effect in reducing disease incidence. However, in these trials row spacing was only as wide as 44cm. Therefore, the current trials will investigate the effect of row spacing up to 66cm in two hybrid varieties at two different seeding rates to determine if row spacing or plant density can ameliorate the effect of sclerotinia stem rot, with or without fungicide application.

Method

A field trial was conducted in the Kwinana West port zone to evaluate the effect of various agronomic practices on the incidence and impact of Sclerotinia. The trial was sown onto canola stubble in a paddock that had 70% infection in the 2017 season and was in lupins in 2016. Two different varieties of canola were sown, Hyola 404 (RR) and Pioneer® 43Y23 (RR) at two targeted plant densities (30 and 15 plant/m^2), three row spacings (22, 44 and 66 cm) with and without fungicide (Prosaro®) applied at 30% bloom at the recommended rate. Two runs of the seeding equipment were used for each row spacing plot to allow accurate measurements on the wider row spacings. There were six replicate plots per treatment.

Plant emergence counts were conducted at 10 weeks after sowing. At 20% bloom, petals were collected from the buffer plots and plated onto agar to determine if infection of the canopy had occurred. Prior to the 30% bloom spray, water sensitive card was placed within the canopy then allowed to dry. The percentage coverage of the spray for each row spacing was determined using the SnapCard spray app. Two weeks prior to harvest the plots were rated for Sclerotinia infection using a scale from 0 (no disease) to 6 (plant lodging from disease). One week prior to harvest, 10 plants were collected from each plot and plant architecture parameters (stem diameter, plant height, number of branches, length to first branch) were measured. Grain yields were determined at harvest from the centre of each plot.

Statistical analyses were performed as a strip-plot design using Genstat 19th Edition at the 5% significance level.

Results

Plant Emergence

At 10 weeks after sowing, there were significant ($P>0.05$) differences in the effect of row spacing and sowing density on plant emergence (Figure 1). Emergence was higher at the high target plant density (30 plants/m^2) compared with low target density (15 ppm^2) overall and emergence was lower in 44cm and 66 cm when compared with 22 cm row spacing. Emergence was also significantly higher for Hyola 404 (29 plants/m^2) compared with Pioneer® 43Y23 (24 plants/m^2).

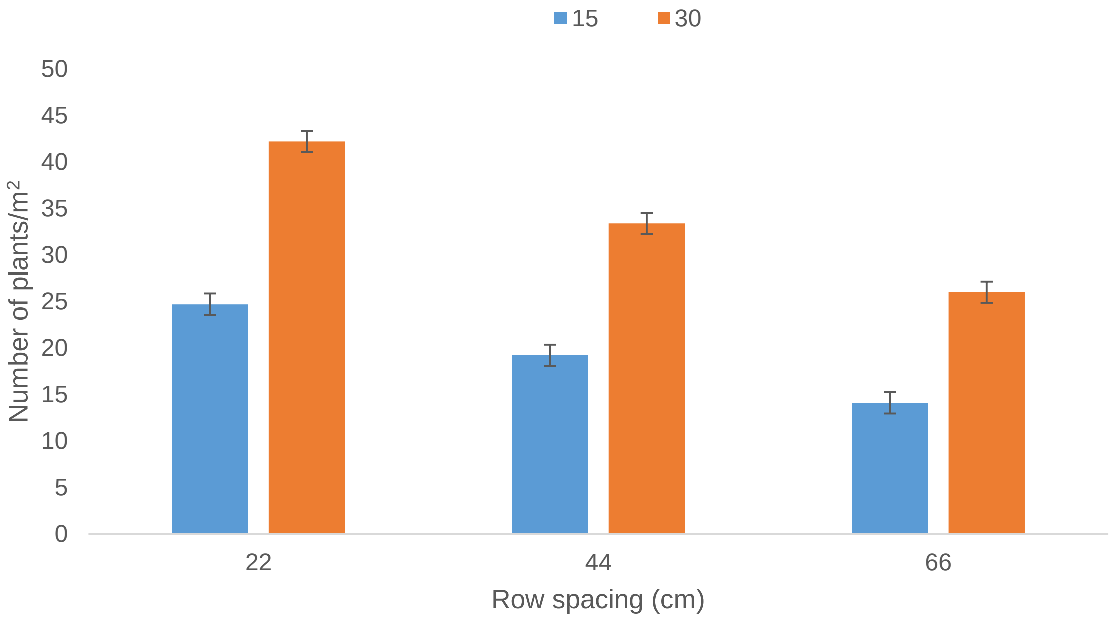

Figure 1. Emergence of canola plants (Hyola 404 and Pioneer® 43Y23) 10 weeks after sowing at 22, 44 and 66 cm row spacing and at low (15 plants/m^2) and high (30 plants/m^2) target densities at the Toodyay trial site. Bars above the column represent least significant difference at 5%

Disease incidence

Although petal testing demonstrated up to 100% infection in the petals collected at different sites in the trial (data not shown), very little disease was observed just prior to harvest. Row spacing did not have an impact on disease incidence in this trial, however, at the higher plant density, Hyola 404 demonstrated increased disease incidence compared with Hyola 404 at the lower plant density and compared with Pioneer® 43Y23 at both plant densities (Figure 2). The application of fungicide significantly reduced sclerotinia disease rating (0.2) in the canola compared with the unsprayed treatments (0.8).

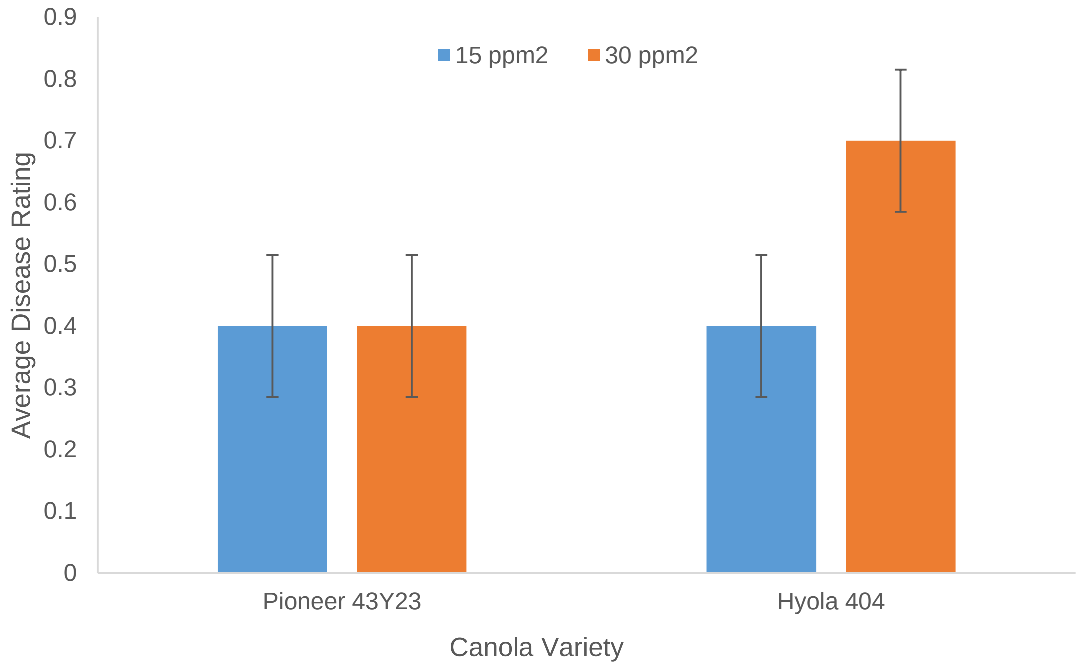

Figure 2. Incidence of disease in canola at low (15 plants/m^2) and high (30 plants/m^2) target densities at the Toodyay row spacing trial two weeks prior to harvest in 2018. Bars above the columns represent LSD (5%)

Influence of row spacing, density and variety on canola grain yields and architecture at harvest

Increasing row spacing had a significant ($P<0.05$) impact on canola grain yields at harvest. There was a 14% reduction to 44cm row spacing and 26% reduction to 66cm in grain yields compared with the 22cm row spacing. Plant density also had an effect on grain yield with grain yields 8% greater in the 30 plants/m^2 target plant density. Variety and fungicide did not have a significant effect on grain yields.

To understand if row spacing and plant density induce changes in the plant that may impact sclerotinia stem rot development in canola, 10 plants per plot were removed just prior to harvest and the plant architecture was measured. Increasing plant density significantly decreased branching in the canola plants at harvest, but increasing row spacing increased branching (Table 1). There was significantly more branching observed in Pioneer® 43Y23 than in Hyola 404. Increasing row spacing to 44 or 66cm significantly increased plant height compared with the 22cm row spacing although increasing plant density decreased plant height. Increasing plant density or decreasing row spacing reduced the stem diameter. The stem diameter was also narrower in Hyola 404 compared with Pioneer® 43Y23.

Table 1. The influence of row spacing, variety and target plant density on canola grain yields and plant architecture at harvest at the Toodyay trial site in 2018

	Grain Yields	No. of branches	Plant height	Length to 1st branch	Stem Diameter
Row spacing					
22	2.7	8	118	37	0.86
44	2.3	11	122	31	0.95
66	2.0	14	124	26	1.10
LSD (5%)	*0.17*	*0.06*	*3.78*	*3.36*	*0.07*
Target plant density (actual)					
15(21)	2.3	13	123	26	1.01
30(32)	2.4	9	120	36	0.83
LSD (5%)	*0.14ns*	*0.05*	*3.09*	*2.74*	*0.06*
Variety					
Pioneer® 43Y23	2.3	12	122	30	1.01
Hyola 404	2.4	10	120	33	0.93
LSD (5%)	*0.14ns*	*0.05*	*3.09ns*	*2.74*	*0.06*

Conclusion

Sclerotinia disease ratings were low in this trial as is expected in a season with a dry and late start (Bennett et al. 2018) but there was more disease in the Hyola 404 at the higher plant density than the other treatments. This aligns with anecdotal observations of WA growers who also note that this variety often appears to be more highly branching than other varieties. As this could explain the increased susceptibility to the disease in this variety, the plant architecture was examined prior to harvest. However, Pioneer® 43Y23 had significantly more branching than the Hyola 404 and a reduced length to the first branch. There was no significant difference in plant height between the two varieties but stem diameter was narrower in Hyola 404 than Pioneer® 43Y23. This may be explained by the high disease rating in the Hyola 404 at the higher plant density, particularly without fungicide application, as the infection may have caused a reduction in stem diameter. Overall, the plant architecture dimensions or row spacing trial did not indicate a mechanism for increased or reduced disease control. This trial will be repeated in 2019 when seasonal differences may produce a higher disease pressure and a better understanding factors affecting disease.

Grain yields decreased with increasing row spacing and reducing plant density. However, the benefits to growers for using a wider row spacing include reduced seeding fuel costs (up to 30%), improved stubble handling, improved safety when using IBS herbicides and conservation of moisture until later in the season which can “drought proof’ canola (Harries & Seymour 2015). Although long-term research suggests that crops are less competitive with weeds at a wider row spacing (Borger et al. 2016, wider row spacing can support additional weed control tools like shielded spray systems enabling the use of low cost contact herbicides with the additional benefit of reducing spray drift (Foster et al 2018).

Overall, this trial demonstrates that refining the agronomic package for wide row spacing in canola could lead to reduced up front and in season input costs.

References

Bennett SJ, Brooks K, Ashworth M, Denton-Giles M and Michael P (2018) Factors affecting sclerotinia stem rot infections in canola. GRDC Research Updates, Crown Perth, 26-27 February.

Borger C, Riethmuller G and D'Anuono M (2016) Eleven years of integrated weed management: long-term impacts of row spacing and harvest weed seed destruction on *Lolium rigidum* control. Weed Research 56:359-366.

Seymour M 2018 Canola response to plant density at Wongan Hills 2013 trial report. DPIRD website: https://www.agric.wa.gov.au/canola/canola-response-plant-density-wongan-hills-2013-trial-report?page=0%2C1 accessed on 25/05/19.

Acknowledgments

Many thanks to Frank Panizza for hosting this trial.

GRDC 'Building Crop Protection and Production Agronomy R&D Capacity in regional Western Australia' project (DAW00256)

Important disclaimer