Poor wheat crops following canola - a survey of farmers and agronomists

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Abstract

In response to anecdotal reports of poor wheat growth following canola in south eastern Australia, a survey of farmers and agronomists was conducted. Around 17% of wheat crops following canola were reported as performing below expectations. Symptoms included poor early vigour, poor tillering, low yield and symptoms of nutrient deficiencies. The reported risk factors were inadequate fertiliser application to the wheat, retention of canola stubble, use of minimum tillage, application of sulfonylurea herbicides and dry seasons. Field experiments are required to further explore this issue.

Key Words

nutrition, zinc, early vigour, water, herbicides, rotations, stubble

Introduction

The area sown to canola in Australia has greatly expanded during the last 10 years. Wheat growth following canola is generally reported as enhanced in comparison to wheat following wheat due to reduced levels of fungal pathogens (1). Recently, however, there have been anecdotal reports of wheat after canola exhibiting poor growth and low yields. Consequently, a survey was conducted to establish the extent of poor wheat performance after canola and gain insights into symptoms, risk factors and potential remedies for the problem.

Methods

A mail survey of agronomists and farmers was undertaken during October 2001. Agronomists were drawn numerically (every fifth entry) from a database of attendees at general agronomy seminars in NSW, Victoria and SA. Farmers were accessed through the Birchip Cropping Group (Vic) and The Crop Science Society (SA). In NSW, Incitec dealers were requested to forward surveys to customers. Respondents were entered in a draw for a prize. Respondents were asked a series of questions regarding observation of instances where wheat crops following canola were “below expectations”, the symptoms of these poor crops, associated circumstances (risk factors) and potential remedies. Respondents were usually asked for their ideas (ie unprompted) before being asked to select from a supplied list of potential answers (prompted).

The survey drew a response rate of around 22% with 105 agronomist and 309 farmer respondents. While the response rate varied greatly between regions, being especially low for NSW, the similarity of the responses received from farmers and agronomists suggested a reasonably accurate picture was gained of the situation. Only surveys from farmers who currently, or in the past, had grown canola were analysed. Results for only a selection of questions are included in this paper. Results are presented as either the proportion of the total number of respondents to a question where the answer fell into a particular category or the proportion of the responses to a particular question which fell into a particular category.

Results

Background

Six percent of farmers who had grown canola indicated they did not intend to do so again; this rose to 11% in SA. In the drier areas, rainfall and risk were an issue, while in SA’s MidNorth and the Yorke

Peninsula, better returns from alternatives such as grain legumes were mentioned. The remaining farmers had most recently sown wheat after canola on 11% of the cropping area on their farm.

Extent of problem

A high proportion of respondents had perceived poor wheat crops after canola but only around 20% were dissatisfied to some extent with most recent wheat crops after canola (Table 1). Half of the farmers who had observed instances of poor growth indicated they were unable to lessen or remedy the problem. When asked what proportion of the area of land most recently sown to wheat after canola was affected, 8-15% was nominated (Table 2). Forty of 268 farmers nominated an area affected, again indicating about 15% of farms had areas of poor wheat growth after canola. On these farms an average of 75% of the area sown to wheat after canola was affected. Regions showing a higher than average incidence were the Victorian Wimmera and Mallee, and the Eyre Peninsula and MidNorth of SA.

Table 1. Comparison of past observation of poor wheat crops after canola and observation of poor growth of most recent wheat crops after canola (% of respondents).

	Past observation	Most recent wheat crop after canola	
	Definitely observed instances where crop performed below expectations	**Dissatisfied to any degree**	**Very dissatisfied**
Agronomists	**57 (n=102)**	**17 (n=102)**	**2 (n=102)**
Farmers	**31 (n=258)**	**22 (n=253)**	**5 (n=253)**

Table 2. Area most recently sown to wheat after canola performing poorly (% of area).

	NSW	Vic	SA	Average
Agronomists – area "performing below expectations"	**11**	**27**	**17**	**15 (n=102)**
Farmers – area with which they were "dissatisfied"	**<1**	**9**	**7**	**8 (n=46)**

Symptoms

Unprompted, respondents indicated 7 main categories of symptoms (Table 3). When prompted, agronomists most commonly reported poor early vigour (17% of responses), patches of poor growth (12%), symptoms of nutrient deficiencies (12%), poor tillering (12%) and poor establishment (10%).

Table 3. Most commonly reported symptoms of poor wheat growth after canola (unprompted) (% of responses).

	Farmers	Agronomists

Table 4: Risk factors for poor wheat growth after canola (unprompted) (% of responses).

	Agronomists (n=53)

	(n=60)	(n=55)		
Poor establishment	5	7	Inadequate nutrition	35[A]
Poor vigour	21	27	Stubble retention	26[B]
Patchy growth	1	7	Lack of moisture (drier areas)	16
Poor tillering	2	10	Weed control/SU herbicides	12
Poor yield	16	4	Presence of diseases	9[C]
Windrow/stubble related	13	2	Other (numerous)	2
Nutrient deficiencies/ yellowing	17	18	[A] included N at 12% and Zn at 6.5% [B] included allelopathy at 15% [C] slugs, nematodes, *Rhizoctonia*	
Other (numerous)	25	25		

Risk factors (associated circumstances) and remedies

Unprompted, agronomists considered poor wheat crops following canola were most likely to be associated with inadequate wheat nutrition (especially N and Zn), problems with stubble management and crop establishment, use of minimum tillage, a dry start to the season (drier regions only), difficulties with weed management/herbicides (especially sulfonylurea [SU] herbicides) and disease (Table 4). When prompted, a dry start to the season became the most strongly associated circumstance (Table 5). Wet summers/weedy fallows, liming of the preceding canola crop and application of Zn-fertiliser to the wheat were not considered to be circumstances conducive to the problem occurring.

Table 5. The response by agronomists to given (prompted) circumstances potentially associated with poor wheat crops after canola. Respondents were asked "if you have seen any *poor wheat crops* following canola, did these apply?" and given the options of "yes", "no" and "unsure" (% of respondents: n=102). The balance for each circumstance (40-53%) did not answer the question.

Circumstance	Associated "yes"	Regions where agronomists most commonly thought the circumstance was associated with poor wheat crops following canola	Not associated "no"	Unsure
Dry start to season	42	Vic: Wimmera. NSW: Riverina, drier areas	11	3
Wheat sown with min. tillage	34	NSW: Central West, SW slopes	14	4

Canola stubble retained	33	NSW: Central West. SA: MidNorth	13	9
Inadequate N-fertiliser on wheat	32	SA: Eyre, Yorke Pens. NSW: SW slopes	16	12
SU herbicides on fallow or wheat	31	NSW: SW slopes, Central West, Riverina	14	9
Canola windrowed	28	NSW: Central West. SA: Yorke Peninsula	15	7
Inadequate P fertiliser on wheat	21	NSW. Mallee (all states)	29	6
TT canola sown prior	20	SA: Mid North. NSW: SW slopes Vic: Western District	22	10
Wet summer/ weedy fallow	16	NSW: Riverina, SW slopes	20	11
Canola previously limed	13	NSW: Riverina, SW slopes	32	7
Zn used on wheat	11	(none)	29	10

The potential remedies most mentioned by farmers and agronomists all involved addressing the identified associated circumstances: an appropriate nutrient regime (particularly for N and Zn); better treatment of canola stubbles; avoidance of minimum tillage for wheat; and better assessment of pre-sowing soil moisture (Table 6). Reducing the intensity of wheat-canola rotations was often mentioned, especially by respondents from the Yorke Peninsula of SA who suggested following canola with barley.

Table 6. Agronomy practices suggested to remedy poor growth of wheat after canola (unprompted) (% of responses).

	Agronomists (n=78)	Farmers (n=53)
Suitable nutrient regime	38	40
Stubble management (burning, harrowing)	18	16
Reduce canola-wheat rotation intensity/grow barley instead of wheat	11	15
Avoid direct drilling/cultivating at depth/use special tynes	7	16

As canola uses more water select paddock considering moisture	6	4
Avoid specific herbicides especially SUs, trizazine/simazine	4	2
Other (numerous)	16	7

Discussion

Suboptimal performance of wheat was perceived to be occurring on 8-15% of the area sown after canola. Although there was no indication that the problem was increasing over time (data not shown), this could have been masked as canola is a relatively new crop (37% of respondents had less than 5 years experience) and the problem seems to occur sporadically/seasonally (Table 1). The actual loss of yield associated with the problem was not estimated by the survey and the relationship between the respondents perceived dissatisfaction and yield requires further investigation.

Respondents stated the problem primarily manifested as poor vigour/low tillering/patchy growth and nutrient deficiency symptoms. The poor growth could also be indicative of poor nutrition, as well as other factors including disease. Canola can host *Pratylenchus neglectus* (2) and some *Rhizoctonia* groups.

Perceived risk factors and remedies fell into four main categories, the most frequently mentioned being nutrition, especially N. A role for Zn was also indicated by the perceived absence of the problem when wheat received Zn-fertiliser (Table 5). Canola crops do remove greater amounts of some nutrients than cereals and other crops (3) and at Junee in 2001, a yield response to Zn was obtained for wheat after canola but not for wheat after wheat or wheat after field pea (M. Ryan pers. comm.). Canola may exacerbate emerging nutrient deficiencies, particularly in regions where cropping intensity is increasing along with its adoption. Canola does not host mycorrhizal fungi (AMF) which are implicated in crop P and Zn uptake, and following crops may be poorly colonised by AMF (4). However, recent research has shown AMF are not important for wheat growth or nutrition in SE Australia (4). This situation may differ in the NE wheatbelt (5).

Many respondents also mentioned stubble retention, and especially allelopathy, as a possible cause of the poor wheat growth. Recent field research suggests physical constraints of heavy stubble can be misinterpreted as allelopathy (6). The windrowing of canola may cause strips of heavy stubble load, leading to physical problems with sowing, strips of poor establishment/poor early growth and, if nutrients are limiting, strips of enhanced growth corresponding to the windrows. An association between the problem and minimum tillage/stubble retention may also reflect a higher incidence of *Rhizoctonia*, although weedy fallows were not considered a high risk factor (Table 5).

A dry start to the season was considered a strong risk factor and respondents from drier regions repeatedly commented that canola extracts more soil water than other crops. This result could reflect canola finishing later than other crops, affecting growth of following crops in a dry start through leaving less soil water and increasing soil strength. The resulting reduction in wheat root growth could exacerbate nutrient limitations directly, as well as indirectly through worsening the impacts of root pruning due to SU herbicides (7) or pathogens. Many of the reported symptoms, especially micronutrient deficiencies, are consistent with SU damage (8) and agronomists reported an association between SU use and the problem.

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References

(1) Kirkegaard, J.A., Hocking, P.J., Angus, J.F., Howe, G.N and Gardner, P.A. 1997. Field Crops Res., 52: 179-191.

(2) Potter, M.J., Vanstone, V.A., Davies, K.A., Kirkegaard, J.A. and Rathjen, A.J. 1999. J. Nematol., 31: 291-298.

(3) Ryan, M.H. and Angus, J.F. 2002. Plant and Soil, (In press).

(4) Ryan, M.H, Norton, R.M., Kirkegaard, J.A., McCormick, K.M., Knights, S.E. and Angus, J.F. 2002. Aust. J. Agric. Res., 53: 1173-1181.

(5) Thompson, J.P., Owen, K.J. and Clewett, T.G. 2001. Proceedings of the 2nd Australasian Soil Borne Disease Symposium, Lorne. p.50-51.

(6) Bruce, S.E. et al. 2003. Proceedings of the 11th Australian Agronomy Conference (this volume).

(7) Lemerle, D. and Cousens, R.D. 1993. Weed Science, 41: 127-132.

(8) Rengel, Z. and Wheal, M.S. 1997. J. Exp. Bot., 48: 927-934