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Juncea canola in the low rainfall zone of south-western NSW

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Brassica juncea (Indian mustard), a close relative of canola (*Brassica napus*), is being developed as a drought and heat tolerant alternative oilseed to canola for the low rainfall zones of the Australian cropping belt. The crop has a number of advantages over canola and will deliver the same rotational benefits as canola. As a relatively new crop, breeding, selection and agronomic research have not progressed as far as canola. Continuing research will deliver significant improvements in yield, herbicide tolerance, quality parameters and crop management recommendations.

This Primefact covers the key areas of management of *Brassica juncea* needed for successful crops in the low rainfall zone. It is targeted primarily at types grown for edible oil, but the same principles apply to condiment mustard and industrial mustard. *Brassica juncea* will be referred to as juncea canola throughout this Primefact.

The strategies proposed are based on current information and management experience with the crop in NSW. This Primefact will be updated as new agronomy and varietal information becomes available.

Juncea canola checklist

1. Determine if your farm is in the appropriate rainfall zone where juncea canola would benefit your farming system (see map page 4).
2. Ensure the market is stable and the price on offer is competitive with canola.
3. Select a paddock which:
   - is free of harmful herbicide residues and has a soil pH_{Ca} > 5.0
   - has good soil structure and preferably standing stubble
   - has at least 70 cm of stored subsoil moisture
   - has a low broadleaf weed population if using a conventional variety.
4. Aim to sow in the first 2 weeks of May.
5. Sow seed at 2–4 kg/ha to achieve an evenly established stand of 20–35 plants/m^2 for early sowing and 35–50 plants/m^2 for later sowing.
6. Juncea canola seed is smaller than canola, so reduce sowing rates accordingly.
7. Sow in rows 15–30 cm wide. Wider rows can reduce yield potential.
8. Apply nutrition according to soil test results – in general apply 8–12 kg P/ha, 15–20 kg S/ha and 30–50 kg N/ha.
9. Apply crop protection products to limit impacts from pests and weeds. Read Permit PER 9343 (expiry 3/03/2012) before using any product on juncea canola.
10. Assess crop maturity for suitability to direct heading or windrowing. Note seed colour is yellow when mature.

Types of *Brassica juncea*

There are three different types of *Brassica juncea* or Indian mustard that growers may have access to in the next few years.

Juncea canola has oil and meal quality similar to canola and therefore has the same market end-use (Table 1). Fatty acid profiles of the oil and the level of and types of glucosinolates in the meal all meet the quality specifications for canola. The oil is edible with high levels of

Figures 1 and 2. B. juncea varieties are being developed for different end-uses. (Photos Don McCaffery)

the desirable oleic acid and low levels of erucic acid, and the meal can be substituted for canola meal in animal diets (low glucosinolates).

Condiment mustard has different meal and oil quality to juncea canola. The level of glucosinolates in the meal after crushing is much higher than juncea canola and is responsible for the 'hot and spicy' taste of table mustard. The oil has a distinct 'nutty' flavour, but the erucic acid level is sufficiently low to make it suitable for human consumption.

Table 1. Typical seed quality characteristics for canola, juncea canola and condiment mustard when grown in the low rainfall zone.

Character	Canola	Juncea canola	Condiment mustard
Oil %	36–42	34–40	34–40
Oleic Acid %	57–63	57–63	variable
Linoleic Acid %	18–25	18–25	variable
Linolenic Acid %	8–13	8–13	variable
Erucic Acid %	<1	<1	1–20
Glucosinolate in meal (µmoles/g – 10% MC)	<30	<30	110–160
Allyl Glucosinolate in meal (µmoles/g – 10% MC)	0	<1	NA

Industrial mustard is a *B. juncea* type that is not suited to either of the edible markets for juncea canola or condiment mustard because of the high levels of erucic acid and/or glucosinolates. Industrial mustard may have a use in a number of industrial products including biodiesel.

Advantages of growing juncea canola over canola in south-western NSW

Juncea canola is a good alternative to canola in the drier grain growing region of south-western NSW for the following reasons.

1. Juncea canola can tolerate much drier and hotter conditions during flowering and pod fill. In very dry years, it is not unusual for juncea canola to out-yield most canola varieties by up to 30% and hence be a more reliable break crop than canola. As an example of juncea canola's stress tolerance, in the extremely dry seasons of 2004 and 2007 it yielded up to 0.3 t/ha in trials, whereas the canola was not harvested. Under dry conditions juncea canola is able to accumulate more dry matter than canola, primarily through greater leaf turgor pressures and by maintaining photosynthetic leaf area for longer, not by altering any of the known components of yield. Whilst the seeds are smaller and there are less seeds per pod, juncea canola produces more pods per plant than canola.
2. Juncea canola is generally more vigorous in the early stages of growth than open-pollinated varieties of canola. This is an advantage when sowing in wider rows in low rainfall areas, allowing the crop to:
   - develop groundcover earlier, minimising competition from weeds
   - reduce water losses from soil evaporation, and
   - access moisture deeper in the profile.

Crop vigour is strongly correlated to sowing date; the earlier the crop is sown, the more vigorous the early plant growth.

3. Juncea canola is more tolerant of shattering than canola, providing the option of direct heading in some paddocks. However, the crop will still tend to mature like canola, with some parts of the paddock ready for harvest ahead of others. Experience from commercial crops in 2007 and 2008 suggests that while direct heading may be preferred, windrowing may still be needed to ensure even ripening and harvesting on time. Improved shattering tolerance is also beneficial when the crop is in the windrow.
4. Juncea canola offers rotation benefits similar to canola. It is an excellent break crop to minimise cereal diseases such as crown rot, take-all and rhizoctonia, and also reduces the number of root lesion nematodes following harvest, particularly *Pratylenchus neglectus*, which dominate in lighter red soils. Similar to canola, the decaying root system of juncea canola releases compounds called isothiocyanates which inhibit nematode populations.
5. Juncea canola also allows more grass weed control options (similar to canola), which can be used as a tool in herbicide resistance management.

Disadvantages of growing juncea canola compared with canola

1. Juncea canola is currently marketed through a 'closed loop' system, with receival, storage, segregation and marketing arrangements made through the contract. It is likely that only selected grain delivery sites will receive juncea canola, but as it becomes more popular, the delivery options will increase.
2. The oil content of current juncea canola varieties is about 1–2½ percentage oil points lower than the best performing early maturing canola. This disadvantage may be offset by more consistent yields in dry seasons.
3. A problem encountered in the 2007 and 2008 drought seasons was the smaller seed and lower seed weight of juncea canola compared to canola. Juncea canola seed size is normally smaller than canola under normal growing conditions but under drought conditions the seed can become very small. During the 2007 harvest, this very light seed was easily blown out of the back of the header.
4. In the badly drought-affected crops of 2007, the crop stems were more prone to snapping, particularly following wind storms, which increased shattering and lodging and made harvesting difficult.
5. With current canola production systems, growers have the option of a range of herbicide tolerance types – Triazine Tolerant (TT), Imi Tolerant (e.g. Clearfield® or CL) and Roundup Ready®. Juncea canola gives less flexibility in weed management as presently it only has one conventional type and two CL types available to growers.
6. Observations in 2008 suggested that juncea canola may be more sensitive to acid soil conditions (pH_{Ca} < 5.0) than canola.

Varieties and yield performance

Currently there are three commercial varieties of juncea canola and one condiment mustard that have been tested and found to be well adapted to the low rainfall cropping zone of NSW. Table 2 summarises yield performance and oil contents for the seasons 2007 and 2008 for northern NSW.

Note: There is no yield data for south-western NSW due to drought.

Suitable production zones

Juncea canola and condiment mustard can be grown anywhere in NSW where canola is currently grown. However, because of its adaptation to dry environments, the crop can be competitive with canola in cropping regions where long-term average canola yields are around 1.2 t/ha or less. In southern NSW this will be in areas where long-term mean annual rainfall is < 425 mm; in central NSW < 450 mm (Figure 3). In these regions average 'in-crop' rainfall (1 May – 15 October) ranges between 170 mm and 200 mm, but, like annual rainfall, is highly variable. Canola is likely to out-perform juncea canola in the better seasons, i.e. earlier sowing time, adequate subsoil moisture and favourable spring rainfall. Juncea canola can be more reliable when sowing time is delayed and/or the spring is very dry. It provides the opportunity to produce a more consistent yield.

Paddock selection and crop establishment

There are a number of key management decisions that will influence the success of your crop.

Avoid herbicide residues and drift. Juncea canola, like canola, is very sensitive to residues from Group B (e.g. Glean®, Logran® and Ally®) and Group C (e.g. atrazine and simazine) herbicides. Adhere to the plant-back periods following use of these herbicides and plan ahead when applying any residual herbicide. Whilst not completely tolerant, the Imi-tolerant Oasis CL and Sahara CL will have more tolerance of Group B herbicide residues, but will still be sensitive to Group C herbicides. Group I herbicides such as MCPA are extremely damaging if they drift onto juncea canola.

Table 2. Average yield and quality of Juncea canola varieties Dune, Oasis CL and Sahara CL in northern NSW in 2007 and 2008, compared with Tarcoola and AG-Outback canola.

Variety	Type	Yield as % of Tarcoola		Oil content (%)	
		2007#	2008##	2007*	2008**
Dune	Conventional juncea canola	90	125	35.0	40.5
Oasis CL	Imi-tolerant juncea canola	97	128	35.8	42.0
Sahara CL (J05Z-08960)	Imi-tolerant juncea canola	116	138	36.5	40.6
Tarcoola	Conventional canola	100	100	36.3	42.0
AG-Outback	Conventional canola	105	133	34.1	40.2
Average yield Tarcoola (t/ha)		**1.48**	**1.58**		

Note: All yield data is from northern NSW. Sowing times for Tamworth and Coonamble in 2008 were 10 June and 26 June respectively thus enhancing the yield advantage of juncea canola over canola.

Yield # Bellata, Tamworth; ## Coonamble, Tamworth

Oil% * Coonamble, Bellata, Tamworth; ** Coonamble, Tamworth

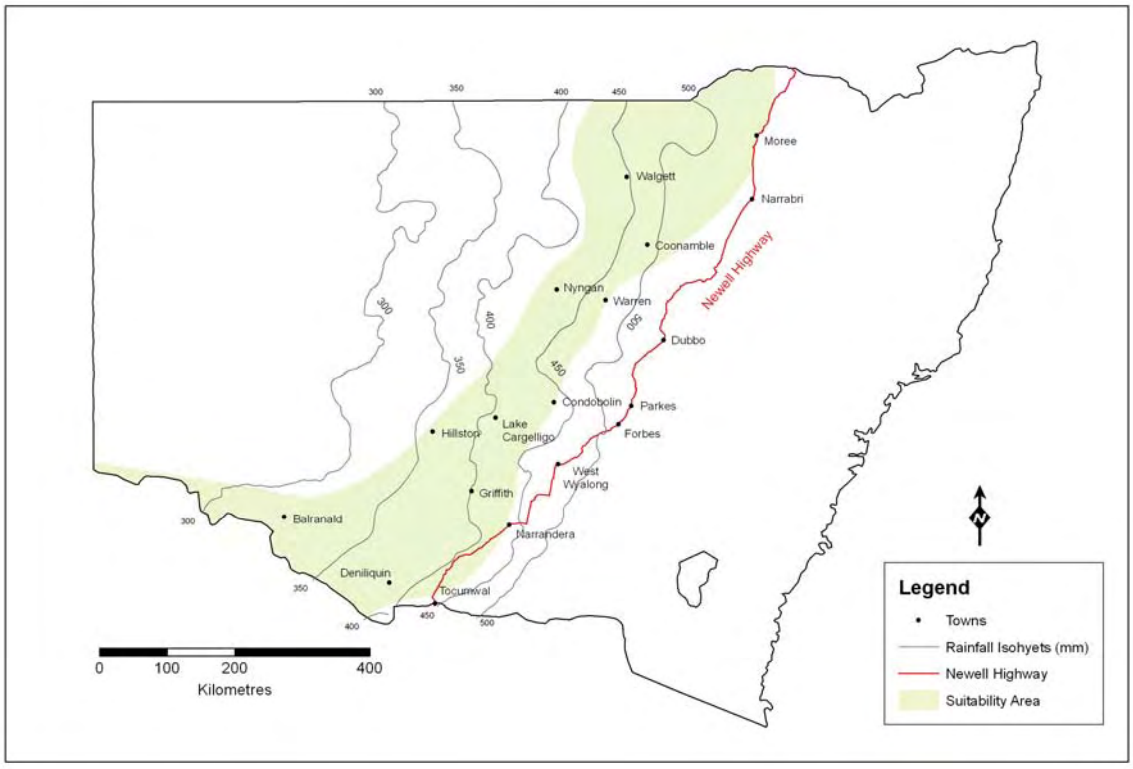


Figure 3. Suitable production zones for Brassica juncea (Juncea canola and condiment mustard) in NSW.

Soil types. Juncea canola will grow in most soils in south-western NSW but soils with a pH_{Ca} of 5.5–7.5 are preferred. More acid soils (pH_{Ca} < 5.0) should be checked for aluminium levels and limed if necessary. It will grow in sand or clay textured soils, and appears to tolerate soils with excess free carbonates. Paddocks with subsoil constraints such as hard pans should be avoided or ameliorated before sowing. Sodic soils which crust over after rain can reduce plant establishment and are best avoided or ameliorated with gypsum prior to sowing. Like canola, it is quite sensitive to waterlogging.

Figure 4. Subsoil constraints such as hard pans can severely restrict root development, access to subsoil moisture, and hence yield. (Photo Barry Haskins)

Subsoil moisture. Juncea canola plants respond very well to subsoil moisture, especially when sown early into well structured, fertile soils. The plant's vigorous tap root system is able to extract moisture from deep within the profile, allowing the crop to be better buffered against the hot, dry conditions which can occur in spring. For this reason, it is important to select a paddock with good subsoil moisture. Aim to sow into a paddock with at least 70 cm of subsoil moisture. It is also important that there is enough moisture in the seedbed as juncea canola needs slightly more moisture than cereals for germination and establishment. In the low rainfall cropping zone the best moisture will be in a long fallow paddock (18 months), which should also be a cleaner paddock for weeds and diseases.

Sowing into a paddock with minimal subsoil moisture is risky, as the crop will be totally reliant on growing season rainfall to produce a profitable yield.

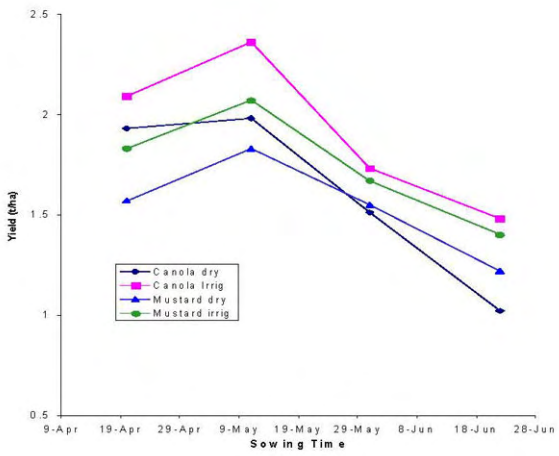
Retained stubble. Sowing into retained stubble will provide adequate protection for the emerging seedling, particularly against sand blasting on lighter soil types (an issue for some growers in 2007). Juncea canola, like canola, is very susceptible to sand blasting, and is easily damaged or killed by even moderate sand blasting up until the 4–6 true leaf stage.

Stubble aids in moisture conservation during the fallow period and early crop establishment. Stubble cover minimises damage caused by soil movement (rain drop splash and sheet erosion) when the crop is very young. It can also buffer against cold soil temperatures from the first few frosts.

Sowing time. Generally, for most crops the earlier the crop is sown the higher the potential yield. Early sown juncea canola crops will have stronger stems and more vigorous root systems, allowing the crop to flower and fill seeds before the onset of the hotter and drier conditions of mid spring. An early sowing time is important with juncea canola to enable the crop to maximise its dry matter by mid flowering, providing a solid platform for seed filling when flowering ends.

However, if sown too early juncea canola can grow too tall, be more prone to disease pressure, the canopy can become rank, and the crop is more at risk of frost damage as pod filling is occurring too early. In addition there may be difficulty in harvesting a very bulky crop. A time of sowing trial conducted at Condobolin in 2000 highlighted the importance of early sowing time, but not too early, to maximise yields (Figure 4). As a general rule sowing time should be 7–10 days later than an equivalent early maturing canola. Further trials are planned to determine the optimum sowing time for juncea canola in different environments.

Figure 5. Yield of canola and mustard in response to sowing time and supplementary irrigation at Condobolin Agricultural Research and Advisory Station. (Source: Dr Neil Fettell)



Suggested sowing times based on the Condobolin trial and grower experience with commercial crops in 2007 and 2008 are outlined in Table 3. Individual varieties may vary slightly, but these are typical sowing windows for various regions. If growers choose to grow the crop in more eastern areas (medium-high rainfall), then sowing times should be delayed by 10–20 days from those nominated in Table 3.

Plant establishment. Limited data suggests that plant population targets for juncea canola are similar to canola. Aim for an established plant population of 20–35 plants/m^2 for early sowing and 35–50 plants/m^2 for later sowing. This may equate to between 2 and 4 kg seed/ha, depending on seed size. Juncea canola seed is typically only 75%–95% the size of canola, so seed size needs to be checked and seeding rates reduced from those of canola for the same plant population.

Table 3. Suggested sowing times for the low rainfall zones of south-western NSW.

	Mid April	Late April	Early May	Mid May	Late May	Early June
Nyngan		>	●	●	<	
Condobolin		>	●	●	<	
Griffith		>	●	●	<	
Deniliquin		>	●	●	<	

● Optimum sowing time

> Early – yield reduction likely; too vegetative, lodging, disease and/or frost

< Late – some yield reduction likely (about 10%); lack of spring moisture and heat stress

Equally important as plant population is achieving a uniform plant density. Getting an even plant establishment is essential for a successful crop, as it provides better competition against weeds, allows more even moisture and nutrient utilisation, and promotes even crop maturity and ripening across the paddock.

Juncea canola seeds are quite small and should not be sown too deep. To achieve an even plant stand aim to sow at a depth of approximately 2–3 cm into good moisture. Ensure sowing speeds are not too fast to minimise soil throw onto the neighbouring rows. Also ensure proper tine breakout, so that the tine operates at a constant depth across the seeder width and across soil types. Low breakout causes uneven row depth, and patchy establishment.

Ensure stubble is moved to the side of the sowing row, as thick stubble will reduce establishment. Sowing points should be narrow enough to handle stubble without causing stubble and soil to drag, and also deliver the seed to a constant depth without excessive seed bounce. It is essential that the seed is buried behind the tine, and air flow from air seeders is not excessive, causing the small seeds to be blown from the seed row.

Innovative growers are inter-row sowing using precision guidance equipment as a suitable sowing technique for no-till farming systems.

The use of press wheels is advisable in most situations. Press wheels minimise excess soil being dragged on top of the small seeds, ensuring a constant seed depth and good seed-soil contact. Dragging harrows is not recommended unless the seed depth can be kept uniformly shallow.

If the seedbed becomes wet and sticky, seed and soil may stick to the press wheel and be scraped to the surface. Under these conditions it is usually time to stop sowing and wait for the soil to dry.

Dry sowing is generally not recommended in the low rainfall zone. The practice is considered too risky for the following reasons:

- Insufficient rainfall after sowing may result in a split germination, with uneven growth affecting subsequent operations.
- There is no opportunity to get a pre-sowing weed kill.
- The predominant red soil type is prone to crusting after heavy rainfall which can seriously reduce emergence.
- It is possible that germination and crop establishment occur too late for a profitable crop.

Row spacing. The optimum row spacing for juncea canola is similar to wheat and canola. In the low rainfall zone, row spacing is usually a compromise between what is suitable for the crop and what is manageable with minimum or no-till seeders. In most instances 30 cm row spacing is a good compromise. Both row spacing and plant population will be the subject of further research. Trials in 2007 indicated that 30 cm row spacing was better than 60 cm. When sown in 60 cm rows juncea canola yielded slightly less and had a higher frequency of lodging than the 30 cm spacing. The 60 cm spacing also resulted in less stubble after harvest, increasing the risk of soil erosion.

Crop nutrition

There is no research information to suggest juncea canola has different nutritional requirements to canola. Some early research conducted in the Mallee of north west Victoria suggested that nitrogen requirements were lower than for canola, but until further trial work indicates otherwise, fertiliser rates normally applied to canola should be used on juncea canola. Selected nitrogen and phosphorus trials conducted in the Mallee region of Victoria are presented in Tables 4, 5 and 6. Juncea canola may have better salt and boron tolerance than canola and may be able to better respond to N on sites where these problems occur (Table 5).

Depending on soil test results, target application rates are likely to be about 8–12 kg P/ha and up to 30–50 kg N/ha. Agronomy trials are currently examining the response to nitrogen fertiliser. Sulfur is also an important nutrient and should be applied as sulfate sulfur (e.g. Gran Am) at 15–20 kg S/ha. These rates are similar to canola. Zinc responses

Table 4. Seed yield response of three mustard lines to 40 kg N applied as urea at sowing. (Source, G. Castleman)

Mean seed yield (t/ha) 1992/93				
		Applied nitrogen (N) (kg/ha)		
Variety	**Maturity**	**Nil N**	**40 N**	**Mean**
Pusabold	Late	1.44	1.39	Not significant
Tm-18	Early	1.17	1.41	Significant
CSIRO-6	Mid	1.53	1.75	Significant
Mean Yield		1.38	1.51	

Table 5. Yield response of B. juncea (JN004) to 40 kg N banded urea on a soil with high subsoil boron at Warracknabeal. (Source, R. Norton)

Mean seed yield (t/ha)			
Treatment	**Canola**	**Wheat**	**Juncea canola**
Nil nitrogen	1.94	2.97	1.55
40 kg N/ha	2.04	3.03	1.81
Significance	Not significant	Not significant	Significant

Table 6. Seed yield response of an early maturity B. juncea (Cv. CSIRO-1) to rates of pre drilled phosphorus applied at sowing. (Source, G. Castleman)

Seed yield (t/ha)				
Year		Rate of phosphorus (kg P/ha)		
	Nil P	**5 P**	**10 P**	**20 P**
1993	1.18	1.37	1.28	1.40
1992	1.35	1.48	1.52	1.71
Mean	1.27	1.43	1.40	1.56

are very soil type specific and are not common in south-western NSW. However, if a soil type is known to be zinc responsive then a zinc supplemented fertiliser at sowing is advisable.

Crop protection

Permit PER9343, (expiry 3/03/2012) allows most crop protection products registered for canola to be used on juncea canola. Users can obtain a copy of the permit on the APVMA website. http://services.apvma.gov.au/permits/response.jsp

Users must carefully read the permit and comply with all conditions of the permit before applying any crop protection product to juncea canola.

Weed control

Weed control strategies in juncea canola are similar to canola. Weed control will be more difficult when growing varieties with no herbicide tolerance. The herbicide tolerant Clearfield® varieties, Oasis CL and Sahara CL make weed control easier as the herbicide Intervix® may be used. However the costs of post-emergent herbicides are sometimes considered too expensive in the regions that juncea canola is grown. Breeding programs are currently developing triazine tolerant varieties.

For this reason ensure the paddock chosen has low weed pressure, especially broadleaf weeds. If necessary apply one or two knockdown herbicides before sowing to reduce weed numbers. This strategy may be needed when the autumn break occurs early. Known problem weeds are the mustard species, wild turnip, wild radish and fumitory, although most broadleaf weeds will result in a yield penalty if not controlled.

A residual herbicide for grass weed control such as trifluralin is best ‘incorporated by sowing’ (IBS) with a knife point/press wheel seeding system. The IBS technique allows a ‘hot blanket’ of herbicide to be thrown in between the plant rows to aid in weed control. The plant row itself may have little if any herbicide but weed control is achieved by crop competition. When using the IBS technique, it is extremely important to vary sowing speed according to the width of soil throw, so that each tine is not throwing soil into the neighbouring seed row. If soil throw does occur, significant crop damage will result.

Figure 6. Broadleaf weeds such as mustard species and fumitory can be a problem in juncea canola. (Photo Barry Haskins)

Grass weeds can be easily controlled post-emergence by Group A 'fop' and 'dim' herbicides, so long as weeds are not resistant to this chemistry.

Whilst clopyralid (e.g. Lontrel®) has been used extensively in canola for thistle and capeweed control, crop safety trials have shown a very narrow safety margin, and in a small number of instances resulted in a 5%–10% yield penalty. Therefore there could be a small trade-off when applying Lontrel® to juncea canola. Experience has shown that early crop application (2–4 leaf) reduces the risk of yield loss with *B. juncea* compared to a later (6–8 leaf) crop application.

Insect pests and viruses

Juncea canola is subject to the same range of pests as canola and there is no evidence that the crop is more tolerant to specific pests. However, because the crop is likely to be grown in low rainfall environments, the range of pests and populations of specific pests will be different to those of canola grown in medium–high rainfall environments.

Earth mites are a common pest at establishment but aphids can also be a problem at this time as they suck sap from small plants and transmit viruses. Autumn aphid numbers can be high in some regions, particularly with early sowing after summer rainfall. Therefore early sown crops are more predisposed to attack. Aphid flights are generally more common in northern NSW, but the south-west of the state can also experience high numbers of aphids, particularly where crops are establishing under dry, warm autumn conditions.

Aphids are the main vector in the spread of viruses. The main viruses likely to occur in juncea canola are *Beet western yellows virus, Turnip mosaic virus* and *Cauliflower mosaic virus*. The main control techniques include using seed treated with imidacloprid (e.g. Gaucho®), controlling perimeter broadleaf weeds and particularly summer growing brassica weeds, and sowing into standing cereal stubble. Standing stubble has been shown to reduce virus problems in pulse crops as the stubble deters aphid entry into the crop. Seek advice before spraying aphids in a vegetative crop.

Spring aphid infestation is common in canola when spring conditions are dry and warm. As juncea canola is adapted to the low rainfall, warmer environments of the cropping belt, expect some aphids in the crop as it matures. Control recommendations are the same as for canola.

Heliothis and diamondback moth can also be expected in juncea canola and may warrant control measures when threshold numbers are exceeded.

All insecticides registered for canola are approved under permit (PER9343, expiry 3/03/2012).

Figure 7. Viruses diseases such as Turnip mosaic virus are more prevalent in northern NSW. (Photo Rod Bambach)

Diseases

Blackleg. Juncea canola can be infected with the blackleg fungus, but has its own particular resistance pattern, which can be similar to canola. Because of this, the recommendations for managing blackleg in juncea canola are essentially the same as for canola. Ensure there is 500 m separation from last season's juncea canola or canola stubble and only grow the crop 1 year in 4 in the same paddock. Blackleg is considered a lesser problem in the low

rainfall zone, so fungicide seed dressings are generally not necessary.

White rust. This disease is more prevalent in juncea canola than it is in canola, but is not considered a problem in NSW. The weed shepherds purse is a host of white rust.

Sclerotinia. The fungal disease Sclerotinia is not likely to be a problem in the low rainfall cropping zone. It is however, common in canola crops in more eastern medium–high rainfall areas and in some central and northern river valleys. It is favoured by warm, wet and humid conditions in spring. The host range of the disease includes most broadleaf weeds and broadleaf rotation crops including chickpeas, field peas, lupins and faba beans. In recent years Sclerotinia has been observed at low levels in some chickpea crops in central NSW. Crop separation and rotation guidelines are similar to managing the disease in canola.

Harvest management

The principles for harvesting juncea canola are similar to canola. Aim to harvest a clean, evenly ripened grain sample at a moisture content of no more than 8%.

Direct heading. Juncea canola can be direct headed as it is less prone to shattering than canola. Direct heading is more suitable for crops that mature evenly and are not excessively tall. Draper fronts with batt reels seem to be best suited for direct heading. Once the crop is ripe for harvesting, delays must be avoided as juncea canola will still shatter if adverse conditions prevail.

Figure 8. Dark spots are common on B. juncea but do not affect yield. (Photo Katrina McDougall)

Windrowing. Where uneven maturity is expected or in particularly windy regions, windrowing is the safest option pre-harvest. As well as ensuring even maturity, windrowing enables harvest and delivery to be scheduled with other farming operations. As with canola, windrowing can occur when the seed moisture content reaches 30%–35%, and when 60%–70% of seeds have changed colour and are firm. Windrowing before this stage results in unripened seeds which are small and pinched, and windrowing too late may promote ripe pod shattering. Seed colour changes from translucent green to yellow, as opposed to canola that turns brown then black as the seed ripens.

Desiccation. An alternative to windrowing is to desiccate the crop. Desiccation can only be done by aerial application. Apart from promoting more even crop ripening it can be used to control weeds such as thistles which could cause harvesting difficulties. Desiccation is expensive and most of the time avoidable by windrowing. Reglone® is the only product permitted (PER9343, expiry 3/03/2012) as a pre-harvest desiccant.

Marketing options

In the immediate future, juncea canola will be marketed through a ‘closed loop’ system. Contracted growers will be advised about delivery centres. Delivery standards and payment options are the same as for canola. There are no area contracts.

Condiment mustard currently has a domestic market of around 2000–4000 tonnes. Export markets are not well developed, so any production beyond domestic requirements could become a liability for the grower. Major markets in NSW are Palos Verdes at Cowra and Yandilla at Wallendbeen.

Markets for industrial mustard are still being developed. A word of caution: *B. juncea* mustard varieties targeted specifically for industrial purposes are lower yielding than current juncea canola and condiment mustard varieties. If the oil quality of the mustard destined for industrial use does not meet quality standards of either juncea canola or condiment mustard then marketing options become extremely limited.

The Australian Oilseeds Federation (AOF) established a juncea canola working group to oversight market and quality issues. The AOF has recognised market choice protocols. See the AOF website www.australianoilseeds.com/ for more information. For juncea canola the market and quality issues are currently being managed through a ‘closed loop’ marketing arrangement. Condiment mustard seed markets have similar ’closed loop’ systems in place.

Over time, as production increases, ongoing quality assessment will occur and formal discussions with export markets will be entered into.

Acknowledgments

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John Sykes, Research Leader (Pulse and Oilseed Genetics and Improvement), NSW DPI, Dubbo

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Further information and industry contacts

Publications

Winter Crop Variety Sowing Guide 2009, NSW DPI

Weed Control in Winter Crops 2009, NSW DPI

Insect and Mite Control in Field Crops, NSW DPI
Website www.dpi.nsw.gov.au/agriculture

Virus diseases in canola and mustard, Agnote DPI/495, NSW DPI

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