Brassica juncea - critical agronomy factors for the low rainfall zone of western NSW

Don McCaffery[1], Barry Haskins[2], Rod Bambach[3], Neil Fettell[4]
[1]NSW Department of Primary Industries, Locked Bag 21, Orange NSW 2800, Australia, don.mccaffery@dpi.nsw.gov.au
[2]NSW Department of Primary Industries, PO Box 1087, Griffith NSW 2680, Australia, barry.haskins@dpi.nsw.gov.au
[3]NSW Department of Primary Industries, 4 Marsden Park Road, Calala NSW 2340, Australia, rod.bambach@dpi.nsw.gov.au
[4]NSW Department of Primary Industries, PO Box 300, Condobolin NSW 2877, Australia, neil.fettell@dpi.nsw.gov.au

ABSTRACT

Brassica juncea is a relatively new oilseed crop in NSW. Research is being supported by grower and agronomist experience to develop improved management guidelines for growers. Major agronomy factors leading to successful crops are; selecting a soil type that grows the best wheat crops, presence of good subsoil moisture at sowing, sowing the crop on time, sowing shallow but into moisture and obtaining the right plant population for the environment. Other important factors are; avoidance of herbicide residues, achieving good weed control, sowing into retained stubble and paying attention to crop nutrition.

Key words: *Brassica juncea*, canola, subsoil, moisture, establishment

INTRODUCTION

Brassica juncea is a relatively new oilseed crop in NSW. The two main types grown in NSW are the canola quality *B. juncea*, referred to as juncea canola, and condiment mustard. Juncea canola was only commercialised in 2007, but condiment mustard has been grown for a specific domestic niche market since the late 1980's. *B. juncea* has drought and stress tolerant attributes considered superior to conventional canola. It therefore should be better adapted than canola to the low rainfall cropping zone of western NSW. Anecdotal evidence suggests *B. juncea* can be competitive with canola in western NSW where long-term average yields for canola are around 1.2 t/ha or less.

Industry development for *B. juncea* has been relatively slow compared to canola. Early research and grower experiences were obtained with condiment mustard on the heavy grey soils of north-western NSW which has a summer dominant rainfall pattern, relying on a balance of stored subsoil moisture and in-crop rainfall for profitable crops. Annual area sown to condiment mustard has fluctuated in line with seasonal conditions and is currently thought to be 3,000–4,000 ha. The release of the first juncea canola has significantly expanded options for grain growers across the entire low rainfall zone. After severe drought reduced production in 2007 and following some indifferent results in 2008 after another dry spring, it is estimated 10,000–10,500 ha has been sown in 2009.

The release of juncea canola has allowed knowledge and experiences to be gathered over a much wider range of environments, soil types and farmer practices. Current research is focusing on agronomy issues such as time of sowing, row spacing, plant population and nutritional aspects. This research is being supported by agronomist and grower experience to help improve agronomy recommendations.

This paper discusses the critical agronomy factors for success with *B. juncea* in the low rainfall zone of western NSW and is based on current knowledge and experience.

CRITICAL AGRONOMY FACTORS

The low rainfall cropping zone of NSW is vastly different from Victoria and South Australia, particularly in relation to rainfall. In southern NSW the environment is temperate, in the centre it

is temperate with slight summer rainfall dominance, and in the north it is temperate to sub-tropical with strong summer rainfall dominance. In these environments spring rainfall is less reliable compared to the Mediterranean environments of Victoria and South Australia. Growing season temperatures are generally milder during winter and hotter during spring. Days are also longer in NSW. Therefore the crop season is generally shorter and the crop is more reliant on subsoil moisture because of the less reliable spring rainfall.

Soil type

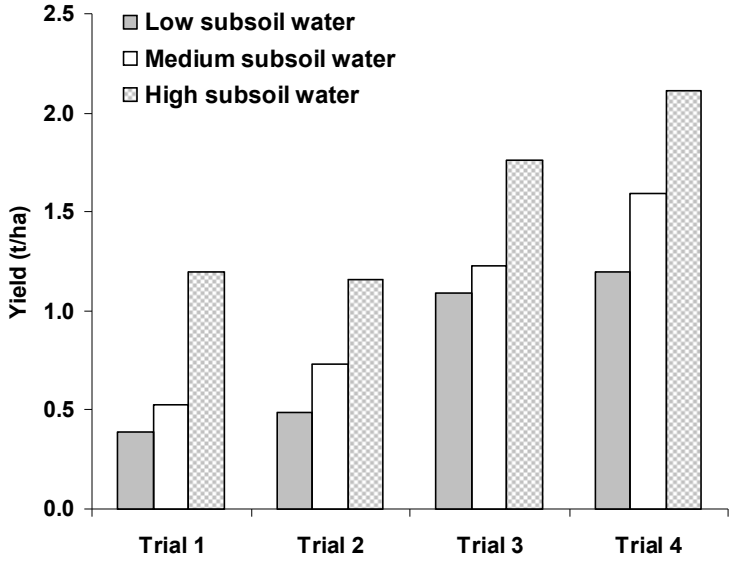
B. juncea will grow in most soil types but soils with a pH_{Ca} of 5.5–7.5 are preferred. Despite its heat and moisture stress tolerance the crop will respond best in soils with good water-holding capacity with no constraints to root growth. Poorer soils, including those with subsoil constraints such as sodicity, compacted layers, low pH, crust after rain, or are gravelly with low water-holding capacity are better suited to pastures or winter cereals. This requirement is no different to canola.

Subsoil moisture at sowing

Soils of the low rainfall zone vary in their water holding capacity. The cracking clay soils of north-western NSW hold the most amount of water, in the range 120–150 mm per metre of wet soil. In south-central NSW, plant available water (PAW) holding capacity of the predominant red soil type could be as low as 50 mm, but is mostly in the range 80–125 mm per metre of wet soil. In the south and centre, at least 70 cm of wet soil or 60 mm of PAW at sowing is desirable to reduce the risk of crop failure. In the north one metre of wet soils or 120–150 mm PAW is desirable. Subsoil moisture provides the buffer needed for the crop to set some yield if spring conditions are hot and dry.

Figure 1 shows the yield response of canola to starting soil water at Condobolin. The same principles would equally apply to *B. juncea.* Adequate soil moisture is not only important for yield but also for oil content. *B. juncea* oil content is already 1–2½ percentage oil points lower on average than the best performing early maturing canola, being in the range 34–38% over the past few years.

Figure 1. Response of canola yield to starting soil moisture in four comparisons at Condobolin NSW, in 2002 and 2003.



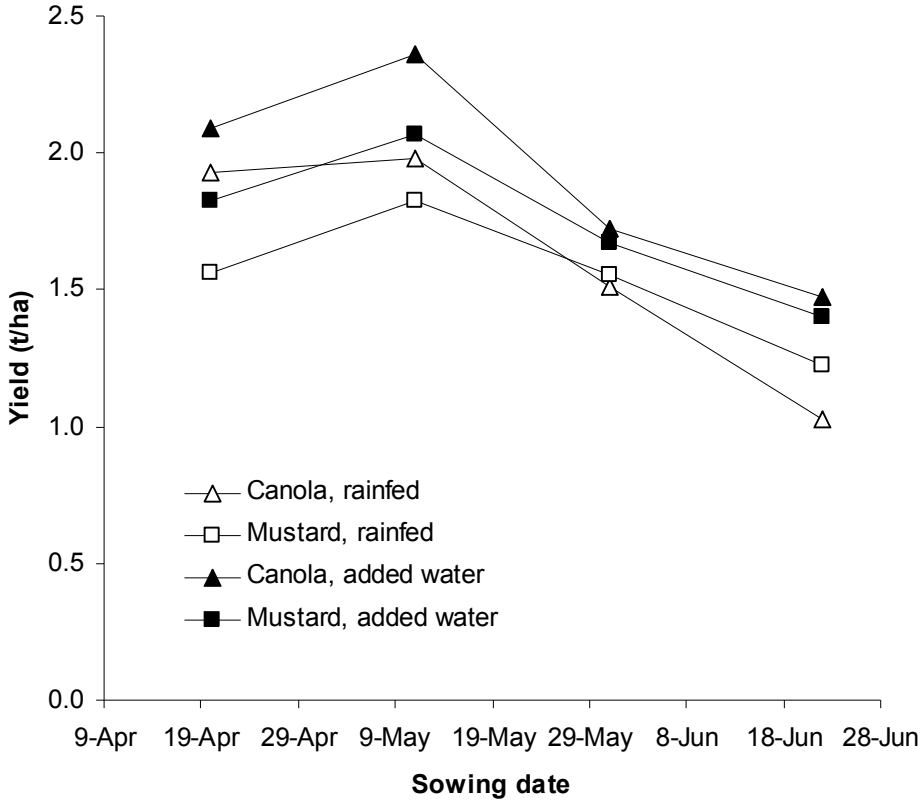
Sowing time

Sowing time of *B. juncea* is determined as much by the seasonal break as by any tactical management decision. Moisture availability, maturity of the variety, risk of frost damage, and spring moisture stress are all factors to be considered in the sowing decision in the low rainfall zone. In the absence of severe frost generally the earlier the crop is sown the higher the

potential yield. This is because the crop has a longer flowering period (producing more pods) and can complete seed filling before the onset of hotter and drier conditions of late spring. However, if sown too early the crop can grow too tall, become rank and cause harvesting difficulties. It will also increase the risk of yield loss from frost damage.

Research at Condobolin in 2000 highlighted the importance of early sowing time, but not too early, to maximise yields (Figure 2). As a general rule sowing time should be 7–10 days later than an equivalent early maturing canola. For southern and central NSW, it is the first two to three weeks in May (Haskins *etal*. 2009). In northern NSW it is mid-late May, stretching into early June at Moree (McCaffery *etal*. 2009). In the north, this sowing time will put seed filling after mid-September when the risk of frost damage is much lower.

Figure 2. Yield of canola and mustard in response to sowing time and supplementary irrigation at Condobolin NSW in 2000.



Sowing depth

B. juncea seed is typically smaller than conventional canola, and significantly smaller than hybrid canola. Smaller seeds store less energy so sowing depth should be shallower than for canola. Sufficient seedbed moisture close to the soil surface to allow shallow sowing is best achieved in a stubble retention/no-till system. With this system, sowing can commence on a smaller rainfall event. Narrow sowing points or discs with press wheels will reduce soil disturbance and hence moisture loss from around the small *B. juncea* seed.

Plant establishment

A uniform crop establishment is the primary objective in sowing any crop. Targeting a uniform plant population range is more important that manipulating row spacing. Most row spacing adjustments on commercial seeders are designed to handle cereal stubble loads in a no-till system, not the needs of the particular crop. In southern and central NSW row spacing is commonly 30–33 cm, often using GPS guidance systems to 2 cm accuracy to allow inter-row seeding. In northern NSW row spacings out to 60–66 cm have not reduced yield. Plant population targets for *B. juncea* are similar to canola. Seed size however should always be

checked so that seed rates can be adjusted for the target plant population. In southern and central NSW 20–35 plants/m^2 is preferred for early sowings, and 35–50 plants/m^2 for later sowings. In northern NSW the target is 35–50 plants/m^2. For wider rows, like 60 cm, this would equate to 18–30 plants per metre of row, or 5.5–3 cm between plants. This density per metre of row may need reviewing for wide (60 cm or more) row spacings.

OTHER AGRONOMY FACTORS

There are a number of other factors which can be important in individual crops. Whilst it is not a specific agronomy factor, the flexibility to direct head as opposed to windrowing is an important potential cost saving in the low rainfall zone.

Herbicide residues

B. juncea is grown in rotation with winter cereals. Like canola, the crop is very sensitive to residues of Group B (for example, Glean®, Logran® and Ally®) and Group C (for example, metribuzin, diuron, atrazine and simazine) herbicides. Clearfield® varieties are more tolerant of Group B soil residues. The crop is also very sensitive to drift from the phenoxy Group I herbicides, and to their soil residues at sowing. It is therefore critical that herbicide plant-back periods are adhered to and spray drift reduction strategies are adopted. Field observations in 2008 and 2009 suggest that *B. juncea* may be more susceptible than canola to phenoxy spray drift, particularly at the bud initiation to flowering stage.

Effective weed control

The major broadleaf weeds of the low rainfall cropping zone are the *Brassica* weeds such as the mustard species, wild radish, charlock, wild turnip and turnip weed. Other weeds such as capeweed and fumitory species are also often a problem. With the release of the first Clearfield® juncea canola variety in 2008, many of these problem weeds can now be adequately controlled, although herbicide costs can be an issue in lower rainfall areas. Triazine tolerant juncea canola varieties are also in the breeding pipeline. However, for growers of condiment mustard, the only control options are those used for conventional canola and approved under permit (PER 9343, expiry 03/03/2012), which means good rotational weed control is required to achieve a relatively broadleaf weed-free paddock at sowing.

Crop nutrition

B. juncea has been promoted as a lower input crop with lower fertiliser costs than canola, yet there is no strong evidence to date to suggest it is any different. Depending on soil test results, suggested fertiliser rates are 8-12 kg P/ha, up to 30-50 kg N/ha and 15-20 kg S/ha as sulfate sulfur. The nitrogen requirement can be supplied from pulse crops or pasture, or from long fallow. Nitrogen requirements can be topped up depending on seasonal conditions.

CONCLUSION

B. juncea is well adapted to the low rainfall cropping zone of western NSW. Many of the critical agronomy factors are not dissimilar to ordinary canola. A better understanding of the agronomy factors will improve management recommendations and adoption by growers. It is possible, that 30,000–40,000 ha could be grown in NSW in the next five years. This will depend on its relativity and profitability against early-maturing canola, and seasonal and climate variability.

REFERENCES

Haskins, B, McCaffery, D. and Bambach, R. 2009: Juncea canola in the low rainfall zone of south-western NSW. Primefact 783. NSW Department of Primary Industries, available at http://www.dpi.nsw.gov.au/agriculture/field/field-crops/oilseeds

McCaffery, D. Bambach, R. and Haskins, B. 2009: *Brassica juncea* in north-western NSW. Primefact 786. NSW Department of Primary Industries, available at http://www.dpi.nsw.gov.au/agriculture/field/field-crops/oilseeds