Juncea canola can be considered as an alternate oilseed crop that is adapted to the semiarid areas of the northern Great Plains where high temperature and drought stresses often limit the productivity of conventional napus and rapa canola species.

*Brassica juncea* canola, a relatively new oilseed species developed from *Brassica juncea* mustard, has an oil and meal quality equivalent to conventional canola species. *Juncea* canola cultivars seem to have improved phenological characteristics, such as earlier flowering, longer duration of flowering and improved drought tolerance during the reproductive growth period. These characteristics should help improve the adaptation of this new species to the drought-prone regions of the northern Great Plains.

However, it was unknown whether these characteristics of this new species would hold true under diverse environments. Also, little information was available regarding the adaptability of this crop species and its relation to nitrogen (N) use efficiency, even though this information is key in minimizing production costs and environment impacts.

Two field experiments were conducted at four sites in Saskatchewan: Melfort, Scott, Saskatoon, and Swift Current over the 2003-2006 growing seasons. For Experiment 1, the two objectives were to determine: i) yield potential and response to environmental conditions of *juncea* canola in different soil-climatic zones; and ii) N use efficiency (NUE), N fertilizer use efficiency (NFUE) and N uptake of *juncea* canola under diverse environments. Experiment 2 evaluated five canola/mustard species/cultivars to determine the difference in the degree of resistance to seed and pod shattering under straight combine versus swathing management.

In Experiment 1, five oilseed species/cultivars, including *Sinapis alba* yellow mustard (cv. AC Base); *Brassica juncea* canola (cv. Amulet); *Brassica juncea* condiment mustard (cv. Cutlass); *Brassica rapa* canola (cv. Hysyn 110); and *Brassica napus* hybrid canola (cv. InVigor 2663), were grown under various N fertilizer rates including 0, 25, 50, 100, 150, 200, and 250 kilograms per hectare (kg/ha) at four sites from 2003 to 2005.

On average, alba mustard and rapa canola began flowering the earliest at 40 days after seeding (DAS), 49 DAS for napus canola (latest), and 44 DAS for *juncea* canola (intermediate). Flowering duration was longest for *juncea* canola (30 days) and shortest for napus canola (22 days). The napus canola and *juncea* mustard produced higher (1684 kg/ha) seed yields than the three other oilseeds (1303 kg/ha on average).
The results of this study showed that all oilseed species responded to N fertilizer rates in a similar manner, with a general trend of decreasing NUE and NFUE with increasing N fertilizer rate. The seed yield for all oilseeds was highly responsive to N fertilizer rates from zero to about 100 kg/ha, and thereafter, the rate of yield responses declined (Figure 1). The amount of N fertilizer required to achieve the maximum seed yield was 106 kg/ha for *rapa* canola, 135 kg/ha for alba mustard and napus canola, and 162 kg/ha for the two *juncea* species.

The seed yields of *juncea* canola and alba mustard were less responsive than other species/cultivars to various rates of N fertilizer, while the napus canola had the greatest yield response to increased N fertilization. Therefore, regardless of the oilseed species/cultivars, the application of adequate N fertilizers will help minimize yield variability and reduce production risks.

Experiment 1 showed that crop management practices made a significant difference in the growth and yield of *juncea* canola. Overall, *juncea* canola had lower seed yield than more popular hybrid napus canola, and the yield stability of *juncea* canola was lowest among the five oilseed species when examined across diverse environments. Earlier flowering, longer flowering duration, and greater tolerance to drought stress exhibited by *juncea* canola make the crop best adapted to the drier areas of the northern Great Plains, but the overall yield of the *juncea* cultivars tested in the experiment were lower than hybrid *napus* canola. The improvement of seed yield and yield stability will be the key to potentially adapting this new oilseed species to a wider range of environmental conditions.
In Experiment 2, plots of the five oilseeds were either swathed or desiccated with glyphosate after physiological maturity. Swathed plots were picked up and combined after windrows were dry, while desiccated plots were straight combined. All plots were combined with a plot scale combine harvester when seed had dried to near 10% seed moisture. Crops that were straight combined had greater seed yield than crops that were swathed. *Juncea* canola and *juncea* mustard produced an average of 13.7% greater seed yield when they were straight combined than when swath harvested. Straight combining of *rapa* canola resulted in 7.0% greater seed yield than swathing, while *napus* canola did not show any difference in yield between the two different operations.

Under high shattering or adverse harvesting conditions, all oilseed species/cultivars tested in the study had seed yield losses ranging from 2.4 to 7.7%, which was significantly higher than when harvesting conditions were favourable. Under high shattering conditions, there were large differences in yield loss among species during straight combining, with the yield loss the greatest for *juncea* mustard and *napus* canola; both losing >7% of the total seed yield. Yield loss was lowest for *rapa* (2.4%) and *juncea* (3.8%) canola, with *alba* mustard intermediate (5.2%). Under low shattering conditions, there were no significant differences among the five species/cultivars in the number of shed pods or shattered seeds, and the overall yield loss was less than 2.5% of the total seed yield.

Brassica juncea is well adapted to the drier areas of southwest Saskatchewan, such as this field at Swift Current, 2008.

*Source:* Yantai Gan, Swift Current Research Centre
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