Canola Growth Inhibitor Trial, 2007

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Abstract

There is interest in growing canola for hybrid seed production in central Oregon. However many growers use hand- or wheel lines to irrigate their crops, which will be problematic if the crop grows to more than 1 m in height. An experiment was conducted when two known growth regulators of canola were applied at two dates using winter and spring canola. Plant height was reduced when the chemical paclobutrazol was applied either at bolting or just prior to flowering, although not to levels that would restrict the height of the plant to less than 1 m. The response was mixed in terms of grain yield: it reduced yield in one winter cultivar, had no effect on one winter and one spring cultivar, and increased yield in one spring cultivar. Further research is required to identify the best growth inhibitors and how to manage them for irrigated canola.

Introduction

Canola cannot be grown for grain in the three central Oregon counties due to the risk of cross pollinating with other brassica species. However, it can be grown for seed and in the autumn of 2007, 70 acres were sown for hybrid winter canola seed production in two fields in Jefferson County. One factor limiting the production of hybrid canola seed in central Oregon is managing the height of the crop to remain under 1 m in height so that wheel or hand lines could be used to irrigate the crop. There have been several reports regarding the use of growth inhibitors on canola, with limited success. Armstrong and Nicol (1991) used several growth inhibitors at flowering on dryland spring canola in a terminal drought environment. Two growth inhibitors, ethrel and paclobutrazol, reduced plant height significantly with the latter increasing yield by 10 to 15 percent. Child et al. (1993) successfully used several fungicides, including tebuconazole, to reduce the height of canola but made no comment regarding the effect on yield. The aim of this experiment is to investigate the effect of ethrel and paclobutrazol on the height and yield of both winter and spring canola grown under irrigation in central Oregon.

Methods and Materials

The experiment consisted of four trials: winter canola irrigated using hand-line sprinklers; winter canola irrigated initially using hand-line sprinklers but in the spring and summer using furrow irrigation; spring canola irrigated using hand-line sprinklers; and spring canola irrigated initially using hand-line sprinklers but in the late spring and summer using furrow irrigation. All trials were located at the Central Oregon Agricultural Research Center at Madras (44.68°N, 121.15°W, 2,424 ft elevation) and arranged as randomized complete blocks. All plots measured 20 ft long by 4 ft wide (6 rows wide with 8 inches between rows). In all trials the treatments included control, paclobutrazol

pre-bolt (PB early), ethrel pre-bolt (EL early), paclobutrazol pre-flowering (PB late), and ethrel pre-flowering (EL late). Paczol was applied at 250 ml a.i./ha (3.4 oz/acre) while the ethrel was applied as 1,000 ml a.i./ha (13.7 oz/acre). Both were applied with a non-ionic surfactant in 20 gal water/acre. In both winter trials the cultivars used were the hybrid line 'Baldur' and the open-pollinated cultivar 'Virginia', both of which were supplied by Croplan Genetics. In the spring trial the cultivars were the open-pollinated cultivars 'Clearwater' and 'Gem', both of which were supplied by the University of Idaho's brassica breeding program. The winter canola trials were sown 5 mm (0.2 inch) deep on August 31, 2006. Just prior to sowing, 1 pint/acre of Treflan was applied and incorporated into the soil. On September 1 both trials were irrigated and had emerged within 14 days. On March 9, 2007, the 'pre-bolt' treatments were applied while the 'pre-flowering' treatments were applied on April 18. The spring canola trials were sown 2.5 cm (1 inch) deep on April 10, 2007. Just prior to sowing, 1 pint/acre of Treflan was applied and incorporated into the soil. On April 19 both trials were irrigated and had emerged within 4 days. On May 25 the 'pre-bolt' treatments were applied while the 'pre-flowering' treatments were applied on June 14. For all trials crop heights were recorded twice weekly from pre-bolting until maturity. The first and sixth rows and 2 ft on each end of plots were removed prior to harvest. A 1-m^2 sample was taken from a representative section from each plot in both the winter and spring sprinkler trials and weighed. The number of branches in this sample was then counted, as was the number of pods, before being threshed and 100-seed weight determined. The number of seeds/ft^2 was determined from the machine yield and the seed weight. The remainder of the plots was then swathed using a sickle-bar mower and the windrows were threshed in the field. Swathing and harvesting occurred on July 2 and from July 13 to 16, respectively for the winter canola and on August 13 and 20, respectively for the sprinkler irrigated spring canola. Unfortunately, the flood-irrigated spring canola could not be swathed before it was attacked by birds and shattered and so this trial was abandoned. Oil content was conducted by the University of Idaho's brassica breeding team using nuclear magnetic resonance (NMR) spectroscopy.

Results and Discussion

The winter canola yields were quite high, especially Baldur, for both the sprinkler- and flood-irrigated trials (Tables 1 and 2). The growth inhibitors, however, had little effect on yield and paclobutrazol decreased yield for Virginia under sprinkler-irrigated conditions, although it increased it for the flood irrigated. The early applications of ethrel and paclobutrazol decreased the number of branches in Virginia when applied early but no effect was observed when it was applied later in the season. Paclobutrazol early had a mixed effect on seed number when applied early, increasing it in Baldur but reducing it in Virginia. Ethrel applied late also seemed to increase seed weight when applied late.

Table 1. Machine yield and yield composition of the winter canola growth inhibitor, sprinkler-irrigated trial at Madras, Oregon, 2007.

Treatment[1]	Yield (lb/ac)	Branches/ft^2	Pods/branch	Seeds/ft^2	100-seed wt (g)
Baldur control	4,836	3.77	116	27,394	0.48
Baldur EL early	4,304	4.43	102	27,314	0.46
Baldur EL late	4,665	4.14	119	28,478	0.51
Baldur PB early	4,477	4.31	165	32,283	0.46
Baldur PB late	4,799	4.57	118	33,842	0.46
Virginia control	4,213	8.37	91	29,343	0.49
Virginia EL early	4,527	7.09	110	29,081	0.49
Virginia EL late	4,150	7.83	90	26,906	0.51
Virginia PB early	2,988	6.63	83	20,064	0.46
Virginia PB late	3,852	7.14	100	27,549	0.48
LSD (0.05)	1,007	1.15	33	5,806	0.03

[1]PB = paclobutrazol, El = ethrel

Table 2. Yield of winter canola in a growth inhibitor, flood-irrigated trial at Madras, Oregon, 2007.

Treatment[1]	Yield (lb/ac)
Baldur control	3,582
Baldur EL early	3,434
Baldur EL late	4,011
Baldur PB early	3,825
Baldur PB late	3,902
Virginia control	2,945
Virginia EL early	3,110
Virginia EL late	3,461
Virginia PB early	3,502
Virginia PB late	3,731
LSD (0.05)	1,031

[1]PB = paclobutrazol, El = ethrel

The spring canola yields were considerably lower than those of the winter plots and this was caused primarily by fewer pods/branch and fewer seeds/ft^2. Neither growth inhibitor had a consistent effect on seed yield or branches/ft^2, but both increased the number of pods/branch regardless of when they were applied, and for Clearwater this continued so that there were more seeds/ft^2. The growth inhibitors had little effect on seed weight, although applying ethrel early to Gem reduced seed weight significantly.

Table 3. Yield and yield composition of the spring canola growth-inhibitor sprinkler-irrigated trial at Madras, Oregon, 2007.

Treatment[1]	Yield (lb/ac)	Branches/ft^2	Pods/branch	Seeds/ ft^2	100-seed wt (g)
Clearwater control	1171	7.35	26	3117	0.47
Clearwater EL early	1611	6.40	48	6624	0.47
Clearwater EL late	1299	7.15	45	6321	0.45
Clearwater PB early	1679	6.53	53	6718	0.48
Clearwater PB late	1642	7.60	62	8243	0.48
Gem control	1564	7.33	35	5333	0.53
Gem EL early	1683	7.60	56	6745	0.46
Gem EL late	1865	6.75	53	4392	0.48
Gem PB early	1670	7.48	42	6226	0.48
Gem PB late	1821	6.68	40	4111	0.49
LSD (0.05)	527	NS	8	2353	0.03

[1]PB = paclobutrazol, El = ethrel. NS = Not significant.

Paclobutrazol significantly reduced the heights of both the winter and spring canola later in the season, while ethrel tended to reduce height and then compensate and catch up to the control later (Figs. 1a and b). It is interesting to note that the winter canola continued to grow a further 80 cm (31.5 inches) after it had started flowering, whereas the spring canola had almost reached its full height by flowering.

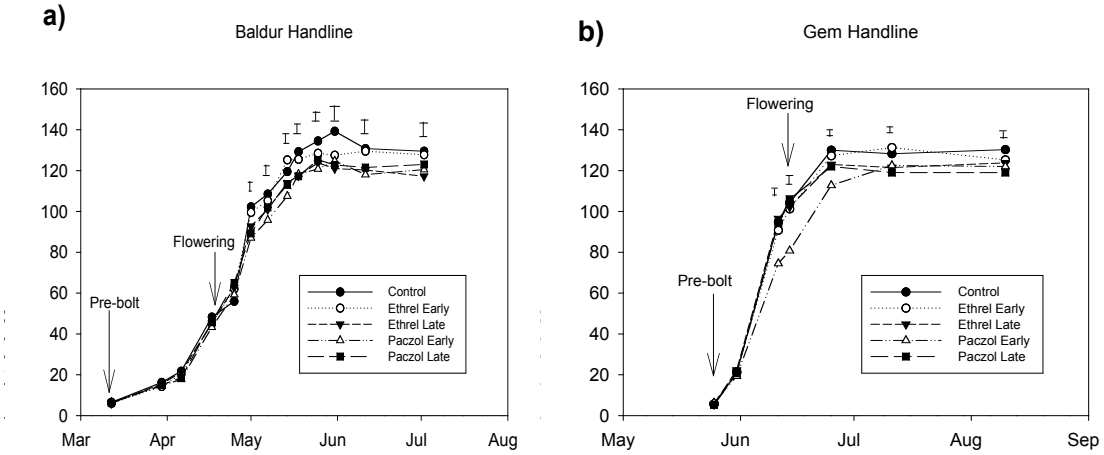

Figure 1. Height throughout the growing season in a) Baldur and b) Gem, grown using handline irrigation, Madras, Oregon, 2007. Paczol = Paclobutrazol

Conclusion

The growth inhibitors paclobutrazol and ethrel had a limited effect on plant growth and yield composition. Paclobutrazol did reduce plant height in both winter and spring canola, although not so much that they could be grown under wheel lines. A further year of data is required to confirm these results.

References

Armstrong, E.L., and H.I. Nicol. 1991. Reducing the height and lodging in rapeseed with growth regulators. Australian Journal of Experimental Agriculture 31:245-250.

Child, R.D., D.E. Evans, J. Allen,and G.M. Arnold. 1993. Growth response in oilseed rape (*Brassica napus* L.) to combined applications of the triazole chemicals triapenthenol and tebuconazole and interactions with gibberellin. Plant Growth Regulation 13:203-212.

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