Effect of Seeding Date on Canola Seed Quality

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Canola (*Brassica napus*), a cool season crop, is very sensitive to heat particularly at the flowering stage of growth. Nutall et al. (1992) reported a 3°C increase in mean maximum daily temperature (21 to 24°C) during flowering resulted in a 0.4 tonne ha^{-1} decrease in seed yield.

Canola sown in the Fall or mid-April flowers 18 to 24 days earlier and can yield up to 30% higher than can canola sown in mid-May (Johnson et al. 1998). Canola seed weights have averaged 30% and 20% higher for Fall and early spring seed dates, respectively, as compared to the late spring seeding date. These plants flower and mature in June and thereby escape mid-summer heat and drought stresses.

The objectives of this study were to determine the effect of seeding date on the size, maturity, germination rate and emergence rate of canola seed.

Materials and Methods

Canola seed of *Brassica napus* cv. Quest harvested from seeding date studies at Scott, Saskatchewan in 1998 and 1999 were used in this study. Seed date treatments were Fall, early spring and mid-May. Actual planting dates for Fall seeded canola were October 31 and October 28 in 1998 and 1999, respectively. Early spring treatments were seeded on April 16 and April 15, and mid-May treatments were seeded on May 18 and May 20 for 1998 and 1999, respectively.

Seed maturity was determined visually using a 10X binocular microscope. The following four categories were selected (1) black-smooth - mature; (2) black-ridged - mature;

(3) immature - brown to tan in color; (4) damaged - cracked seed. Seed size was estimated using a series of sieves; 1.7 mm; 1.4 mm; 1.18 mm and 1.0 mm.

Both germination and emergence rates were used to determine seed vigour. Germination tests were conducted at either a constant 22 or 8°C in the absence of light. Each seed lot was replicated four times with 50 seeds placed on moist paper in a 15 mm Petri dish. The number of seeds exhibiting radicle emergence was recorded every day until germination ceased.

Seedling emergence was evaluated by planting 20 seeds at a depth of 2.5 cm in a sandy loam (Entic Haploboroll) soil collected from the field of Kernen Crop Research Farm of the University of Saskatchewan, Saskatchewan, Canada. Prior to seeding both soil and water were equilibrated to 8°C. The study was conducted in a controlled environment chamber maintained at 60% r.h., 14 h photoperiod with fluorescent lights (750 µnmol m^{-2} s^{-1} at pot height) and 8°C light/5°C dark temperature regime. Pot size was 10 x 10 cm.

Canola seeds were primed in 100 µM s-ABA for 36 hours at 23°C as described previously (Zheng et al. 1994). Following priming the seeds were dried back to their original moisture content by leaving them in open dishes at 23°C for 24 to 36 h.

Results and Discussion

The mean temperature for June in 1998 and 1999 was 14.3 and 14.0°C, respectively, whereas the mean temperature for July was 18.3 versus 15.0°C. The amount of precipitation was the biggest difference for the two years. Total rainfall in 1999 was 238 mm versus 71.7 mm for 1998. The July average was 81 mm in 1999 compared to 18.3 in 1998.

The effect of seeding date on seed size is shown in Figure 1. In both years, over 80% of the seeds from the Fall planting date were greater than 1.70 mm in size. A slightly smaller percentage of seed from the April seeding date fell into this category. Only 12.5% of the 1998 seed from the May seeding date were larger than 1.7 mm, whereas 44% of the 1999 fell into this category. The majority of the seed for the May seeding date for both years were in the 1.40 to 1.70 mm range.

The distribution of mature and immature seed for the three seeding dates is shown in Figure 2. On average for both years, seed from the Fall and April seeding date had the highest percentage of mature seed (59 to 66% of the total seeds). Only 16 to 22% of the seed from the May seeding date were classified as mature. We have demonstrated that black mature smooth seed produce more vigorous seedlings compared to brown or tan colored seeds (Thompson and Gusta, unpublished data).

The final seed germination percentage and germination rate at 22°C were similar for all three seed lots in 1998 (Fig. 3). For the 1999 seed lots, seed from the Fall and April seeding date were similar in regards to rate and percentage seed germination (Fig. 3). Seed from the May seeding date germinated at a slower rate and the final germination count was 85% compared to 97% for the other two seed lots. At 8°C, there was no difference in either germination rate or percent germination of seed from the Fall or April seeding date (Fig. 3). However, seed from the May seeding date germinated slower and fewer seeds germinated. The time for 50% germination (T_{50}) was 4.3 days for the May seeding date versus 4.25 for the Fall and April seeding dates. Similar results were obtained for the 1999 seed lots.

To evaluate seed vigour, we compared seedling emergence of seedling at 8°C for the three seeding dates for both years (Fig. 4). While there was no difference in either the rate or final number of seedlings for the Fall and April seeding dates, there was a dramatic difference for both of these parameters for the May seeding date. The T_{50} for the Fall and April seeding dates in 1998 was 13.5 days versus 16.9 days for the May seeding date. In 1999, the difference in T_{50} was 1.6 days between the May seeding date and the two other dates. Seed size was expected to account for the difference in seedling vigour. However, as shown in Fig. 4, these differences disappeared if the seeds were primed with ABA. No differences in either seeding rate emergence or final emergence was observed for all the seed lots. Priming is known to initiate many of the metabolic events associated with germination (Zheng et al. 1998). Drying the seeds to their original moisture content preserves these events and allows the seeds to germinate under less favourable conditions (Gao and Gusta, unpublished results).

Summary

In comparison to the conventional May seeding date, seed from Fall and April sown canola are larger, more mature and produces more vigorous seedlings. Seed size alone does not account for the difference in seedling vigour between these seed lots. Seed from Fall and April sown canola has several distinct advantages over May sown canola for commercial seeding.

References

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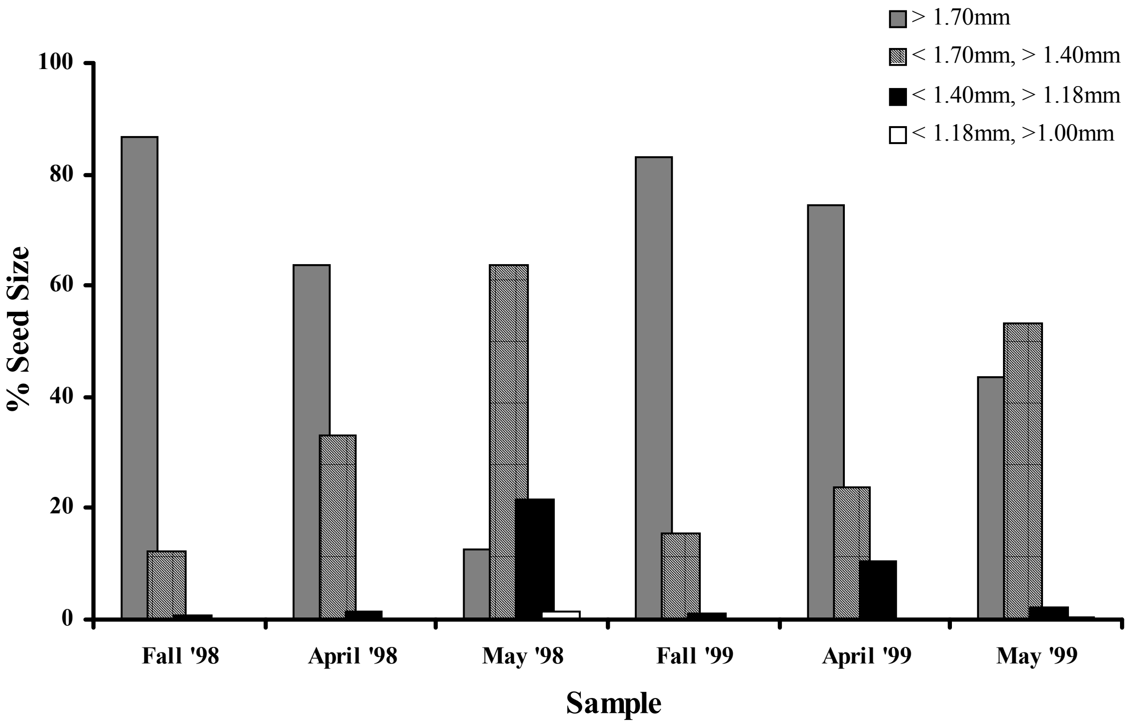

Figure 1. Comparative Size of Canola Seed from Fall, April and may seeding Dates.

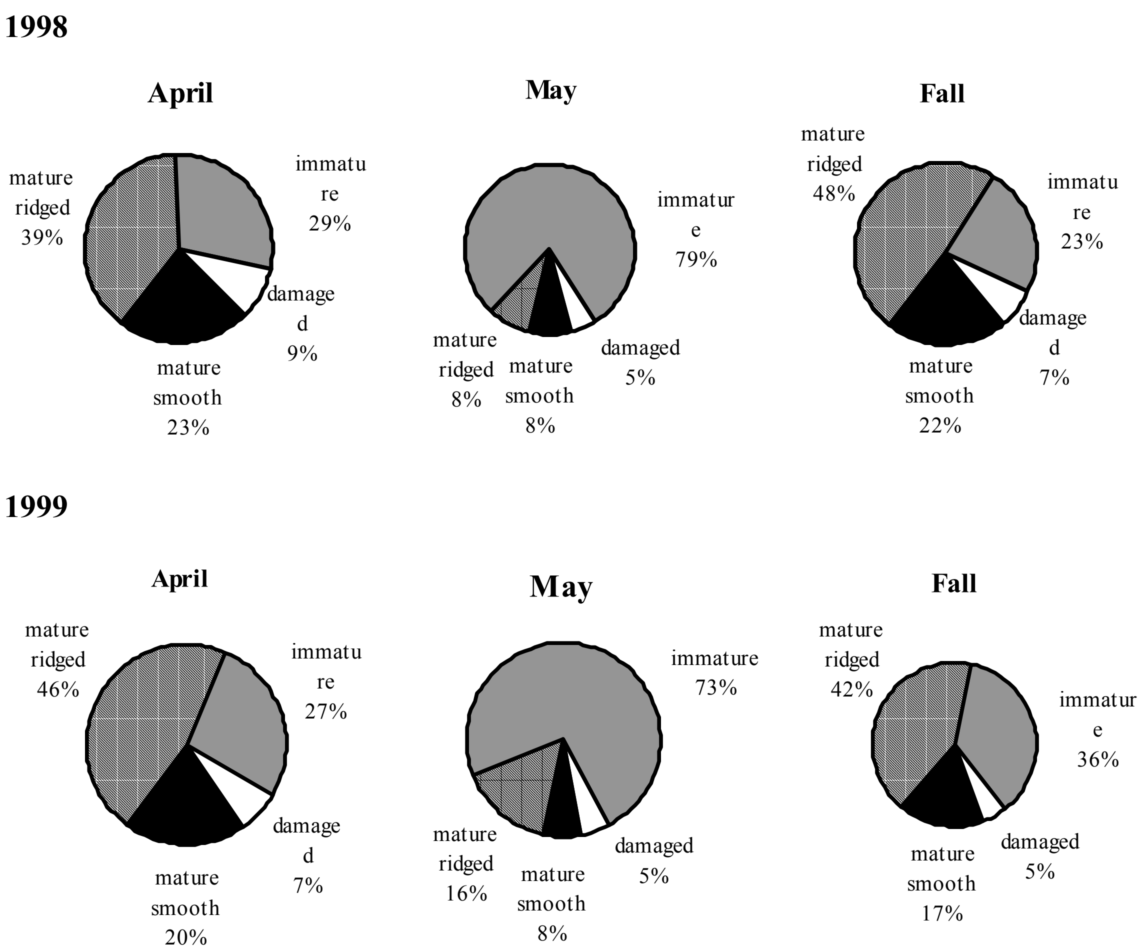

Figure 2. Percentage of Mature, immature and Damaged Seed from Fall, April and May Seeding Dates.

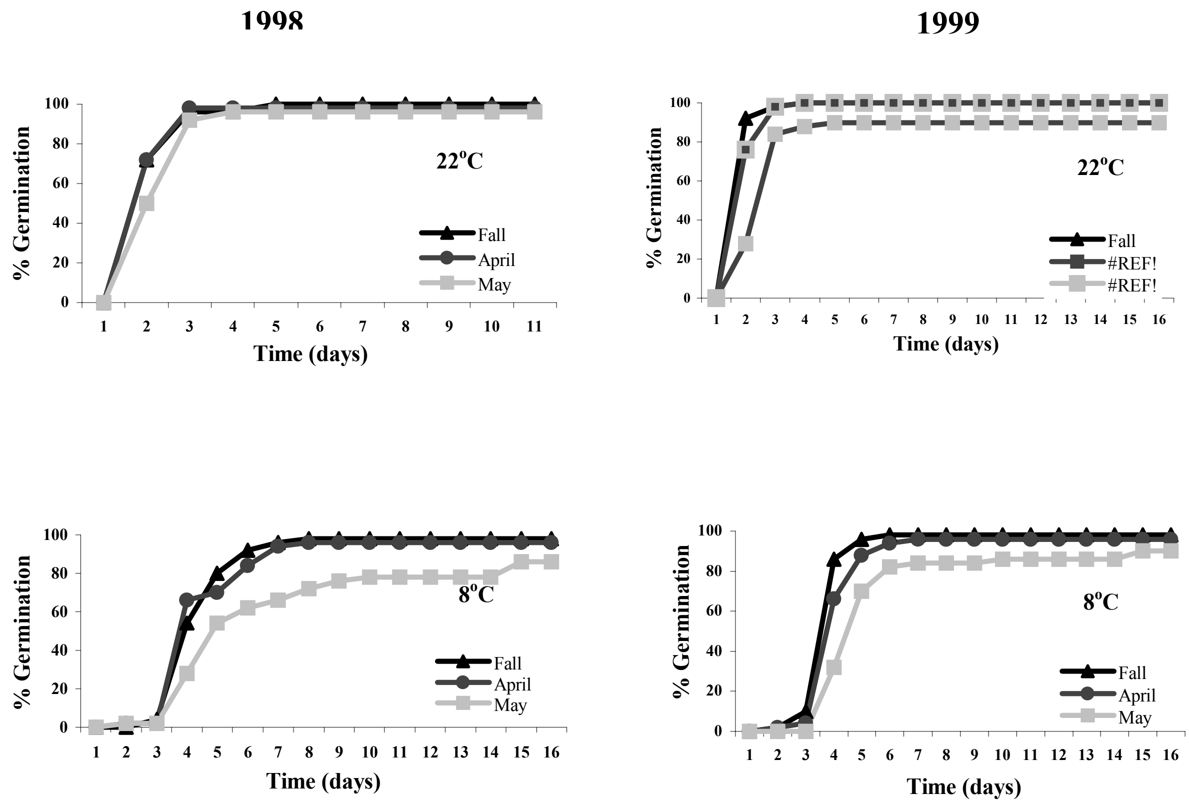

Figure3. Comparative Germination of Canola Seed at 8^0 C and 22^0 C with ddH_20 from Fall, April and May seeding dates

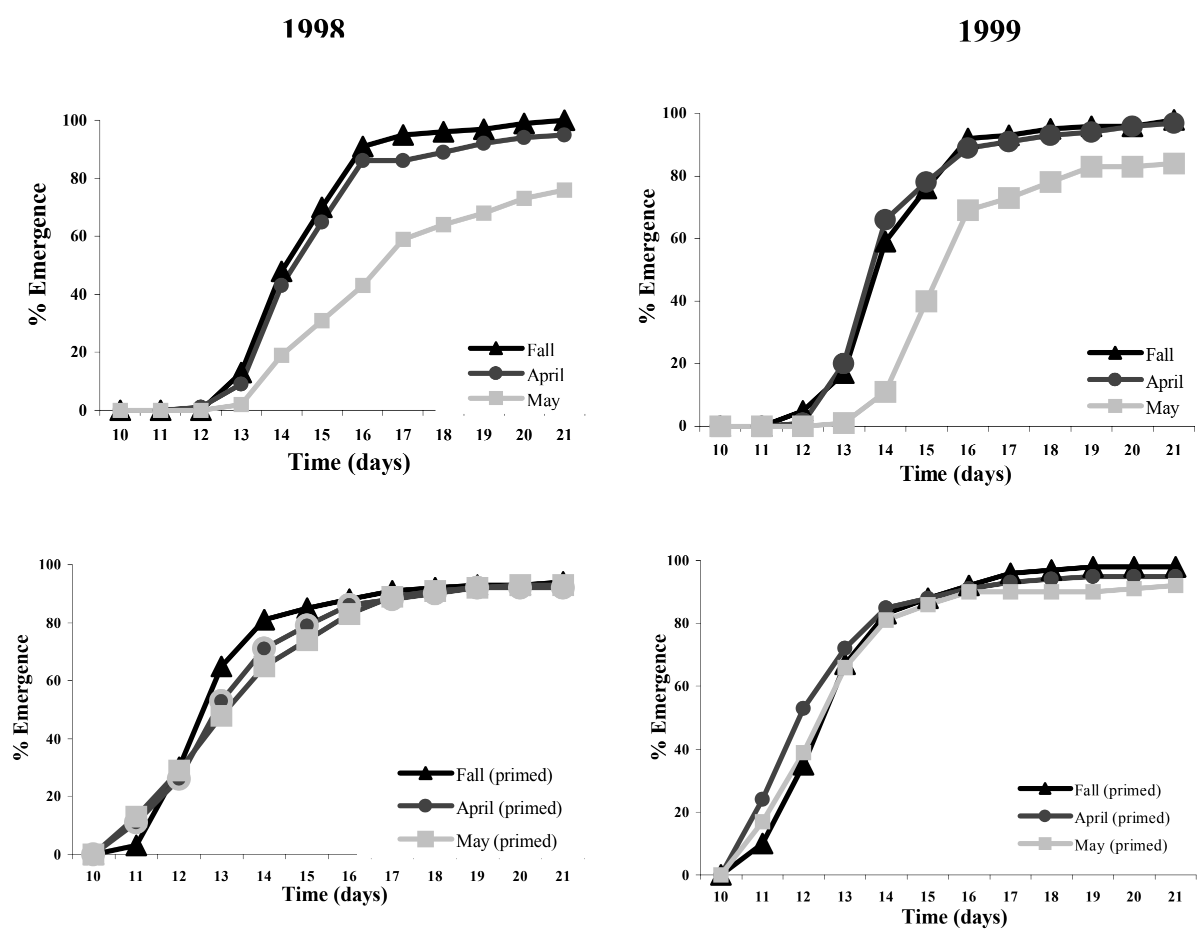

Figure 4. Comparative Emergence of Canola Seed at 8^0 C from Fall, April and May seeding Dates