Vernalization Requirements for Spring-Sown Canaryseed

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Introduction

In a spring seeding date experiment at Swift Current weekly growth stages of cereal, oilseed and pulse crops were recorded according to a universal growth stage scale (Lancashire et al. 1991). While crop development for wheat *(Triticum aestivum* L.) was slightly accelerated at later seeding dates, as is expected when crops are grown during a period of drier and warmer climatic conditions, canaryseed *(Phalaris canariensis* L.) growth was significantly slower at the latest seeding date (Fig. 1). Due to the marked difference in soil temperatures at each seeding date, the possibilityof a low-temperature (cumulative vernalization) response was considered, as was previously reported for some spring wheat cultivars (Jedel et al. 1986.) In this study, a similar delay in crop development at the latest seeding date was also observed for Argentine canola, a crop for which cumulative vernalization response has recently been reported (Murphy and Scarth 1994). Our objective was to investigate vernalization response in canaryseed in controlled climatic conditions. Experiment 1 measured the time required to effect a vernalization response and -Experiment 2 investigated genetic differences for this phenomenon among three canaryseed cultivars.

Experiment 1

Five low temperature treatments were imposed to canaryseed planted in pots in a controlled environment chamber. The treatments consisted of seed exposure to continuous 5°C for 0,3,7, 14 and *28* d after seeding and prior to increasing the chamber temperature to a **22/12°C** for the remaininggrowth, always set for 16/8 h light/dark regime. An experimental unit consisted of 4 systematically arranged pots per block, with 4 plants per **1.8-L pot**. A four-replicate RCB design was used, A temperature base of 0°C was used to measure the thermal time to reach the emergence, I-leaf and flowering stages of crop development. The thermal time to 50% emergence did not differ among treatments but longer low temperature exposure delayed development to the 4-leaf stage while shorter exposure periods increased the interval from seeding to flowering markedly (Table 1). As the thermal time between seeding and flowering decreased, dry weight at flowering also decreased.

Experiment 2

Three low temperature treatments were imposed to three canaryseed cultivars planted in pots in a controlled environment chamber. The treatments consisted of seed exposure to continuous 5°C for 0,7 and 14 d after seeding and prior to increasing the chamber temperature to a 22/l 2°C for the remaining growth, always set for 16/8 h light/dark regime. The cultivars were Cantate, CDC Maria, and Keet. An experimental unit consisted of 2 systematically arranged pots per block, with 4 plants per 1.8-L pot. A six-replicate RCB design was used in a 3 X 3 factorial arrangement. Practically, the thermal time to 50%

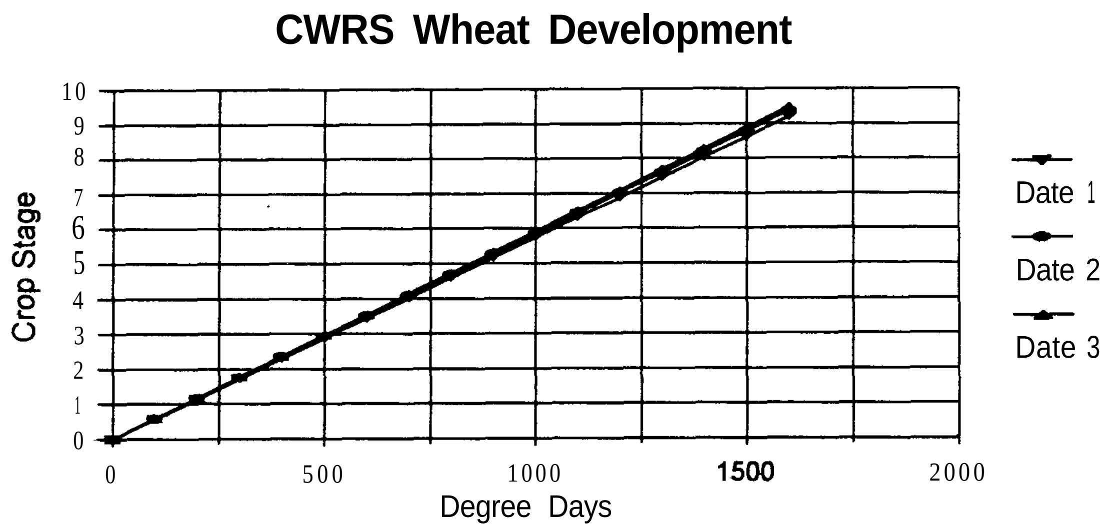

Fig. 1. Katepwa wheat development vs. degree day accumulation for three spring seeding dates at Swift Current, 1995-97.

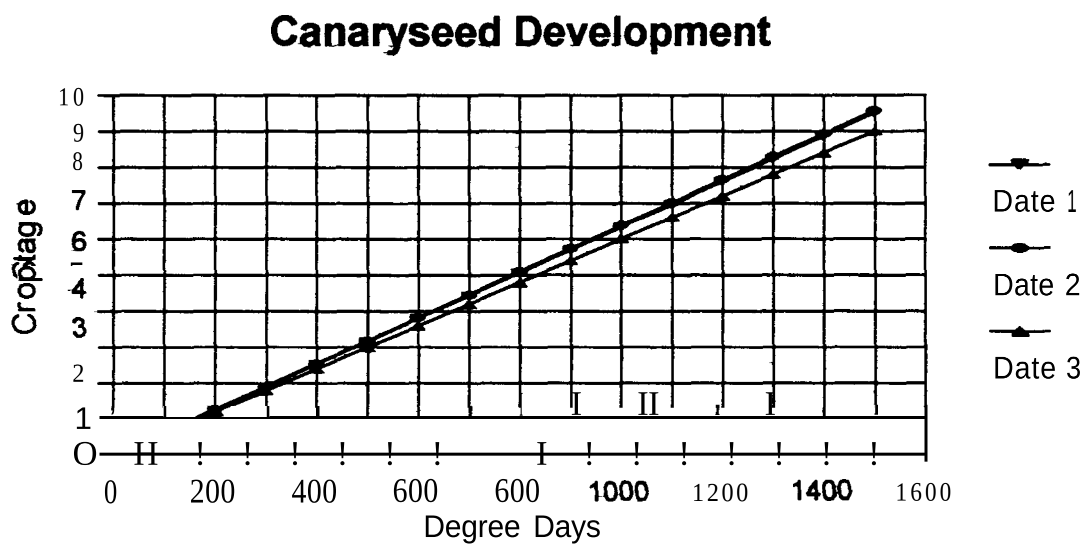

Fig. 2. Keet canaryseed-development vs. degree day accumulation for three spring seeding dates at Swift Current, 1995-97.

Table 1. Cumulative degree days (Tbase = 0°C) to reach emergence, 4-leaf, and anthesis growth stages in Keet canaryseed exposed to continuous 5°C for 0,3, 7, 14 and 28 d after planting.

Days @ 5°C	Emerge	4-Leaf	Anthesis	Dry Wt	Heads/plant
	---------- Degree Days	----------		g/plot	#
0	120a	388c	844b	17.2a	5.la
3	121a	414bc	869a	14.7ab	4.2b
7	142a	430b	841b	13.9b	4.9ab
14	121a	446b	782c	13.2b	5.la
28	112a	487a	767c	12.4b	5.7a

Values within a column followed by the same letter do not diier (P<O.05).

emergence did not differ among temperature treatments within cultivars, in agreement with Expt. 1. Also consistent with Expt. 1, longer low temperature exposure delayed slightly the development to the 4-leaf stage for all three cultivars, while shorter exposure periods increased the interval from seeding to flowering markedly, with the possible exception of Cantate. Finally, as the interval between seeding and flowering decreased, the dry weight also decreased. The dry weights are lower in Expt. 2 because the experimental unit was represented by eight plants, compared with 16 in Expt. 1, and because plant harvesting occurred at an earlier stage in Expt. 2.

Discussion

Agronomic practices for canaryseed, such as optimal seeding date, have not been well researched for this specialty crop. Producers in the prairies have the choice of seeding canaryseed early into cold soils, although this is most likely to occur in semiarid regions due to typically drier early spring soil conditions. By sowing early into cold soils, the evidence presented here indicates that crop development occurs faster, which may minimize the degree of 'haying off common to cereal crops facing terminal summer drought. The net effect on crop yield would be expected to be positive. In fact, lower dry matter accumulation at anthesis and higher seed yield from the earliest seeding date for canaryseed in the spring seeding date experiment at Swift Current agrees with this theory (Fig. 3). An equally important question relates to what happens to yield potential when seeding into warm soils, resulting in a slower rate of crop development, in areas such as the Black and Grey soil zones where drought is not common. Can seed yield potential be increased with delayed seeding in this situation? Delayed maturity would increase the risk of fall frost damaging the yield, but since canaryseed bid feed markets are not dependent on strict seed quality standards, this risk may be minimal. Counteracting this increased yield potential may be increased infestation by aphids, known to be more severe in later seeded crops. An inexpensive multi-site collaborative experiment would provide valuable information about the importance of seeding date in different regions of western Canada.

Table 2. Cumulative degree days (Tbase = 0°C) to reach emergence, 4-leaf, and anthesis stages in Cantate, CDC Maria, and Keet canaryseed exposed to continuous 5°C for 0, 7 and 14 d after seeding.

Cultivar	Days @ 5°C	Emerge	4-Leaf	Anthesis	Dry Wt
		Degree Days			g/plot
Cantate	0	136a	317b	749a	3.4ab
	7	144a	340a	750a	4.1a
	14	139a	342a	708a	2.8b
CDC Maria	0	130b	321b	807a	6.7a
	7	147a	355a	786a	4.8b
	14	143ab	333b	722b	3.3b
Keet	0	127a	319b	803a	6.0a
	7	141a	347a	804a	5.5a
	14	135a	340a	710b	3.3b
SE		7.6	8.8	26.0	0.9

Values within a cultivar and column followed by the same letter do not differ ($P<0.05$).

References

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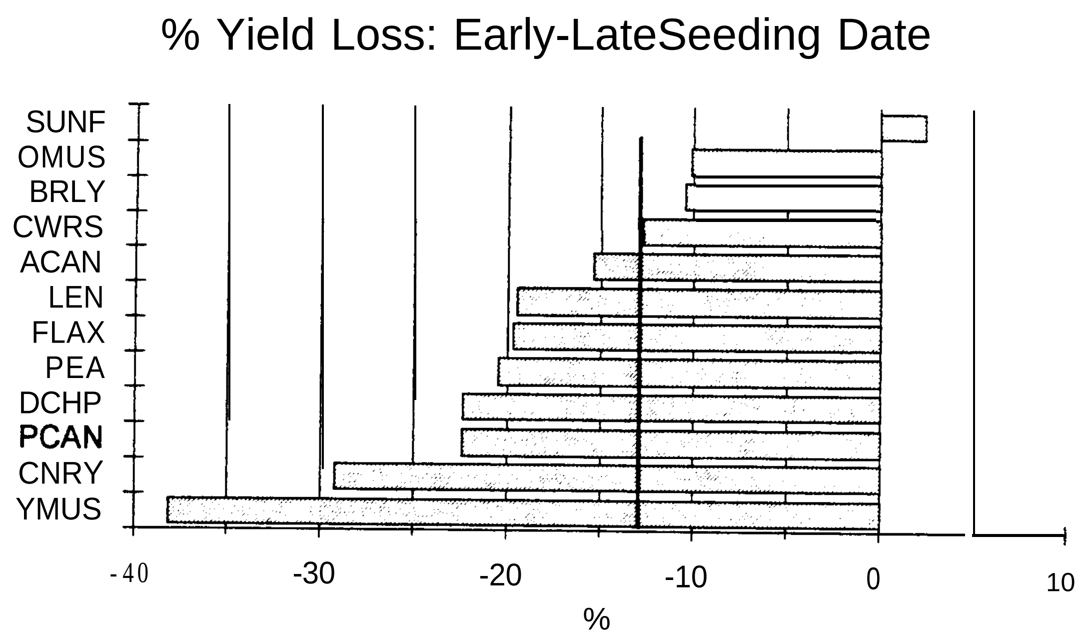

Fig. 3. Yield loss (%) by delaying seeding 4-5 wk from earliest possible spring date for 12 crops, including spring wheat (CWRS) and canaryseed (CNRY), direct-seeded into wheat stubble at Swift Current, 1994, 1996-97.