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Comparative effect of lodging on seed yield of flax and wheat

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Introduction

Lodging can limit crop productivity and hamper harvest. Conditions that normally promote plant growth, such as abundant soil nutrition and moisture, may, when in excess, increase the risk of lodging. Flax (*Linum usitatissimum* L.) can be severely affected by lodging, particularly when susceptible cultivars are grown under conditions of higher than normal precipitation or when subjected to high plant density regimes (Gubbels and Kenaschuk 1989) that may weaken plant stems.

Objective

The objective of this study was to examine the frequency and severity of lodging, in advanced breeding lines of flax and wheat, grown in multi-location field tests across the Prairie Provinces of western Canada, and comparatively study the effect of lodging on the seed yield of these two crop species.

Material and methods

Seed yield and lodging data means from 16 years (1994-2009) of the Flax Co-operative (FC) test and from 29 years (1981-2009) of the Central Bread Wheat Co-operative (CBWC) test were used in this study. Twenty seven and thirty one environments (location-years) for flax and wheat, respectively, which had lodging data with mean (M) values ≥ 2.0 and standard deviation (SD) values ≥ 1.0 were considered suitable for this study. Linear regressions, with seed yield as the dependent variable and lodging as the independent variable, were initially conducted on the data from each selected environment. Yield and lodging least squares means over all environments were estimated for each entry (breeding line or check variety) and crop. These least squares means were then plotted and regression (seed yield being regressed over lodging) lines fitted.

Results and Discussion

Of the 27 selected flax environments, 20 (74%) had significant linear regression coefficients, with values that ranged between -49 and -329 kg ha-1. These negative coefficients indicated that seed yield of flax was negatively affected by lodging, with seed yield reductions that ranged between 3 and 13% for each unit of lodging increase. Of the 31 selected wheat environments, only 7 (23%) had significant linear regression coefficients, with values that ranged between -103 and -291 kg ha-1, with seed yield reductions that ranged between 3 and 9% for each unit of lodging increase.

When data from all selected environments were combined, analyzed and plotted (Fig. 1), negative linear regression coefficients (-123 and -106 kg ha^{-1}, for flax and wheat, respectively) indicated predicted seed yield losses of 32% and 16% for flax and wheat, respectively, when lodging was most severe (lodging score = 8), compared to the absence of lodging (lodging score = 1). However, the linear regression R2 for wheat was not significant,

indicating a poor association between seed yield and lodging, with only 10% of the seed yield variability explained by the effect of lodging, compared with 42% for flax.

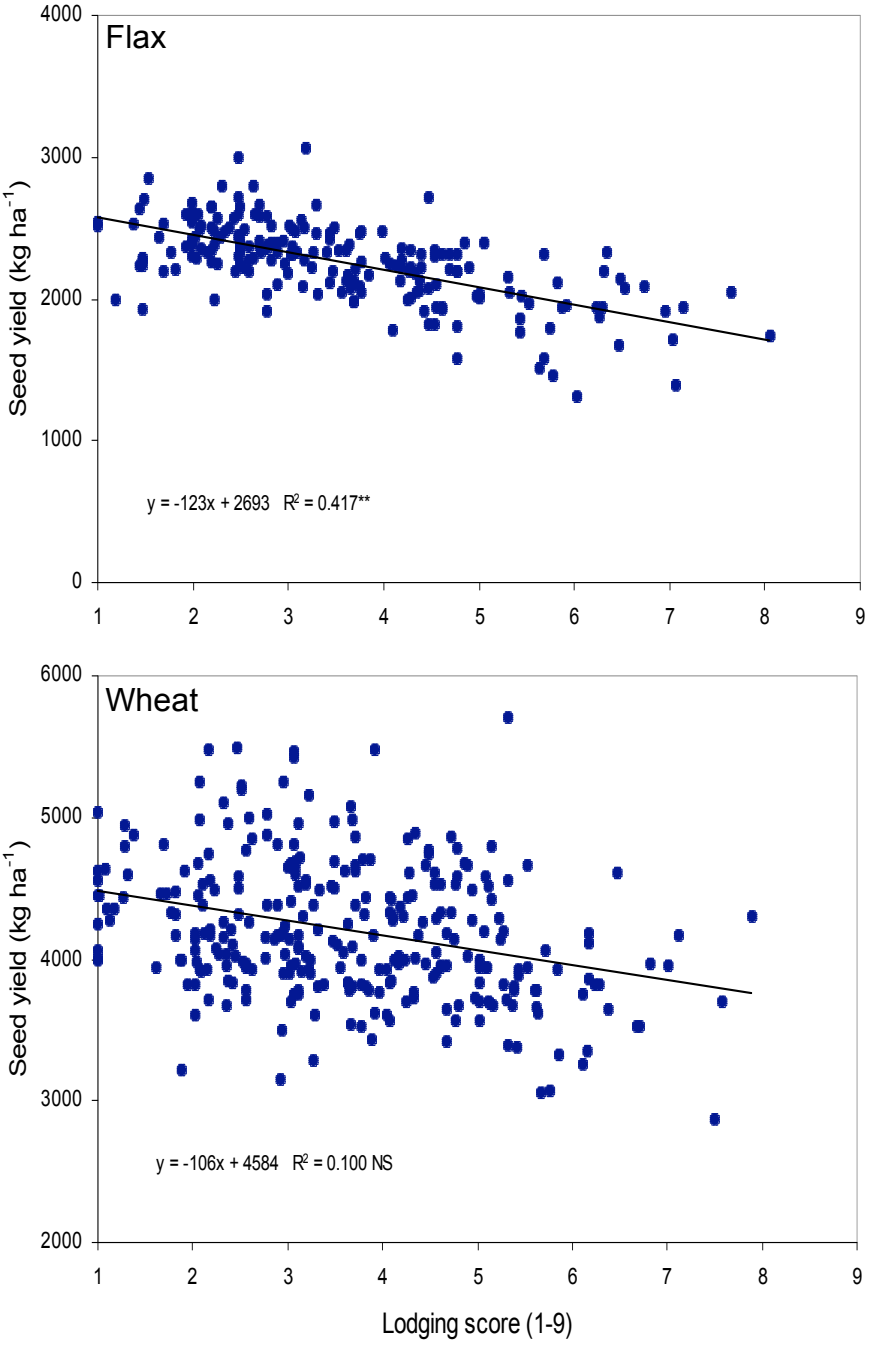

Fig. 1. Regression of seed yield over lodging of advanced flax and wheat breeding lines, evaluated in the Flax Co-operative test and the Central Bread Wheat Co-operative test, respectively, conducted in several locations in the provinces of Manitoba, Saskatchewan and Alberta, Canada, in the time period 1994-2009 for flax and 1981-2009 for wheat.

Conclusions

Flax was more frequently affected by lodging (74% of selected environments), than wheat (23% of selected environments), with an average seed yield reduction of 32% and 16%, respectively, when lodging was most severe. This indicated that, in most cases, lodging was not as important a factor in the determination of seed yield differences among wheat breeding lines as it was for flax.

Lodging in flax has been observed in association with infections by pasmo, caused by *Septoria linicola* (Speg.) Garassini, (Rashid 2001), which needs to be further investigated.

References

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