Flax Cultivar Food Quality Evaluation

Eric P. Klassen – Johnson Seeds

Background

Johnson Seeds purchases human consumption flaxseed on the basis of samples sent from producers. Samples must contain less than 5 per cent dark and/or immature seeds to be selected. It is difficult for Manitoba flax producers to produce flax with less than 5 per cent of these visually distinquishable poor quality seeds. A large part of this situation is due to environmental conditions - heavy dues, rainfall on mature fields, etc, but a recent study conducted by Dr. Dave McAndrew of the AAFC Morden Reseach Centre has shown that the cultivar effect is also significant (personal communication). He did his study on only a few cultivars, so it was felt that it would be good to follow up by evaluating more recently released cultivars.

Objective

The human consumption (HC) food quality flax market pays a premium to producers who can meet the standard. If the probability of having Manitoba Interlake produced flaxseed selected for the HC market can be increased by recommending specific cultivars, it should earn more revenue for Interlake producers and make flax production in the Interlake region more attractive. It will also allow Johnson Seeds to be more competitive by saving on freight costs incurred from purchasing seed from regions further west. The objective of the trial was to evaluate harvested flaxseed for human consumption (HC) quality; measuring the effects of cultivar, planting date and test location on seed quality.

Methods

A small plot (1.2 x 3m), four replication trial was conducted by Johnson Seeds at Arborg, MB in 2008 and 2009 using 10 flax cultivars, planted on May 17 and May 27, in 2008 and on May 29, in 2009. In addition, flax harvest samples for eight genotypes across eight Manitoba locations were received from the Manitoba Crop Variety Evaluation Trials (MCVET), in 2008. In 2009, seed samples were received from MCVET trials conducted at six Manitoba locations on six flax genotypes. HC quality was determined through a visually subjective rating system where a rating of three or less was considered acceptable, four or more was definitely not acceptable; and through a more objective system where the unacceptable seeds in a 5 or 10 gram sample were picked out and reported as a percentage of the whole sample. A sample is considered unacceptable if it has 5% or more unacceptable seeds. Three different individuals - the Johnson Seeds agronomist, seed processor and trader each subjectively rated the seed samples from the Arborg trials, although only the agronomist evaluated samples from all reps, so no statistical analysis could be performed on the ratings by the processor and trader.

Discussion

The weather in 2008 was cool and wet with a delayed start to the season in the Manitoba Interlake Region. Other regions of Manitoba were also below normal for temperature, but the level of moisture varied considerably between regions. Most of the regions suffered from rainfall during the harvest season, which will have adversely affected seed quality. In 2009, the spring was again late due to cool and wet conditions. Most trials had to be seeded late, with the Arborg MCVET flax trial not seeded until the middle of June. The summer continued to be well bellow normal for temperature, which further delayed crop development. Some above normal temperatures, along with dry conditions were experienced in September allowing the crops to mature and be harvested under good conditions, with the exception of the Arborg, MCVET trial, which could not be harvested until the end of October.

In both years, the Johnson Seeds Arborg small plot trial produced good reliable data with significant variety and seeding date effects seen for seed yield and other agronomic characteristics; and for HC seed quality. For the purpose of this report, only the effects on HC seed quality will be presented and discussed. In 2008, the cultivar and seeding date effects for HC seed quality were significant although the cultivar effect was not consistent between seeding dates, so the results of each planting date should be examined separately. **Figure 1** shows the results of the HC quality analysis of the 10 cultivars planted on May 17, while **Figure 2** includes the results from the May 27 seeding date. The coefficient of variation (CV), which expresses the proportion of variation in the data that cannot be explained, was quite a bit higher for the objective measure of bad seeds (26.3%) than the subjective rating system (9.3%). In 2009, the trial using the same cultivars as in 2008 was planted at the end of May. Significant results for both percent bad seeds and the seed quality rating were observed. The CV was again higher for per cent bad seeds (51.6%) than for the seed quality rating (7.4%). In certain seed samples it was quite clear as to which seeds were good and which were poor, while in other samples the line between good and poor seeds was not as distinct. The varieties also differed in their shade of brown seed colour. The variety Prairie Grande, for example, produced seeds so dark that even the good seeds looked too dark. This colour factor also made it more difficult to pick out only the darkest seeds.

Figure 3 shows the seed quality assessment results of the 2009 trial. The harvest conditions in 2009 were excellent, generally producing human consumption quality seed, except for the poorest cultivar. Analysis of the three trials combined showed a significant interaction effect between cultivar and year/planting date. This means that the cultivars did not produce entirely consistent results for seed quality in the different trials, so only the individual trial data are presented here. Although in general, the cultivars CDC Sorrel, Lightning, Macbeth and Prairie Blue produced the best seed quality in 2008, with Prairie Grande consistently producing the poorest quality. In 2009, all that really can be said is that Prairie Grande rated the poorest for seed quality. In 2008, the subjective ratings made independently by three different individuals were not entirely consistent with each other or with the more objective bad seeds per cent, while in 2009 the ratings were more consistent. This is likely because most of the samples in 2008, were in the marginal area for seed quality, as is not uncommon for the Manitoba Interlake Region, while in 2009, with the better quality, the samples were easier to rate.

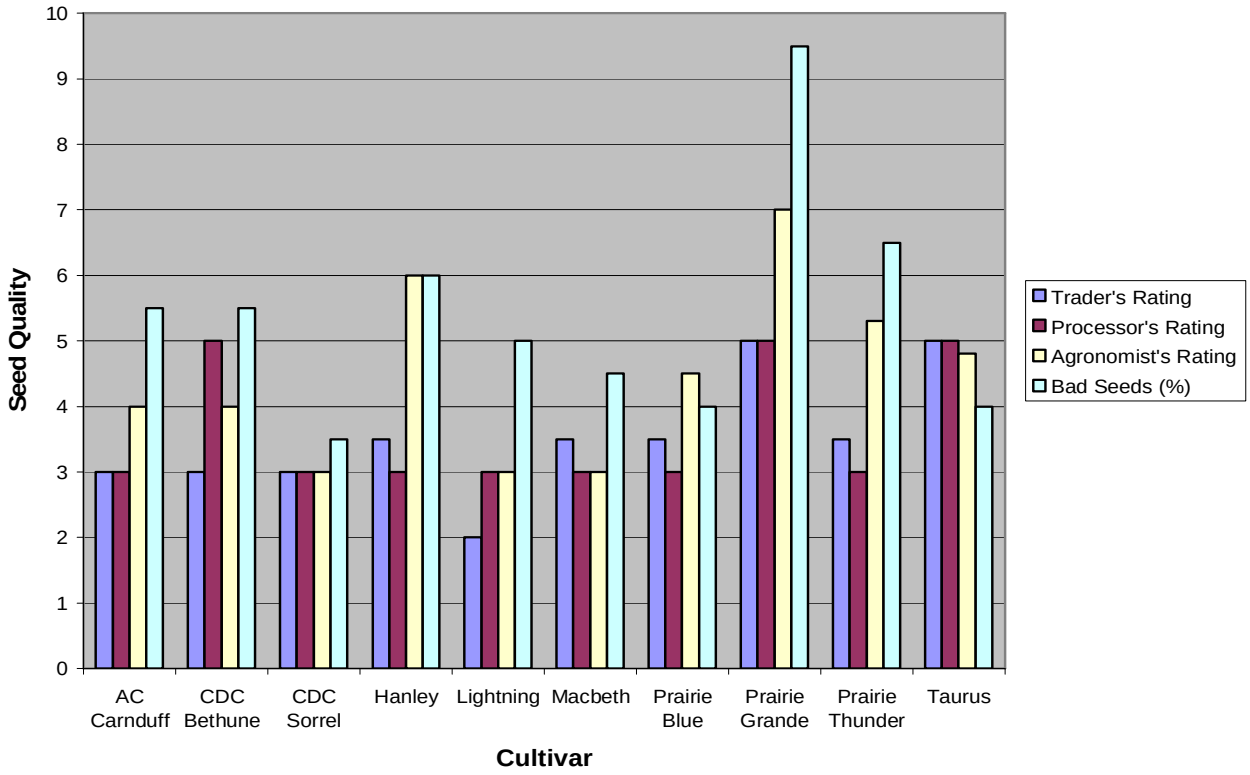

Figure 1: Flax Cultivar HC Seed Quality Analysis for May 17, 2008 Planting Date; Arborg, MB

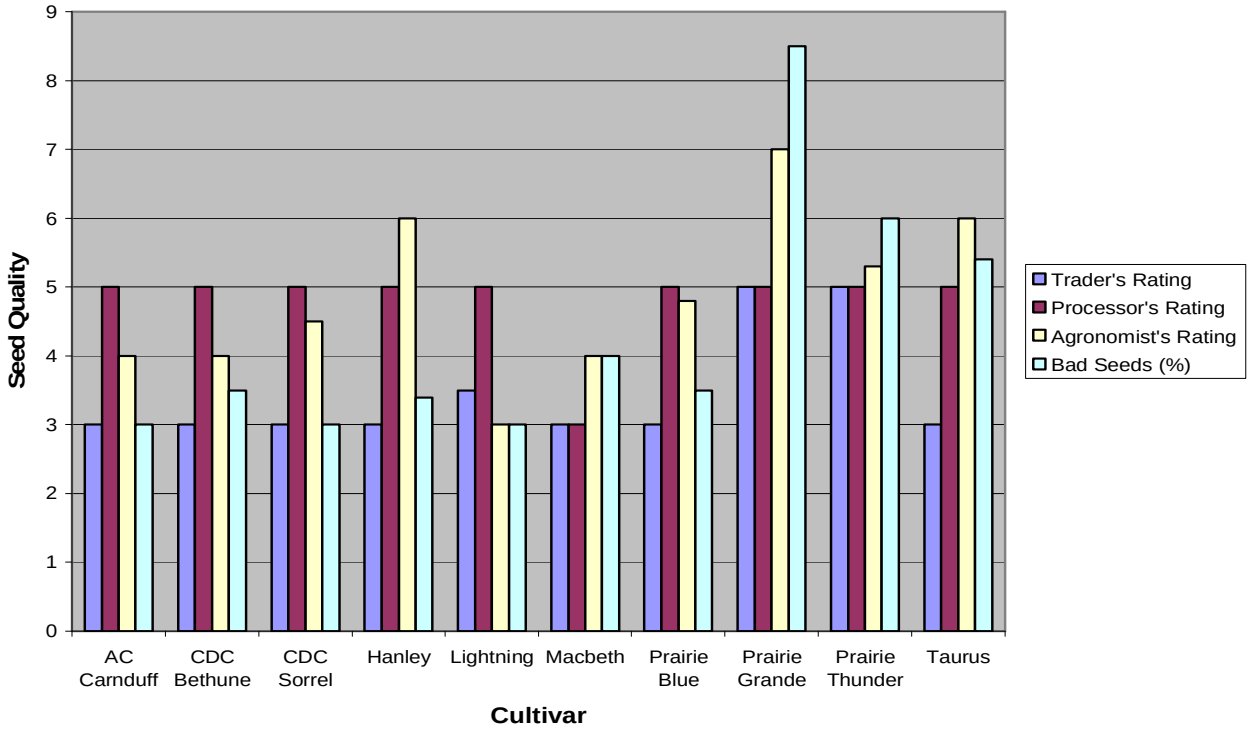

Figure 2: Flax Cultivar HC Seed Quality Analysis for May 27, 2008 Planting Date; Arborg, MB

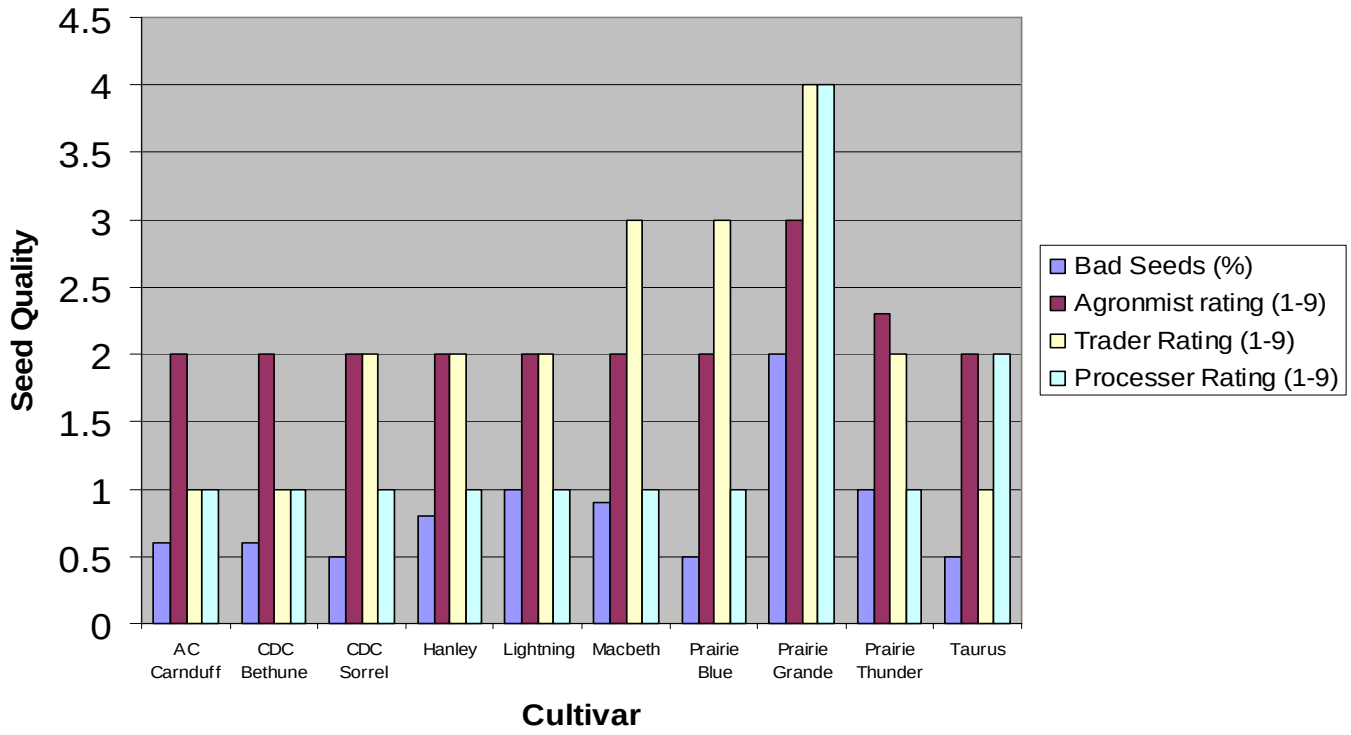

Figure 3: Flax Cultivar HC Seed Quality Analysis for May 29, 2009 Planting Date; Arborg, MB

In 2008, flax harvest samples for eight genotypes across eight Manitoba locations were received from the Manitoba Crop Variety Evaluation Trials (MCVET) for HC seed quality analysis. In 2009, flax harvest samples from six genotypes across six Manitoba MCVET locations were received. Both cultivar (**Figure 4**) and location (**Figure 5**) effects were significant with CDC Sorrel, Hanley, Prairie Blue and FP2214 producing the best seed quality, in 2008. CDC Bethune, Prairie Thunder, Prairie Grande and FP 2223 produced the poorest seed quality that same year. The Hamiota, Rosebank and Portage sites produced the best quality harvest samples, with the samples from the Dauphin, Melita, Stonewall and Thornhill sites being the poorest. In 2009, Prairie Grande again provided the poorest seed samples (**Figure 6**), with the Arborg, Boissevain and Dauphin sites producing the poorest quality seed (**Figure 7**).

As the seed quality rating analysis produced the lowest error variation (CV), the bad seeds (%) evaluation was not used to combine the two years of data. **Figure 8** shows the variation of the five genotypes included in each of the two years of testing. Both the year effects and the genotype effects were significant for the seed quality rating, whereas the interaction effect between year and genotype was not significant, which indicates that the genotypes showed consistent relative seed quality both years. The cultivar Prairie Grande consistently produced the worst seed quality with CDC Sorrel, FP2214 and CDC Bethune significantly better seed quality. Prairie Thunder produced intermediate seed quality. Although genotype differences were significant, the variation between genotypes was small in comparison to the seed quality differences between locations/years. **Figure 9** shows the variation between the five sites included in both years. Statistically, the year effect was not significant, but the location effect was, as was the interaction effect between location and year. This can definitely be seen in the Stonewall data; it produced the best seed quality in 2009, but only the third best in 2008.

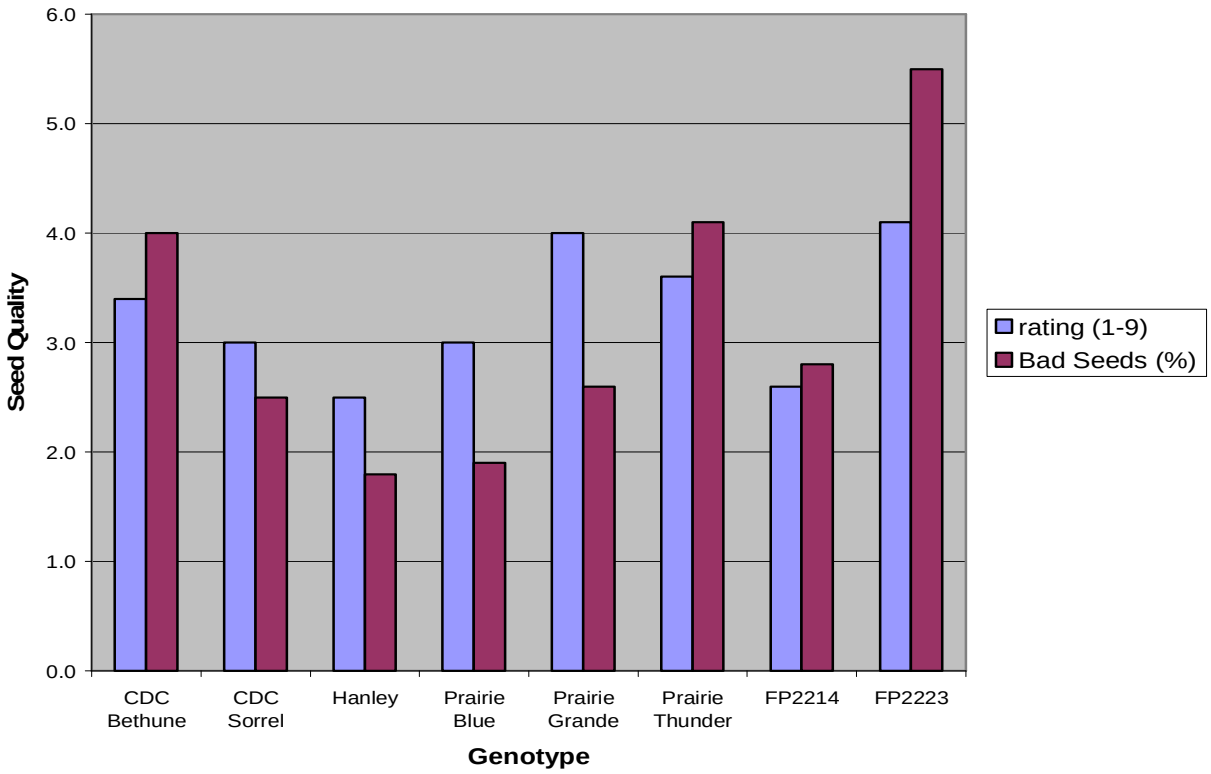

Figure 4: Means of the HC Seed Quality for Eight Flax Genotypes, MCVET, 2008

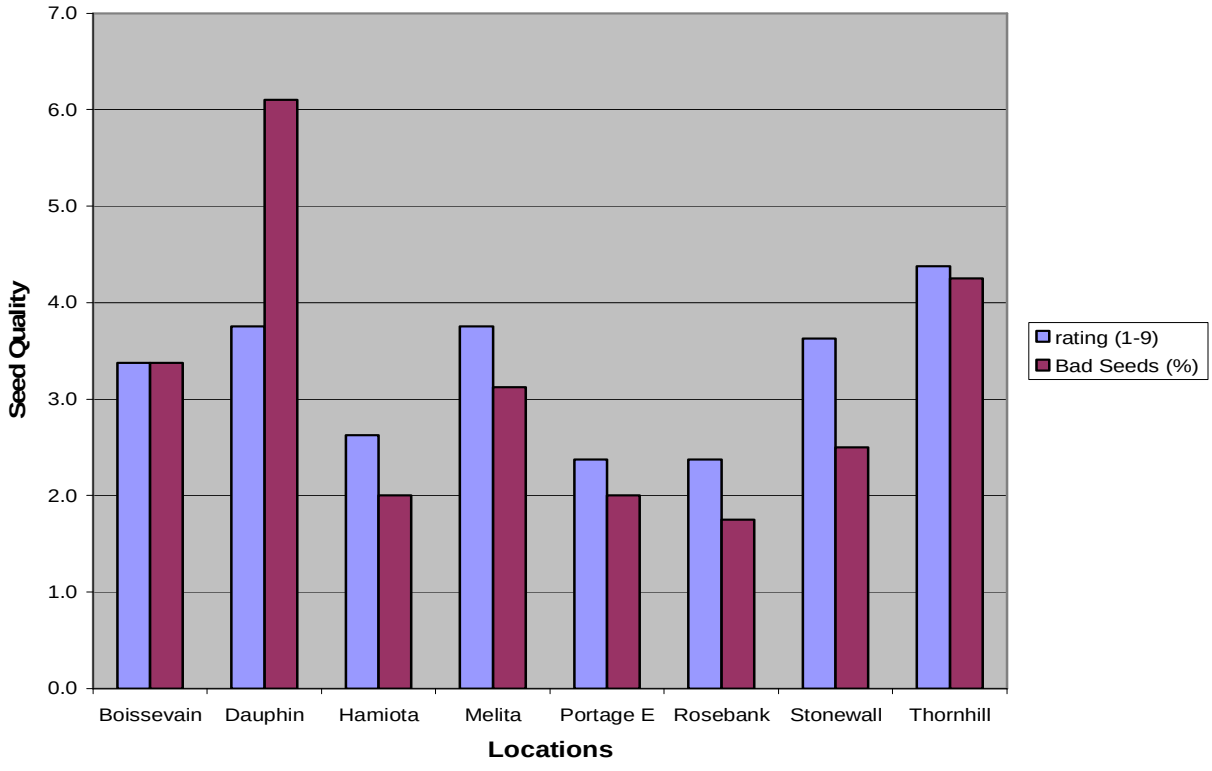

Figure 5: Means of the HC Seed Quality for Eight MCVET Locations, 2008

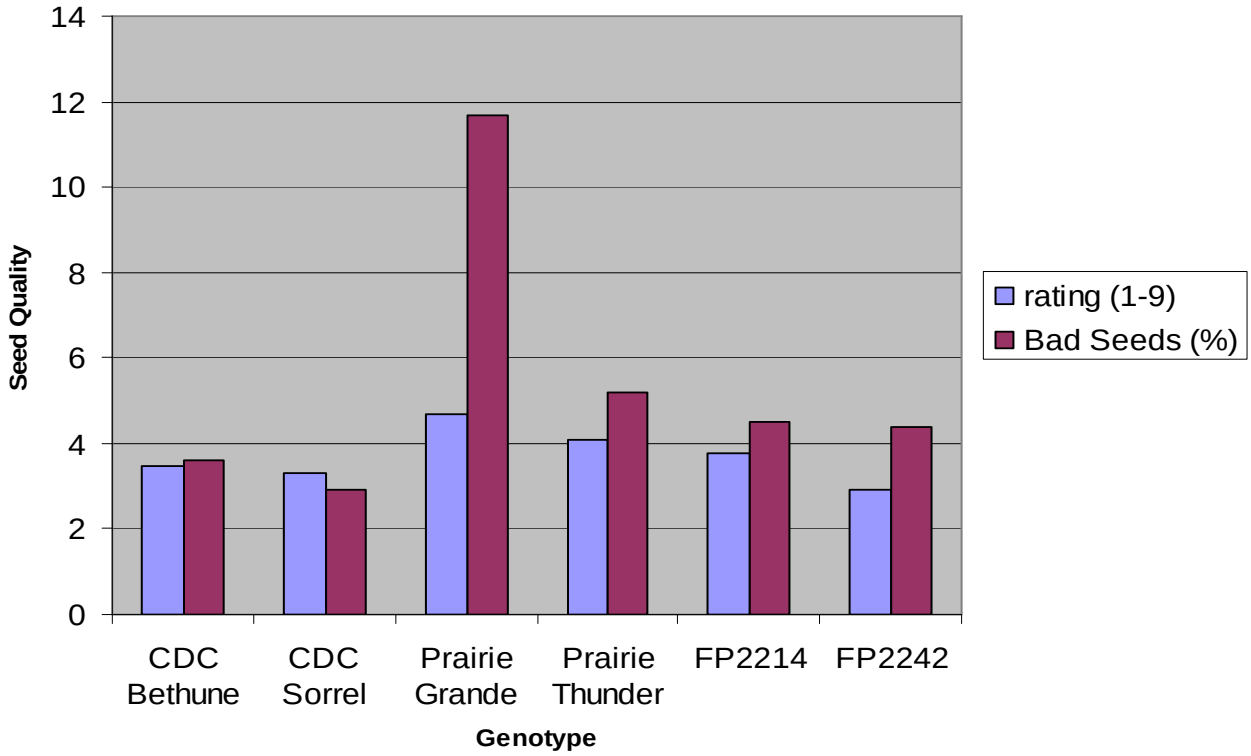

Figure 6: Means of the HC Seed Quality for Six Flax Genotypes, MCVET, 2009

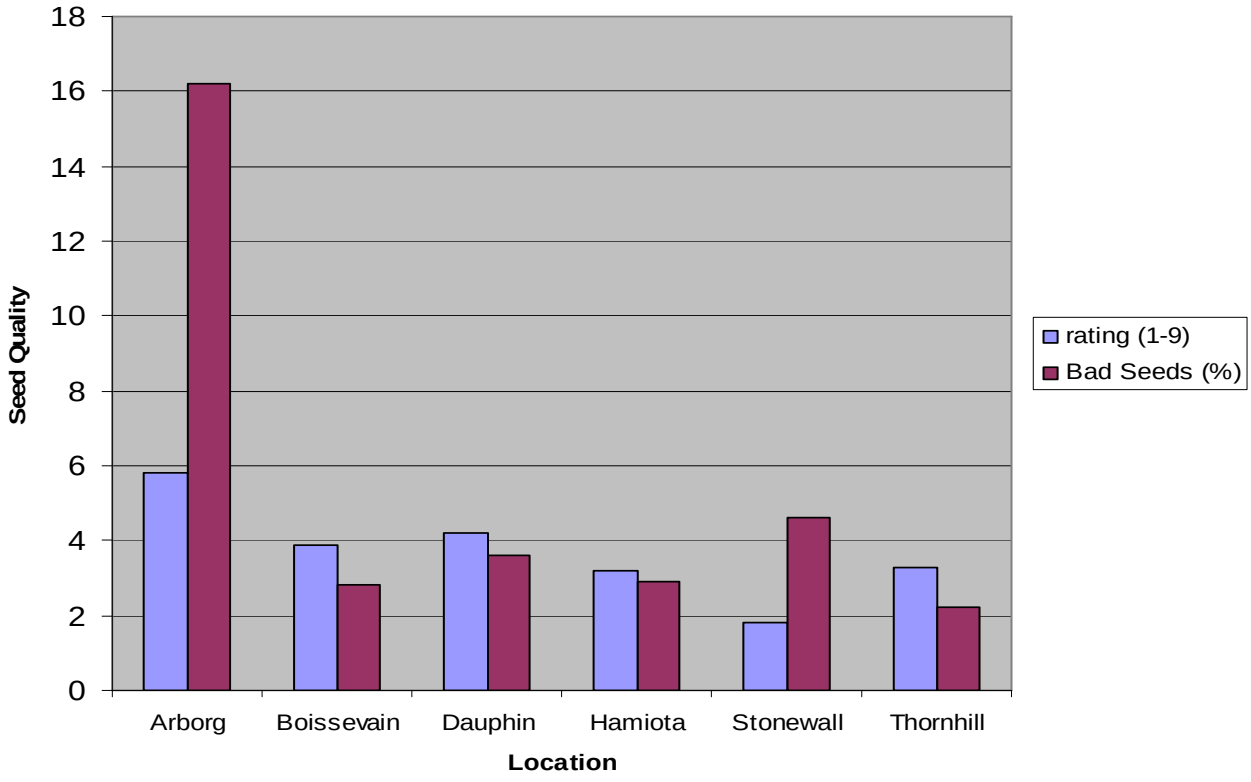

Figure 7: Means of the HC Seed Quality for Eight MCVET Locations, 2009

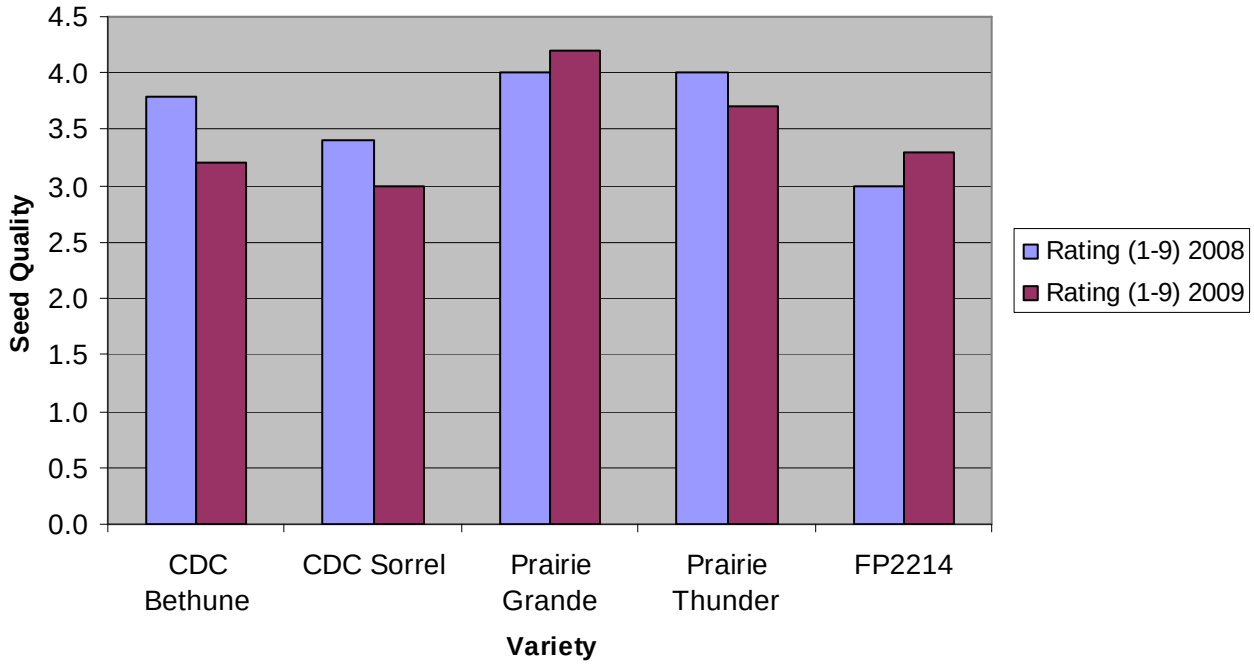

Figure 8: Means of the HC Seed Quality for Six Flax Genotypes Over Two Years, MCVET, 2008 and 2009

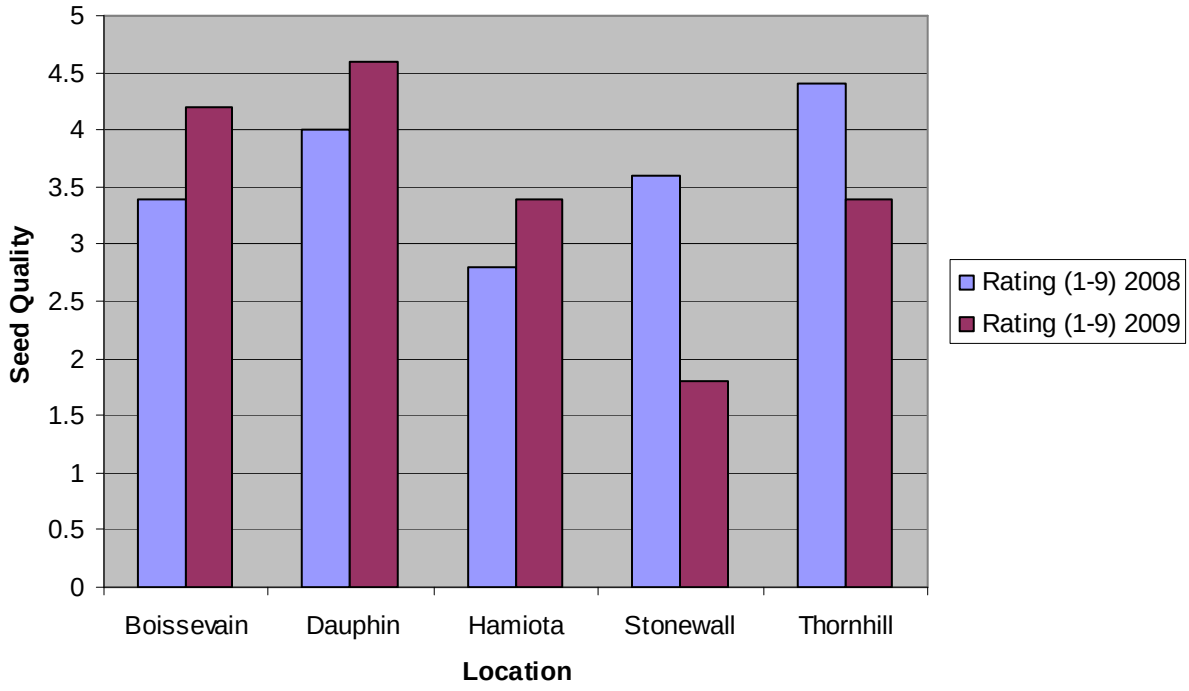

Figure 9: Means of the HC Seed Quality for Five MCVET Locations Over Two Years, 2008 and 2009.

Results

These results indicate that the genetic make up of the flax does have an influence on the potential to produce human consumption quality seed, even in regions where HC quality seed is more difficult to obtain. There is enough of an effect due to genotype that it would be useful to have the varieties put forward for registration rated for HC quality - not as a basis to reject candidate varieties, but so more information would be available to producers. Although the effect of the genotype is significant, that influence is less than the influence of the environment. In some years and in some localized regions, HC quality will be difficult to obtain, regardless of the variety grown.

There will continue to be a tendency to prefer to select flax seed from the regions that produce the highest quality seed. Until most of the highest quality seed has been sold, there will be little interest in selecting from the more marginal areas. Commercial selections are made on a subjective basis, so the better the seed quality appears when originally selected, the better the chance of the final cleaned product being accepted at the next stage in the human consumption flaxseed market.

Aknowledgements

Support for this research was received through the Prairies East Sustainable Agricultural Initiative (PESAI)