Variation in Soybean Seed Quality Across Canada

Food-type soybean varieties grown in Manitoba yielded similarly to those grown in eastern Canada, but protein often fell short of the 42% target for export.

WHILE MANITOBA GROWS soybeans primarily for crushing and meal, farmers may want to take advantage of the lucrative food-type, non-GM soybean export market. However, this market demands specific seed quality targets such as bright yellow colour, large, round seeds and protein concentration of at least 42%.

This project characterized and compared the quality of food-type soybeans grown in Manitoba to those grown in eastern Canada where production is well established. The results show the potential for Manitoba food-type soybeans and identify areas that require improvement. Six varieties (AAC Edward, AAC Mandor, OAC Prudence, AAC Malika, JARI, DH863) suitable for both regions, were grown at seven sites in Manitoba (Roblin, Melita, Carman, Glenlea, Portage la Prairie, Morden, Arborg) and two sites in eastern Canada (Ottawa, ON and Ste. Anne de Bellevue, QC) in 2015 and 2016. Varieties were analyzed for yield and maturity along with appearance (size, roundness, colour, brightness), minerals (iron, zinc, sulfur, cadmium concentration), nutrients (protein, oil, sugar concentration, oil profile) and human health components (isoflavones, lutein, Vitamin E).

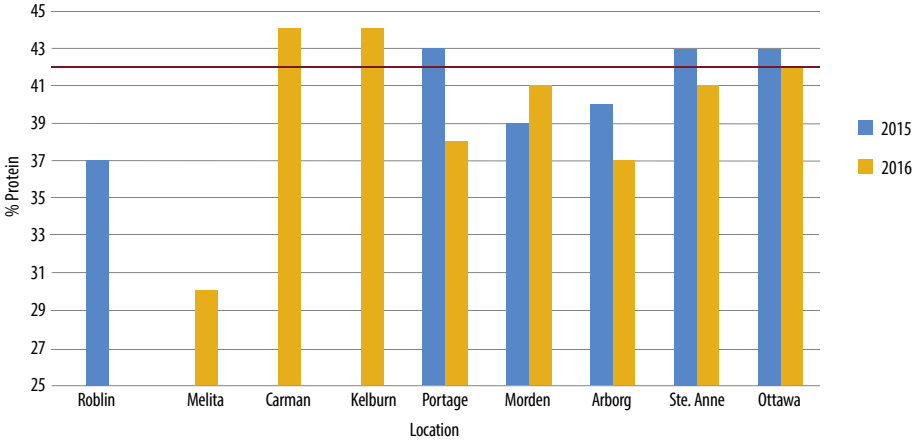
Average soybean yields across Manitoba locations ranged from 24.4 bu/ac to 68.7 bu/ac, which was comparable to or higher than eastern Canadian sites. Varieties took longer to mature in Manitoba than in Ontario. Since soybeans are photoperiod-sensitive, longer days and cooler nights in early summer slow development, delaying the onset of flowering in Manitoba.

Manitoba soybean seed size was generally smaller and seeds were not as bright in colour compared to eastern Canada. This is a disadvantage in the tofu and soymilk markets. However, these markets also prefer round seed and Manitoba soybeans had a distinct advantage in this area. Cooler nights, causing expression of pigments in the seed coat, could have caused the darker colour. Breeders could focus on increasing seed size for Manitoba varieties since this trait is genetically regulated.

Soybeans grown in Manitoba often had greater than 40% protein concentration but rarely exceeded the 42% target for export (Figure 1). Varieties varied in protein, indicating that it is possible to increase protein concentration through breeding. In terms of oil, six out of ten Manitoba locations produced low, two produced medium, and two produced high concentrations. Low to medium oil concentration is an advantage for soymilk. Manitoba soybeans consistently had higher sugar concentrations, likely caused by the slower rate of development. They also contained more polyunsaturated fats, linolenic acid and linoleic acid. But, they contained less monounsaturated fats, oleic acid, saturated fats, palmitic acid and marginally less stearic acid, all of which point to a potential health advantage. Natto soybeans, which require a small, round seed, high sugar concentration and high linolenic acid concentration, may be a very good fit for Manitoba food-type soybean production.

Manitoba soybeans had only one third as much isoflavone, but higher lutein concentrations. There were no regional differences in Vitamin E concentrations. Cadmium concentration in food-type soybeans cannot exceed 200 ppb, a threshold that was exceeded in four of the Manitoba trials. Since varieties differ in their ability to accumulate cadmium, proper screening of varieties for the food-market could remedy this issue. Seed iron concentration was similar across all locations in both years while sulfur and zinc varied by year.

Figure 1. Mean concentration of protein (% dry matter) across six short-season varieties grown in Manitoba, Ontario and Quebec in 2015 and 2016.



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