seed yield and the highest yielding treatments were Meadow, PG2908 and PG2601 with 5073, 5141.2 and 5110.2 kg ha^{-1} respectively. Protein content was also significant and ranged from 22.6% for Meadow to 24% for PG6150.

Table 5.1a Analysis of variance and mean comparison for plant height, mildew, mycosphaerella blight, days to maturity, lodging, seed yield, TKWT and protein content of peas at Melita in 2019

TRT	Variety	Height (cm)	Mildew (1-5)	Mycosphaerella (1-5)	DTM	Lodging (1-9)	Yield kg ha^{-1}	TKWT (g)	Protein (%)
1	PG3312	84.7	2	2.7	90abc	6ab	4864.2bcd	209.3a	23.7abc
2	PG2601	80.7	2.3	2.3	90abc	3c	5110.2ab	209.5a	23.9ab
3	PG3308	78.0	2.3	2.7	91a	5b	4836cd	204.1a	23.6bc
4	PG6150	86.0	2.7	2.3	91a	7ab	4779.8d	204.2a	24.0a
5	PG2908	88.3	1.3	2.7	89bc	6ab	5141.2a	182.0b	23.1d
6	PG2805	91.3	1	2.3	90ab	7ab	4817cd	206.9a	23.3cd
7	Meadow	82.0	2	2.7	89c	5ab	5073abc	184.8b	22.6e
	CV	**6.6**	**41.8**	**25.9**	**0.7**	**21.7**	**3.0**	**2.1**	**1.0**
	P value	**0.14**	**0.238**	**0.962**	**0.016**	**0.011**	**0.035**	**<0.001**	**<0.001**

References

Schatz, B. 2009. Field Pea Production. North Dakota Extension Services. A-1166 (Revised) www.ag.ndsu.nodak.edu.

Xue, A. G. and Warkentin, T. D. 2001. Partial resistance to Mycosphaerella pinodes in field pea. *Canadian Journal Plant Science* **81: 535–540.**

6.0 Protein content in conventional soybean varieties and comparison of their genetic potential with geo-environmental characteristics

Project duration: 2018-2023 (CFCRA cluster)
Collaborators: AAFC Ottawa-Elroy Cober

Objectives

1. To determine protein content differences among 20 conventional soybean varieties across seasons and locations.
2. To compare the genetic potential of conventional soybean varieties with geo-environmental characteristics.

Background

Soybean is one of the most important oil and protein source used for both livestock and humans in many countries around the world. The seed quality of soybean is determined by the composition of oil, protein, fatty acids, sugars and minerals, which is also affected by the environment (Bellaloui et al. 2015). For both feed and livestock nutrition, a high and stable protein content is desirable. However, in Western Canada, protein content in soybean is lower as compared to the Eastern region as a result of climatic conditions of lower temperatures, shorter growing season and low rainfall. Nevertheless, many soybean varieties of early maturing groups are being developed with a focus on improved protein content (Vollmann et al., 2000).

Materials and Methods

The trial was initiated in 2018 by AAFC and will run until 2023 across Canada at Ottawa, Beloeil, in Ontario, Brandon, Melita, Roblin and Morden in Manitoba, Outlook and Saskatoon in Saskatchewan. In the 2019 growing season in Melita, the trial was arranged as randomized complete block design with 20 treatments (conventional varieties) replicated 4 times on Waskada loam soil. The treatments were inoculated with granular BASF inoculant prior to seeding at a depth of 1" on the 13th of May. Seeding was done under no till system on oats stubble and granular fertilizer blend was side banded at a rate of 7-35-20-7-2Zn (N-P-K-S) lb ac^{-1} at the same time. Chemical weed control included a burnoff application with a single tank mix of 0.75L ac^{-1} Roundup, 0.1 L ac^{-1} Authority and 0.015 L ac^{-1} Aim and in-season application of 0.91L ac^{-1} Basagran + 0.12L ac^{-1} Select and 0.5% v/v Amigo adjuvant in a single tank mix. During the season, Lorsban insecticide was applied to control cutworm while Matador was applied late in the season for the control of grasshopper populations at a rate of 30 ml ac^{-1}. Several observations were made and these included; emergence date (when 50% or more of plant had emerged from each plot), plant height at maturity, days to 50% flowering, days to maturity, harvest date, moisture content at harvest, grain yield and protein content. The data were analyzed by AAFC in Ottawa.

Results and Discussion

Summary results presented in this trial are for 2018 and 2019 growing season.

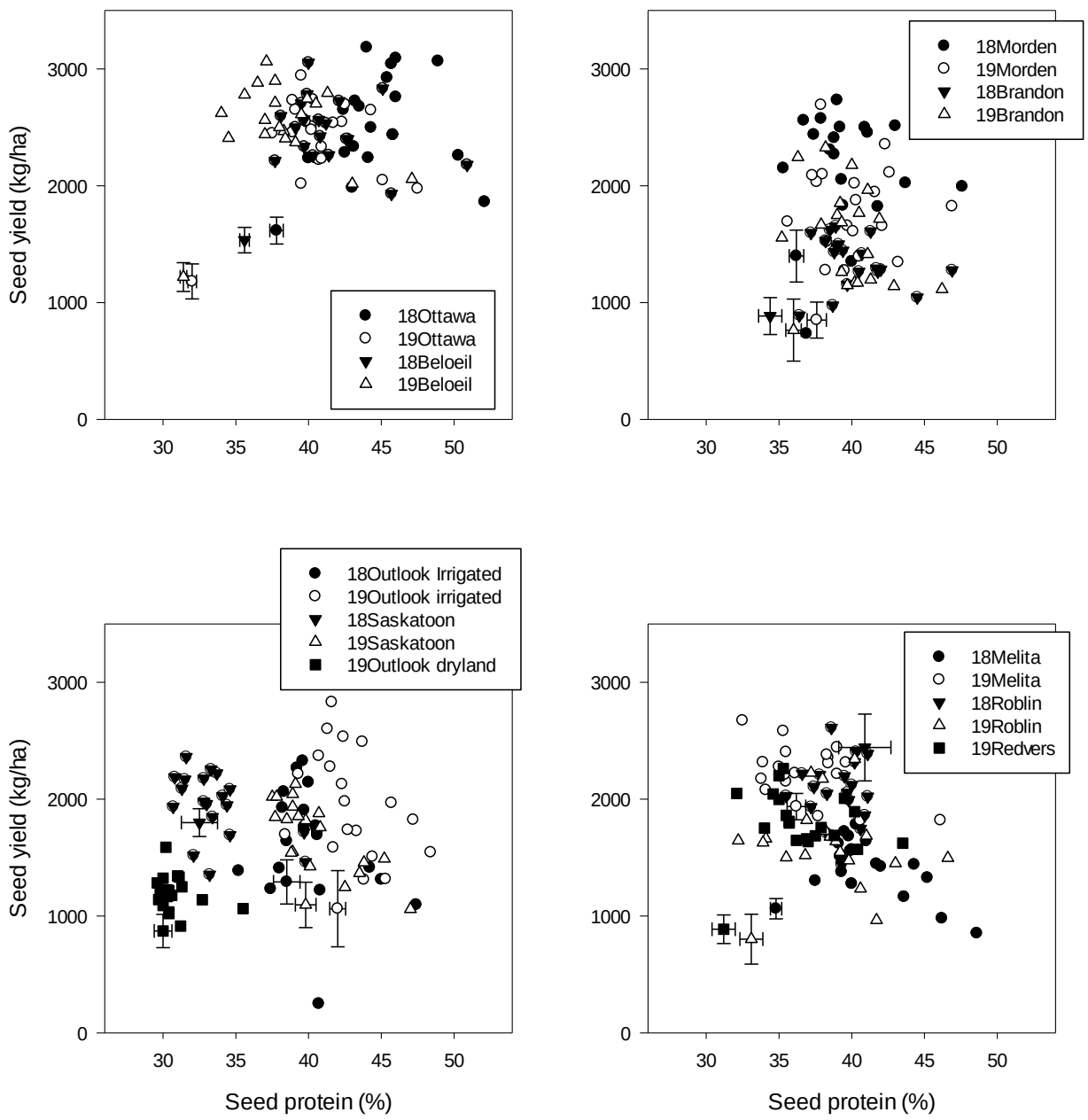

Figure 6a. Seed yield and protein for each site. The error bars are two standard errors and are shown for the non-nodulating line at each location.

At the eastern locations, 2019 was a lower protein year, included for the non-nodulating line. There was a striking difference between 2019 Outlook irrigated and dryland sites.

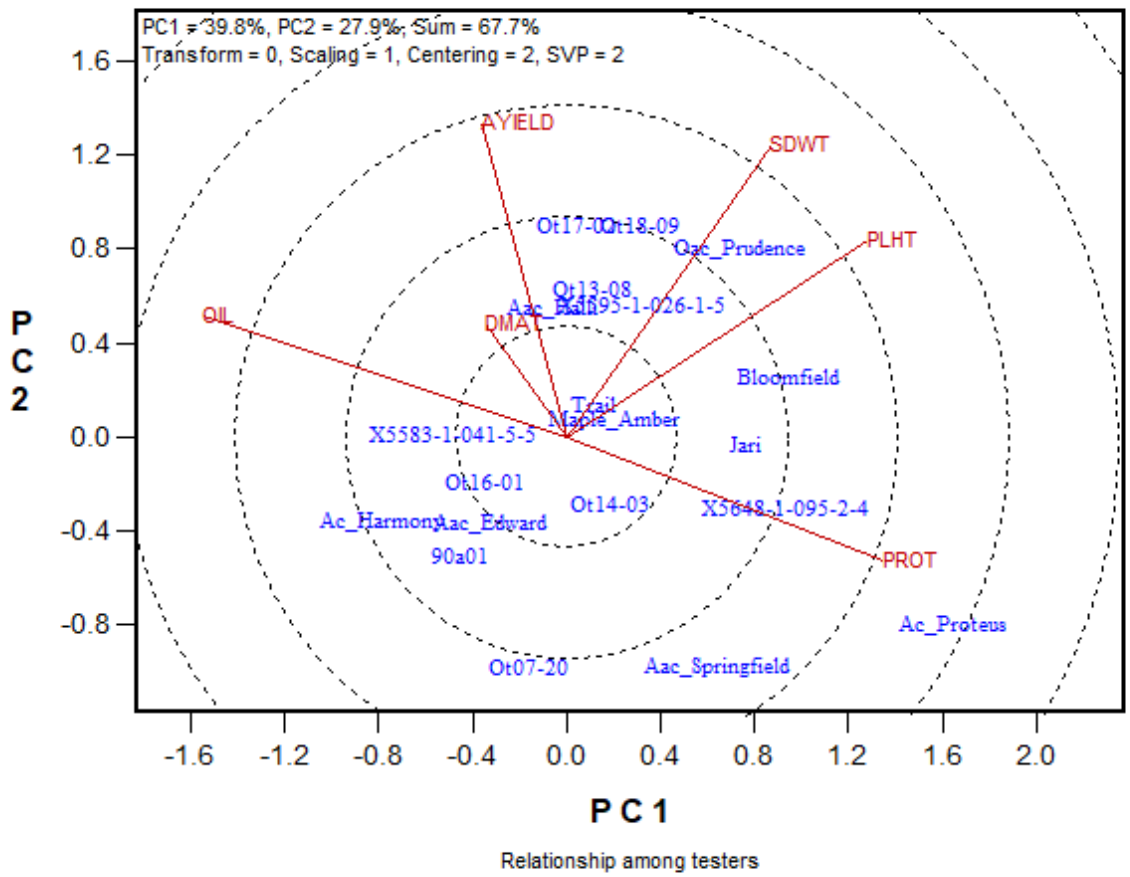

Figure 6b. GGEbiplot for all sites and agronomy data, 2018-2019.

In the biplot, parameters separated with a 180° angle are inversely related, such as protein vs. oil. Parameters at 90° angle are independent, such as seed weight vs. oil or protein. Parameters with a small angle are correlated.

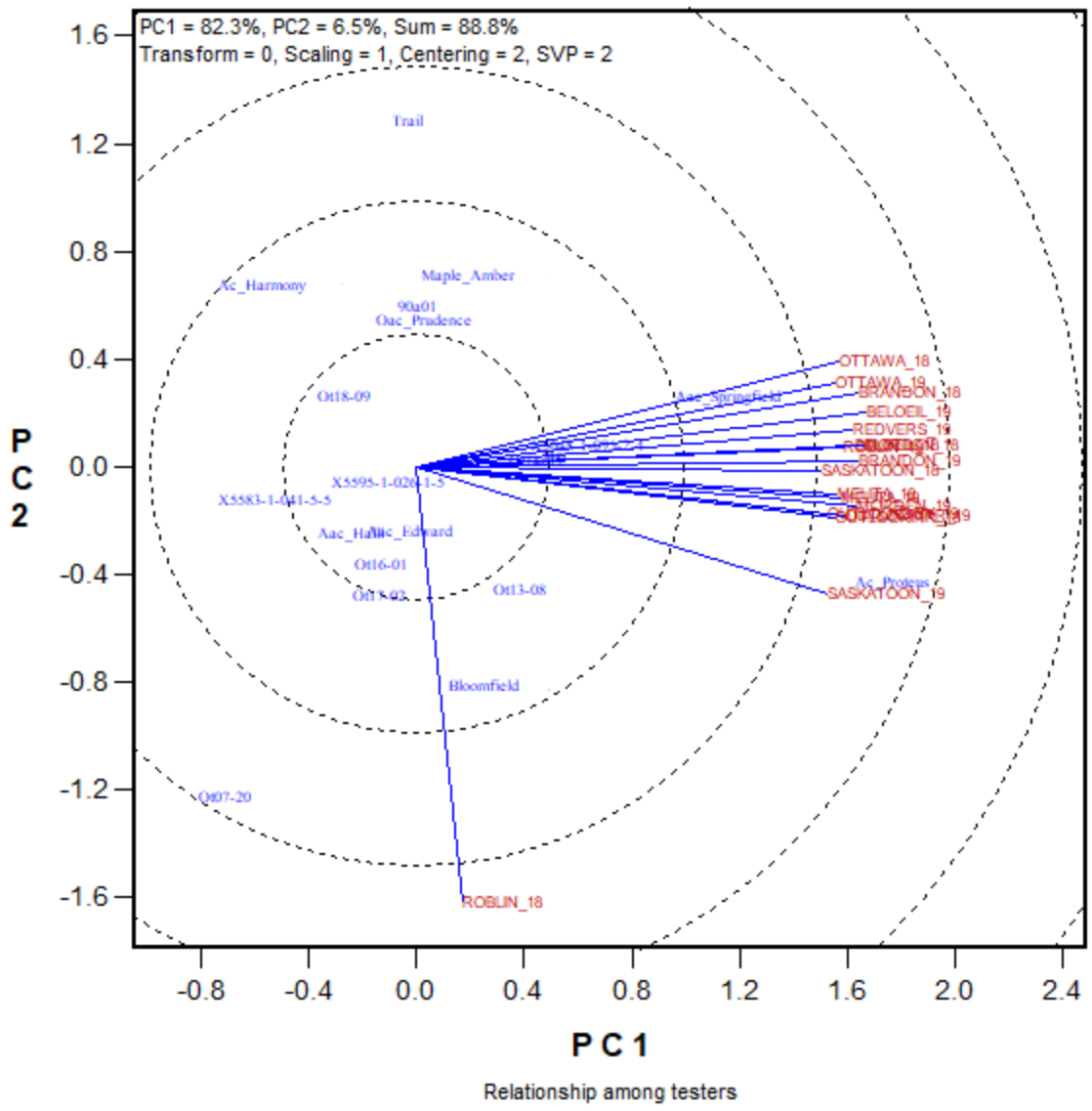

Figure 6c. A genotype by location biplot for seed protein content, 2018-2019.

As seen in Figure 6a, Roblin-2018 had high seed protein for the non-nodulating line (OT07-20) and in this biplot Roblin-2018 is distinct from all other locations. Something different happened at Roblin in 2018. The soil N fertility must have been high.

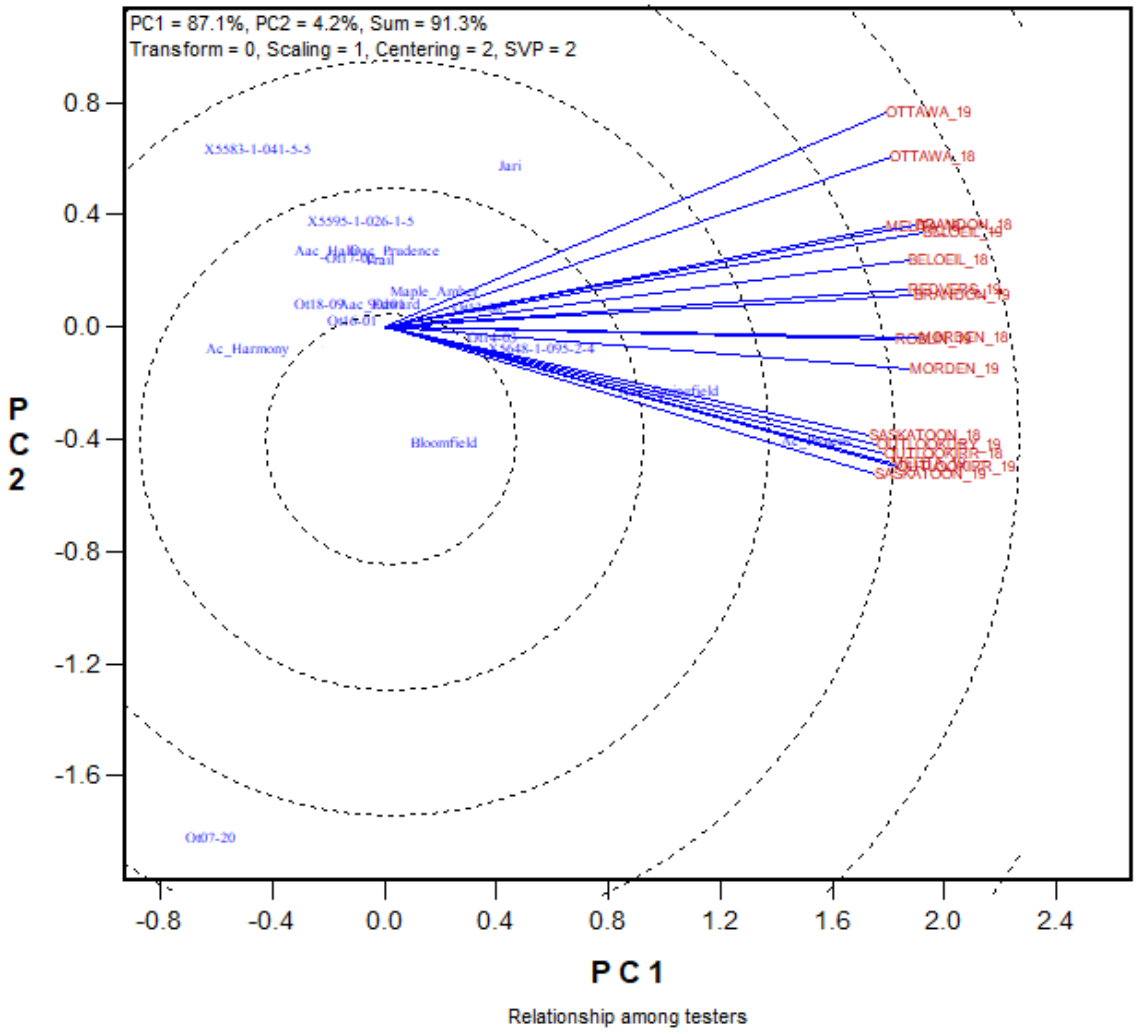

Figure 6d. A genotype by location biplot for seed protein content, 2018-2019 with Roblin-2018 excluded. In this biplot, we see some east-west south-north sorting of locations.

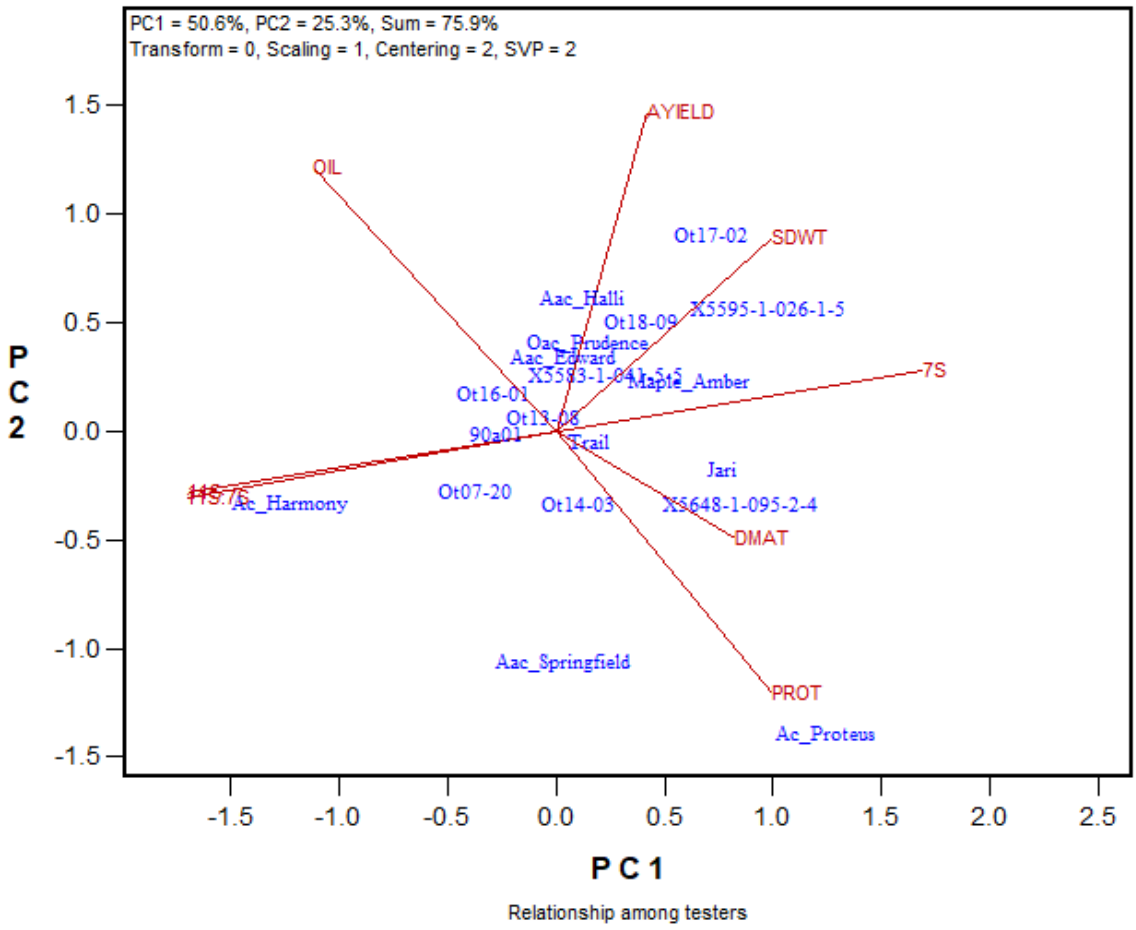

Figure 6e. Soybean protein quality analysis (11S:7S and 11S sit on top of each other) from 2018 grown seed is shown in this biplot.

For the three protein composition traits (11S, 7S and the 11S:7S ration), there was no location by variety interaction, there was a replication within location effect, and variety effect. The two fractions are inversely related and there is a somewhat negative relationship between protein and 11S. This makes sense if sulphur containing amino acids are limited in soybean which means it may be difficult to combine higher protein with higher 11S:7S ratio. AAC Springfield seems somewhat promising in its combination of higher protein and higher 11S:7S ratio.

References

Bellalloui, N., Bruns, H. A., Abbas, H. K., Mengistu, A., Fisher, D. K., and Reddy, K. N. 2015. Agricultural practices altered soybean seed protein, oil, fatty acid, sugars and minerals in the Midsouth USA.