

MPSG ANNUAL EXTENSION REPORT

PROJECT TITLE: Soybean Protein Content Variation among Genotypes Grown in Morden and Ottawa

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PART 1: PRINCIPAL RESEARCHER

NAME:	Anfu Hou
POSITION:	Research Scientist
INSTITUTION:	AAFC Morden Research Centre
EMAIL:	anfu.hou@agr.gc.ca
PHONE:	204-822-7528

PART 2: EXECUTIVE SUMMARY

Soybean protein content varies among varieties and is also affected by environmental factors. Very short growing environments may reduce soybean protein content and coincidentally increase oil content. In this project, we will evaluate soybean varieties and breeding lines for protein and oil content at Morden, MB and Ottawa, ON. Thirty-two early-maturing soybeans were grown in 2015 at both locations in a randomized complete block design with three replications. The average yield of the 32 lines at Morden (1385 kg/ha) was much lower than Ottawa (2802 kg/ha). The seed at Morden (158 g/1000 seeds) was also smaller than Ottawa (178 g/1000 seeds). The overall average protein content for 32 lines grown at Morden (40%) was 2.2% lower than the average grown at Ottawa (42.2%), while the oil content was similar at two sites. Significantly negative correlations were found between oil and protein content at both locations. High protein content soybeans were identified for both Morden (up to 45.5%) and Ottawa (up to 49.8%). The trial will be repeated in 2016 and 2017.

PART 3: PROJECT ACTIVITIES AND PRELIMINARY RESULTS

Soybean seed contains approximately 40-42% protein and 20-22% oil on a dry matter basis. Due to the nature of multiple gene control of protein content, environment plays a significant role on protein content in soybean varieties. General studies indicate that soybeans produced in the north have lower protein content than that produced in south, due to climatic conditions such as low temperature and high amount of precipitation. Low temperature at the root zone reduces nitrogen (N) fixation which may lead to reduced seed protein in northern regions. High precipitation during seed filling also reduces protein content.

Similar maturity group of soybean varieties are grown in Morden and Ottawa. Materials that mature in Ottawa can generally mature in Morden. The soybean breeding materials from ECORC (Ottawa) have been evaluated in Morden for adaption and yield performance for many years now. Evaluation of select soybean varieties and breeding materials will reveal information on their protein and oil content variation at two sites and associations with other agronomic performances and climatic conditions.

Methodology:

Thirty-two lines were used in this research, which consisted of 12 early maturing varieties from Ottawa and 20 plant introduction materials selected at Morden. One breeding line, OT07-20 is a non-nodulating isoline. This line allows us to roughly estimate fixed N since all the N in OT07-20 comes from soil N. It would be interesting, when we have multiple year data to do some fixed N estimates across locations and years. In 2015, the trial was grown at both Morden and Ottawa. Each line was planted in two, 5m long and 75 cm spaced rows with 120 seeds per row in a randomized complete block design with three replications. Edge, Basagran and Poast were sprayed for weed control. Plots were harvested at natural maturity. Field notes were taken for flowering date, plant height, maturity, lodging, seed size and yield. The seed samples were also estimated for protein and oil content using a Foss Infratec 1241 Grain Analyser.

Progress:

The 2015 trials were successfully conducted at both Morden and Ottawa. The Ottawa site was seeded on June 15, and harvested on October 20. The Morden seeding was delayed until June 10 due to the wet weather and a seeder broken-down, but all plots matured naturally and harvested on September 30. Significant difference was observed between Morden and Ottawa for yield, protein and oil content (Table 1).

At Morden, the average yield of the 32 entries (1385 kg/ha) was less than half of that grown at Ottawa (2802 kg/ha). Morden seed size (158.6 g/1000 seeds) was also smaller than seeds produced at Ottawa (178.8 g/1000 seeds). The Morden site protein content ranged from 34% (OT07-20) to 45.5% (S63), and Ottawa site ranged from 36.5% (OT07-20) to 49.8% (S63). The non-nodulating line (OT07-20) had the lowest protein content at both Morden and Ottawa, while the PI selection S63 had the highest protein content at both sites. S63 has suitable maturity for southern Manitoba growing conditions and can be used for crossing for early-maturing soybean protein content improvement. The mean protein content of the 32 lines at Morden (40%) was 2.2% lower than Ottawa site (42.2%). The Morden oil content ranged from 17.2% (S63) to 23.1% (OT07-20), and Ottawa oil content ranged from 16.1% (S63) to 22.9% (OT07-20). The average oil content at Morden (20.4%) was similar to Ottawa site (20.2%). Correlation analysis revealed a strong negative relationship between oil and protein content (-0.8507 for Morden and -0.9249 for Ottawa). No significant relationships were found between oil and protein content with yield and seed size. The trial will be repeated in 2016 and comprehensive analysis will be conducted for protein and oil variation for soybeans grown at Morden and Ottawa.



APPENDIX

Table 1. Agronomic performance of 32 early-maturing soybean lines grown at Morden and Ottawa in 2015.

Entry	Morden					Ottawa			
	Days to	Yield	Seed	Percent	Percent	Yield	Seed	Percent	Percent
	Maturity	Kg/Ha	Weight	Oil	Protein	Kg/Ha	Weight	Oil	Protein
Maple Ridge	103	1331	151.3	20.8	38.6	2857	175.2	21.2	39.4
Trail	119	1923	154.0	21.3	38.9	3422	179.9	20.7	41.6
S22	105	1393	146.0	20.8	39.9	2192	160.7	21.0	40.7
S5	119	1578	179.3	22.1	35.6	2662	197.9	22.0	38.7
S142	103	1269	151.0	22.0	35.4	2342	189.5	22.8	37.2
S110	112	1231	155.7	21.5	36.9	2690	185.9	21.4	41.0
S59	113	1452	178.3	22.0	36.1	3271	208.1	22.0	39.3
S159	110	1814	159.7	21.4	38.7	3407	179.7	22.0	40.0
S96	119	1480	159.3	21.1	37.5	3099	199.0	20.8	41.6
S131	115	1318	180.0	20.9	38.2	3096	219.4	19.8	42.2
S127	118	1826	165.7	20.8	37.3	3324	201.1	20.5	41.0
S11	98	875	152.7	19.3	41.5	2249	159.8	19.5	41.6
S39	99	1129	135.7	19.2	42.6	2451	144.3	19.4	42.5
S16	112	1280	161.0	19.9	41.6	2532	187.5	19.4	43.8
S69	109	989	153.7	19.4	42.1	2863	173.4	20.4	43.1
S104	114	1317	185.3	18.6	41.7	2862	221.8	18.9	45.4
S140	105	1220	157.7	18.8	42.8	2387	195.9	18.6	45.0
S94	96	615	160.3	20.0	40.9	1233	170.7	20.4	40.8
S146	102	759	189.0	17.4	44.3	1291	229.8	17.4	45.9
S120	89	880	169.3	17.7	43.2	1460	192.8	17.0	45.7
S150	101	1322	130.3	17.9	42.3	1518	93.6	17.9	43.6
S63	109	1255	138.7	17.2	45.5	2636	109.0	16.1	49.8
OT07-20	109	1151	156.0	23.1	34.0	3245	184.6	22.9	36.5
OT94-47	104	1241	158.3	22.6	38.5	2812	187.0	22.2	39.9
OT13-07	104	1787	165.7	22.2	38.0	3434	182.7	22.0	40.1
AAC Edward	103	1622	139.3	22.0	38.8	3551	157.3	21.2	40.1
OT13-05	106	1308	155.0	19.5	42.9	3179	165.5	18.8	46.0
AAC Mandor	110	1884	150.0	20.8	38.4	3660	195.0	20.4	40.6
OT13-04	113	2114	159.3	19.9	42.9	3782	169.1	18.4	47.4
Jari	112	1691	169.0	19.5	43.1	3892	183.5	19.4	44.9
OT13-08	109	1782	157.7	22.5	40.8	3066	165.1	21.3	41.9
OT14-03	113	1497	149.7	19.9	42.1	3216	157.6	20.2	41.9
Overall Mean	108	1385	158.6	20.4	40.0	2803	178.8	20.2	42.2
C.V.%	3	16	12.8	2.3	1.9	16	3.8	2.6	2.0
LSD (.05)	5	443	39.6	0.9	1.5	858	13.3	1.0	1.6

