ORGANIC SOYBEAN PRODUCTION IN ONTARIO IN 2005

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Introduction

Soybean is a potentially valuable new crop for Oregon. Soybean could provide a high quality protein for animal nutrition and oil for human consumption, both of which are in short supply in the Pacific Northwest. In addition, edible or vegetable soybean production could provide a raw material for specialized food products. Soybean is valuable as a rotation crop because of the soil-improving qualities of its residues and its nitrogen (N_2)-fixing capability. Because of the high-value irrigated crops typically grown in the Snake River Valley, soybeans may be economically feasible only at high yields.

Soybean varieties developed for the midwestern and southern states are not necessarily well adapted to Oregon's lower night temperatures, lower relative humidity, and other climatic differences. Previous research at Ontario, Oregon has shown that, compared to the commercial cultivars bred for the Midwest, plants for eastern Oregon need to have high tolerance to seed shatter and lodging, reduced plant height, increased seed set, and higher harvest index (ratio of seed to the whole plant). The objective of the soybean breeding program at the Malheur Experiment Station (MES) is developing cultivars adapted to eastern Oregon. Selection criteria have included high yield, zero lodging, zero shatter, low plant height, and maturity in the available growing season. None of these lines are transgenic.

The increase in the market for organic foods, including organic dairy products, has increased the demand for organically produced animal feed. This trial tested three of the most promising soybean cultivars developed at MES for performance under organic production.

Materials and Methods

The trial was conducted on an Owyhee silt loam (pH of 7.5, 1.9 percent organic matter) previously planted to wheat. The field was disked twice, moldboard plowed, groundhogged twice, and bedded to 30-inch rows in the spring of 2005.

Three Oregon State University soybean lines were planted in plots 4 beds wide by 25 ft long. The plots were arranged in a randomized complete block design with six replicates. The seed was planted on June 2 at 200,000 seeds/acre in 3 rows on each 30-inch bed using a plot drill with disk openers. The rows were spaced 7 inches apart (Fig. 1). *Rhizobium japonicum* soil implant inoculant was applied in the seed furrow at

planting along with the seed. Emergence started on June 10. The trial was irrigated with a minisprinkler system (R10 Turbo Rotator, Nelson Irrigation Corp., Walla Walla, WA). Risers were spaced 25 ft apart along the flexible polyethylene hose laterals that were spaced 30 ft apart and the water application rate was 0.10 inch/hour.

The field was irrigated when the soil water tension at 8-inch depth reached 50 centibars (cb). Soil water tension was monitored by six granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed in the bed center at 8-inch depth. Sensors were automatically read three times a day with an AM-400 meter (Mike Hansen Co., East Wenatchee, WA). The last irrigation was on September 10.

The field was hand weeded on July 8 and on July 19. The field was sprayed with Aza-Direct® (azadirachtin) at 0.025 lb ai/acre and Success® (spinosad) at 0.19 lb ai/acre on July 21, July 29, August 3, August 17, and August 26 for control of lygus bugs, stinkbugs, and spider mites. Aza-Direct and Success are approved for organic crop production according to the Organic Materials Review Institute (O.M.R.I., Eugene, OR).

The middle two beds in each four-bed plot were harvested on October 10 using a Wintersteiger Nurserymaster small plot combine. Beans were cleaned, weighed, and a subsample was oven dried to determine moisture content. Samples of each cultivar were sent to Oregon State University for analysis of crude fat and crude protein. Crude fat was analyzed using ether extraction and crude protein was analyzed using a copper catalyst Kjeldahl method. Moisture at the time of analysis was determined by oven drying at 100°C for 24 hours. Dry bean yields, crude fat, and crude protein were corrected to 13 percent moisture. Variety yield and seed counts were compared by analysis of variance. Means separation was determined by the protected least significant difference test.

Results and Discussion

Yields in 2005 ranged from 55.7 bu/acre for 'M9' to 57.2 bu/acre for 'M12' (Table 1).

Yields in this trial were substantially lower than for the same cultivars in a trial under conventional production practices in another field at MES. Yield differences between the conventional and organic systems may be explained by differences in irrigation systems, soil types, and planting dates. The conventional system was furrow irrigated. Lack of experience in irrigating soybeans with the minisprinkler system resulted in a drier average soil water tension for the organic system (34.4 cb) than the conventional furrow irrigation system (28.2 cb). The field used for the organic system had soil with a history of lower productivity than soil used in the conventional production system. The later planting date of the organic soybeans resulted in emergence 10 days later than the conventional soybeans, so the soybeans developed during a later and less favorable time of year. The conventional soybeans reached maturity on September 6 and the organic soybeans reached maturity on September 16. In spite of these differences, it is clearly feasible to produce organic soybeans at Ontario, Oregon.

Table 1. Performance of soybean cultivars under organic production in 2005. Yield, crude fat, and crude protein were corrected to 13 percent moisture, Malheur Experiment Station, Oregon State University, Ontario, OR.

Cultivar	Origin	Seed weight	Yield	Crude fat	Crude protein
		seeds/lb	bu/acre	%	%
M9	M92-330	2,522	55.7	21.5	35.8
M12	M92-330	2,441	57.2	21.0	35.6
106	M92-085	2,486	56.0	20.9	34.3
LSD (0.05)		NS	NS	NS	NS

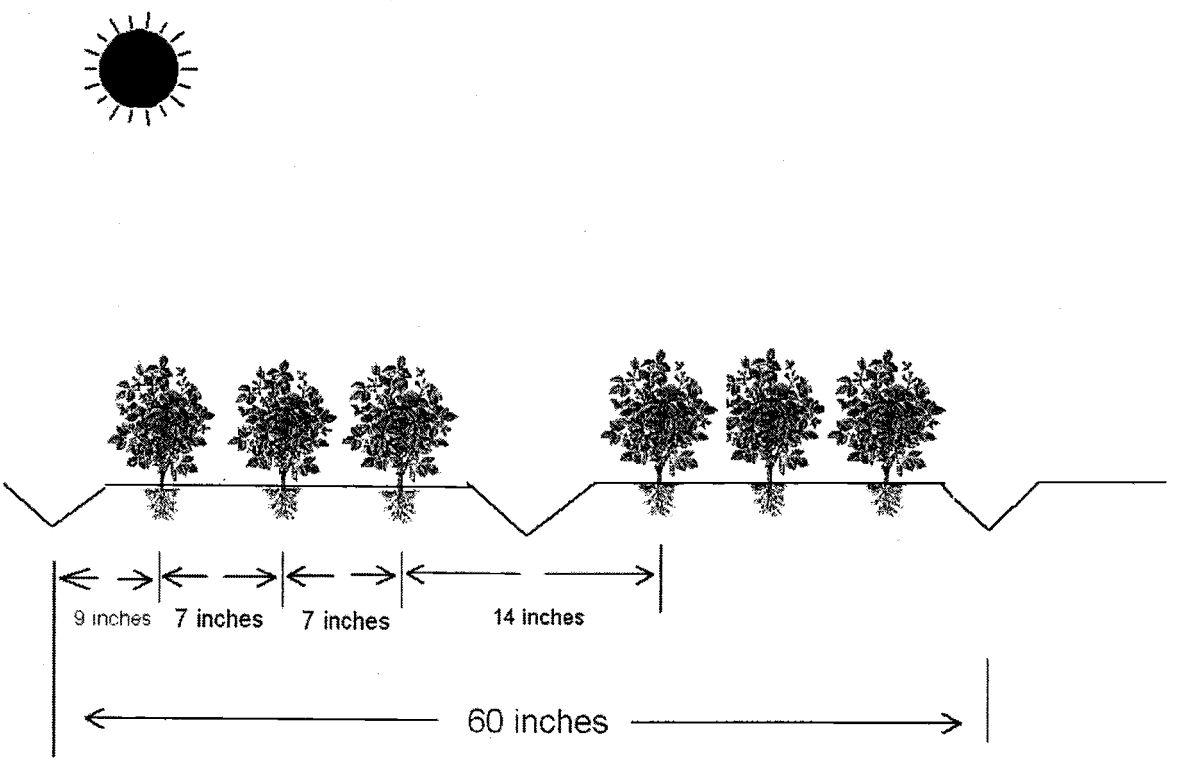

Figure 1. Soybean planting configuration used in 2005, Malheur Experiment Station, Oregon State University, Ontario, OR.