



UNIVERSITY OF WISCONSIN AGRONOMY, SOYBEAN RESEARCH, UNIVERSITY OF WISCONSIN-EXTENSION

## Natto Soybean Production in Wisconsin

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### INTRODUCTION

Natto is a traditional Japanese food made from soybean fermented with a particular bacteria spp. Natto-type soybeans are usually less than 5.8 mm (no. 14.5 screen) in diameter and have a clear hilum and thin seed coat. Smaller beans are preferred, as the fermentation process is able to reach the center of the bean easier. Opportunities exist for Wisconsin growers to access markets for identify preserved soybean and thereby gain premiums in the market above the current commodity price (S. Sinner, personal communication, SB&B Foods, 2018). Natto soybean production is similar to conventional production, although seed size and quality issues are more important.

The objectives of this study were:

- To evaluate the effect of soybean seeding rate coupled with fungicide and insecticide seed treatments on natto soybean stand establishment, growth, and seed yield
- To evaluate foliar fungicide use for disease control on several natto soybean varieties
- To evaluate various seeding rates on four varieties of food grade soybean for seed yield, growth characteristics and seed quality

### MATERIALS AND METHODS

Field studies using small plots were conducted during the 2017 and 2018 growing seasons at three Wisconsin locations (Arlington, Chippewa Falls, and Platteville), resulting in 5 environments (year x location). The previous crop was corn and a randomized complete block design with 4 replications was used at all site-years. Plots were established using a plot planter with a seed cone at a 15 in row spacing.

Three distinct trials (objectives) were repeated each year at each location. **Objective one** (seed treatment) treatments included five seeding rates (100 000 to 260 000 seeds  $a^{-1}$ ) and two seed-applied fungicide-insecticide treatments: NTC and CruiserMaxx (thiamethoxam, mfenoxam, and fluioxonil, Syngenta) using cultivar SB&B Brand SB80 [0.4RM]. In **objective two** (foliar fungicide), treatments included a NTC and Endura (boscalid, BASF) foliar fungicide applied at R1 stage on three natto cultivars (SB&B Brand SB80, SB0512 [0.5RM], and SB4020 [0.6RM]) planted at 220 000 seeds  $a^{-1}$ . Treatments in **objective three** (seeding rate) were three seeding rates (180 000, 220 000 and 260 000 seeds  $a^{-1}$  and four natto and food grade cultivars (SB80, SB0512, SB4020, and DuPont Pioneer Brand P91M10 [1.1RM]).

Cultivars chosen for these studies have the desirable seed characteristics and yield potential to be grown in Wisconsin and be marketable in the food-grade sector. Grain yield and moisture were determined by mechanically harvesting a 165 ft<sup>2</sup> area in each plot soon after maturity (R8). Seed yield in all studies were adjusted to a moisture content of 13.0%. A grain subsample was collected from each plot during harvest and analyzed for protein and oil content using near-infrared (NIR) spectroscopy. Seed size was measured by determining the weight of 100 seeds and by sieving through a no. 14.5 round hole sieve.

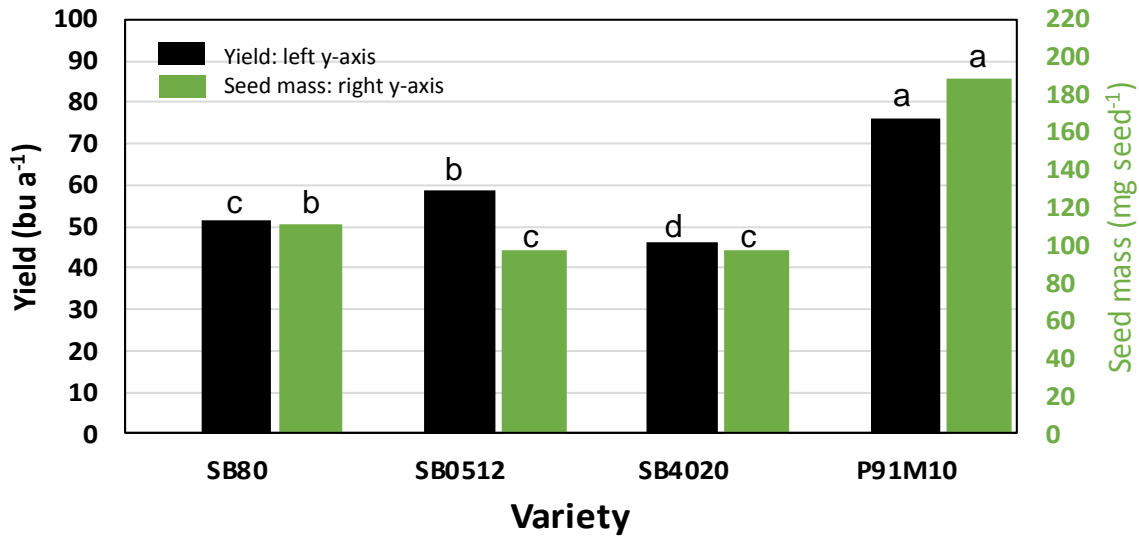


Fig. 1. Seed yield and mass of four food grade soybean varieties averaged across three seeding rates. Means sharing the same letter within each variable are not significantly different from each other. 2017-2018.

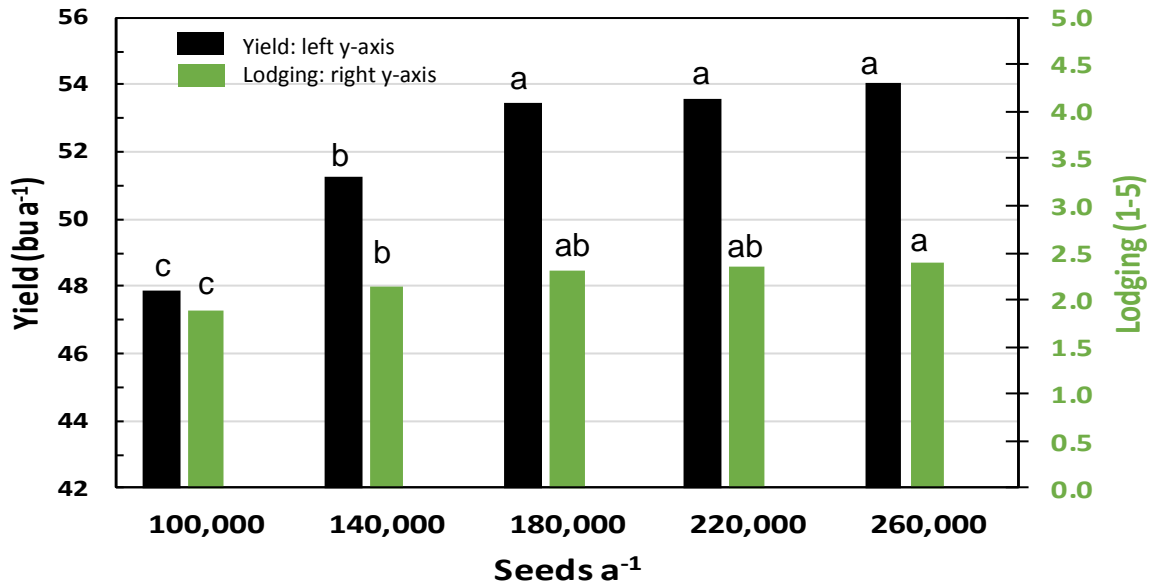


Fig. 2. Seed yield and lodging of food grade soybean (cultivar SB80) at five planting densities averaged across two seed treatments. Means sharing the same letter within each variable are not significantly different from each other. 2017-2018.

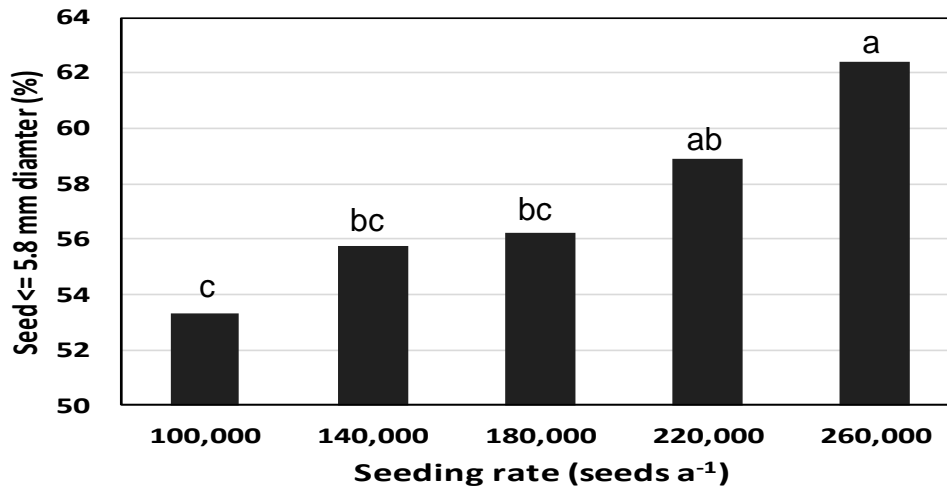


Fig. 3. Percentage of seeds passing through a 5.8 mm round hole sieve at five planting densities averaged across two seed treatments. Means sharing the same letter within each variable are not significantly different from each other. 2018.



Fig. 4. Natto soybean showing severe lodging.

#### KEY FINDINGS

- Variety selection and seeding rate are the most important agronomic and economic considerations (Figs. 1, 2, and 3)
- Seeding rates above 140 000 seeds a<sup>-1</sup> resulted in highest yields and smaller seed sizes, similar to Kandel (2008)
- A combination fungicide plus insecticide seed treatment or a foliar fungicide had minimal impacts on any of the response variables
- Varieties varied in incidence of white mold (*Sclerotinia sclerotiorum*), however seeding rate did not impact white mold incidence, but increased plant lodging (Fig. 4)

#### OTHER CONSIDERATIONS

- Seed size and seed quality characteristics are the most important factors in marketing natto soybean
- Seed protein is not a major consideration in the natto market
- Natto seed used for food must be small, clean, free of foreign material, and no mold, smell, or off-coloration
- The decision to grow natto soybeans requires a local market and generally a contract with a buyer
- Many markets require seed with a diameter less than 5.8 mm and seeding rate is an important agronomic consideration to achieve this

#### CONCLUSIONS

Natto soybeans have the potential to attract premium pricing in WI. Most contracts with buyers include specific variety requirements as well as strict quality grading. Agronomically, natto soybeans generally yield less than conventional varieties, but price premiums may offset this in an economic analysis. Growers should select high yielding varieties with good seed quality characteristics.

#### REFERENCES

Kandel, Hans, Endres, G., Schatz, B., Johnson, B., Deplazes, C., and Lee, DK. 2008. Plant Population Effects on the performance of natto soybean varieties. North Dakota State University.

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