Nitrogen Relationships in Soybean in Southwest North Dakota

Best management practices are needed to achieve optimal crop yields. Soybean has the ability to form a symbiotic relationship with nitrogen (N)-fixing bacteria; however, it may be possible to increase yield through addition of synthetic N fertilizer, however addition of N reduces the plants need to form a relationship with N-fixing bacteria. It may be possible that with a dryer environment in southwest North Dakota that the N-fixing bacteria are less productive. The Dickinson Research Extension Center worked with the Hettinger Research Extension Center to observe the effects of different agronomic management strategies on soybean growth and yield. Objectives of the research were to evaluate yield and growth differences between four N management strategies applied to two soybean cultivars with different maturities grown at two populations. The research was conducted at two locations, however only data from the Hettinger location was recorded due to herbicide damage. Soybean production has been increasing in southwest North Dakota recently and there are many questions on the proper management for the regional differences compared to the Red River Valley. 2017 was a difficult year with drought conditions, however rains during August contributed to soybean yields (Tables 1 and 2).

Table 1. NDAWN rainfall data for Hettinger, ND during the 2017 growing season.

Month	Precipitation (in)
April	1.18
May	0.60
June	0.34
July	1.68
August	1.78
September	1.89
October	0.01

Rainfall in August aligned with reproductive growth of soybeans allowing the plants to attain decent average yields considering the poor conditions during vegetative growth. Although there were no significant differences among N treatments alone (Table 2.), there were differences in yield with the interaction between populations of 80,000 and 160,000 plants per acre and the N treatments (Table 3.), this interaction needs to be further investigated before making any conclusions. No significant yield differences were found between populations, 80,000 plants/acre averaged 23.3 bu/ac while 160,000 plants/acre averaged 24.2 bu/ac. This lack of difference in yield may be due to the drought, however more work will need to be conducted to observe the effects of plant population on yield in western ND.

In August, five soybean plants per plot were excavated to observe the number of nodules per plant. Table 2 shows that there were significant differences between the inoculated and non inoculated treatments. While there is no significant decrease in nodule production with the fertilized treatment, a higher rate of N would most likely further decrease nodule number. While there is a difference in number of nodules, this did not translate into a difference in yield.

Table 2. Nodules per plant and yield across nitrogen treatments for soybean in Hettinger, ND 2017.

Nitrogen Management	Nodule/plant	Bushels/acre
No inoculant/no N added	0.6b	22.4
No inoculant/30 lbs N added	1.4b	24.1
Inoculant/no N added	23.3a	23.9
Inoculant/30 lbs N added	19.9a	24.4
LSD (0.05)	10.44	ns

Table 3. 2017 soybean yields in Hettinger, ND across plants per acre and nitrogen treatments. Soybeans were planted May 18th.

	Yield	
Nitrogen Management	bu/acre	
	80,000	160,000
No inoculant/no N added	24.0ab	20.9b
No inoculant/30 lbs N added	21.3b	26.8a
Inoculant/no N added	23.4ab	24.5ab
Inoculant/30 lbs N added	24.4ab	24.5ab
LSD (0.05)	3.9	

Drought conditions in 2017 reduced yield capacity for soybeans. Under drought conditions a plant population half of the recommended seeding rate was able to yield just as well as the full rate. While it may be possible that with higher rainfall a larger yield is possible, more work should be conducted before changing recommendations. Under drought conditions with a reduced yield potential, it could be possible to reduce seed input costs without losing bushels.