Effect of Variety, Population (Stand) and Nitrogen on Sugarbeet Quality in Michigan

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Have varieties changed over time in how they respond to production practices of increased stand or nitrogen application rates? To address this question, the following objective of the impact of nitrogen and stand (B/100) on three varieties' yield and quality in Michigan was determined. To address this objective the following research was conducted over three location-years in Michigan with two locations in 1998 at Weber location in Ruth and Stoutenburg location in Sandusky (Stout) and one location in 1999 at the Fogg location in Saginaw. The experimental design was a RCBD with 4 replications with 3 factorial of split plot design. The factorial consisted of three commercially grown varieties, US H20 (1970's), Hilleshog E4 (1982 to present –limited) and Hilleshog E17 (1996 to present); (intended and thinned) population of 130, 180 and 230 beets per 100 feet of row; and nitrogen rates of 80, 130, 180 and 230 pounds nitrogen per acre (lbs. N/A). Plots were two rows; row width of 28 or 30-inches; and 30-feet long before alleys were cut. Nitrogen and stand were split onto variety. Yield and quality data was collected with only quality data of %S (sucrose content), %CJP (clarified juice purity) and RWST (120-day slice equation) presented.

Results (see tables) and summary will be given in order of RWST, %S and %CJP. The main effect of stand (B/100) combined over nitrogen and variety showed increasing RWST and % S as stand increased from 130 to 180 B/100, but no change from 180 to 230 B/100. With an interaction of nitrogen by location, the Weber location's RWST decreased with additional nitrogen applications from 80 through 180 lbs. N/A. Stoutenburg and Fogg locations had no decrease in RWST from 80 to 130; but decreased RWST from 130 to 180 lbs. N/A. The Fogg location decreased RWST from 180 to 230 lbs. N/A. Main effect of nitrogen decreased RWST and % S with all nitrogen applications. With improved genetics, varieties have increased RWST and %S at the Weber and Stoutenburg locations for all three varieties. The Fogg location E17 had higher RWST and %S compared to either E4 or H20. Weber location's %CJP decreased at 80 to 130 lbs. N/A; %CJP at Stoutenburg and Fogg location decreased 130 to 180 lbs N/A; and %CJP at Fogg location decreased 180 to 230 lbs N/A. Variety H20's %CJP decreased with all additional nitrogen applications. Variety improvement has maintained %CJP with nitrogen rates 80 to 130 lbs N/A for E4 and E17. Variety improvement has maintained %CJP with nitrogen rates 130 to 180 lbs N/A for E17.

In conclusion, varieties have changed over time, but they all responded the same way to increasing stand of 130 to 180 B/100 improving RWST, %S and %CJP for H20, E4 and E17. However, variety E17 maintained %CJP at higher nitrogen applications. Future research locations will be conducted at least one more year in Michigan.

Table 1: Main effect of stand (B/100) on RWST, %S and %CJP.

Stand (B/100)	RWST	%S	%CJP
130	253.4	18.1	92.3
180	256.7	18.3	92.5
230	257.6	18.3	92.7
LSD (0.05)	2.7	0.1	0.2

Table 2: Interaction of nitrogen rate and location for RWST.

Nitrogen (lbs N/A)	Weber RWST	Stout RWST	Fogg RWST	AVG RWST
80	280.9	266.3	251.2	266.2
130	274.3	262.0	248.6	261.6
180	264.4	253.3	234.2	250.6
230	259.3	250.5	225.5	245.1
LSD (0.05)		5.4		3.1

Table 3: Interaction of variety and location for RWST.

Variety	Weber RWST	Stout RWST	Fogg RWST	AVG RWST
H20	252.5	241.5	230.1	241.4
E4	272.6	258.6	232.7	254.6
E17	284.1	273.9	256.9	271.7
LSD (0.05)		5.4		3.1

Table 4: Main effect of nitrogen rate for %S.

Nitrogen (lbs N/A)	%S
80	18.7
130	18.5
180	18.0
230	17.8
LSD (0.05)	0.2

Table 5: Interaction of variety and location for %S.

Variety	Weber %S	Stout %S	Fogg %S	AVG %S
H20	17.7	17.6	16.9	17.4
E4	19.0	18.8	17.1	18.3
E17	19.5	19.5	18.3	19.0
LSD (0.05)		0.2		0.1

Table 6: Interaction of nitrogen rate and location for %CJP.

Nitrogen (lbs N/A)	Weber %CJP	Stout %CJP	Fogg %CJP	AVG %CJP
80	94.2	92.4	92.6	93.1
130	93.7	92.2	92.5	92.8
180	93.6	91.7	91.5	92.3
230	93.2	91.6	91.0	91.9
LSD (0.05)		0.4		0.2

Table 7: Main effect of variety for %CJP.

Variety	AVG %CJP
H20	92.2
E4	92.2
E17	93.1
LSD (0.05)	0.3

Table 8: Interaction of nitrogen rate and variety for %CJP.

Nitrogen (lbs N/A)	H20 %CJP	E4 %CJP	E17 %CJP	AVG %CJP
80	93.1	92.6	93.4	93.1
130	92.4	92.6	93.4	92.8
180	92.0	91.9	93.0	92.3
230	91.5	91.6	92.6	91.9
LSD (0.05)		0.4		0.2