



# MICHIGAN SUGARBEET REACH

Research & Education Advisory Council

## Management Guidelines for Improving Sugarbeet Quality

### OVERVIEW

Sugarbeet companies from around the world have invested millions in research to discover what it takes to produce high quality sugarbeets. There are certainly many factors that impact quality that are uncontrollable such as rainfall, length of growing season and the amount of sunlight in a given season. However, there are many factors that are controllable that sugarbeet producers can manage that will effectively improve quality. Research has concluded that maximizing quality (% Sugar) and recoverable sugar per acre (RWSA) involves more than a dozen controllable factors /practices. When it comes to maximizing quality “It’s a Package Deal”. Not implementing any one factor can and will limit sugar production.

### FACTORY/ECONOMIC IMPACT

*Beet quality is the key to maximizing factory efficiency and company profit.*

Michigan Sugar factories currently have a limited amount of capacity (tons) of sugarbeets that they can process in a day and during the length of a campaign. It takes the same amount of energy and time to process a poor quality sugarbeet that it does for a high quality beet. Factory efficiency per pound of sugar can be significantly improved by simply increasing the sugar content of incoming beets. For every one percent increase in sugar content, approximately 15 pounds more sugar can be extracted per ton. This will generate over 60 million additional pounds of sugar per campaign, valued at 18 million dollars.

### VARIETY SELECTION

*High quality varieties can provide large financial benefits, but they may come with the risk of reduced*

*disease tolerance or lower yield potential.*

Variety selection should be field specific and encompass multiple considerations including disease resistance, tonnage and sugarbeet quality. In 2013, there were 19 varieties offered for sale to the Michigan Sugar growers. When examining the results of the Michigan Sugar Official Variety Trials, it is very easy to see the differences in quality as measured by percent sugar and/or recoverable sugar per ton (RWST). In comparing two varieties with similar tonnage, one variety showed an advantage of 14 pounds of sugar per ton and 442 pounds more sugar per acre. The monetary difference is about 102 dollars per acre. Quality is certainly an important consideration when selecting varieties. The benefits of a high sugar variety can easily be lost if serious issues exist in the field such as cyst nematode or uncontrolled Rhizoctonia and Cercospora. Make sure you are aware of the strengths and weaknesses of each variety and manage them accordingly.

### PLANTING DATE

*Early planting extends the growing season which will significantly impact yield and quality.*

The longer beets have to grow the higher the potential for increased yield, sugar content and quality. Planting date changes the length of the growing season and allows the sugarbeets to capture more sunlight that is converted and stored as sugar. Under ideal situations we would want our sugarbeets to be fully canopied by June 20<sup>th</sup>, the longest day of the year. Michigan Sugar Company conducted a trial with four planting dates, two weeks apart, starting in mid-April. Starting with the earliest planting date the pounds of sugar per ton were 237, 232, 219 and 197. To gain the most in sugar quality, take advantage of early planting opportunities if soil conditions are right, even in late March.

## POPULATION

*Populations can have a large impact on quality, but thin, even stands may not economically justify replanting.*

Achieving an even stand with optimum plant population is very important to maximize yield and quality. Even stands will allow for better topping and improved quality. Research has also shown that large sugarbeets are of lower quality than smaller beets. It is recommended that final emergence is 175-225 beets per 100 feet in both 22 and 30 inch rows. These ranges are for ideal stands. Research has shown that sugarbeets are excellent compensators when stands are thin. Replant trials have shown in many cases it is economically better to keep uniform stands as low as 75 beets per 100 feet rather than replant. However, Michigan Sugar research has shown in 30 inch rows that RWSA and RWST were reduced when populations were as low as 60 and 90 beets or very high at 300 beets. In this research, RWST ranged from 274 pounds to 250 pounds per ton. In limited population trials in 22 inch rows, quality increased up to 250 beets in 100 foot of row. Many factors can affect your stand establishment including: crusting, wind erosion, variety, planting depth, seedling disease and soil health. Increasing organic matter in soils through conservation tillage, manure, or cover crops will be beneficial.

## NARROW ROWS

*Multiple research trials consistently show quality gains with narrow rows.*

Research conducted by Michigan Sugar Company, Michigan State University and Sugarbeet Advancement concludes that sugarbeet root yields were increased by two tons per acre and percent sugar improved by 0.3 in narrow rows. Research from other growing areas has reported similar results. Narrow rows will canopy faster and capture more sunlight and convert it to sugar. Research observations have shown when wide rows are 80 percent canopied, narrow rows will be 100 percent. Some varieties with small tops may never completely canopy in wide rows.

Narrow rows also allow for higher sugarbeet populations with better in row spacing. For example, if a grower wants 45,000 plants per acre, it would require 190 beets per 100 foot of row in 22 inch rows compared to 260 beets per 100 foot in 30 inch rows. Numerous research trials have shown that in narrow

rows, high populations will improve yield, quality and reduce replanting in poor emerging conditions.

## NITROGEN

*Nitrogen is the single most important nutrient that needs to be managed in a sugarbeet crop.*

No other nutrient has been more studied. Too little nitrogen can reduce tonnage; too much nitrogen will reduce quality. Optimum nitrogen rate can vary depending on planting/harvesting date, previous crop, plant population and tillage systems. Managing nitrogen properly includes application rate, placement and timing. Recommendations are based on optimizing tonnage, quality and net return. General recommendations when following a low residue crop such as dry beans or soybeans is 90 to 130 pounds per acre. When planting in high residue crops such as corn or wheat stubble, the recommendation would be 130 to 160 pounds. When clover is incorporated as part of the previous crop, rates may be reduced by about 30 pounds per acre. Manure applications prior to sugarbeets, a soil nitrate test is highly recommended.

Research conducted by Michigan Sugar Company and Sugarbeet Advancement has shown 2" x 2" starter placement of 40-50 pounds of nitrogen improves early season growth, especially under high residue situations. This should be coupled with pre-plant incorporated nitrogen or an early side-dress application at about the 4-6 leaf stage. Late side-dress application will keep beet foliage green longer, but will also lower beet quality. A high quality beet crop will have off color foliage prior to harvest.

## RHIZOCTONIA ROOT ROT

*Rhizoctonia will reduce quality, but the impact can be reduced with fungicide applications and variety selection.*

Root diseases of sugarbeets will decrease revenue per acre by reducing both tonnage and quality. Rhizoctonia root rot is by far the most significant of the root diseases. Research conducted by Sugarbeet Advancement has shown moderate levels of this disease can reduce yields by five tons and sugar by one percentage point. Recent USDA research (Campbell and Fugate) also indicates that diseased beets put into storage have a significantly higher respiration rate and will not store as well as non-infected beets. The most effective approach of minimizing Rhizoctonia impact is selecting varieties with an appropriate level of ge-

netic tolerance coupled with a fungicide application. Many growers will apply a Quadris in furrow treatment followed by a six to eight leaf application. Susceptible varieties benefit the most from this type of application.

### **SUGARBEET CYST NEMATODES**

*In a random field survey conducted in 2007, SBCN were detected in 22% of the fields sampled.*

Research has shown heavy infestations can cause yield losses up to 15 tons per acre with reduced quality. Research conducted in 2008 at four field locations, with moderate levels of nematodes, showed an average loss of 3 ½ tons per acre and over one half percent in sugar when comparing a nematode resistant variety to a susceptible. Sugarbeet producers need to be aware that yield losses can occur with relatively low nematode populations that show no visual symptoms. Some oil seed radish varieties act as a nematode trap crop and can also enhance yield and quality when used in a beet rotation. When high populations are present, oil seed radish should be used along with a SBCN tolerant variety. It is critical for growers to check existing beet fields in August for cyst on the root hairs. Michigan Sugar also offers free soil testing through the MSU Diagnostic Service. If SBCN are found, resistant varieties should be used in that field. Be aware that Rhizoctonia incidence and nutrient deficiency is often increased in the presence of SBCN.

### **CERCOSPORA LEAF SPOT**

*Cercospora leaf spot infections will reduce sugarbeet yield, percent sucrose and increase the level of impurities in the beets.*

Long term research conducted by Michigan Sugar Company has shown that uncontrolled Cercospora reduced sugar levels by 0.6%, purity by 0.5% and yield by 3.4 tons when compared to the best spray program. When Cercospora was partially controlled sugar content was lowered by about 0.2%. Be aware, partial control of Cercospora will also increase the chances of fungicide resistance. Currently, strobilurin resistance has already been identified and the resistance management protocol should be followed closely by growers.

The timing of fungicides is critical for Cercospora control. It is important that the first fungicide application be applied just prior to the first spot. Because of strobilurin resistance, 2013 Disease Severity

Values for fungicide application have been shortened and all products should be tanked mixed. Refer to the latest Cercospora bulletin for the DSV values for your area and varieties.

### **DATE OF HARVEST**

*Later harvest will increase sugar content but may come at the price of lost premiums and more difficult harvest conditions.*

The date of harvest can have a significant effect on sugarbeet yield and quality. Sugarbeets can put on considerable tonnage and sugar during the harvest period, especially when temperatures are warm and the soils have moisture. Five years of harvest data conducted by Michigan Sugar Company showed that sugarbeets harvested towards the end of October and early November had 2.6 percentage point's higher sugar when compared to harvest 33 days earlier. Sugar increased significantly every year. Depending on moisture conditions tonnage usually will increase between one half and 2 tons per week. These quality and yield gains can be greatly diminished if Cercospora leaf spot is not held in check season long.

### **TOPPING**

*Topping is an important factor for both beet quality and storability.*

Three years of research conducted by Michigan Sugar Company has shown that poorly topped beets can result in a loss of 11 pounds of recoverable white sugar per ton (RWST). Similar research conducted by Sugarbeet Advancement reduced RWST by 4-9 pounds. Ten pounds of RWST is approximately \$46 in 25 ton/acre beets at \$50 per ton (\$4600 per 100 acres). Even four pounds RWST would be \$18.50 per acre or \$1850 on 100 acres. A good stand of evenly spaced beets makes proper defoliation easier. Gaps, doubles, and weeds can impact defoliation. Speed is dependent on field and defoliator conditions, but generally should not be more than 3.5 to 4 mph. Topping should not occur more than one half hour ahead of harvest. Recent research has also shown that beet crown temperature of defoliated beets can increase by 5 degrees per hour on warm sunny days. In this study, the un-defoliated beets only gained temperature at a rate of 2.4 degrees per hour. Warmer temperatures will increase respiration rates utilizing more sugar. Defoliators should be adjusted properly, in good repair and stay close to the harvester.



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**SUMMARY**

Research conducted by Michigan Sugar Company and MSU Sugarbeet Advancement over the years has shown a range of effect on quality for each factor discussed. Table 1 shows the maximum influence on sugarbeet quality we have seen with Michigan research. The impact of improving quality by one percent for a grower is an estimated 15 pounds more sugar per ton, which will equate to an increase of \$2.80 per ton based on a \$50 per ton average payment. Producing high quality beets will require producers to fine tune their management skills. Maximizing sugar requires that all factors be addressed as a package. Falling short on any one factor can have a large impact on our “ROAD to 19”.

**Table 1. Maximum Influence on Sugarbeet Quality**

Factor	% Sucrose
Variety Selection	1.5
Planting Date	2.1
Population	2.5
Row Width	0.5
Nitrogen Rate	1.2
Rhizoctonia	1.3
Cercospora	2.1
Nematodes	2.2
Harvest Date	1.5
Topping	0.5

Based on estimates from MSC & SBA research trials.

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