# CAN WE SOLVE SUGARBEET SAND-SYNDROME WITH CULTIVAR SELECTION, LIME AND STARTER APPLICATIONS?

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Sugarbeet growth and production is often lower in coarse-textured sandy soils with low organic matter content. Franzen et al. (2001, 2002) reported that these areas produced good crops of small grains, corn or soybean, but when planted to sugarbeet, marked differences in growth were observed from shortly following emergence through to harvest. Seedling leaves were usually curled inward more prominently than normal, with a purple rim at the leaf edge. Later in the season, the curling and purpling became less pronounced. Sugarbeet seedlings, though at the same leaf growth stage as normal growing beets, were shorter in height and lower in seedling weight. Although the rows might eventually fill in, final yields were lower at harvest than normal growing areas. Research outcomes suggest that syndrome might be caused by disease and perhaps the fertility deficiency symptoms were only secondary effects.

**Table 1. Basic information of experiment sites**

| | Ada, MN | Sabin, MN |
|---|---|---|
| **Previous crop** | Corn | Soybean |
| **Soil Series** | Glyndon | Wyndmere |
| **Initial soil N 2ft (lb/ac)** | 47 | 47 |
| **EC (ds $m^{-1}$)** | 0.31 | 0.62 |
| **pH** | 8.2 | 8.2 |
| **Olsen P (ppm)** | 22 | 10 |
| **Extractable $K_2O$ (ppm)** | 100 | 113 |
| **Planting** | May 6 | May 4 |
| **Harvesting** | Sep. 16 | Sep. 21 |

Study objectives are (i) evaluate different potassium (K) based starter fertilizers effect to reduce 'sand-syndrome' and improve sugarbeet productivity in sandy soils, (ii) compare performances of different sugarbeet cultivars' response to sand syndrome and sandy soils of low productivity zone, and (iii) evaluate interactive effect of cultivar selection and K-based starter fertilizers on sugarbeet yield and quality.

This trial was conducted at (i) Ada, MN and (ii) Sabin, MN, with previous history of 'sand syndrome' and no prior history of spent lime application. Initial soil properties and background information are presented in table 1.

Field trials were laid out in split-split-plot randomized block design with four replications. Main plot factor will be lime addition, (i) spent lime at the rate of 10 ton/acre and (ii) without lime (check); sub-plot factor will be potassium and starter fertilizers, (1) control, (2) Muriate of potash (KCl) or MOP broadcasted (0-0-60) at the rate of 60 lb $K_2O$/ac, and in furrow applications of (3) 2-17-17 at the rate of 3 gallon/ac, (4) 6-24-6 at the rate of 3 gallon/ac, (5) 9-18-9 at the rate of 3 gallon/ac; and sub-sub plot factor will be cultivar, (i) susceptible (BTS 80RR52 RP) and (ii) resistant (Crystal 093).

Sugarbeet was planted with a John Deere Max Emerge II planter. Individual treatment plots measured 11 feet wide and 30 feet long. Sugarbeet was placed 1.25 inches deep with 5 inch in-row spacing. A 22 inch row spacing was used. Spent lime was applied just before planting and incorporated within the soil surface. Soil nitrogen (N) levels were adjusted with urea to 130 lb N/ac of available residual soil test plus added fertilizer N. Roundup herbicide was applied twice for weed control and Quadris was applied at the four-six leaf stage and again three weeks later to help control rhizoctonia root rot. Three fungicide applications, Inspire, Topsin and Headline were applied for Cercospora leaf spot control. Middle-two rows of the plot were harvested for yield and quality. Beet yield and sugar content for two sites were analyzed using SAS ANOVA method (SAS 9.4, 2012, SAS Institute) and presented in table 2.

**Table 2. Beet yield and sugar content in response to lime, cultivar and starter applications at Ada and Sabin sites during 2015 growing season**

| | | | Yield (tons/ac) | | %Sugar | |
|---|---|---|---|---|---|---|
| **Lime** | **Cultivar** | **Starter** | **Ada** | **Sabin** | **Ada** | **Sabin** |
| No | Resistant | Control | 38.18 | 29.95 | 16.25 | 19.23 |
| No | Resistant | 0-0-60 | 38.45 | 30.43 | 15.50 | 19.00 |
| No | Resistant | 2-17-17 | 38.46 | 30.44 | 15.83 | 18.73 |
| No | Resistant | 6-24-6 | 39.01 | 32.54 | 15.90 | 18.90 |
| No | Resistant | 9-18-9 | 39.72 | 28.82 | 15.93 | 19.15 |
| No | Succeptible | Control | 40.75 | 33.53 | 15.73 | 19.10 |
| No | Succeptible | 0-0-60 | 40.20 | 32.88 | 15.43 | 18.88 |
| No | Succeptible | 2-17-17 | 39.77 | 31.22 | 15.65 | 18.95 |
| No | Succeptible | 6-24-6 | 38.72 | 33.57 | 15.58 | 18.85 |
| No | Succeptible | 9-18-9 | 34.85 | 34.18 | 15.45 | 19.23 |
| Yes | Resistant | control | 39.43 | 30.96 | 16.03 | 18.68 |
| Yes | Resistant | 0-0-60 | 37.28 | 31.51 | 15.68 | 18.70 |
| Yes | Resistant | 2-17-17 | 37.76 | 29.42 | 15.95 | 18.75 |
| Yes | Resistant | 6-24-6 | 37.26 | 31.79 | 16.20 | 19.30 |
| Yes | Resistant | 9-18-9 | 37.25 | 29.31 | 16.03 | 18.73 |
| Yes | Succeptible | Control | 34.25 | 30.59 | 15.85 | 18.93 |
| Yes | Succeptible | 0-0-60 | 36.04 | 30.34 | 15.60 | 18.48 |
| Yes | Succeptible | 2-17-17 | 39.03 | 31.92 | 15.40 | 18.83 |
| Yes | Succeptible | 6-24-6 | 39.83 | 30.01 | 16.08 | 19.03 |
| Yes | Succeptible | 9-18-9 | 38.75 | 30.30 | 15.80 | 18.90 |

We did not observe any sand syndrome in our plot during the growing season. Lime, cultivar and starter had no effect on yield and sugar content at both locations (Table 2 and Table 3). At Ada, the highest sugarbeet yield of 40.75 t/ac and sugar content 16.25% were achieved with no lime-susceptible cultivar-no starter (control) and without lime-resistant cultivar-without starter, respectively. At Sabin, the highest yield of 34.18 t/ac and sugar content of 19.30% was noted under without lime-susceptible cultivar-starter (9-18-9) application and with lime-resistant cultivar-starter (6-24-6) applications, respectively. We did not observe any specific trend of treatment combinations on yield and sugar content.

**Table 3. Main factor effects on sugarbeet yield (tons/ac) in response to lime, cultivar and fertilizer applications at Sabin and Ada during 2015 growing season.**

| Factors | Levels | Sabin | | | Ada | |
|---|---|---|---|---|---|---|
| | | Tons/ac | Sugar% | | Tons/ac | Sugar% |
| Lime | No lime | 31.76 | 19.00 | | 38.81 | 15.72 |
| | Lime | 30.62 | 18.83 | | 37.69 | 15.86 |
| Cultivar | Susceptible | 31.86 | 18.92 | | 38.22 | 15.66 |
| | Resistant | 30.52 | 18.92 | | 38.28 | 15.93 |
| Starter | Control | 31.26 | 18.98 | | 38.16 | 15.96 |
| | MOP | 31.29 | 18.76 | | 38.00 | 15.55 |
| | 2-17-17 | 30.75 | 18.81 | | 38.76 | 15.71 |
| | 6-24-6 | 31.98 | 19.02 | | 38.71 | 15.94 |
| | 9-18-9 | 30.66 | 19.00 | | 37.64 | 15.80 |

References:


1. Franzen, D.W., D.H. Hopkins, M. Khan. (2001) Initial investigations of poor sugarbeet areas. 2000 Sugarbeet Research and Extension Reports. P.135-139.
2. Franzen, D.W., N. Cattanach, J. Giles, M. Khan. (2002) Improvements in sugarbeet growth with amendments in sandy soils with a history of poor sugarbeet performance. 2002 Sugarbeet Research and Extension Reports. P.106-113.