Experiences with Sugarbeet on Land Flooded by the Sea

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On Feb. 1, 1953, large areas in the Netherlands, Belgium and England were flooded by the North Sea. The tides reached a level which had not occurred for ages and seawalls were broken in many places. The floods reached far inland, and since the water level in the river estuaries was low, saltwater came up the rivers much farther than with normal tides.

In the Netherlands, about 340,000 acres were flooded in the southwest part of the country both on the mainland and on the islands. This area (situated from 1-15 feet below sea level) largely consists of clay and silt soils reclaimed from the sea and is considered as one of our best areas for agricultural purposes.

Sugar beets have been grown in this area for more than 100 years. The tonnage per acre is high, with 18 tons per acre as a normal 10-year average and up to 30 tons in good years on the best farms.

In normal years, in this flooded area, about 35,000 acres of sugarbeet are grown. This catastrophe gravely influenced the situation for the sugar factories in this area and the sugar production of the country was expected to suffer severely. To our pleasant surprise, a very good crop (18 tons per acre for the total acreage of the Netherlands) and a considerable increase in acreage in the east part of the country outweighed the loss in the western area.

It was necessary to bring the land back into production as quickly as possible. As soon as the water had been drained from a certain area, soil samples were taken and the salt content determined. Near the sea the salt content was found to be very high but more inland, it decreased gradually, more or less in proportion with the salt content of the floodwater. Since the 1953 spring period was abnormally dry, the salt was not washed down by rain and in early summer a white crust of salt covered many fields.

Barley can be cultivated better than other crops on soils of high salt content; therefore, a large acreage of barley was sown. Sugar beets, also fairly resistant to salt, were planted on about 15,000 acres from which approximately 12,000 acres were harvested. The other 3,000 acres gave little, if any yield, mainly for the following reasons:

1. No germination at all, due to the high salt content, poor soil structure or a combination of both.
2. Seedlings killed by drought in May, aggravated by the increase in salt content.
3. Very slow growth during the season, resulting in few marketable beets at harvest.

A very interesting phenomenon occurred around the middle of June when the long period of dry weather was suddenly broken by heavy rain storms. Everybody expected the moisture to be favorable to the crops, espe-

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cially on the salt land. Within 24 hours and very unexpectedly, many farmers were alarmed to find beets completely collapsed—even those which had been growing unexpectedly well. Investigation showed that the plants had bcome more or less "adapted" to the high concentration of salt in the soil solution. This sudden dilution of the salt concentration permitted the plants to take up more water than could be absorbed by the plant tissue, causing the cells to burst. In many roots the central cylinder was loosened from the surrounding tissue, permitting bacteria and fungi to invade the plants, causing the death within a few days. In some fields, nearly all of the plants died, in other fields, the larger plants survived, leaving fields with long gaps and poor stands.

On many fields later in the summer, plants were found with symptoms characteristic of calcium deficiency, even though these soils are rich in calcium carbonate. The same was experienced years ago with beets on the island of Walcheren which was flooded during the last war. Analysis then and now showed that these beets had a normal calcium content but the sodium content was increased to 300-400 percent of normal. It was concluded that calcium deficiency was relative and not direct and was eventually talked of as a sodium toxicity, indicating that the balance between calcium and sodium in the plant had been upset.

Many fields in the flooded areas showed a much higher percentage of virus yellows than fields on the neighboring "dry" land. In part, this was due to late drilling and opeji stands, which in our country foster the development of this disease. With only beets and barley growing in those areas, it was found that aphids concentrated on the beet crop.

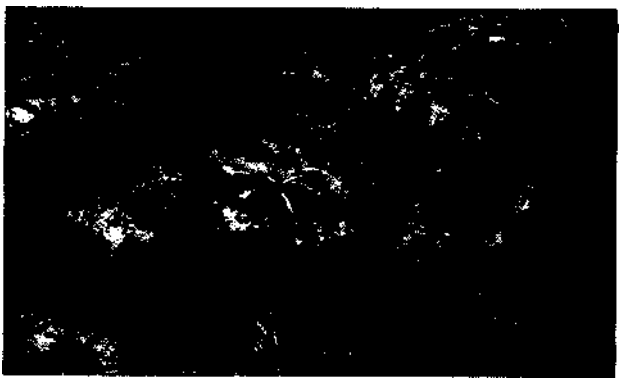

Figure 1.—Young beet plants killed by rain. (See text).

Yields varied from 16 tons on land with low salt content to 3 tons on salt land. In general, the sucrose content was $1^{1/2}$-*2* percent lower than normal.

Processing of these beets caused difficulties, with lower purity and a high production of molasses. It was difficult to store these beets. They have a tendency to spoil very rapidly since the whole enzymatic system in the root is out of balance. The same was true for mangolds in these areas, which is evidenced by reports that many clamps are 100 percent spoiled.

The soil complex is still saturated with sodium in these areas and, from past experience, we must expect a poor quality beet for several years to come. It is expected that at least 30,000 acres of beets are to be grown in these areas *in* 1954, which proposes quite a headache for some of our factories.