The gene that boosts sugar beet yields

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A European team of researchers has discovered a gene with the potential to increase sugar beet yields. Presented in the journal *Current Biology*, the findings of the study show how the long-sought bolting gene B in the sugar beet crop could help seed producers boost cultivation efficiency by mitigating yield-reducing contaminations, and could also support breeders in their efforts to create new cultivars with larger beets.

Led by researchers from Kiel University in Germany and the Umeå Plant Science Centre in Sweden, the team identified that the gene, known as BvBTC1, determines if and when a beet plant will flower. The problem with early flowering is that it stops the root growth of the beet, which in turn shrinks global sugar beet yields. This only causes trouble for farmers.

Europeans recognize the important role sugar beet plays in the economy. Sugar beet differs from cereals in that its seeds that develop after blossoming are not harvested. Only the thickened roots that are rich with sugar are used.

It is common for sea beet, described by experts as the wild ancestor of the sugar beet, to flower in the first year of growth. No beet is produced at all. Unlike the wild type, the domestic sugar beet develops into a large beet that is then collected before it flowers during the second year.

European farmers usually grow sugar beet from spring to fall. They avoid planting the seeds before winter, because it would blossom after winter and only develop small roots. The colder temperatures trigger a plant's blossoming.

"It was obvious that there was a genetic difference between the early flowering beets which occur in the wild and domesticated sugar beets, with tremendous implications for agricultural use," said Andreas Müller, lead investigator at the Plant Breeding Institute in Kiel . "We wanted to know which difference that is, how it evolved, and whether we could use the underlying gene to control flowering and thus increase sugar yield."

In their study, the researchers grew and evaluated the deoxyribonucleic acid (DNA) of thousands of plants in order to pinpoint the location of the so-called bolting gene. They later compared the genes at this location with the genetic sets of other plants.

"We expected to find a similar gene as in the commonly studied Arabidopsis thaliana plant, but surprisingly we found a completely different one," said lead author Pierre Pin, a doctoral student at Umeå Plant Science Centre. "The next step was to verify the gene's function in an experiment in which this gene was inactivated in sugar beets by genetic engineering. The plants did not flower,' he added. 'This

flowering experiment was the final proof that we had identified the bolting gene of sugar beets."

Commenting on the findings, Professor Ove Nilsson of Umeå Plant Science Centre said: "The characterisation of the bolting gene B, now termed BvBTC1, and the finding that it has a key role in the regulation of flowering, is a major achievement both for the sugar industry and for flowering control research."

Kiel's Professor Christian Jung called the results groundbreaking, "because the genetic mechanism controlling flowering in sugar beet differs from all other plants that have been examined so far."

More information: Pin, P.A. et al., 'The Role of a Pseudo-Response Regulator Gene in Life Cycle Adaptation and Domestication of Beet', *Current Biology*, 2012, published online 17 May.

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