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Speed breeding practices in sugar beet: An application to Yellowing disease resistant breeding.

Biennial sugar beet (*Beta vulgaris*) can ensure high sugar production in the field by continuing to grow vegetatively until harvest, but they require several months of vernalization period to induce flowering to obtain seeds. This absolute vernalization requirement is a decisive factor in the lifecycle of a biennial plant. Interestingly, two strains have been found in biennial sugar beet that can flower quickly under a 24-hour condition without being exposed to cold temperatures. We named the flowering characteristics 'BLOND' (bolting by longer than natural daylength) and made crossings between strains of the BLOND and normal biennial to obtain segregating generations of F1, F2 and BC1F1. Their flowering rates were investigated under a 24-hour day length by supplementing light at night both in summer and winter. Those results suggested that they were controlled by a few strong genes with dominant effect. Thus, the flowering tendency of BLOND can be applied for speed breeding. Furthermore, as a case study, this study demonstrates that by simultaneously using its speed breeding platform based on BLOND and the already developed DNA marker selection, yellowing disease resistance breeding can be achieved in a short period of time.