

# Breeding for winter-annual growing of caraway (*Carum carvi*)

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Caraway (*Carum carvi*) is a member of the *Apiaceae* family. It is used as a spice and pharmaceutical easing gastrointestinal afflictions. The effect is attributable to essential oil content. Major components are carvone and limonene. For pharmaceutical use the European pharmacopoeia demands an essential oil content above 3 % by distillation. Besides economic issues, growing of caraway provides benefits in crop rotation for subsequent crops and increases agricultural diversity. In addition, a variety of insects finds nourishment in caraway fields during flowering.

However, as a slow growing crop caraway is particularly affected by extreme environmental conditions. In 2018, yield losses up to 80 % due to summer drought were measured in Saxony-Anhalt. Furthermore, severe infections by powdery mildew were observed in late ripening caraway trials. As one possible solution, we suggest avoiding such conditions by winter annual growing. Sowing in autumn would result in earlier ripening and harvesting in the following year. However, this strategy requires adapted genetic material: Biennial cultivars, which are still widely grown in Europe, need vernalization for flowering induction. The necessary plant size to receive the cold stimulus is usually not reached after late sowing. The newly bred Czech variety

'Aprim' instead lacks a vernalization requirement. Furthermore, annual breeding lines with potential winter-hardiness were found and preselected.

In 2018/2019, 'Aprim' and four preselected lines were tested for winter-hardiness and essential oil content by sowing in parcels of 12 m<sup>2</sup> in four repetitions. Essential oil content was estimated using non-invasive near infrared spectroscopy (NIRS). Predictions were based on extraction values as reference, which were measured by gas chromatography flame ionization detection (GC-FID). At last, predicted extraction values were corrected towards distillation by a regression function. Both, extraction and distillation values were gathered in prior trials.

'Aprim' was found to have a sufficient winter survival rate of about 91 % ± 6 % S.E., whereas even the best breeding line showed only a winter survival rate of about 34 % ± 10 % S.E. By contrast for 'Aprim' an essential oil content of 2.1 % ± 0.05 % S.E. was estimated, whereas even the breeding line with the lowest average content reached 4.8 % ± 0.24 % S.E.

For future efforts, it follows that crossings between 'Aprim' and breeding lines of high essential oil content might be the most promising way to gain genetic material for winter annual growing.