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A European study on the time of flower initiation in apple

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Apple trees induce new flowers in the middle of summer for the subsequent season. This ontogenetic process starts with flower induction followed by flower initiation and floral organ development. Many studies have been performed to determine the exact time point of flower induction at microscopic level in the past and doming of the apex was defined as first sign of floral commitment. Several research projects were focused on transcriptional changes in relation to flower induction, but the results obtained do not provide sufficient evidence about the exact starting time, the first genes triggering this process at the molecular level and environmental factors responsible for the developmental switch from the vegetative to the generative state. All these studies provide only information about the behavior of one specific genotype in response to the environmental conditions at the place of investigation. A systematic study across multiple environments is still missing.

Therefore, a first European study was performed using the cultivar 'Golden Delicious' as a model. Spur buds of 'Golden Delicious' were investigated at jointly defined time points starting in spring right after full bloom until autumn in Sweden, Germany, Italy, Bosnia & Herzegovina and Greece. These spur buds were investigated at microscopic level, but also at the level of mRNA expression of known genes involved in flower induction/initiation and floral organ development. The results obtained were compared with widely used phenological and/or ontogenetic marks for estimating the exact time point of floral induction like days after full bloom (DAFB), a certain number of bud scales at the vegetative apex, or a critical number of nodes within the bud. Furthermore, the information retrieved by microscopy and gene expression analysis was compared with different environmental keys like day length, temperature and light intensity, respectively, to identify the most relevant trigger for flowering induction in apple.