FORMATION OF GENERATIVE ORGANS OF APPLE TREE UNDER WATER DEFICIENCY CONDITIONS

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Background: In apple trees, floral bud initiation, differentiation and formation of generative organs occur in the summer-autumn period preceding flowering. Among the factors that can change the regularity of these processes, water regime is a crucial aspect.
The aim of this study was to identify the characteristics of the formation of apple tree generative organs depending on the variety and to evaluate the effect of water deficiency on floral morphogenesis and the quality of flower buds.
Materials and methods: Floral buds of apple trees of the Granny Smith and Golden Spur varieties were examined in dynamics, from the moment of initiation (June of the previous year) until the moment of flowering, 50 buds in each sample from control trees (irrigation, around 90% soil water content) and trees growing at a moisture level of 30% of the control.
Results: The formation of flower buds in the apple tree begins in June after the end of the first wave of shoot growth. The beginning of formation and the rate of differentiation largely depend on climatic factors and the characteristics of the variety. The generative organogenesis is the most important element of tree productivity. In the summer, the differentiation of fruit buds depended on the degree of water stress, which often led to a stop of this process. Trees affected by drought in the moment of bud initiation were able to recover the differentiation process after optimization of the water regime, showing physiological plasticity expressed in the normalization of the formation of flower buds. During the drought that lasted throughout July, the trees' ability to recover was not observed, which disrupted the process of flower bud differentiation. It was found that trees exposed to summer water deficits had bigger buds. This may be due to increased levels of abscisic acid, which stops plant growth and stimulates earlier bud formation in drought conditions as a response to water stress. In addition to slowing down development and changes in bud size, water deficiency leads to the formation of abnormal flowers. Water stress in the autumn negatively affected bud size. During this period, water deficit can cause strong competition between the buds, which complete the organogenesis of the flower in early autumn. As a result, morphological abnormalities and signs of browning and tissue necrosis were observed in the flower buds. Almost all the examined flower buds collected from control trees had morphologically well-developed generative organs, and only 3% showed abnormalities. In contrast, the number of abnormal flower buds in trees growing in drought conditions varied from 10% to 12%. The most frequent abnormalities were associated with necrosis at the ovary or pistil level. Flowering, as usual, occurred in the 2-3 decade of April without differences between the variants. However, there is a difference in the varieties: Granny Smith begins to bloom in the second decade of April, while Golden Spur - in the third. Apple trees exposed to water deficit showed a reduced number of flowers compared to the control.
Conclusions: This study highlights the importance of water availability in the summer-autumn period to provide better conditions for the formation of normal floral buds to avoid crop decline or loss in the coming year. With the dry and hot autumn-winter seasons increasing in recent years, optimal water supply is becoming essential.
Keywords: floral buds, differentiation, apple trees, drought, water deficit.