

ANATOMIC CHANGES IN THE EPIDERMIS STRUCTURE OF THE LEAF APPARATUS AS AN INDICATION OF THE INFLUENCE OF PHYSIOLOGICALLY ACTIVE SUBSTANCES ON THE PLANT BODY

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Special features of the inflow, moving and translocation of physiologically active substances (herbicides, plant growth regulators and others) influence considerably anatomical and morphological structure of certain cells, tissues and organs. At a later stage this determines main features of the plant body functioning and affects productivity of young crops.

At present it has been proved that xenobiotics are able to move quickly in plants to the zones with the highest meristematic activity. In these zones they directly or indirectly (because of the disbalance of endogeneous phytohormones and of physiological and biochemical processes) influence the stages of cell development. The cells respond to chemical stimulus in the most active way at the embryonal stage. This was proved by the example of applying carboxylic acids, thiocarbonates, dinitroanilin and other herbicide compounds. Mitotic activity of cells at the stage of division can be violated under the application of herbicides. This in its turn causes disbalance of the stages of stretching and differentiation of cells and changes in anatomical and morphological structure of certain embryonal tissues and organs.

The formation of anatomical and morphological structure of plants is considerably affected by exogenous plant growth regulators. Thus, in most cases they enhance mitotic activity in meristem of plants. However, far too little attention has been paid to the study on their influence on anatomical and morphological changes in plants during their combined use with herbicides. At the same time few studies on this issue indicate that the optimal rates of herbicides applied together with plant growth regulators cause the increase of the size of epidermic cells per unit leaf area and the length of stomata. This corresponds to the functioning of leaf apparatus which has optimal surface and photosynthetic productivity. In this respect thorough study of anatomical structure of certain tissues and organs of agricultural crops is of great importance for complete disclosure of xenobiotics mode of action on plant bodies as this enables to optimize the rates of applied preparations and decrease their negative impact on the environment. From these considerations the influence of herbicides belonging to different chemical classes applied separately and in the mixtures with biologically active substances (plant growth regulators and microbiological preparations) on anatomical plant structure of spring barley was carefully examined. The examination of anatomical structure was carried out according to the procedure described by Z.M. Hrytsayenko, A.O. Hrytsayenko and V.P. Karpenko (2003).

The results of the undertaken study indicate that herbicides depending on the chemical composition of the active substance, the application rate and their combination in mixtures with biologically active substances are able to influence significantly the formation of anatomical structure of leaf apparatus, in particular epidermis. Thus when applying higher rates of herbicides Granstar 75 (25g/ha), 2,4 DA – 500 (1,0 l/ha), Dicopur F 600 (1,5 l/ha), Lintur (140g/ha), Harmony (20g/ha) and Caliber (70 g/ha) to spring barley plantings the number of epidermic cells per 1mm² of leaf increases. The increase in a number of epidermic cells is related to the formation of xeromorphic features which characterise the plants that grow and develop under unfavourable conditions. This is proved by the calculated coefficient of morphostructure of epidermis (the ratio of the number of epidermic cells per unit leaf area in the variant when preparation is used to the number of epidermic cells in the variant without preparation application).

Our calculations illustrate the following: the lower the value of the coefficient (lower than 1), the less is the number of cells formed per unit leaf area, though they have larger size and surface. This anatomical structure corresponds to mesomorphic type of leaf surface and characterises mesophytic plants that have high productivity.

At the same time the increase of the coefficient (up to 1 and more) indicates the increase of the number of epidermic cells per unit leaf area, though surface of cells in this case decreases and this corresponds to xeromorphic type of leaf apparatus which characterises xeromorphic plants. Thus in case of application of optimal rates of herbicides in the mixture with biological preparations, the coefficient of morphostructure of epidermis was 0,80 – 0,90 and this corresponds to mesomorphic type of leaf area and conforms with the highest indices of plant productivity.

Generalized data of the research into morphostructure of leaf epidermis when applying herbicides of different chemical classes and their combinations with biologically active substances show that the leaf apparatus of spring barley with optimal structure is formed when the index of morphostructure is 0,7-0,9, its value is 0, 9 -1,0 and higher. In this case leaf apparatus with xerophytic properties is formed which leads to the decrease of leaf area and its productivity.

Thus anatomical changes in the epidermis structure of the leaf apparatus under the application of physiologically active substances is a direct reflection of the level of the preparations influence on metabolic processes in plants and may serve for disclosing of mode of action of investigated preparation on the plant body at different stages of its growth.