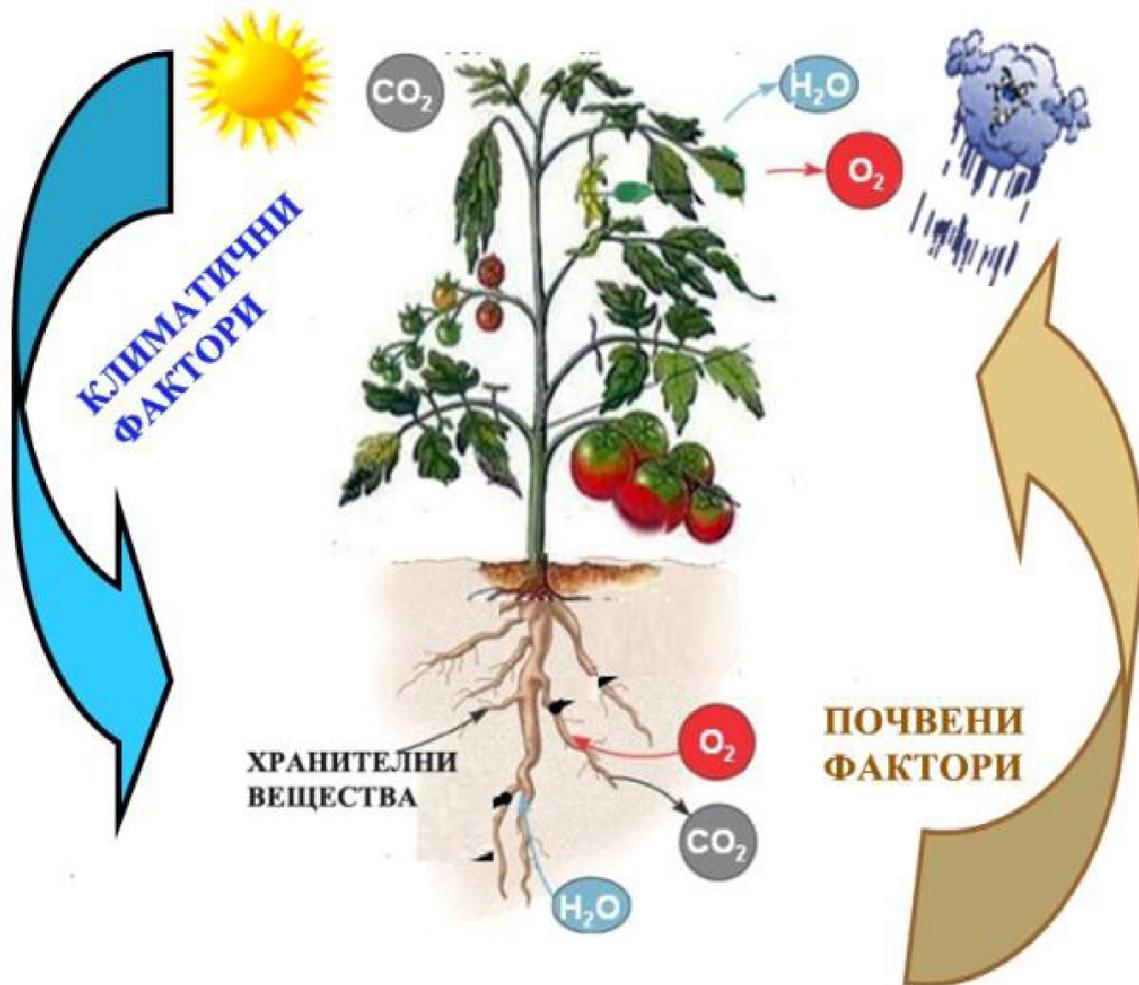


Visual diagnostics – Can we “talk to plants”?

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All plants suffer from physiological disturbances (non-infectious diseases) caused by a number of abiotic factors. As a result, product quality decreases, yield diminishes, and/or plant growth and development are stunted. In many cases, these disturbances can be avoided or overcome if their symptoms are known and the causes that generate them are understood. Consequently, subsequent crop protection activities are related to the correct implementation of the most appropriate agricultural practices under specific conditions.

Visual diagnostics allow one to „converse” with plants and determine physiological disturbances by their external appearance. These disturbances are caused by various factors – environmental impact, plant diseases and

pests, damage from herbicide application, air pollution.

Through their reactions to growing conditions, plants communicate with us. Therefore, any deviation from the normal appearance of the cultivated crop should be a cause for concern. It is a signal for disruptions in the plant's life cycle, which affect yield and/or product quality and can lead to significant economic losses. That is why identifying visual symptoms is the first step and a very powerful diagnostic tool in assessing the nutritional and/or health status of plants. The method is simple, accessible for widespread use in agriculture.

Visual diagnostics is a qualitative method based on the fact that the absence, deficiency, or excess of a given nutrient element leads to a disruption of the biochemical processes occurring in the plant. This, in turn, results in changes in its external appearance – alteration of leaf color, size, or shape, appearance of spots on them, shedding of leaves or fruits, changes in reproductive organs, alteration of the overall appearance of the plant. In more severe cases, the plant dies.

A major disadvantage of this method is that external signs of deficiency or excess appear very late, when impaired nutrition has led to deep, irreversible changes, and human intervention is not always effective. Therefore, it is important to identify the first signs and immediately react with the necessary agricultural practices to overcome the given problem.

The changes that occur are diverse, as the physiological role of nutrient elements varies. However, visual diagnostics are not always sufficient to determine the nutritional status of the plant. It is difficult in many cases:

- Simultaneous deficiency of two or more elements, which results in symptoms not characteristic of any of them.
- In many crops, the signs of deficiency and excess of a given element are similar.
- The manifestation of deficiency or toxicity symptoms depends on the crop and variety.
- Symptoms of deficiency of one element may be similar to symptoms of toxicity from another element.
- Diseases and pests often cause symptoms similar to impaired nutrition.
- The deficiency or excess of a given element may be due not to an actual deficiency or excess of the element in the soil, but to other factors (soil-climatic) that affect its uptake by plants – low or high temperature, insufficient or excessive moisture, unfavorable ratio between nutrient elements, etc.
- Changes in the external appearance of plants may be due to phytotoxicity caused by improperly conducted spraying with plant protection products or foliar fertilization.

Therefore, visual diagnostics should be accompanied by a chemical analysis of the soil or plants to clarify the causes of disturbances in plant growth and development, i.e., to elucidate the interaction between various factors in the soil-plant system and to increase the effectiveness of fertilizers and other yield-enhancing factors.

One of the most important factors for effective crop production is a balanced nutritional regime. But it is a dynamic factor that constantly changes depending on the plant's development stage and specific soil-climatic conditions. Therefore, timely identification of symptoms caused by nutritional disorders in plants and distinguishing them from symptoms caused by diseases and pests helps to avoid long-term plant damage.

However, the limited capabilities of visual diagnostics should not be forgotten. On one hand, it is a qualitative method and can „tell” us that nutrition with a given element is impaired, but not indicate the necessary amounts of fertilizer to be applied. On the other hand, symptoms of impaired nutritional status may appear when irreversible changes have occurred in the plant organism, making it difficult to make the appropriate correction for plant recovery, which could result in significant economic losses for the producer. Therefore, the importance of soil analysis, which provides direct information about the soil's nutritional regime, and plant analysis, which allows detection of nutritional disorders in plants before external morphological changes appear, should not be underestimated.