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Визуal diagnostics – are we able to “communicate with plants”?

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All plants suffer from physiological disorders (non-infectious diseases) caused by a number of abiotic factors. As a result, product quality is reduced, yield decreases and/or the growth and development of plants are inhibited. In many cases, these disorders can be avoided or overcome if their symptoms are recognized and the causes that give rise to them are known. The subsequent crop protection activities are related to the correct implementation of the most appropriate agronomic practices under the specific growing conditions.

Visual diagnostics makes it possible to “communicate” with plants and to determine physiological disorders by their external appearance. These disorders are induced by various factors – environmental impact (nutritional regime, climatic factors), plant diseases and pests, damage from herbicide application, air pollution.

Visual diagnostics is a *qualitative method* based on the fact that the absence, deficiency or excess of a given nutrient leads to disruption of the biochemical processes taking place in the plant. This results in changes in its external appearance – change in the colour, size or shape of the leaves, appearance of spots on them, leaf or fruit drop, alterations of the reproductive organs, change in the general appearance of the plant. In more severe cases the plant dies.

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

The resulting changes are different because the physiological role of the nutrients is different. Nevertheless, visual diagnostics is not always sufficient to determine the nutritional status of the plant. It is impeded in many cases, such as:

- Simultaneous deficiency of two or more elements, in which case symptoms appear that are not characteristic of any one of them.
- In many crops, the symptoms of deficiency and excess of a given element are similar.
- The manifestation of symptoms of deficiency or toxicity depends on the crop and the variety.
- Symptoms of deficiency of one element may be similar to the symptoms of toxicity of another element.
- Diseases and pests often cause symptoms similar to those of disturbed nutrition.
- Deficiency or excess of a given element may not be due to a real deficiency or excess of that element in the nutrient medium, but to other factors (soil and climatic) that affect its uptake by plants.
- Changes in the external appearance of plants may be due to phytotoxicity caused by improperly carried out spraying with plant protection products or foliar fertilization.

Therefore, *visual diagnostics should be accompanied by chemical analysis of the nutrient medium or of the plants*, in order to clarify the causes of disturbances in the growth and development of the cultivated crop.

The causes of disturbances in plant nutrition can conventionally be divided into three groups:

- **Deteriorated nutritional regime –** lack, deficiency or excess of nutrients, unfavourable reaction (pH) of the nutrient medium, salinization, unfavourable ratio between nutrients (*antagonism* – a phenomenon in which ions interfere with each other in their uptake by plants, *synergism* – a phenomenon in which ions facilitate each other's uptake by plants).

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- **Adverse growth factors** – conditions of the nutrient medium (temperature, oxygen content, drought, waterlogging, etc.), climatic conditions (air temperature and humidity, solar radiation).
- **Air pollution** with gases (ozone, carbon dioxide, sulphur dioxide, ammonia, etc.) that may have a direct toxic effect or may indirectly and more long-term affect plants by changing the acidity (pH) of the nutrient medium.