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Research Article

CHEMICAL COMPOSITION OF PLANTS AND ITS ANALYSIS

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ABSTRACT

In recent years, consistent reforms have been implemented in the republic on the protection of medicinal plants, the rational use of natural resources, the creation of plantations for the cultivation of medicinal plants and their processing. The chemical composition of plants and the quality of the harvest depend on the amount of dry matter in the plant, consisting of water and organic and mineral compounds. If the amount of water in the vegetative organs of most crops is 70-95 percent, then in their seeds this figure can range from 5 to 15 percent.

KEYWORDS

In the plant, consisting of water and organic and mineral compounds.

INTRODUCTION

The ratio of dry matter and water in a plant is not always the same, it changes depending on the biology of the plant, its age and growing conditions. Cereals contain 85-88 percent dry matter and 12-15 percent water, tomatoes and cucumbers contain 4-8 percent dry matter, 92-96 percent water, and root vegetables contain 20-25 and 75-80 percent, respectively. The dry matter of agriculturally grown plants consists of 90-95 percent of organic compounds - proteins and other nitrogenous substances, carbohydrates (sugars, starch, fiber, cellulose, pectin) and fats, as well as various mineral compounds.

Currently, as a result of scientific research, it has been established that 20 elements are absolutely necessary for the normal development of plants, and 12 are conditionally necessary (conditionally necessary elements are indicated in brackets):

I. H (Li), Na, K, Cu, (Ag)

II. Mg, Ca, Zn, (Cr, Cd)

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III. B, (AL)

IV. C, (Si, Ti, Pb)

V. N, P,V

VI. O, C, Mo, (Cr, Se)

VII. Cl, I, Mn, (F)

VIII. Fe, Co, (Ni)

In addition to C, O, H, nitrogen, phosphorus, potassium, calcium, magnesium, iron and sulfur are necessary for the normal development of plants. These are microelements (phosphorus, potassium, calcium, magnesium, iron). The above elements are relatively abundant in plants, from a few percent to a hundredth of a percent of dry matter, and therefore they are macroelements. In addition to the macronutrients mentioned above, small amounts of manganese, molybdenum, copper, zinc, cobalt and vanadium are necessary for normal plant growth and development. The amount of each of these elements in a plant ranges from one thousandth to one hundred thousandth of a percent, which is why they are called trace elements. When assessing the quality of agricultural crops, the assessment is based on the content of organic compounds necessary for humans - proteins, fats, carbohydrates, vitamins and other indicators. These compounds are formed in the plant simultaneously and as a result of nutrition from the root.

Proteins are high-molecular organic substances consisting of hundreds and thousands of amino acid residues, which are crucial in metabolism and are one of the main reserve substances of plants. The elemental composition of proteins is unchanged, i.e. constant, in which there is 51-55 carbon, 21-24 oxygen, 15-18 nitrogen, 6.5-7 hydrogen and 0.3-1.5 percent sulfur. According to their structure, proteins are divided into two groups: simple proteins consisting of amino acid residues, i.e. proteins, and complex proteins tightly linked to each other by non-protein compounds.

The main structural unit of all proteins are amino acids - organic fatty or aromatic acids containing, in addition to carboxyl groups (COOH), one or two amino groups (NH_2).

In general, plant proteins consist of 20 amino acids and two amides. It is very important that plant proteins contain "essential" amino acids (valine, leucine, isoleucine, trenine, methionine, cystidine, lysine, tryptophan and phenylalanine), since they are not broken down in the body of humans and animals. Humans and animals receive these amino acids only from plants along with food and feed. Therefore, the quality of plant products is assessed not only by the amount of proteins, but also by their digestibility and overall value based on determining their fractional and amino acid composition.

The amount of proteins in the vegetative organs of plants is usually 5-20 percent of their mass, 6-20 percent in the seeds of grain crops, and 20-35 percent in the seeds of legumes and oil crops. When assessing the quality of agricultural crops, most flours use the "crude protein" indicator, which is the sum of all 19 nitrogen compounds (protein and non-protein compounds). "Crude protein" is calculated by multiplying the total amount of nitrogen in plants by 6.25 (the average amount of nitrogen in protein and non-protein compounds is 16 percent).

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Carbohydrates are sugars (monosaccharides and oligosaccharides containing 2-3 monosaccharide residues) and polysaccharides (starch, cellulose, pectin substances) in plants. The products of all agricultural crops contain small amounts of sugar, which is stored in the roots and some parts of vegetable crops, grapes, berries and fruits. In most plants, monosaccharides are predominantly glucose and fructose, while oligosaccharides are in the form of the disaccharide sucrose. Monosaccharides, primarily glucose, are the main source of energy during plant respiration, and its phosphate esters, together with other sugar phosphates, are involved in photosynthesis, the breakdown of complex carbohydrates and other metabolic processes. Glucose is found in large quantities - up to 8-15% in grapes, while the total amount of carbohydrates in fruits and berries is about half. Fructose is contained in grain fruits by 6-10%, and in honey it is more concentrated. It is a disaccharide consisting of sucrose-glucose and fructose, which is found in fruits and berries, as well as carrots, beets and onions in amounts up to 4-8 percent. Sucrose makes up about 14-22 percent in sugar beets and 11-25 percent in sugar cane juice and is the main carbohydrate reserve. Therefore, the purpose of growing these crops is to obtain raw materials to satisfy human needs for sugar.

Starch is mainly stored in tubers, bulbs and seeds as the main reserve of carbohydrates. The amount of starch in tubers of early potato varieties is 10-14%, and of middle and late varieties - 16-22%. The amount of starch in the grain of plants of the cereal family is about 55-70 percent. Starch is a carbohydrate that is easily absorbed by the human and animal body and is broken down into glucose by enzymatic (using amylase enzymes) and acid hydrolysis. Fats and fatty substances (lipids) are structural components of the cytoplasm of plant cells, and in oilseeds they act as reserve compounds.The average oil content of the most important agricultural oilseeds and soybeans is as follows (in %):

Sesame - 60 Flax - 30

Sesame - 45-50 Hemp - 30

Olive - 45-50 Seed - 25

Sunflower - 24-50 Soya - 20

The chemical composition of the oils is a mixture of esters of trihydric alcohol, glycerin and molecular fatty acids. Vegetable oils contain unsaturated acids such as oleic, linoleic and linolenic acids, and saturated acids such as palmitic and stearic acids. The composition of fatty acids in vegetable oils determines their basic properties - the level of viscosity (consistency), liquefaction temperature, drying, boiling and saponification properties, as well as their nutritional value. Vegetable oils contain linoleic and linolenic fatty acids, "essential" for humans, which are not broken down in the human body. Lipids include phosphorites, waxes, carotenoids, steorins and fat-soluble vitamins A, D, E and K. Cellulose is the main part of the plant cell wall, which is associated with lignin, pectins and other compounds. Cellulose consists of 95-98% cotton fiber, 80-90% flax, hemp and flax fiber. Among cereals, fiber makes up 10-15% in the seeds of oats, rice and millet, 3-5% in the seeds of cereals and legumes, 1% in tubers and potato tubers. The amount of fiber in the vegetative parts of plants ranges from 25 to 40 percent of their dry weight. When cellulose is completely broken down, it produces glucose. Pectins are high molecular weight polysaccharides found in fruits and plant fibers.

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These substances bind together separate bundles of fibers in fibrous plants, and are also widely used in the confectionery industry. The structure of these polysaccharides is based on a chain consisting of methyl groups with polygalacturonic acid residues formed when the monosaccharide galactose is proteinized. The number of individual groups of organic compounds in agricultural plant products and the quality of the product fluctuates to a certain extent depending on the biological characteristics of the plant, variety and growing conditions, and agricultural technology. To increase the number of crops and improve their structural qualities, it is important to properly organize plant nutrition conditions. For example, an increase in nitrogen nutrition of plants increases the size of the main crop and its protein content, and phosphorus-potassium nutrition causes the accumulation of sugar in sugar beets and a large amount of starch in potato tubers. Also, phosphorus-potassium fertilizers increase the amount of oil in oilseed plants and improve its quality indicators. So, by creating favorable conditions for plant nutrition with the help of fertilizers, it is possible to increase their productivity, the amount of the most necessary organic compounds in dry matter, and quality indicators.

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