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Study The Effect Of Phytohormones On The Physiological And Biochemical Properties Of Common Bean And Broad Bean

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Abstract
This article provides information on the importance of phytohormones in ensuring high and quality yields from broad bean and common bean. According to it, the correct selection of the type, rate, and duration of phytohormones based on the climatic conditions of the plant serves to increase high yields and grain quality.
Keywords: broad bean, common bean, yield, phytohormones, Gibberellin, Cytokinin, Auxin, Silicic acid (SA), Abscisic acid (ABA).

Introduction. Today, the world's population's demand for sustainable food supply and high-protein products is increasing the importance of legumes. Among them, broad bean (Vicia faba L.) - a crop widely known as broad beans, plays an important role in human nutrition, animal husbandry, as well as maintaining soil fertility. Broad beans contain an average of 24–32% protein, 50–60% starch, essential amino acids, vitamins and minerals, making them a strategic food crop in the world market. According to the Food and Agriculture Organization of the United Nations (FAO) [7; p. 196], the demand for Vicia faba has been growing steadily over the past decade. By 2020 [8; 366-p.] Vicia faba is cultivated on more than 2.5 million hectares in the world, with a total production volume of more than 5.7 million tons. The largest producing countries include China, Ethiopia, Great Britain, Australia and Canada. The average yield in these countries is 1.8–3.2 t/ha.

The cultivation of Vicia faba in the world continues to grow by 2–3% per year. The main reasons for this growth are: the increase in the global need for high-protein food; the increase in the demand for cheap and high-quality protein for livestock; the role of the crop in increasing soil fertility; stress resistance in the conditions of climate change.

Another important aspect of the legume crop is its effectiveness as a repeat crop. Due to its short growing season (80–110 days), high growth vigor and heat resistance, the volume of planting in repeat areas is expanding year by year in European, Asian and African countries.

In the conditions of the Republic of Uzbekistan, the expansion of legume crops is also an urgent task. A number of state programs are being implemented in the republic to increase the volume of legume crops. The resolutions and decrees of the President of the Republic of Uzbekistan, such as PF-4947 [12], PQ-2832 [13], on the diversification of agriculture and the widespread introduction of protein-rich crops, create great opportunities for the development of broad beans in repeated areas. Broad beans Vicia faba L. (family Fabaceae), also known as broad beans, are an important legume crop. It has the ability to grow in a variety of climatic conditions (Abdel Latef et al., 2018), [1; pp. 1065-1073]. According to FAOSTAT [9] (2019), this crop is cultivated on an area of about 2.6 million hectares worldwide and yields about 5.4 million tons per year. Known for its nutritional value, legume contains 27-40% protein, 50-60% carbohydrates, as well as essential minerals and vitamins. In addition, its ability to fix nitrogen contributes to the sustainability of agriculture by

increasing soil fertility and overall productivity (Kumar et al., 2015), [11; pp. 159-162].

The main factor in the growth and development of plants are hormones. Phytohormones are organic substances with relatively small molecular mass and have high physiological activity. Their amount in tissues is very small, that is, in picogram and nonogram masses relative to 1 g of water weight. Phytohormones are synthesized in tissues and organs and act at very low concentrations (10’13 - 10’5 mol/1). In some cases, they are synthesized and act within a single cell. Phytohormones differ from other physiologically active substances, such as vitamins and trace elements, in that they contain a whole physiological and morphogenetic program. For example, root formation, fruit ripening, and other physiological processes are examples of this. Currently known phytohormones are derivatives of amino acids.

Methods and Materials. The studies were conducted in laboratory and field experiments using physiological and biochemical methods. Field experiments “Methods of conducting field experiments”, “Methodology of field experiments” (B.Dospekkhov), “Methodology of the State Variety Testing of Agricultural Cultures”, “Methods of agrochemical, agrophysical studies of the soil of Central Asia”, Leaf area (Leaf Area Meter), chlorophyll content (SPAD-502 plus) and Total chlorophyll (Chl a + Chl b) Spectrophotometer equipment, physiological experiments such as “Practical on plant physiology” O.M.Khramchenkova, net productivity and potential of photosynthesis A.A.Nichiporovich (weight method), number and weight of nodules G.S.Posipanov, biochemical composition of stems and grains in Soxhlet and Lowry equipment, and organoleptic (sensory method), Krember methods and V.N.Polozhiy methods were used to determine economic indicators.

Gibberellin GAs are mainly diterpenoid acids with four rings (tetracyclic) in their structure. There are different types of GAs (GA_1, GA_3, GA_4, GA_7) - some of them are biologically active. They can be produced in the seeds, young leaves and roots of the plant, but in plants they are mainly found in growing parts: seeds, growing tips of the stem, young leaves, roots [6; 761-p.]. The main functions are as follows:

-stem elongation: when GA is applied, internodes lengthen, stem height increases;

-seed initiation: stimulates the synthesis of enzymes that break down reserve substances (e.g. starch) in the seed, thereby initiating the growth process;

-dormancy breaking: when shoots or seeds are in a state of prolonged dormancy, GA prepares them for growth;

-leaf and fruit development: leaf surface expansion, fruit growth, and sometimes seedless fruit formation are also associated with GA;

-senescence delay: GA helps to slightly delay the aging process of leaves and other organs.

Mechanism of action. GA binds to a receptor in the plant and through this binding forces the degradation of DELLA proteins that inhibit growth. GA turns on the growth mode by “killing or stopping” it. There is also an interaction between GA and other hormones (Auxin). However, if used in the wrong amount or under the wrong conditions, growth can exceed the norm and cell structure can be damaged.

Cytokinins are phytohormones that stimulate cell division in plants and control development[7; p. 682]. Chemical, distribution and main properties: mainly adenine-like molecules with various additions at the N6 position (compounds such as Zeatin, Kinetin and 6-Benzylaminopurine), are formed in roots, young leaves, meristematic (actively

dividing) tissues, and then spread throughout the plant. Cytokinins are transported from the roots to the upper parts (branches, leaves) through the xylem tissue. Their action is carried out by special “two-component” conducting cells: receptors, phosphate transfer proteins and response regulators are activated inside the cell. Main biological functions: stimulation of cell division (cytokinesis) and meristematic activity - they promote the formation of new cells, branching and development of side shoots - high cytokinin levels promote bud opening and branching, reduction of apical dominance, i.e., activation of side branches in addition to the main branch. Delaying the aging of leaves and organs - cytokinins help maintain the green color of leaves, slow down the loss of chlorophyll and protein. Promotes the development of chloroplasts and photosynthesis - promotes the proper formation of chloroplasts in leaf cells. Also participates in functions such as nutrient transport, germination, and the development of root and shoot tissues.

Auxin is a natural compound (hormone) produced by plants that plays an important role in the growth and development of plants. Auxins affect various developmental processes in plants, including cell elongation, root and leaf development, and plant elongation.

Salicylic acid (SA) is an important phytohormone (plant hormone) that regulates plant growth, development, photosynthesis and, most importantly, triggers defense systems against pathogens (e.g. fungi, viruses) and environmental stresses (abiotic), inducing systemic acquired resistance throughout the plant. It is a natural phenolic compound essential for balancing growth and immunity, and acts as an important signaling molecule.

Abscisic acid (ABA) is an important plant hormone that regulates growth, development and stress responses, and is known as the "stress hormone" for its role in closing stomatal pores during drought, inducing dormancy (buds, seeds) and controlling fruit ripening, mainly acting as a natural inhibitor of germination and growth to help plants survive harsh conditions such as drought, cold and high salinity. It balances growth with survival, influences leaf senescence, wax accumulation, and coordinates responses through complex signaling pathways involving receptors such as PYR/PYL/RCAR.

Expected results from the research. To ensure active growth and development of fava bean and common bean and high-quality grain yields, optimal methods and norms for applying phytohormones to them are being determined, and resource-saving technologies are being developed through these methods, which will increase the economic efficiency of cultivation technology and reduce the cost of the resulting product. It is expected that fava bean and common bean will increase the fertility of soils cultivated.

Conclusion. Currently, the use of phytohormones is expanding. Through their proper use, in addition to obtaining high-quality and high-yield fava bean and common bean, resource-saving technologies are being developed, which will increase the economic efficiency of cultivation technology and reduce the cost of the resulting product. It is expected that legumes and beans will increase the fertility of soils where they are grown.

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