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Formation Of a Photosynthetic Apparatus in *Phaseolus Vulgaris L.* Depending on The Application of Gibberillin and Succinic Acid Growth Stimulators

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Abstract: This article describes that using various growth stimulantors, the largest leaf area and photosynthetic potential are formed. The highest indicators of leaf area were observed in the variants gibberillin and succinic acid - (40.2 and 39.3 m2 / m2). At the same time, the photosynthetic potential (FP) exceeded the control variant by 290.9 and 160.1 thousand m^2/ha/day. It was revealed that, depending on the different methods of seed treatment in the beans of vegetable beans, the content of protein, fat, total sugar, vitamin C, starch and nitrates was different.

Key words: vegetable beans, seed treatment, growth stimulators, leaf area, photosynthetic potential, biochemical composition of beans.

Introduction

At the present stage of the development of technologies for growing agricultural crops, one of their most important elements has become chemical substances that can regulate plant growth - the so-called plant growth regulators. Since hormones are formed in plants in negligible quantities, they are obtained on an industrial scale by synthesis. The use of growth regulators in accordance with the recommendations ensures the necessary and safe effect on the plant. Growth regulators in low doses stimulate the development of plants, and in high doses they inhibit [7, 12, 15, 25].

The multifactorial influence of gibberellins on plant development is striking. The most prominent are their abilities, such as increasing the linear growth of plants, changing the activity of enzymes, increasing the intensity of respiration, and enhancing photosynthesis [3, 9].

In the natural environment, the level of natural gibberellin is not enough for the development of the flowering process, the plants need conditions for a long day and stimulation with gibberellins accelerates the flowering of plants [11, 20].

However, the effect of gibberellin treatments on different plants is expressed in different ways. In some plants, they can prevent a decrease in the amount of chlorophyll and weaken the accumulation of carotenoids in fruits, enhance the processes of axillary branching, while in others, they inhibit chlorophyll synthesis, lengthen the stem and leaf petioles, and in dwarf forms of plants, increase the length of internodes and delay the branching of secondary shoots [14, 22, 23, 27].

According to B.A. Rubin (1976) [18], acting on seeds with gibberellic acid, you can accelerate their germination and increase germination. Treatment with gibberellic acid preparations can dramatically increase or decrease the activity of plant enzymes.

It is noted that seeds have an increased susceptibility to their treatment with gibberellin, since it takes part in accelerating seed germination. In this case, gibberellins act together with cytokinins in this way: first, gibberellins enter the germination process, directing nutrients to the germination site; later, cytokinins are connected, stimulating the formation of new proteins and cells [4, 16].

The research of scientists it follows that the use of auxins and gibberellins on seed material and germinating seeds contributes to the production of plants highly adapted to arid conditions. And the treatment of adult plants with these preparations enhances adaptability, relieves stress and increases productivity [6, 10, 13].

It has been proven that when using growth regulators to increase adaptation to various stressful situations, the maximum possible yield is achieved [8, 17, 21].

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The specificity of the influence of phytohormones is such that, while accelerating the metabolism in the plant, they at the same time enhance the adaptability to stress factors [19].

Scientists have found that treatment with ambiol, sodium humate, crezacin and other regulators of winter wheat seed growth increases the resistance of winter wheat plants to low temperatures and arid conditions [2, 24, 26].

Methodology And Material

Material for research: vegetable beans of the Star East variety, various plant growth stimulants, sodium humate, succinic acid, gibberellin.

Leaf area and net productivity of photosynthesis were determined by phases: branching, flowering, bean formation, and onset of ripening.

Determination of the leaf area was carried out by the method of incisions and dry mass of plants. Samples were taken in four repetitions at three points of a plot with a size of 0.5 m^2 typical in terms of plant density. In laboratory conditions, the number of plants was counted, their height, the number of branches, trifoliate leaves and beans were determined.

The leaf blades were separated from the petioles (petioles were attached to the stems), and the leaves, stems, and beans were weighed separately. 25 leaf blades were taken from the sample and 100 punches were taken in four places of each blade with a special drill. Weighed leaves, stems and beans were ground, taken on an analytical balance, two portions weighing 10 + 0.01 g of each organ into weighing bottles and dried in a drying cabinet at 105 ° C for 4 hours until constant weight. The selected cuttings of the leaf blades were also dried. After drying, the weighing bottles were weighed and the value of the absolutely dry matter of each organ and the cuttings was calculated according to the generally accepted technique (Methodology for conducting field agrotechnical experiments with oilseeds, 2010). According to the value of the absolutely dry mass of leaves and the mass of cuttings, the leaf area per 1 m^2 of sown area was calculated according to the generally accepted method (Nichiporovich A.A., 1956).

Counting the yield was carried out by a continuous method: immediately after harvesting, the seeds from the counting area of each plot were weighed and after weighing, single samples of seeds weighing about 0.5 kg were taken to determine moisture and weediness. The harvest was brought to 100% purity and to standard (14%) moisture content of pure seeds according to the generally accepted method (Methodology for conducting field agrotechnical experiments with oilseeds, 2010).

Determination of oil content, protein content, total sugar, starch, vitamin C, bean seeds was carried out in the laboratory of agrochemistry (Agrochemical service station, together with Kadyrhodjaeva D) on an IR analyzer Matrix-I in accordance with regulatory methods [5].

Research Results

When studying the effect of treatment of seeds of vegetable beans variety Star East with various growth stimulants, it was found that the leaf surface area of plants in all variants actively increased from flowering to the formation of beans, and a decrease in photosynthetic activity occurred from the formation of beans to the filling of seeds [1], (Fig. 1).

As the studies carried out in Fig. 1., seed treatment with various growth stimulants had a significant effect on the growth dynamics of the leaf surface of vegetable beans, which was noted already in the first half of the growing season of plants.

In variants in which the conditions of symbiotic activity were optimized, the leaf surface area reached the highest values. So, in the flowering phase, on average over the years of research in the control variant, the leaf surface index for vegetable beans was 3.28 m^2/m^2, and in the phase of beans formation - 3.93 m^2/m^2, and in the phase of seed filling - 3.96 m^2/m^2. The largest leaf area index was in the gibberellin variant, the flowering phase was 4.27 m^2/m^2, the bean formation phase was 5.21 m2/m2, and in the seed-filling phase - 3.86 m^2/m^2.

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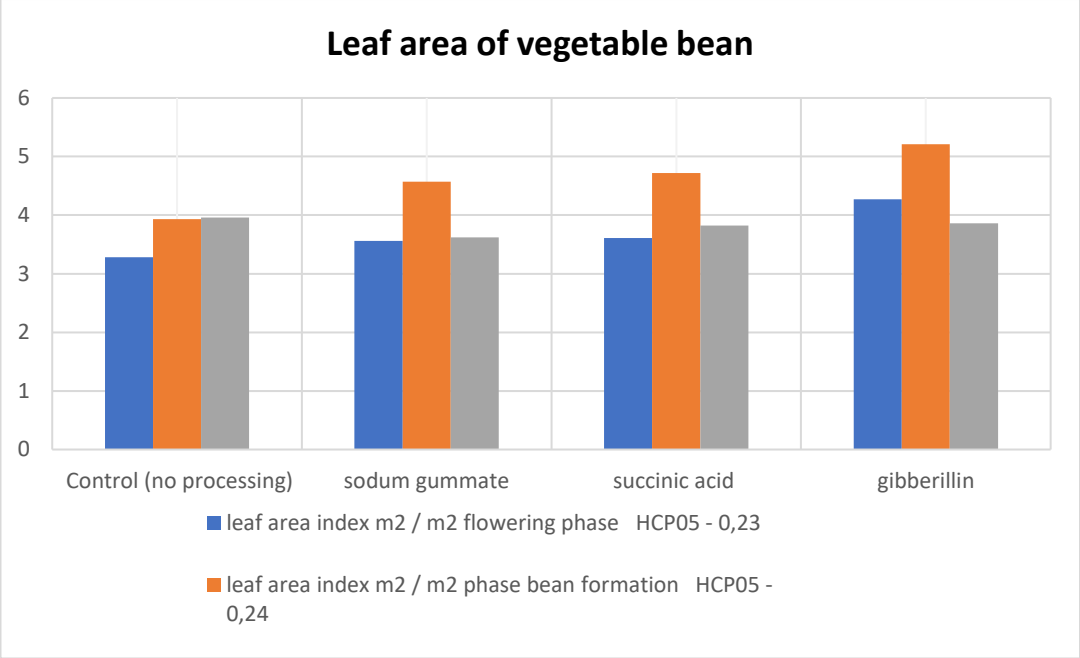

Rice. 1 - Leaf surface area of vegetable bean plants depending on seed treatment with growth stimulants, average for 2020 - 2021.

The assimilation surface of the leaves reached its maximum value in the phase of bean formation. The highest indicators of leaf area were observed in the variants gibberillin and succinic acid - (40.2 and 39.3 m^2/m^2).

It was revealed that during two years of research, seed treatment with stimulants gibberilin and succinic acid contributed to a significant increase in the photosynthetic potential (FP), which exceeded the control by 290.9 and 160.1 thousand m^2/ha/day. (Table 1).

The highest FP was established when processing vegetable beans with a stimulant gibberillin — 1,117.4 thousand m^2/ha/day in comparison with the control variant (without treatment) - 826.5 thousand m^2/ha/day.

The net productivity of photosynthesis reached its maximum value in the phase of bean formation, but no direct dependence on FP has been established.

It was revealed that the indicator of the net productivity of photosynthesis decreased in those variants where the photosynthetic potential increased. This means that the greatest photosynthetic potential was when the seeds of vegetable beans were treated with gibberellin and succinic acid, in comparison with the control variant, while the net productivity of photosynthesis in the same variants decreased, remaining the highest in the control variant.

Table 1.

Indicators of photosynthetic activity of vegetable beans of Star East variety depending on treatment with growth stimulants for 2020-2021

Growth stimulant	Maximum leaf area, thousand m^2/ha	FP, thousand m2/ha/day	FPP, g/m2/day
Control (no processing)	30,7	826,5	3,23
Sodium gummate	32,3	905,8	3,16
Succinic acid	39,3	986,6	3,05
Gibberilin	40,2	1 117,4	2,90
HCP_{05}	2,2	47,2	0,12

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It was revealed that, depending on the different methods of seed treatment in the beans of vegetable beans, the content of protein, fat, total sugar, vitamin C, starch and nitrates was different (Fig. 2).

As shown by biochemical analyzes, depending on various methods of pre-sowing preparation of seeds for sowing, in the beans of vegetable beans of the Star East variety, the protein content varied from 19.7 to 23.3%, oil 1.16-1.43%, total sugars - 3,8-4.5%, vitamin C - 92-106 mg%, starch - 3.0-3.3%, nitrate nitrogen - 105-110 mg/kg, which is significantly lower than the MPC (200 mg / kg).

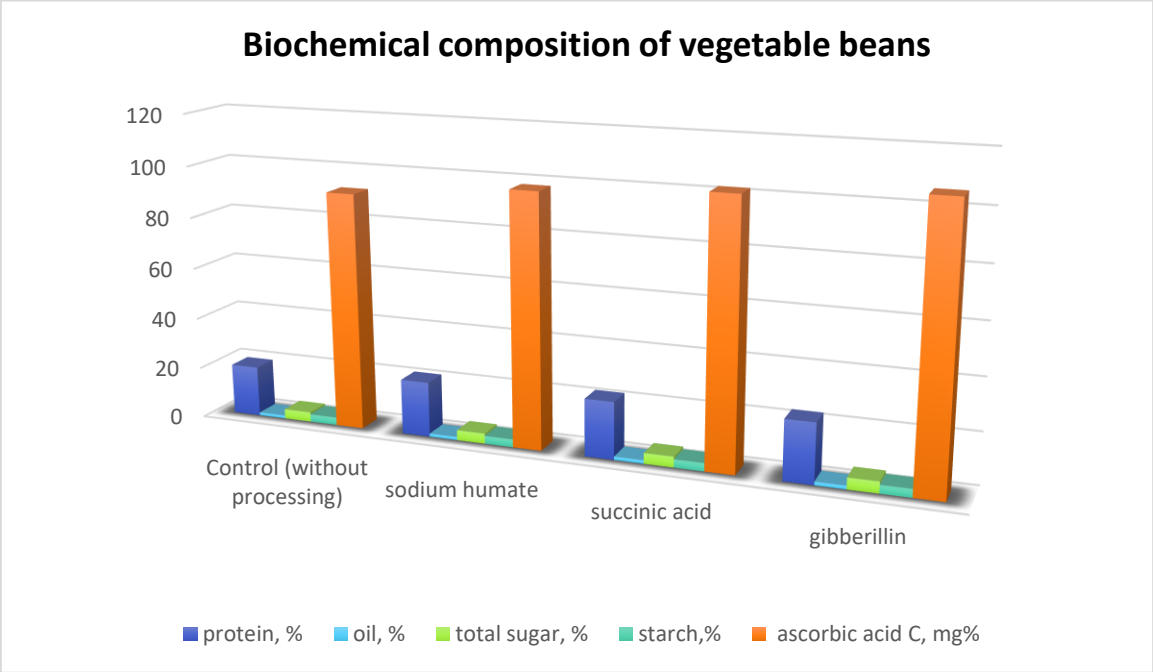

Fig. 2. Biochemical composition of vegetable beans of the Star East variety in the phase of technical ripeness (green beans), depending on the seed locks in various growth stimulators (2020-2021)

Conclusions

Based on the foregoing, it can be concluded that, using various growth regulators, it is possible to influence the physiological processes and biological properties of vegetable beans in the direction desired for humans.

In general, it can be noted that when using various growth stimulants, the largest leaf area and photosynthetic potential are formed. The highest indicators of leaf area were observed in the variants gibberillin and succinic acid - (40.2 and 39.3 m^2/m^2). At the same time, the photosynthetic potential (FP) exceeded the control variant by 290.9 and 160.1 thousand m^2/ha/day.

It was revealed that, depending on the various growth stimulators of seed treatment in the beans, the content of protein, fat, total sugar, vitamin C, starch and nitrates was different.

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