



The Influence of the Norms of Mineral Fertilizers and Biostimulants on the Formation of the Reproductive Organs of Corn

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Abstract: *The article highlights the issues of the influence of the norms of mineral fertilizers and biostimulants on the features of the formation of generative organs of corn in the conditions of gray soils of the Kashkadarya region. Improving plant nutrition with mineral fertilizers (nitrogen, phosphorus, potassium) and biostimulants (Avangard Start, VL-77) somewhat accelerated flowering and cob formation, which ensures a high yield of corn grain.*

Keywords: *Corn, mineral fertilizers, biostimulants, generative organs, cobs, panicles, flowering.*

Introduction. Corn in Uzbekistan is cultivated on an area of about 40 thousand hectares. However, its yield is still low and does not even reach half of the potential of released varieties and hybrids [11,13]. Therefore, the study of the formation of generative organs depending on mineral fertilizers and biostimulants is of great scientific and practical importance. Since in practice it is often found that on the cob of corn there are underdeveloped spikelets in the upper part and sometimes at the base of the cob [1,3,6,7]. This situation negatively affects the formation of yields and the quality of corn grain.

Material and methods of research. The purpose of this study is to improve the performance of the upper part of the cob by improving the nutrition of plants with macro and microelements. A scientific study of the influence of the norms of mineral fertilizers and biostimulants on the number of rudiments of the reproductive organs and subsequently formed on the cob of grains in the conditions of gray earth soils of the Kashkadarya region was not carried out.

Experiments to study the effect of mineral fertilizers on the intensity of the formation of reproductive organs were carried out in 2021-2022. in the farm "Mul khosil sifat" of the Karshi district of the Kashkadarya region with a zoned corn hybrid Uzbekistan 300 MW, according to the "Methodology of field experiments for studying agricultural practices for the cultivation of corn" [5,12]. Accounting and observations on the formation of the fruiting organ of corn - the cob was carried out by the method of biological control of plant development, developed by M.F. Kuperman [9].

The total area of the experimental plot is 92 m², the accounting plot is 58 m², the repetition is 4-fold, the total area of the experimental plot is 4416 m².

The soil of the experimental plot is a typical serozem, slightly saline, humus - 0.81%, phosphorus - 46 mg/kg, potassium - 214 mg/kg. The climate is sharply continental, the average air temperature is 18.0 °C, air humidity is 46%, precipitation is 350 mm.



The following forms of mineral fertilizers were used in the experiments: ammophos (11% nitrogen, 36% phosphorus), urea (46% nitrogen), potassium sulfate (60% potassium). Vegetating plants were treated with biostimulants VL-77 (drug consumption 500 ml/ha) and Vanguard Start (drug consumption 1.5 l/ha). The composition of the VL-77 biostimulator is polyethylene oxides (770 g/l) and humic acids purified from salt (30 g/l). The biostimulant Avangard Start contains nitrogen (100 g/l), phosphorus (70 g/l), potassium (20 g/l), calcium (10 g/l), boron (5 g/l), iron (10 g /l), ultramicroelements, amino acids, Mn, Zn, Cu.

Results and its discussion. To obtain high yields and improve the quality of the grain of this crop, a balanced mineral nutrition is necessary, which directly affects the formation of the generative organs of plants. A number of studies indicate their positive effect on the formation of fruiting organs and the dynamics of flowering plants [14,16, 17, 18].

The formation of the fruiting organs of the corn hybrid Uzbekistan 300 MW, depending on the norms of mineral fertilizers and biostimulants, are shown in table 1. The analysis of the obtained data shows that the norms of mineral fertilizers in the range from N₁₀₀P₇₅K₅₀ kg/ha of wood to N₂₅₀P₁₇₅K₁₂₅ kg/ha of wood dynamically affect the length of the upper embryonic cob and the size of the growing cone of the corn panicle.

Observations have shown that when mineral fertilizers and biostimulants are applied in all studied variants, the differentiation of male and female inflorescences begins earlier than in the control variant (without fertilizers). Thus, in the N₂₅₀P₁₇₅K₁₂₅ + VL-77 variant, the length of the upper rudimentary cob was 26.2 mm, while in the N₂₅₀P₁₇₅K₁₂₅ variant, kg/ha of wood was 24.3 mm, which is 9.8 mm and 7.9 mm higher, respectively, according to compared with control (without fertilizers). On the N₂₅₀P₁₇₅K₁₂₅ + Avangard Start variant, the analyzed indicator was 25.1 mm, which is 1.1 mm lower than in the N₂₅₀P₁₇₅K₁₂₅ + VL-77 variant. A similar phenomenon occurs with the size of the growth cone of the corn panicle at different rates of mineral fertilizers and biostimulants. It should be noted that the figures for the variants with mineral fertilizers and the VL-77 biostimulator were slightly higher than for the variants with mineral fertilizers and the Avangard Start biostimulator.

Table 1. Formation of corn fruiting organs depending on the norms of mineral fertilizers and biostimulants.

№	Experience options	Length of the upper rudimentary cob, mm (25.VI - 15th leaf)	Panicle growth cone size, mm (20.VI)	The final size of the panicle, mm
1	Without fertilizer	16,4	22,6	323
2	N ₁₀₀ P ₇₅ K ₅₀	22,2	26,3	342
3	N ₁₈₀ P ₁₂₀ K ₉₀	23,5	28,5	352
4	N ₂₅₀ P ₁₇₅ K ₁₂₅	24,3	32,5	363
5	Without fertilizers + Avangard Start	18,4	23,8	331
6	N ₁₀₀ P ₇₅ K ₅₀ + Avangard Start	24,0	29,2	350
7	N ₁₈₀ P ₁₂₀ K ₉₀ + Avangard Start	25,3	33,0	359
8	N ₂₅₀ P ₁₇₅ K ₁₂₅ + Avangard Start	25,1	35,3	364
9	Without fertilizers + VL-77	19,2	24,5	337
10	N ₁₀₀ P ₇₅ K ₅₀ + VL-77	24,5	31,5	353
11	N ₁₈₀ P ₁₂₀ K ₉₀ + VL-77	25,6	34,8	361
12	N ₂₅₀ P ₁₇₅ K ₁₂₅ + VL-77	26,2	36,5	367



The application of mineral fertilizers in the range $N_{100}P_{75}K_{50}$ kg/ha wood - $N_{250}P_{175}K_{125}$ kg/ha wood has a positive effect on the growth of the corn panicle. At the same time, the final size of the panicle was 361-367 mm on the options, respectively, $N_{180}P_{120}K_{90}$ + VL-77 and $N_{250}P_{175}K_{125}$ + VL-77 and 352-363 mm on the options of mineral fertilizers and without biostimulants.

Thus, biostimulants, especially the VL-77 biostimulator against the background of mineral fertilizers, contributed to the earlier laying of side shoots and accelerated ear formation.

Many authors note that the formation of the panicle begins with the appearance of 6-7 leaves of corn, while the panicle grows at a very slow pace, and when the 10-11th leaf appears, the growth of the panicle ends, the size of the panicle increases significantly [2,4,15]. During this period, the growth of corn reached 13-16 mm per day. In the range $N_{100}P_{75}K_{50}$ kg/ha of wood - $N_{250}P_{175}K_{125}$ kg/ha of wood, the cobs of the upper nodes grew strongly compared to the control. Their most intensive growth took place as they approached the flowering period. Therefore, to obtain large cobs, it is necessary to provide nutrients, especially from the time they deploy the upper leaves of the main stem. When applying $N_{250}P_{175}K_{125}$ + Avangard Start and $N_{250}P_{175}K_{125}$ + VL-77, not only the upper lateral cob primordium is affected, but also the rudiments on the nodes of the main stem from top to bottom, as well as on the nodes of the stalk of the cobs, can develop before the ejection of threads and before the formation of grain.

Thus, the application of mineral fertilizers and biostimulants can increase the number of rudiments developed into normally grained corn cobs.

Mineral fertilizers, especially on variants with $N_{250}P_{175}K_{125}$ + Avangard Start and $N_{250}P_{175}K_{125}$ + VL-77 biostimulants on gray soils, provided more intensive growth and differentiation of the corn panicle of the Uzbekistan 300 MW hybrid (Table 2).

The application of mineral fertilizers in the range of $N_{100}P_{75}K_{50}$ kg/ha of wood - $N_{250}P_{175}K_{125}$ kg/ha of wood improved the nutritional conditions of corn, prevented the premature death of the embryonic cob of the third node of the main stem, while this cob developed on the variant without phosphorus. In subsequent phases of development, the lower buds of cobs gave a weak increase. The cobs of the upper nodes grew vigorously when mineral fertilizers + biostimulants were applied. At the same time, their most intensive growth took place as they approached the flowering period.

Table 2. The dynamics of flowering of corn cobs depending on the norms of mineral fertilizers and biostimulants

№	Experience options	Flowering cobs, %		
		June		
		1-10	11-15	16-21
1	Without fertilizers	30	51	19
2	$N_{100}P_{75}K_{50}$	48	46	6
3	$N_{180}P_{120}K_{90}$	52	42	6
4	$N_{250}P_{175}K_{125}$	54	41	5
5	Without fertilizers + Avangard Start	33	50	17
6	$N_{100}P_{75}K_{50}$ + Avangard Start	51	44	5
7	$N_{180}P_{120}K_{90}$ + Avangard Start	54	41	5
8	$N_{250}P_{175}K_{125}$ + Avangard Start	56	39	5
9	Without fertilizers + VL-77	35	49	16
10	$N_{100}P_{75}K_{50}$ + VL-77	53	42	5
11	$N_{180}P_{120}K_{90}$ + VL-77	55	41	4
12	$N_{250}P_{175}K_{125}$ + VL-77	56	40	4



In all variants of the experiment, where a large dose of mineral fertilizers with the use of biostimulants Avangard Start and VL-77, at all nodes of the main stem, by the time the corn entered the phase of the 8th leaf, there were rudiments of the upper, second and partially third from the top, cob. In this case, on average, 2 and 3 cobs were formed per plant. This ensures a high yield of corn grain on gray soils in the conditions of the Kashkadarya region of Uzbekistan.

Conclusions. When growing Uzbekistan 300 MW maize hybrid per grain on serozem soils, regular connections were established between changes in the formation of reproductive organs and plant nutrition with macro and microelements in the form of mineral fertilizers and biostimulants. The positive effect of mineral fertilizers and biostimulants in the norms $N_{250}P_{175}K_{125}$ + Avangard Start and $N_{250}P_{175}K_{125}$ + VL-77 on the growth and development of the fruiting organ of corn - the cob, which ensures a high grain yield in the conditions of the Kashkadarya region of the Republic of Uzbekistan, was revealed.

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