

# Effect of agrochemical AminoPlus brand: Amino Zn on growth and production processes, corn plant yields

*N. V. Chernysheva*<sup>\*</sup>, *Ya. K. Tosunov*, and *A. I. Barchukova*

Kuban State Agrarian University named after I.T. Trubilin, Krasnodar, Russia

**Abstract.** Corn is one of the most widespread and popular grain crops in the world, which is due to its widespread use in the food industry, forage production and for technical purposes. In the world, the largest acreage of corn is concentrated in the USA and China; in the Russian Federation – in the Krasnodar Territory, in which more than 500 thousand hectares are sown with corn annually. The problem of increasing corn production can be solved, first of all, by increasing its yield. Given the high responsiveness of corn plants to organomineral fertilizers, an increase in yield and gross grain yields can be achieved by optimizing the nutrition regime. The tested agrochemical AminoPlus brand: Amino Zn is an organomineral fertilizer, which provides systemic and dosed foliar fertilization of corn plants (in phases 4-6 and 8-10 leaves), optimally providing the plant with nutrients, enhanced plant growth, the process of formation of reproductive organs and, ultimately, corn yield. The maximum yield of corn in grain – 53.5 centners per hectare (in the control – 44.4 centners per hectare) was obtained during foliar fertilizing of corn plants with the agrochemical AminoPlus brand: Amino Zn at a dose of 2.0 l/ha; the consumption of the spray material – 300 l/ha.

## 1 Introduction

Corn is a crop whose cultivation area is ubiquitous. And although, according to FAO, in the list of crops in terms of the area of crops, it is in third place after wheat and rice, in terms of gross harvest – in second place after wheat. Corn grain is used for food, forage and technical purposes. In the food industry, corn grain is used to produce flour, cereals, butter, starch, as well as canned grain. Distinguished by high feed qualities, corn grain is considered an indispensable component of compound feeds. Good food is considered not only whole grain, but also grain-core mass. Corn grain is of great importance as a raw material for industry. Starch obtained from corn is used both in the food and paper, chemical, pharmaceutical industries [1].

The widespread use of corn grain in the food industry is due to the content of its main nutrients – carbohydrates, proteins and oil, which account for up to 95% of the dry matter of

---

\* Corresponding author: [nv.chernisheva@yandex.ru](mailto:nv.chernisheva@yandex.ru)

the grain. Based on this, the creation of new recipes for food products from corn allows us to saturate the modern market with useful and high-quality products.

As an industrial raw material in the world, corn is most widely used for the production of starch, the share of which is 75%, and the share of corn starch in the total world starch production is 31%. It should be noted that corn starch is used in the production of more than 500 items of paper, textile, woodworking, chemical and pharmaceutical industries.

In forage production, different parts of corn of different ripeness are used: whole plants are used for green fodder during the flowering period – milk ripeness; for silage – a whole plant in the wax ripeness phase; as concentrated feed – a mixture of grains, rods and wrappers during corn harvesting; corn grain harvested at full ripeness is an important ingredient in the production of compound feeds for pigs and poultry.

In addition, in recent years, corn has been used as a vegetable raw material in the production of fuel (biodiesel, bioethanol, biomethanol). From the point of view of ecological assessment of corn cultivation, it has no equal among cultivated plants.

Based on the above, one of the main tasks of modern agriculture is to identify techniques and methods that make it possible to provide corn plants with a balanced feeding. An important condition for increasing the yield of corn is a fertilizer system that would provide plants with not only macro-, but also microelements [6, 8, 9]. Organic fertilizers and new complexes of organomineral agrochemicals have a positive effect on the growth of corn plants and its productivity, which are a source of nutrients used for processing seeds and plants and the response of corn to them is better than other cereals [4, 5, 10].

## 2 Research methodology

The research work was carried out on production crops (equalized by development) of corn in the educational-experimental plot "Kuban" of the Kuban State Agrarian University (department 1).

The object of the study was a middle-early hybrid Krasnodar 291 AMV (growing season – 106-110 days), characterized by good drought hardness and resistance to bubbly smut and stem rot.

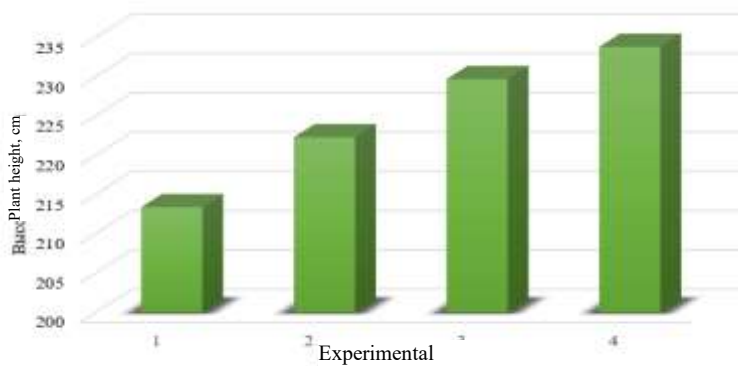
The scheme of the experiment included: control variant (1), in which foliar fertilizing was not carried out, and experimental variants in which foliar fertilizing with the agrochemical AminoPlus brand: Amino Zn in doses of 1.0, 1.5 and 2.0 l/ha (variants 2, 3 and 4, respectively) were carried out twice - in phases 4-6 and 8-10 leaves.

The studies were carried out in four-fold repetition, on plots of 25 m<sup>2</sup> in size. The previous crop is winter wheat. All measures for the care of culture are generally accepted on the farm. The treatment of plants was carried out in doses and at the time indicated in the experiment scheme with an Orion 5 knapsack sprayer.

The selection of plant samples for biometric analysis was carried out during the period of milk ripeness of the cobs. Harvesting was carried out in the phase of full ripeness. Before harvesting, for structural analysis of the crop (determination of the length and mass of the cob, the number of grains from the cob and their mass, grain yield, mass of 1000 grains), cob was selected from each variant (from 20 plants). Corn yield on the cob was determined by gross of harvested cobs from the accounting area; grain yield – by gross of grain from the accounting area after threshing the cobs. The research data were processed by the method of variance analysis according to B. A. Dospekhov [3].

### 3 Study results

Based on the data obtained in the experiment, the stimulating effect of the tested agrochemicals on the growth of corn plants in height was established (Fig. 1); the growth of the leaf apparatus and the mass (wet and dry) of the aboveground organs (Table 1).



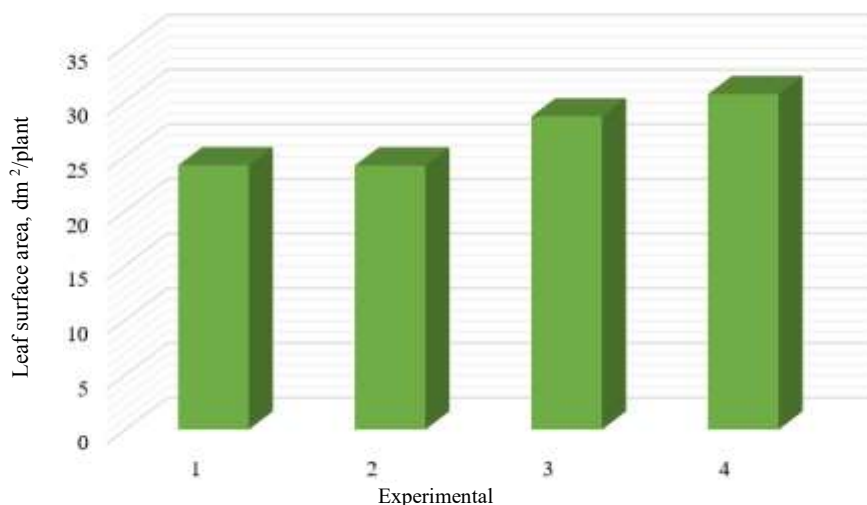
**Fig. 1.** The effect of the preparation AminoPlus brand Amino Zn on the height of corn plants.

Figure 1 shows that two-fold foliar fertilization of corn plants with the tested agrochemicals activated growth processes. In experimental variants, plant growth in height increased with an increase in the dose of the drug (at a dose of 1.0 l/ha - 22.3 cm, 1.5 l/ha - 229.7 cm, 2.0 l/ha - 233.8 cm, in the control - 213.4 cm).

**Table 1.** The effect of the preparation AminoPlus brand Amino Zn on the biometric indicators of corn plants.

Variant	Plant weight without cob, g		Number of leaves, pcs.	Leaf length, cm	Leaf width, cm	Leaf area, dm <sup>2</sup>
	raw	dry				
1	295.32	93.62	8.1	61.8	7.1	24.16
2	305.46	99.27	8.5	63.4	7.4	27.142
3	318.52	108.30	8.8	63.8	7.5	28.63
4	326.66	113.02	9.2	64.5	7.6	30.67
LSD <sub>05</sub>	16.03	4.13	0.3	2.3	0.3	1.01

The research data (Table 1) show that the raw mass of corn plants (without the cob) during the double foliar fertilization with AminoPlus brand Amino Zn increased by 10.14-31.34%, compared to the control - 295.32 g, the dry mass also increased similarly. At the same time, the absolute values of the raw and dry mass of the aboveground part of the plants (without the cob) increased with an increase in the dose of the agrochemicals and the maximum values were when using the drug at a dose of 2.0 l/ha. Foliar top dressing also stimulated the formation, growth and development of the leaf surface. In the experimental variants, a larger number of leaves were formed (8.5-9.2 pcs., in the control - 8.1 pcs.), the length (63.4-64.5 cm, in the control - 61.8 cm) and width (7.4-7.6 cm, versus 7.1 cm - in the control) of leaves also increased. The increase in the number and parameters of leaves was reflected, respectively, in the size of the assimilation surface - 27.12-30.67 dm<sup>2</sup>, versus 24.16 dm<sup>2</sup> in the control. Considering that the yield of agricultural crops, including corn, is formed in the process of photosynthesis, the main organ of which is the leaf, the size of the leaf surface plays a huge role in enhancing the production process (Fig. 2).



**Fig. 2.** The effect of the preparation AminoPlus brand Amino Zn on the size of the leaf surface.

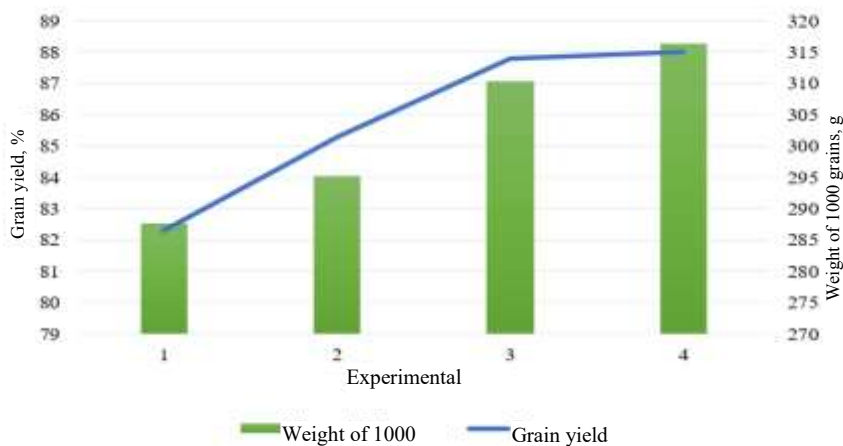
Figure 2 clearly shows an increase in the leaf area with an increase in the dose of the tested agrochemicals, and its maximum increase indicates the fact that during the two-fold foliar fertilization with organomineral fertilizer AminoPlus brand Amino Zn corn most fully used the fertilizer elements for the formation of the leaf apparatus. The intensification of assimilation processes in plants of experimental variants, a more active accumulation of assimilates in them and their transformation into reproductive organs, had a positive effect on the formation of the cob (Table 2).

**Table 2.** The effect of the preparation AminoPlus brand Amino Zn on the biometric indicators of corn plants.

Variant	Cob length, cm	Cob diameter, cm	Cob weight, g	Number of seeds, pcs.	Weight of seeds from the cob, g
1	13.9	3.8	125.81	356.0	103.58
2	14.4	4.0	131.77	379.6	112.43
3	14.7	4.1	135.34	381.2	118.79
4	15.0	4.2	138.15	390.1	121.56
LSD <sub>05</sub>	0.5	0.1		13.4	4.6

As can be seen from the data in Table 2, in the experimental variants, larger cobs were formed in size and weight (length – 14.7-15.0 cm, in the control – 13.9 cm; diameter – 4.0-4.2, in the control – 3.8 cm; weight – 131.77-138.15 g, in the control – 125.81 g), with more grain content (379.6-390.1 pcs., in the control – 356.0 pcs.). The weight of grain from the cob was 112.43-121.56 g in the experimental variants, 103.58 g in the control.

The use of foliar fertilizing with AminoPlus brand Amino Zn in the technology of corn cultivation contributed to the formation of larger grains in the ears, which had a positive effect on grain yield (Fig. 3).



**Fig. 3.** The effect of the preparation AminoPlus brand Amino Zn on the grain productivity of corn.

Figure 3 shows that double foliar top dressing of corn plants contributed to the formation of larger grains (weight of 1000 seeds – 295.29-316.33 g, in the control – 287.65 g), which significantly increased grain yield (85.3-88.0%, against 82.3% – in the control). This had a positive effect on corn yields (Table 3).

**Table 3.** The effect of the preparation AminoPlus brand Amino Zn on the yield of corn.

Variant	Cob yield			Grain yield		
	yield, centners per hectare	increase in control		yield, centners per hectare	increase in control	
		centner/ha	%		centner/ha	%
1	53.9	-	-	44.4	-	-
2	56.8	2.9	5.4	48.5	4.1	9.2
3	58.3	4.4	8.2	51.2	6.8	15.3
4	60.8	6.9	12.8	53.5	9.1	20.5
LSD <sub>05</sub>	2.6			2.0		

The yield increase in the experimental variants was 5.3–12.8% on the cob, 9.2–20.5% in the grain. The maximum corn cob yield (60.8, in the control – 53.9 centners per hectare) and grain yield (53.5, in the control – 44.4 centners per hectare) was obtained by carrying out two-fold foliar fertilizing (1<sup>st</sup> – in the phase of 4-6 leaves, 2<sup>nd</sup> – in the phase of 8-10 leaves) with the agrochemical AminoPlus brand: Amino Zn in a dose of 2.0 l/ha.

## 4 Discussion of results

The data obtained by us, as a result of studies of the agrochemicals AminoPlus brand: Amino Zn in the conditions of field experience (educational-experimental plot "Kuban" of KubSAU) on corn (hybrid Krasnodar 291 AMV), revealed its high biological and economic efficiency. High biological efficiency was manifested in the stimulation of plant growth in height under the action of agrochemicals, the process of increasing the number and area of leaves and, as a consequence, a significant increase in biomass and dry mass of aboveground organs.

A significant increase in the absolute values of the estimated signs of corn plant growth favourably affected the activation of production processes, manifested in the formation of larger in size (length and diameter) and the mass of the cob due to an increase in their ear grain content, the formation of larger grains (mass of 1000 grains), an increase in grain yield.

The most optimal nutrition regime for corn was created when carrying out foliar fertilizing of plants twice (in phases 4-6 and 8-10 leaves) with the agrochemical AminoPlus brand: Amino Zn at a dose of 2.0 l/ha (the consumption of the spray material is 300 l/ha), which manifested itself in the activation of growth processes, the formation of a reproductive organ – the cob and, as a consequence, an increase in the yield of corn grain (53.5, in the control – 44.4 centners per hectare).

## 5 Conclusion

The use of agrochemicals AminoPlus brand Amino Zn in corn cultivation technology at a dose of 2.0 l/ha (two-fold foliar fertilization of plants: 1<sup>st</sup> – in the phase of 4-6 leaves, 2<sup>nd</sup> - in the phase of 8-10 leaves) is effective and expedient, due to the activation of growth and production processes, due to the timely provision of corn plants with nutrients in the required amount quantity and, as a result, increased productivity. The maximum yield increase was obtained with the use of the agrochemical AminoPlus brand Amino Zn at a dose of 2.0 l/ha it was 12.8% – in cobs and 20.5% – in grain, with yields in the control – 53.9 and 44.4 centners per hectare, respectively (consumption of the spray material – 300 l/ha).

## References

1. N. I. Volodarskij, *Biologicheskie osnovy vozdeleyvaniya kukuruzy* (Kolos, M., 1986)
2. S. A. Voloshin, “Vliyanie priemov vozdeleyvaniya na strukturu urozhaya i urozhajnost' kukuruzy na zerno”, in *Nauchnoe obespechenie agropromyshlennogo kompleksa: materialy 8-1 regional'noj nauch.-prakt. konf. molodyh uchenyh* (Krasnodar, 2007)
3. B. A. Dospekhov, *Metodika polevogo opyta* (Kolos, M., 1985)
4. Ya. K. Tosunov, N. V. Chernysheva, A. Ya. Barchukova, *Plodorodie* **6(105)**, 23-26 (2018)
5. Deutsches Maiskomitee e.V. (Hrsg). *Mais – unsere wichtigste Futterpflanze* (Bonn, 1990)
6. F. Jager, *Maisanbauplaner Mitteldeutschland* (KWS Einbeck, 2004)
7. A. Klasink, K. Fruchtenicht, *Dlz agrarmagazin* **4**, 40-43 (1997)
8. R. Schnellhammer, *Dlz agrarmagazin* **4**, 30-34 (2001)
9. H. Sturm, A. Buchner, W. Zerula, *Gerielter dungen. Integriert, wirtschaftlich, umweltgerecht. 3. Auflage* (Dlc-Verland Frankfurt/Main, 1994)
10. Verband Deutscher Olmuphlen e.V. (Hrsg). *Wirtsch altliche schweinemast mit Corn-Cod-Mix (CCM). 3. Aunl. Bonn* (1990)