Development of procedures for corn varieties irrigation as main crops

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Abstract. Corn is the most valuable, high-yielding cereal crop with food, fodder, technical and agrotechnical significance. Corn kernels are used as food. Its grains are very nutritious, containing an average of 10.6% fiber and 1.4% ash. However, the protein amount in corn kernels is low. That is why corn is covered with bread by adding 25-30% wheat flour to it. Due to the high content of fat (4.3-5.0%) in corn kernels, it makes it ferment quickly. Grain husks are separated on special machines and the rest is used to make flour, because corn husks contain 25-40% of fat, which is used for cooking oil.

1. Introduction

In meeting the world's demand for food, industry for raw materials, and livestock for food particular attention is paid to the agro-technologies development for the crops field cultivation, taking into account the biological characteristics of soil crops, soil and climatic conditions. The corn area is the third largest in the world after wheat and rice, and the first in the fodder crops group. Today, the area under corn is 22.5 million hectares in the United States, 20.6 million hectares in China and 11.8 million hectares in Brazil. According to the FAO, in the crops structure, the corn area is 23% higher than in the United States, 63% in Australia, 70% in Germany, 43% in France and 3.5% in Russia, with an average yield of 7-10 tons per hectare [1].

Improving the irrigation method in the corn cultivation in the world in the primary and secondary periods optimizing the nutrient balance in the soil, obtaining high grain and green mass yields, providing the population with food, industry raw materials and livestock with nutritious feed. In this regard, research on the use impact of new phosphorite-based fertilizers in combination with nitrogen and potassium mineral fertilizers on the corn growth, development and yield and the optimal technology development for their application is relevant.

138.5 thousand hectares of land have been allocated in the country for the corn growing, which is a valuable grain and fodder crop for the 2018 harvest, for the first time it is planned to cultivate 1210.9 thousand tons of corn. Today, the average corn yield in the country is 35-45 quintals per hectare. However, this figure can be further increased as a result of the advanced innovative technologies use, making extensive use of existing opportunities. The existing agrotechnologies improvement in corn cultivation, irrigation methods and drip irrigation regimes optimization, which play an important role in the yields formation, is of great theoretical and practical importance [2].
2. The purpose of the research:
Using water-efficient drip irrigation of corn varieties NS-6010 and NS-770 in the conditions of alluvial soils of meadows of Bukhara region, to determine the growth and development of maize as a major crop and its impact on grain and fodder yields, and to improve drip irrigation procedures.

The research object: Grassland alluvial soils of Bukhara region, drip irrigation regimes, maize varieties NS-6010 and NS-770 were taken as the main crop.

Research subjects: meadow alluvial, maize varieties NS-6010 and NS-770, physical properties of soil, water demand, irrigation regimes, number of irrigations, seasonal irrigation norms, water consumption, its growth, development, grain and fodder yields and their quality is the effect on performance.

Research methods: Field, laboratory research, agrochemical analysis, biometric measurements, phenological observations, statistical analysis the cotton selection is carried out in accordance with the methods adopted by the Research institute of seed production agrotechnology "Methods of field experiments". The accuracy and reliability of the obtained data are analyzed mathematically and statistically using the generally accepted B.A. Dospekhov's multivariate method.

Scientific and practical significance of the research: the scientific significance of the research results is the theoretical foundations development for obtaining irrigation quality, number, timing, growth, development, grain and fodder yields quality, using water-saving drip irrigation maize regimes varieties NS-6010 and NS-770 as the main crop.

The practical significance of the research is to develop water-saving drip irrigation regimes in the corn cultivation for grain and green fodder, the corn, grain and fodder yields growth and development and their impact on quality indicators.

The following tasks were performed:
- the influence of drip irrigation regimes application on the agrophysical properties of the main crop soils varieties NS-6010 and NS-770 in the meadow alluvial soils conditions was studied;
- the impact of water consumption, irrigations number, irrigation intervals, irrigation periods and seasonal irrigation norms, as well as water-saving drip irrigation regimes on water consumption in irrigating maize varieties was determined;
- the impact of water-saving drip irrigation regimes on corn growth, development, and grain and forage yields was identified;
- the cost-effectiveness of water-efficient drip corn irrigation varieties was determined.

| Options | Corn varieties | Irrigation methods | Irrigation regime in relation to BFM |
|---------|----------------|--------------------|-------------------------------------|
| 1       |                |                    |                                     |
| 2       | NS-6010        | Furrow irrigation, (control) | 65-65-70 |
| 3       |                |                    |                                     |
| 4       | NS-770         |                    | 70-75-75                            |
| 5       |                |                    | 75-80-80                            |
| 6       |                |                    |                                     |
| 7       | NS-6010        | Drip irrigation     | 65-65-70                            |
| 8       |                |                    |                                     |
| 9       | NS-770         |                    | 70-75-75                            |
| 10      |                |                    | 75-80-80                            |
| 11      |                |                    |                                     |
| 12      |                |                    |                                     |
Experimental system and conducting methods
The field experiments were carried out on the farm "Zamin ota" in Bukhara region, Bukhara district. According to the experimental system, field experiments were carried out in 12 variants and 3 returns. Each plot area is 480 m$^2$, length 100 m and width 4.8 m. The total area of the experimental field is 1.73 ha. Each section consists of 8 rows, furrow length 100 m, row spacing 60 cm, 2 rows on each side are protective rows, (Table 1). According to the experimental options, the for NS-6010 and NS-770 maize varieties irrigation procedures are given.

Soil work during the experiment:
- the morphological structure of the soil was studied before the experiment. To do this, a soil shear was excavated at a depth up to the groundwater level and the soil morphology along the genetic layers was determined.
- the soil water permeability was determined annually at the beginning of the experimental application period and at the end of the application period for all options.
- the boundary field moisture of soil capacity was determined at the beginning of the experiment by framing 2x2 m area.
- soil moisture was determined by systematic thermostatic drying before irrigation. Soil samples were taken and analyzed for every 10 cm of the 1.0 m layer in 3 returns in each variant.
- the difference between the pre-irrigation soil moisture and the Boundary field moisture according to the experimental scheme in determining the irrigation duration and norms was calculated according to S.N.Ryjov formula. [3].
- the water amount supplied to the experimental field was calculated using Chipoletti (VCh-50) water meters and using a sensor in drip irrigation.
- changes in groundwater levels were detected using 3 observation wells installed in the experimental area. The pipes were 40 mm in diameter and installed to 2.5 m depth. The lower 1.2-meter section of the pipes consists of galvanized holes, which are lined with a filter (nylon material). Groundwater levels were measured once every 10 days. [4]
- the mineralization level of groundwater was determined in all observation wells before and after saline leaching and at the end of the growth period, as well as dry residue, chlorine ion, and sulfate amounts were determined.
- at the beginning of the research to determine the soil salt regime, at the beginning and end of the growing season, soil samples were taken for each field and options and the amount of dry residue, chloride ion and sulfate was determined, (in 0-30; 30-50; 50-70 and 70-100 cm).
- before experimenting the humus amount in the layers of soil 0–30, 30–50 cm determined by the method of I.V.Tyurin, total amounts of nitrogen and phosphorus by L.P.Gritsenko, I.M.Maltseva method, nitrate nitrogen by calorimeter method, mobile phosphorus by B.P.Machigin method, exchangeable potassium was determined by the method of P.V. Protasov.[5].
- All agrochemical analyzes were carried out on the basis of "Methods of agrochemical analysis of soil and plants."

Work on phenological observations in the corn plant:
- seed germination and seedling thickness at the end of the application period were determined for each option and return.
- the corn height, the leaves number, the crop elements on the 1st day of each month (May, June, July, August, September, October) on the 75 plants options (75 per repeat), which are constantly monitored;
- Plants (75 plants) on which the weight of 1000 corn pieces was constantly monitored;
- In the experiment, the yield was collected from 4 rows of each stalk, weighed, crushed, cleaned, re-weighed and then determined per hectare;
- quality indicators of corn grain were determined for all options and returns.
Irrigation, feeding and other agro-technical measures of crops in the experimental field conducted on the basis of "Methods of conducting field experiments" of the Research institute of cotton breeding, seed production and cultivation agrotechnologies (RICBSPCA 2007) [6].

3. Conclusion
1. A field was selected for the experiment, its soil section was excavated and described by genetic layers, and morphological features were studied.
2. In order to study the soil volumetric mass of the field experiment area (in the general base) in the spring at three points the soil volume mass was determined from every 10 cm layer to the 0-100 cm layer. During the fall, this work was carried out on all experiment variants.
3. In the spring, the soil water permeability was determined at three points on the common floor, and in the fall on all options.
4. Soil moisture was determined by systematically drying in a thermostat before irrigation on each 10 cm layer of 1.0 m layer in 3 returns in each variant.
5. In order to determine the agrochemical characteristics of the soil, samples were taken from the soil layers of 0-30, 30-50 cm by the envelope method, before starting the experiment (in the spring) the total amount of humus was determined by I.V. Tyurin method, nitrogen, phosphorus by K.Gingburg, E.M.Sheglova and V.V.Vulfius method, potassium by Smith method, nitrate nitrogen-canometric method or Granvald-Lyaju, mobile phosphorus by B.P.Machigin method, exchangeable potassium by P.V.Protasov methods, in the fall, soil samples were taken from these layers according to the options, in which both N, P, K general and mobile types were identified.
6. In order to detect mobile nitrate, phosphorus, and potassium in the soil, a soil sample (0–30; 30–50 cm) of 0–50 cm from all experiment options was taken on two returns before mowing, flowering, and in the fall.
7. The groundwater mineralization level was determined at the beginning of the corn validity period and in autumn in all variants.
8. In order to determine the level and amount of soil salinity the validity period of corn was determined at the beginning and fall of all variants.
9. Phenological observations of corn: seeds germination in each return and seedling thickness, the height of the corn in each variant, the number of harvested branches, the number of harvested elements (on the 1 day of May, June, July, August, September, October), weight of 1000 grains of corn, grain yield, grain quality indicators were studied on all options and returns.
10. In the meadow alluvial soils of Bukhara region, river water was saved through the use of water-saving drip irrigation systems of the main crops corn NS-6010 and NS-770, high and quality grain yields were obtained, the water amount used for irrigation was reduced by 40-45%, grain yield was increased by 20-25 percent, the efficiency of 1 m$^3$ of water as well as recommendations for farmers, farms and clusters suitable for soil and climatic conditions.

Taking into account the importance of corn cultivation and its use in various economy sectors, pharmaceuticals, cattle breeding and other areas the development of water-saving irrigation technology of promising corn varieties NS-6010, NS-770 in the alluvial soils conditions of Bukhara region meadows is an urgent issue. Research work has been carried out on the maize cultivation as the main crop in the alluvial, weakly saline soils conditions of the ancient irrigated meadows of Vobkent and Bukhara districts fields and preliminary results have been achieved and research in this area is underway.

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