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Professional paper

CORN PRODUCTION IN THE REPUBLIC OF NORTH MACEDONIA AND POSSIBILITIES FOR ITS CULTIVATION WITHOUT INTERVENTIONAL IRRIGATION

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Abstract

Corn is an annual plant from the sub-group of millet grains. In the Republic of North Macedonia, there are relatively good soil and climate conditions for its production. It is the third cereal crop in terms of representation on arable land, after wheat and barley. The production of corn grain in North Macedonia in 2021 amounted to 130 769 tons. These quantities of corn in grain obtained from corn production on the agricultural lands in the Republic of North Macedonia do not satisfy domestic demand. The total annual production of wheat, barley and corn grain in 2021 was 526 045 tons. Rye, rice and oats are produced in much smaller quantities than the other cereal plants.

Taking into account the agrotechnical measures applied in the production of corn and the soil-climatic conditions that prevail in Macedonia, this article gives a special review of the problems faced by this production, as well as the possibilities and measures for its production without interventional irrigation.

Key words: *Zea mays, yield, measures, irrigation, grain*

INTRODUCTION

Cereal crops are very significant group of field crops (Vasilevski, 2004). Corn has many uses for human nutrition, domestic animals and the processing industry. The realization of high and stable production of corn is largely influenced by the soil and climate conditions of the region, as well as the degree of agricultural technology used. The quantities of corn produced do not meet the needs in Republic of North Macedonia, although it is the third cereal crop in terms of representation per area on which it is produced.

In relation to the average yield of other cereal crops grown in R. Macedonia, corn and rice have a significantly higher yield that approaches the regional and European averages. These situations are the result of improved agrotechnical measures in corn production, such as:

- using certified seed material of a hybrid nature,
- fertilization with satisfactory amounts of fertilizers,
- timely feeding of the crops at an appropriate stage of the organogenetic development of the plant,
- use of more modern machinery in the production process, etc.

Natural conditions for corn production in the Republic of North Macedonia

The natural conditions in the Republic of North Macedonia provide the opportunity for the cultivation of all cereal plants. Millet grains are very sensitive to low temperatures. Corn in

the phenophase of sprouting tolerates negative temperatures from -2 to -3°C. Corn, despite being a millet grain plant, due to the large habitus it forms, still has a relatively high need for water and it is hard to bare it, especially in the phenophase of fertilization, pouring and ripening of the grain. One of the main problems in the production of cereal plants, including corn, is precisely this factor.

Cereals are mostly grown on all soil types. According to the reaction of the soil solution, cereal plants are divided into two groups: cereal plants that normally grow and vegetate at a neutral or slightly acidic reaction (pH 6-7), like wheat, barley and corn, and cereal plants that tolerate a wider pH interval value, like rye, oats, millet and buckwheat (http://makstat.stat.gov.mk/). Regarding the soil, it should be emphasized the great heterogeneity of the soil types found in the territory of Macedonia and the diversity in terms of fertility and other characteristics of such soils. In this regard, we need consistency in soil fertility tests, all with the aim of proper nutrition of this crop.

Corn production in the Republic of North Macedonia

Table 1 provides data on the representation, yield and realized production of corn in the production years 2019, 2020 and 2021 and the average for the three-year period.

Table 1. Corn production(http://makstat.stat.gov.mk/)

Year	Area (ha)	Yeald (kg/ha)	Production (t)
2019	34 123	4 277	145 528
2020	32 013	4 589	146 434
2021	30 425	4 327	130 769
AVERAGE 2019/21	32 187	4 398	140 910

Data in the table show that the areas under corn have a tendency to decrease from year to year, but the data for the average yield per unit area at the republic level are constant and amount to over 4000 kg/ha. The average corn grain production for the three-year period is 140,910 tons. This amount is not enough for the needs of Republic of North Macedonia, so about 20-25% is imported from the world market.

In these three production years, corn was produced on an average area of 32,187 ha, with an average three-year yield of 4.4 t/ha.

Recommendations and measures for the improvement of production with corn in Republic of North Macedonia

Corn production in the last three-year period does not satisfy domestic demand, although it is the third cereal crop in terms of representation in crop production in our country. Domestic production meets about 75 to 80% of needs. The remaining quantity is still provided by imports.

In order to overcome these conditions and become market independent for corn grain, it is necessary to take certain bolder steps in the organization of production. One of the possibilities is to increase the areas with this cereal plant. At present, the areas with corn are 32 187 ha, as producers grow economically more profitable crops. In such market conditions, realistically, that is also more difficult to do.

Another possibility is to increase the average yield per unit area, which now amounts to 4398 kg/ha. The realization of the second possibility requires a series of steps that must be followed and implemented.

Those steps are as follows:

1. Alleviation of drought periods in the critical phenophases of growth and development of maize with intervening irrigation, especially in the phenophases of stem growth, filling and grain ripening. These phenophases are critical for the final result obtained in the yield and wherever there is no proper distribution of precipitation during the vegetation and the possibility of intervening irrigation of the crops in these phases, irreversible damage occurs in terms of the height of the yield. At the moment, in the Republic of North Macedonia, intervention irrigation is implemented on about 60 - 70% of the surfaces;

2. State investments in the improvement of outdated and non-functional irrigation systems and the construction of new agro-ameliorative systems, use of the drip irrigation system. The

current situation with the irrigation systems is unenviable, and the use of the drip system in the production of this crop is still at an early stage. The areas cultivated with this system are through certain grants and projects, and are very small. From the results obtained in projects where this irrigation system is incorporated, the yields per unit area have increased by 60 - 100%;

3. Increased and improved application of means for plant protection. In standard corn production at the moment, herbicides are used in a sufficient extent for weed protection. But the use of fungicides and insecticides for crop protection during the vegetation is minimal and should be increased;

4. Increased support in the area of subsidies for the production of this crop. At the moment, the subsidy is 10 000 denars/1 ha corn, but in order to help the producers, these funds should be increased by another 80%;

5. Development of measures for corn production in conditions without interventional irrigation, etc.

According to Glemoćlija (2004) agrotechnical measures, with the application of which higher yields can be achieved, among others, are:

- the correct selection of the pre-crop,
- cultivation in crop rotation and avoidance of cultivation in monoculture,
- correct selection of hybrids with appropriate length of vegetation,
- quality tillage,
- use of optimal seed quantities,
- appropriate additional plant nutrition with natural soil fertility,
- breeding pest, disease and weed resistant genotypes.

Proposed agrotechnical measures and steps in corn production in conditions without interventional irrigation

The production of corn without irrigation carries a certain degree of risk in the cultivation of this crop in the amount of yield per unit area, but the measures that are proposed are an option and a possibility for areas where there are no real opportunities for irrigation.

Those measures are the following:

Conservation and preservation of moisture in the soil;

- Cultivation of corn as a first crop;
- Avoidance of corn production as a second crop;
- Deep basic ploughing (35-40 cm);
- Deep pre-sowing soil preparation;
- Application of 2/3 of the nitrogenous and whole amounts of the phosphorous and potassium nutrients provided for this crop with the pre-sowing preparation of the soil;
- Timely sowing if possible and the earliest sowing according to the production area;
- Performing precision sowing;
- Fertilizing with 1/3 of nitrogen fertilizers (UREA 46%) in phenophase 7-8 leaves (stem growth);
- Selection of hybrids with short vegetation (FAO ripening groups 100, 200, 300 and possibly 400);
- Selection of hybrids which are more tolerant to dry conditions and intended for arid areas.

The proposed agrotechnical measures should improve the current state of a large number of areas where soil moisture conservation is not practiced with measures such as:

- mandatory basic ploughing in autumn and another one before sowing;
- early sowing in optimal terms when the temperature conditions allow it, unlike to the current sowing which takes place from the end of April until the beginning of July;
- avoiding hybrids with long vegetation, such as FAO 500, 600, 700 and 800, which are used in combination with later sowing dates;
- to avoid using inappropriate and adapted corn planters, which are often used, especially among younger producers;
- avoiding the standard way of fertilizing, where 2/3 of the required quantity of nitrogenous fertilizers is added by feeding during the vegetation. In this case, the amount of nitrogen fertilizers should be increased before sowing and only 1/3 during the vegetation, in the corresponding phenophases of the crop development, etc.

CONCLUDING REMARKS

Based on the above, the following conclusions and findings can be drawn:

- Corn production in the Republic of North Macedonia (2019/21) amounts to 140,910 tons of grain.
- Domestic production meets about 75 to 80% of needs. The remaining quantity is still provided by imports.
- In order to achieve a higher and stable production, to a large extent, in addition to the soil and climate conditions of the region, it is necessary to improve the degree of applied agricultural technology.
- In order to overcome the dependence on the import of corn grain, all efforts and measures should be aimed at increasing the average yield per unit area.
- Corn production without intervening irrigation carries a certain degree of risk in cultivation.
- The proposed measures are an option and opportunity for areas that do not have real possibilities for intervention irrigation in critical phenophases of the growth and development of corn.

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ПРОИЗВОДСТВО НА ПЧЕНКА ВО РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА И МОЖНОСТИ ЗА НЕЈЗИНО ОДГЛЕДУВАЊЕ БЕЗ ИНТЕРВЕНТНО НАВОДНУВАЊЕ

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Резиме

Пченката е едногодишно растение од подгрупата на просовидни жита. Во Република Северна Македонија постојат релативно добри почвено-климатски услови за нејзино производство. Таа е трета житна култура по застапеност на ораничните обработливи површини, по пченицата и јачменот. Во 2021 година се произведени 130 769 тони пченка. Овие количини на пченка добиени од производство на пченка на земјоделски површини во Република Северна Македонија не ги задоволуваат домашните потреби. Вкупното годишно производство на зрно од пченица, јачмен и пченка во 2021 година изнесувало 526 045 тони. Од останатите житни растенија 'ржта, оризот и овесот се произведуваат во многу помали количини.

Имајќи ги предвид агротехничките мерки кои се применуваат во производството на пченка и почвено-климатските услови кои преовладуваат во Македонија, во трудот е даден посебен осврт на проблемите со кои се соочува ова производство, како и можностите и мерките за нејзино производство без интервентно наводнување.

Клучни зборови: *Zea mays, принос, мерки, наводнување, зрно.*