

THE MANIFESTATION OF THE PRODUCTIVE POTENTIAL IN CORN (*ZEA MAYS L.*) MONOCULTURE ON A TYPICAL CHERNOZEM, WITH SOME FAO 300-400 GROUP HYBRIDS

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Abstract. One of the most important food resources for humans, as well as animals, is the corn. By knowing the control mechanisms for certain corn plant characteristics and traits, new hybrids were created, whose genetic base insures a higher productivity capacity, as well as higher quality traits, genetically resistant to the attack of some pests or other pathogenic agents. A special important role in the corn crop is attributed to zoning and micro-zoning proper for the hybrids, as well as the cultivation technology. Although the importance of crop rotation and cropping system are known, progress in the weed control and fertilization field, and the scientific research carried out in our country determined the authors to test the manifestation of productive potential in some corn hybrids, under monoculture conditions. Two corn hybrids pertaining to the FAO 300-400 maturity group were selected for the study, on a typical chernozem from the Slobozia locality area, in the Ialomita county. Monoculture advantages, allowing for farmer specialization in a single culture and the use of a proper machine set to do so, have encouraged many corn cultivators from America, Canada and, later on, Europe to practice this system. In the experimental year 2014, under agro-pedological-climatic conditions from Baragan Plain, locality Slobozia, farm I.I. Vișan Daniela Elena, hybrid Bonito registered on average 300 g the weight of kernels from the cob and hybrid NK Cobalt had the weight kernels from the cob of 360 g. After laboratory analysis, the weight of 1,000 kernels at hybrid Bonito was 337 g, and at hybrid NK Cobalt was registered the value of 348 g for the weight of 1,000 kernels. In the experimentation year 2014, hybrid Bonito registered a yield of 9,000 kg/ha, while the hybrid NK Cobalt obtained a yield of 8,500 kg/ha, both cultivated under non-irrigated regime, in the agro-pedological-climate conditions of Baragan Plain, locality Slobozia, the farm I.I. Vișan Daniela Elena. Still, long term research has shown that practicing a monoculture for a several years has unfavourable effects on soil characteristics as well as on production.

Key words: corn hybrids, maturity group, monoculture

INTRODUCTION

The corn crop knows a spectacular developing in recent years. New discoveries in the molecular genetics applied to corn conducted to achieving of the more increased yields on the surface unit, with quality properties needed in the domains of corn uses, with genetic resistance to some pests and pathogens.

An important role in the corn crop has the appropriate zoning and micro-zoning of the corn crop, of corn hybrids, as well as the cultivation technologies, complementary components which determine the production, quality and profitability.

This paper aims the detailed knowledge of the corn biology, its characteristics and particularities, merged with technology news in order to achieve cultures that close as much as

possible to the biological potential of cultivated hybrids. Corn crop occupies an important place, is grown on large areas in all country zones, and represents an important source of income.

MATERIAL AND METHODS

In order to achieve the objectives of this paper, were chosen two corn hybrids, produced and improved by foreign companies, found in the Official Catalogue of plant varieties from Romania, 2014.

In this research approach, the two hybrids were cultivated on a surface of 15 ha, as follows: hybrid Bonito, produced by Saaten Union, cultivated on 6 ha and hybrid NK Cobalt, produced by Syngenta, on 9 ha.

The plant farm where the scientific research was conducted, was founded in 1998, being situated in Baragan Plain, Ialomita County, locality Slobozia Noua. The farm disposes of agricultural machinery for soil tillage, seeding, maintenance crop works and harvesting.

Situated in the eastern part of Romanian Plain, Baragan represents a territory with arid climatic conditions and steppe vegetation, which differentiates by the other subunits of Romanian Plain through certain geographical features. Baragan Plain is divided into three subdivisions, this experience was conducted in Central Baragan or Ialomita's Baragan, situated in central part of Baragan Plain, being well delimited by the two valley corridors of Ialomita and Călmățui.

Hybrid Bonito is obtained using modern biotechnology. It has superior agronomical characteristics, can be cultivated in all plain areas and in low hills zones, where the amount of active degrees is higher than 1,200 – 1,400°C. The triple-cross hybrid Bonito, semident corn type, is an early hybrid (340 FAO), with the vegetation period between 105-110 days. Correlated with a relatively short vegetation period, it is described as a hybrid with a stable yield potential and a good tolerance to the water and thermal stress, behaves very well at low temperatures in spring. Recommended plant population under non-irrigated culture is about 60,000-65,000 plants/ha, offering good results even in conditions of minimum technology. Medium height, strong vigor, the weight of 1000 grains is high, has a rapid loss of water in kernel. It adapts well to mechanized harvesting, has a good resistance to plant fall and certain diseases of corn crop: *Ustilago maydis* (Corn smut), *Fusarium* (Stalk Rot), *Helminthosporium turcicum* (Leaf blight).

Hybrid NK Cobalt is a semi-early hybrid (group 340 FAO), with a vegetation period between 120-130 days, stability in productions, increased tolerance to the thermal and water stress factors, adapts well to different pedo-climatic and agrotechnical conditions, with high production capacity, that responds favorable under medium-intensive technology and loses rapidly water from kernel. Medium height hybrid, capitalizes to the maximum the water resources and nutrients available in the soil, offering year after year, stable yields, regardless of the pedo-climatic and agrotechnical conditions. By the increased tolerance to drought, it is recommended for all culture zones for corn in Romania. Earliness and the rapid loss of water from kernels allow an easy harvesting, without additional costs for drying.

The two hybrids taken into study were watched on the entire growing period. In order to measure the parameters highlighted in the paperwork, observations and measurements were effectuated both in field and laboratory. The plants were measured from two adjacent rows, on 10 m length, in four points in the cornfield diagonal, so that the samples be more representative. The determinations were effectuated in the trial field situated at the farm I.I.

Visan Daniela Elena (Figure 1) and in the Phytotechny Laboratory within Faculty of Natural and Agricultural Sciences from University "Ovidius", Constanta.

RESULTS AND DISCUSSIONS

The culture technology applied in the farm was the same for both hybrids (NK Cobalt and Bonito).

Crop rotation. It was opted for monoculture.

Fertilization is a very important element that contributes to the level of production, therefore the judicious conditions of nutrition represents a considerable leverage in achieving high and quality yields. Fertilization was effectuated in 4 phases: in the autumn, before ploughing were applied 200 kg/ha (commercial product) complex fertilizer NPK 20:20:20. In spring were applied 40 kg/ha Nitrogen active substance, incorporated with the sowing machine. During vegetation (post-emergence), before hoeing, on June 10, was applied foliar fertilizer Plonvit (produced by Intermag), the recommended dose was 2 liters/ha. At hoeing was fertilized with another 40 kg N/ha.

Soil tillage. Ensuring the optimal conditions for the seeding and emergence of the crop as well as the biological activity of the soil, is mostly due to the soil tillage. The ploughing was effectuated at 25 cm depth, due to the medium soil type and vegetable scraps remained from the preliminary crop, which must be incorporated into the soil. The second tillage is represented by the disc harrow which was effectuated in two stages: the first disc was effectuated on March 20 with the star disc harrow with roller, and the second disc after 25 days, on April 14.

Seed and sowing. The seed used for sowing is certified, with 95% germination and 97% purity. Before sowing, it was treated by the producers with fungicide against soil pathogens and with insecticides in the farm, using Sedoprid 10 liters/ton for seed protection against soil pests.

Seeding was done with a sowing machine on 8 rows (SPC 8FS), in the optimum period, on April 15, when the temperature registered in the soil, 3 consecutive days, at 7 cm depth was 8°C. Distance between rows was 70 cm. Plant population at seeding used for both hybrids was 68,000 plants/ha, in a non-irrigated terrain.

Crop care works. There have not been chemical treatments in vegetation for chemical control of pests or diseases, other than the treatment of seeds before sowing. Weed control was effectuated both chemical and mechanical, as follows: on April 18 was realized the chemical control in 3 days after sowing, applying before emergence the herbicide Callisto 480 SC (Syngenta) for the control of broad leaf weeds (dicotyles) and gramineous weeds, in a dose of 330 ml/ ha. On June 1 was applied the herbicide Callisto Max (Syngenta), 330 ml/ ha, mixed with systemic herbicide Mistral (Syngenta), with a dose of 1.5 l/ha. The last intervention in weed control was effectuated mechanically, by hoeing on June 15.

Harvesting was effectuated at physiological full maturity, respectively 15% humidity at hybrid NK Cobalt, and 17% humidity for hybrid Bonito. The harvest was mechanized, in the form of grains, with the combine for cereal crops, equipped with cob harvester Laverda M12. Results obtained regarding the behavior of corn hybrids Bonito and NK Cobalt

Results regarding the height of plants. Corn plants of hybrid Bonito had variable heights, from 1.67 m to 2.3 m, with an average of 1.97 m. In the case of corn hybrid NK Cobalt, the plants had at full maturity variable heights, from 1.83 m until 2.3 m, with an average of 1.98 m (Table 1).

Table 1

Results regarding the height of plants at cultivated corn hybrids

Hybrids	Bonito	NK Cobalt
Average height of plants (m)	1.97	1.98
Average (m)	1.975	

Results obtained regarding the height of ear insertion

The height of ear insertion at corn plants of hybrid Bonito was variable, between 75.95 cm - 120 cm, with an average of 96.09 cm.

The height of ear insertion at hybrid NK Cobalt plants was variable, from 75.00 cm to 110 cm, with an average of 88.59 cm (Table 2).

Table 2

Results obtained concerning the height of ear insertion at the studied hybrids

Hybrids	Bonito	NK Cobalt
Height of ear insertion (cm)	96.09	88.59
Average (cm)	92.34	

Results obtained regarding the number of ears on plant

The number of ears on plant at hybrid Bonito was on average of 1.15, and at hybrid NK Cobalt was on average of 1.19 ears on plant (Table 3).

Table 3

Results obtained regarding the number of ears per plant at the experienced hybrids

Hybrids	Bonito	NK Cobalt
Number of ears/plant	1.15	1.19
Average	1.17	

In order to determine the proportion between the main yield and secondary production at the two grown hybrids, were effectuated determinations regarding the weight of whole plants (stalks, cob with kernels), the mass of ear with kernels, the cob weight (without kernels) and kernels (removed from the cob).

Results regarding the weight of whole plants

Table 4

Results obtained regarding the weight of whole plants at the studied hybrids

Hybrids	Bonito	NK Cobalt
Weight of whole plants (g)	513.3	526.6
Average (g)	519.95	

Regarding to the whole plants weight at the studied hybrids, it is observed that hybrid Bonito had the mass of whole plants on average of 513.3 g, and at hybrid NK Cobalt of 526.6 g. Average weight of whole plants at the two hybrids was of 519.95 g (Table 4).

Results obtained regarding the mass of ears with kernels

After the determinations were effectuated, the average mass of the ears with kernels was about 346.6 g at hybrid Bonito, and 410 g at hybrid NK Cobalt. The mean of results regarding the mass of the ears with kernels at the studied hybrids was of 378.3 g (Table 5).

Table 5

Results obtained regarding the mass of ears with kernels at the experienced hybrids

Hybrids	Bonito	NK Cobalt
Mass of ears with kernels (g)	346.6	410
Average (g)	378.3	

Results obtained regarding the mass of cobs without kernels

For the studied hybrids, the results obtained regarding the mass of cobs without kernels was of 46.6 g at hybrid Bonito and 50 g for hybrid NK Cobalt. The average of the values regarding the weight of the cobs without kernels at the experienced hybrids was of 48.3 g (Table 6).

Table 6

Results obtained regarding the mass of cobs without kernels at the experienced hybrids

Hybrids	Bonito	NK Cobalt
Weight of cobs without kernels (g)	46.6	50
Average (g)	48.3	

Results obtained regarding the weight of kernels from the cob

Table 7

Results obtained regarding the weight of kernels from the cob at the analyzed hybrids

Hybrids	Bonito	NK Cobalt
Weight of kernels from the cob (g)	300	360
Average (g)	330	

In the experimental year 2014, under agro-pedological-climatic conditions from Baragan Plain, locality Slobozia, farm I.I. Vişan Daniela Elena, hybrid Bonito registered on average 300 g the weight of kernels from the cob and hybrid NK Cobalt had 360 g the weight of kernels.

The determinations results of 1,000 kernels weight

After laboratory analysis, the weight of 1,000 kernels at hybrid Bonito was 337 g, and at hybrid NK Cobalt was registered the value of 348 g for the weight of 1,000 kernels.

Results of the obtained yields

In the experimentation year 2014, hybrid Bonito registered a yield of 9,000 kg/ha, while the hybrid NK Cobalt obtained a yield of 8,500 kg/ha, both cultivated under non-irrigated regime, in the agro-pedological-climate conditions of Baragan Plain, locality Slobozia, the farm I.I. Vişan Daniela Elena.



Figure 1 – Practical aspects during plant measurements in the field

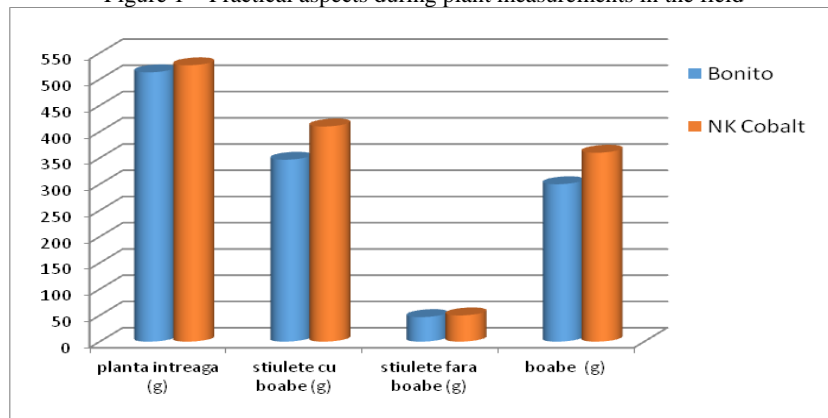


Figure 2 – Yield structure, with components (g)

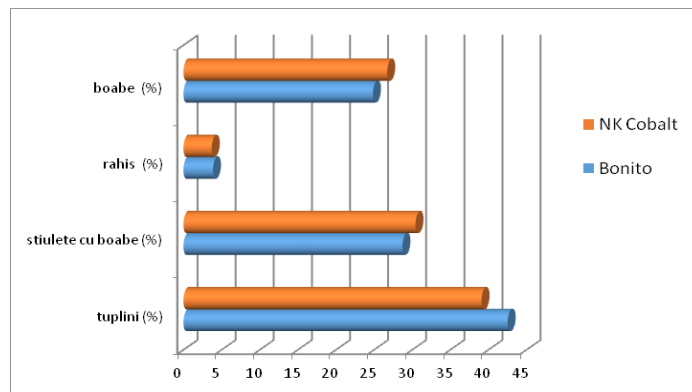


Figure 3 – Yield structure, with components (%)

CONCLUSIONS

It was studied the behavior of some corn hybrids in Baragan area, respective NK Cobalt and Bonito, grown in monoculture, using a classic culture technology, conducting the fertilization in 4 stages. The ploughing was effectuated at 25 cm depth, the disc harrowing was effectuated in two stages: first on March 20 with the star disc harrow with roller, and the second disc after 25 days, on April 14. The seed is certified, germination being 95% and purity 97%, treated by the producers with fungicide against soil pathogens and with insecticides, in the farm, using Sedoprid 10 l/ton for seed protection against soil pests.

Plant population at seeding used for both hybrids was 68,000 plants/ha, non-irrigated.

There have not been chemical treatments in vegetation for chemical control of pests or diseases. Weed control was effectuated both chemical and mechanical, as follows: on April 18 was realized the chemical control, in 3 days after sowing, applying before emergence the herbicide Callisto 480 SC (Syngenta) for the control of broad leaf weeds (dicotyledenous) and gramineous weeds, in a dose of 330 ml/ ha.

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Humidity at harvest was 15% at hybrid NK Cobalt, and 17% humidity for hybrid Bonito.

Corn plants of hybrid Bonito had variable heights, from 1.67 m - 2.3 m, with an average of 1.97 m, and in the case of corn hybrid NK Cobalt, the plants had at full maturity variable heights, from 1.83 m - 2.3 m, with an average of 1.98 m

The height of ear insertion at corn plants of hybrid Bonito was variable, between 75.95 cm - 120 cm, with an average of 96.09 cm, and the height of ear insertion at hybrid NK Cobalt plants was variable, from 75.00 cm - 110 cm, with an average of 88.59 cm

The number of ears per plant at hybrid Bonito was on average of 1.15, and at hybrid NK Cobalt was on average of 1.19 ears / plant.

Regarding to the weight of whole plants at the studied hybrids, it is observed that hybrid Bonito had the mass of whole plants on average of 513.3 g, and at hybrid NK Cobalt was 526.6 g. Average weight of whole plants at the two hybrids was of 519.95 g.

The average mass of the ears with kernels at hybrid Bonito was 346.6 g, and of 410 g at the hybrid NK Cobalt. The mean of the obtained results regarding the mass of the ears with kernels at the studied hybrids was of 378.3 g.

For the studied hybrids, the results obtained regarding the mass of cobs without kernels was of 46.6 g at hybrid Bonito and 50 g at hybrid NK Cobalt. The average of the values obtained regarding the weight of the cobs without kernels at the experienced hybrids was of 48.3 g.

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