Doctoral thesis

Research regarding the behavior of maize hybrids in double crop, in Moara Domnească – Ilfov area

SUMMARY

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The doctoral thesis contains 10 chapters, in the first 3 chapters presents a study based on specialized literature, the next chapters presents the research objectives, the experimentation conditions, the results obtained and the conclusions.

One of the procedures that can highlight the potential of the vegetation factors (light, heat, precipitations etc.) is the use of double crops (Țîru, 1973). These are part of the measures to increase crop production and the human resources and the invested capital to achieve a double harvest is often lower than for the main crop.

In **chapter I** – **The importance and efficiency of double crops**, are defined and classified the double crops, and explained the importance and the efficiency of the double crops. It is specified the best preemergent plants for double crops. It exemplifies a representative number of double crops (soybean, sunflower, millet) and research conducted on them. The chapter contains references to research results on double crops domestically and internationally.

In **chapter II** – **Maize (*Zea mays* L.)**, it's presented the maize crop in terms of importance, chemical composition, biological features, systematics and hybrids, requirements for climate and soil and production technology.

In **chapter III** – **Maize double crop**, describes the current state of research in Romania and abroad on maize double crop. In Romania, one of the first data on maize double crop production technology, are reported by Pleşa and Oblocinski (1963), Hulpoi, Negomireanu, Picu, Sipos, Rosca and Paltineanu (1968). During 1973-1976, Sarca, Cosmin and Neguţ create a special maize breeding program for irrigated double crops for grain and silage production. Among the studies conducted by foreign researchers on the maize double crop are: Alexeev, Trima, Osin, Kononicov (1963), Murphy (1983), Behl (1998), Kratochvil (2006), Kumar (2007), Li-Juan (2011), Graß (2013). Research conducted on the maize double crop, both domestic and foreign researchers, focused on sowing date, the influence of hybrids, irrigation regime, the fertilization doses and the influence of the preemergent plants on the production of the double crop.

In **chapter IV – Research objectives and experimentation conditions**, are presented the objectives of the research and the climatic conditions in which the experiments were conducted.

The research objectives were focused on the better use of the natural conditions of the area of S-E of Romania through the use of maize double crop, establishing the maturity groups of the maize hybrids that can reach physiological maturity, highlighting the maize hybrids with the highest biomass production and establishing the most effective technological elements (agrofond, irrigation regime).

The research has been conducted at the Moara Domnească teaching farm of the University of agriculture science and veterinary medicine of Bucharest, situated in Vlăsiei plain in the S-E in the transition area between steppe to silvosteppe.

The climatic conditions of the year 2013, registered a sum of useful temperature degrees ($t^o \geq 6^oC$) of 1180^oC with 55^oC more than the normal of the area, and for the year 2014 the sum of useful temperature degrees ($t^o \geq 6^oC$) was 1504^oC from sowing to fresh biomass harvest and 1650^oC from sowing to grain harvest. The amount of precipitation for the maize double crop was 149,6 mm in 2013 and 174,8 mm in 2014.

In **chapter V – Material and method**, is presented the biological material, the methods used and the technology applied. The research was carried out in a trifactorial experience, the three factors were: the hybrid, the agrofond and the irrigation regime. The maize hybrids used were: a_1: LG 22.44 (FAO 240), a_2: LG 30.290 (FAO 290), a_3: Cera 290 (FAO 290), a_4: Cera 390 (FAO 390) și a_5: LG 30.489 (FAO 470). The irrigation regimes were: b_1: non-irrigated (check), b_2: irrigated with 450 m^3/ha and b_3: irrigated with 900 m^3/ha. The fertilization levels were: c_1: unfertilized, c_2: nitrogen 80 kg/ha active substance, c_3: nitrogen 80 kg/ha active substance plus foliar fertilization and c_4: foliar fertilization. In 2014 the maize hybrids used were: a_1: Sudoku (FAO 220), a_2: LG 32.32 (FAO 230), a_3: Sunnergy (FAO 270), a_4: PR39B76 (FAO 280), a_5: LG 30.290 (FAO 290), a_6: Bonito (FAO 340) and a_7: LG 30.489 (FAO 470). The irrigation regimes were: b_1: non-irrigated (check), b_2: irrigated with 450 m^3/ha and b_3: irrigated with 900 m^3/ha. The fertilization levels were: c_1: unfertilized, c_2: nitrogen 80 kg/ha active substance, c_3: nitrogen 80 kg/ha active substance plus foliar fertilization, c_4: foliar fertilization and c_5: nitrogen 80 kg/ha active substance, phosphorus 60 kg/ha active substance and potassium 60 kg/ha active substance.

In **chapter VI – The research results obtained in 2013**, are descibed the research results obtained in 2013. It's presented the influence of the hybrid on the fresh biomass production observing that the hybrid LG 22.44 is the best at all irrigation regimes obtaining yield between 28.3 t/ha at non-irrigated and 63.9 t/ha at irrigated with 900 m^3/ha and fertilization level nitrogen 80 kg/ha active substance plus foliar fertilization. The influence of the fertilization level

on the fresh biomass production is analyzed, the fertilization level N_{80} plus foliar fertilization brings an additional 18.1 t/ha fresh biomass. Also it can be concluded that the irrigation regime with 900 m^3/ha registers the highest increase in production, 20.2 t/ha fresh biomass.

Regarding the dry matter production in the conditions of 2013 is found that the hybrid LG 30.489 achieves the highest dry matter production for the non-irrigated and irrigated with 450 m^3/ha variants and the hybrid LG 30.290 obtains the highest productions at irrigated with 900 m^3/ha

The crude protein production registers the highest values at the hybrid LG 30.290 at irrigated with 450 m^3/ha water and fertilization level N_{80}.

In **chapter VII – The research results obtained in 2014**, are described the research results obtained in 2014. From the analysis of the influence of the hybrid on the fresh biomass production results that in the conditions of 2014 the hybrid LG 30.489 registers the highest fresh biomass production. The influence of the fertilization level on the fresh biomass production is statistically significant, the agrofond $N_{100}P_{60}K_{60}$ registers the highest production increases up to 16.7 t/ha fresh biomass. The irrigation with 900 m^3/ha registers the highest production increases, up to 15.5 t/ha fresh biomass.

For the climatic conditions of Moara Domnească – Ilfov in 2014, there is a significant influence of the hybrid on the production of dry matter. Hybrid LG 30.290 registers the highest productions at all three irrigation regimes obtaining productions of up to 19.6 t/ha of dry matter. Also, the agrofond $N_{100}P_{60}K_{60}$ registers the highest production increases at all irrigation regimes.

Concerning the crude protein production, it's observed that the hybrid PR39B76 in a non-irrigated and fertilized with $N_{100}P_{60}K_{60}$ crop registers the highest production of 1009 kg/ha crude protein.

The climatic conditions of 2014 have enabled the maize double crop to reach physiological maturity. So we could determine the influence of the analyzed factors on the grain yield. In a non-irrigated crop the best hybrid at agrofonds N_0, N_{80}, N_{80} plus foliar fertilization and $N_{100}P_{60}K_{60}$ was Bonito registering yields that ranged between 3430.8 kg/ha and 4327 kg/ha, and for the variant with foliar fertilization the hybrid PR39B76 registered the highest yield of 3642.3 kg/ha. For irrigated with 450 m^3/ha water the most productive hybrid was PR39B76, registering yields that ranged between 4050 kg/ha and 5338 kg/ha. For irrigated with 900 m^3/ha water at unfertilized and foliar fertilization agrofonds the hybrid Bonito registers the highest yields that ranged between 4609 kg/ha and 4830.4 kg/ha, while at the other agrofonds the hybrid PR39B76 registers the highest yields that ranged between 5623,4 kg/ha and 5926,8 kg/ha

The influence of the fertilization level on the grain yield results to be statistically significant the highest increases being brought by $N_{100}P_{60}K_{60}$.

The irrigation regime that determined the highest grain yields was the 900 m^3/ha water, that brought yield increases ranging between 1220.4 kg/ha and 1840.8 kg/ha.

After analyzing the grain yield in terms of quality, results that for the non-irrigated crop the hybrid Sudoku registers the highest crude protein production of 456.3 kg/ha and for the irrigated with 900 m^3/ha water crop the hybrid LG 30.290 registers a production of 629.9 kg/ha of crude protein. The agrofond $N_{100}P_{60}K_{60}$ causes the highest crude protein production increases.

In **chapter VIII – Research results expressed as an average for 2013-2014**, is presented the influence of the hybrid, fertilization level and irrigation regime on the average productions of fresh biomass in 2013-2014. It is noticed the hybrid LG 30.290 that registers the highest productions of fresh biomass across all irrigation regimes. The fertilization level of N_{80} plus foliar fertilization determines the highest production increases and the same it's also noticed for the irrigation regime of 900 m^3/ha.

In **chapter IX – Economic efficiency of the maize double crop**, is presented data regarding the economic efficiency of the maize double crop in Moara Domnească area. For the fresh biomass production the most profitable hybrid is LG 30.489 at irrigation regime with 900 m^3/ha and agrofond of N_{80} plus foliar fertilization, obtaining a profit of 3978 lei/ha. For the grain yield the most profitable hybrid is PR39B76 at irrigation regime with 900 m^3/ha and agrofond of N_{80}, obtaining a profit of 1345 lei/ha.

In **chapter X – Conclusions and recommendations**, are presented the conclusions and recommendations of the research regarding the maize double crop in Moara Domnească – Ilfov area in 2013-2014. The earliest hybrid LG 22.44 registers the highest productions of fresh biomass in 2013 and because that in 2014 the sum of useful temperature degrees recorded was higher it permitted the late hybrids to express better their potential. So in 2014 the highest fresh biomass productions were recorded for the hybrids LG 30.489 and LG 30.290. Regarding the agrofond, it been noticed that the high fertilization levels brings significant production increases in both years. The irrigation regime with 900 m^3/ha generates the highest fresh biomass productions in 2013 and also in 2014. The hybrid LG 30.290 registers the highest dry matter production in 2013 and also in 2014.

Regarding the grain yield it is found that the earliest hybrids yields the highest harvests up to 5926.8 kg/ha. The agrofond $N_{100}P_{60}K_{60}$ brings the highest yield increases and the irrigation regime with 900 m^3/ha water registers the highest yields.

Regarding the crude protein production from biomass, it is noticed the hybrids LG 30.290 and PR39B76 with 889 kg/ha and 1009 kg/ha and regarding the crude protein production from grains the hybrid LG 30.290 registers a yield of 629.9 kg/ha at the agrofond $N_{100}P_{60}K_{60}$ and irrigation regime 900 m^3/ha.

For Moara Domnească area it can be recommended the cultivation of hybrids from the FAO 200-300 group with fertilization doses of 80 kg/ha nitrogen active substance plus foliar fertilization for a fresh biomass production and the cultivation of hybrids from the FAO 100-200 and 200-300 groups with fertilization doses of 80 kg/ha nitrogen active substance plus foliar fertilization for a grain production.