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RESEARCHES ON THE INFLUENCE OF HYBRID AND IRRIGATION REGIME ON MAIZE CROP

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Abstract

The research was carried out at ARDS Marculesti, Calarasi County, Romania, in 2017, 2018 and 2019 years. The experiment had two factors, namely: the maize hybrid and the irrigation regime. The investigated maize hybrids were: P9175 (FAO 330), KWS BELLAVISTA (FAO 330), KWS SMARAGD (FAO 350), KWS KASHMIR (370 FAO) and KWS DURANGO (FAO 480). Four irrigation regimes were researched: rainfed, stressed at and after flowering, stressed before flowering and full irrigated throughout the vegetation period. The yield results obtained in the three years of experimentation showed that the lowest yield was obtained for the hybrid P9175, of 10,920 kg/ha. The hybrids Durango, Kashmir and Smaragd gave very significant positive differences compared to the hybrid P9175 taken as a control; these production differences were between 890 and 1760 kg/ha. The Bellavista hybrid gave yields close to those of the P9175 hybrid. Regarding the moisture content of grains at harvest, the lowest values were obtained by the hybrid P9175.

Key words*: yield, grains moisture, irrigation regime, corn hybrid.*

INTRODUCTION

Maize occupies the third place in the world as a cultivated plant, originating from America, North of the equator. It was cultivated in Spain, after which it was also cultivated in Italy. Analyzing the evolution of production between 1939 and 2009 in the US, Assefa Y. et al., (2012) show that it increased from 1,500 kg/ha to over 8,000 kg/ha, mainly due to the application of irrigation and chemical fertilizers. In Romania, 70% of the lands cultivated with maize are in the west plain of the country and in the south of the country (Luca E. et al., 2009; Meluţ L.C. et al., 2009).

According to american researchers, when the average temperature of May falls below 12.7°C, corn production decreases by 15% (Wagger M. G. and Cassel D. K., 2008; Harold V. Eck, 1984; Jackson R.D., 1982;).

A critical period is the flowering, when the temperature must be between 18-24°C (Hall AJ et. Al., 1982; Hajibabaee M. et. Al., 2012). The high temperatures, in this phase, determine a pronounced gap between the appearance of tassel and that of silks (Jackson R.D. et. Al., 1981). At a temperature of 28-30°C, the viability of the pollen decreases. Temperature amplitudes above 30°C during the day and below 10.0ºC at night, which occur in the 6th and 7th stages of organogenesis, prevent the formation of anthers, implicitly the development of pollen grains and the normal development of fertilization processes (DeLoughery RL and Crookston RK, 1979; DeJonge KC et al., 2015; Mahdi M. Al - Kaisi and Xinhua Yin, 2003). In the grain filling phase, the lack of moisture causes them to remain undevelopped (Cakir R., 2004; Lamm F.R. et al. 2012; Mustek J.T. and Dusek D.A., 1980; Claassen M.M. and Shaw R.H., 1970).Under the conditions in our country, maize production is above average when rainfall is over 40 mm in May, 60 mm in June, 60 mm in July and less than 80 mm in August (Melut L.C. et al., 2009).

Considering that 75% of the water pumped from aquifers is used for crop irrigation, (Wallace, 2000; Howell, 2001; cited by Grassinia P. et al., 2011), as well as the fact that during the critical period for water in the months July and August, when large amounts of water need to be applied by irrigation, many researchers, especially in arid and semi-arid areas, have considered the quantitative and economic efficiency of applying irrigation to

maize (DeJonge K.D. et al., 2011; Echarte L. and Andrade L.H., 2003; Grassinia P. et al., 2011; Hao B. et al., 2015). Other reserchers have taken into account the method of irrigation as well as the specific consumption per kg of grain in order to optimise the process (Howell T.A., 2001; Howell T.A. et al., 1989; Howell T.A. et al., 2002; Howell T.A. et al., 1998; Irmak S. et al., 2000; Klocke N.L. et al., 2011). The type of the hybrid, plant density, the nitrogen ammount as well as the plant morphological components were, also researched, in order to be correlate with the irrigation techniques (Lamm F.R., 2017); Marek G.W. et al., 2017; Norwood C.A., 2000; Norwood C.A. and Dumler T.J., 2002; O'Shaughnessy Susan A. et al., 2017; Samia Amiri et al., 2015; Schlegel A.J. et al., 2010; Steele D.D. et al., 1994).

MATERIALS AND METHODS

The research aimed at the yield of corn hybrids between FAO 320-450 ripening groups under irrigated conditions in different phenophases and their response during flowering to water stress.

The experiment was performed according to the method of subdivided plots with two factors and the placement scheme was in randomized blocks which assumes that all variants of a repetition are placed in a block, in this case, the repetition being the same as the block.

The A factor was considered the corn hybrid and it had 5 graduations:

a1 - P9175
a2 - KWS Bellavista
a3 - KWS Durango
a4 - KWS Kashmir
a5 - KWS Smaragd

The B factor was considered the irrigation regime and it had 4 graduations:

b1 - rainfed
b2 - stressed after flowering
b3 - stressed before flowering
b4 - full irrigated

The trial had 3 replications. The sowing and harvesting were mechanically performed, with special equipment for research for experimental plots (Mircea V. et al., 2020).

Figure 1. The BAURAL SP2100 harvester for experimental plots, on two rows

RESULTS AND DISCUSSIONS

The climatic conditions of the years of experimentation are shown in the graphs below.

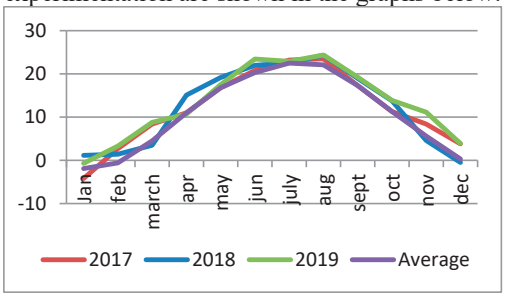

Figure 2. The average monthly air temperature in 2017, 2018 and 2019, compared to the multiannual average, at ARDS Marculesti

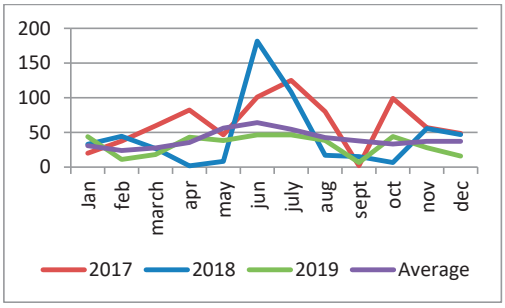

Figure 3. Monthly rainfall in 2017, 2018 and 2019, as compared to the multiannual average at ARDS Marculesti

From these graphs it can be seen that 2017 was a year with average monthly temperatures close to the multiannual average but with very abundant rainfall in the summer months, June, July and August. In September, only 2 mm of precipitation was recorded, but this did not affect the production of corn. Also, in May, 25 mm were recorded, compared to 45 mm as the multiannual average, which determined the drought phenomenon in the first phases of maize growth (Figures 2 and 3).

In 2018, the recorded monthly rainfall was extremely unevenly distributed. Thus, in the first months of spring there were very low precipitations, almost non-existent in April and May (1.80 and 8.20 mm). The average monthly temperature higher than the multiannual average, recorded in April (15.08 compared to 11.00°C) together with the low soil moisture affected the early emergence and growth of corn plants. In contrast, in June and July there were record rainfalls, three to two times higher than the multiannual average (182 compared to 65 mm in June and 108 compared to 55 mm in July). Extremely abundant rainfall during this period favored the growth and development of corn plants in optimal conditions. August and September were dry, but this did not affect corn production (Figures 2 and 3).

In 2019, in the first part of the vegetation period, the average monthly temperatures were very close or identical to the multiannual average.

Regarding precipitation, in 2019, values for the entire vegetation period were recorded below the multiannual average. Early hybrids made better use of the water reserve in the soil, this being observed in the higher yields obtained by early hybrids than late ones (Figures 2 and 3).

The grain yield per hectare registered in 2017 highlights the Durango hybrid, with the highest quantity. The lowest yield was obtained for the P9175 hybrid. The yield differences are very significant positive between the Durango hybrid and P9175 at all irrigation regimes. In rainfed conditions, all hybrids showed very significant positive differences compared to the P9175 hybrid, except for the Bellavista hybrid, which recorded a significantly positive difference (Table 1). When stressed after flowering, the Durango hybrid recorded a distinctly significant positive difference and the Kashmir hybrid recorded a significantly positive difference. At this irrigation regime, the Bellavista and Smaragd hybrids recorded insignificant differences compared to the P9175 hybrid. All the irrigation regimes gave very significant positive differences compared to the rainfed one, taken as a control. This proves the importance of irrigation on corn production. Research related to corn hybrids has also been carried out by Romanian and foreign researchers (Baumhardt R.L. et al., 2013; Domuţa C. et al., 2009; Luca E. et al., 2009).

Table 1. The influence of the hybrid and the irrigation regime on grain yield in 2017

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 - rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.
P9175	**9028**	**100**	**Mt**		**12353**	**100**	**Mt**		**12502**	**100**	**Mt**	
Bellavista	9818	108	789	*	12273	99	-80		12643	101	141	
Durango	11032	122	2004	***	13561	109	1208	**	14692	117	2190	***
Kashmir	10473	116	1444	***	13212	106	858	*	13356	106	853	*
Smaragd	10978	121	1950	***	12670	102	316		13325	106	823	*
DL 5% = 775 Kg/ha DL 1% = 1044 Kg/ ha DL 0.1% = 1386 Kg/ha												
Hybrid	b4 – full irrigated				Comparisons between irrigation regimes							
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Irrigation regime	Yield, kg/ha	%	Diff., kg/ha	Sign.			
P9175	**13109**	**100**	**Mt**		**Rainfed**	**10266**	**100**	**Mt**				
Bellavista	13109	100	0,0		Stressed after flowering	12814	124	2548	***			
Durango	14754	112	1645	***	Stressed before flowering	13303	129	3037	***			
Kashmir	14218	108	1108	**	Ffull irrigated	13755	133	3488	***			
Smaragd	13583	103	473									
DL 5% = 775 Kg/ha DL 1% = 1044 Kg/ ha DL 0.1% = 1386 Kg/ha					DL 5%=346 kg/ha; DL 1%=467 kg/ha; DL 0.1%=620 kg/ha							

The moisture of the grains at harvest is a very important feature because it influences the possibility of keeping the production in silos. If the moisture content of the grains is too high,

the mechanized harvesting process with the combine can also be difficult. In addition, high grain moisture requires additional costs to dry the crop in order to preserve it.

The results obtained in 2017 show that the lowest moisture of grains at harvest was recorded for the hybrid P9175 (14.28%) and the highest for the hybrid Durango (17.88%). This correlates with the yield and the FAO group. When the P9175 hybrid was taken as a control, the differences compared to all other hybrids were very significantly positive. Related to the irrigation regime, this year it is found that the rain fed treatments registered the lowest values, of 14.85%. The moisture content of the grains at harvest increased as irrigation was applied before flowering, after flowering and recorded the highest value, of 16.55% in the case of full irrigated treatment (Table 2).

Tabelul 2. The influence of the hybrid and the irrigation regime on the grain moisture content at harvest in 2017

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 - rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	U, %	%	Diff., kg/ha	Sign.	U, %	%	Diff., kg/ha	Sign.	U, %	%	Diff., kg/ha	Sign.
P9175	13.77	100	Mt		13.80	100	Mt		14.52	100	Mt	
Bellavista	14.98	108.81	1.21	***	15.63	113.26	1.83	***	16.00	110.25	1.49	***
Durango	16.99	123.41	3.23	***	17.29	125.27	3.49	***	18.04	124.29	3.53	***
Kashmir	13.98	101.51	0.21		15.13	109.60	1.33	***	15.49	106.70	0.97	**
Smaragd	14.53	105.50	0.76	*	15.39	111.51	1.59	***	15.88	109.39	1.36	***
DL 5%=0.59 %; DL 1%=0.80 %; DL 0.1%=1.07 %												

Hybrid	b4 - full irrigated				Comparisons between irrigation regimes			
	U%	%	Diff., %	Sign.	Irrigation regime	U%	%	Diff., %	Sign.
P9175	**15.04**	**100**	**Mt**		**Rainfed**	**14.85**	**100**	**Mt**	
Bellavista	16.57	110.20	1.54	***	Stressed after flowering	15.60	105.04	0.74	***
Durango	19.17	127.47	4.13	***	Stressed before flowering	16.23	109.27	1.37	***
Kashmir	16.16	107.41	1.12	***	Full irrigated	16.55	111.45	1.70	***
Smaragd	16.34	108.66	1.30	***					
DL 5%=0.59 %; DL 1%=0.80 %; DL 0.1%=1.07 %					DL 5%=0.27 %; DL 1%=0.37 %; DL 0.1%=0.49 %				

In 2018 year, too, the highest yields were obtained for late hybrids, Durango, Kashmir and Smaragd and the lowest, for early hybrids, Bellavista and P9175. The differences between the Durango, Kashmir and Smaragd hybrids and the P9175 hybrid, which recorded the lowest yield, were distinctly or significantly positive. In the case of stressed after flowering, the Bellavista and Durango hybrids did not show significant differences compared to the P9175 hybrid. Occasionally, certain climatic conditions may cause these differences. However, as an average of irrigation regimes, the Bellavista hybrid recorded a higher yield than the P9175 hybrid but this was not statistically assured (Table 3).

The irrigation regimes gave different results compared to 2017 and 2019. In this sense, if in the other two years the yield increased as irrigation was applied, from rainfed, stressed after flowering, stressed before flowering and full irrigated. This year, the stressed after flowering treatment gave a higher yield than the stressed before flowering treatment (13,038 compared to 12,096 kg/ha). This difference is very significantly positive (Table 3).

The results regarding the moisture of the grains at harvest obtained in 2018 are very similar to those obtained in 2017, in the sense that the lowest value was recorded by the hybrid P9175 (14.28%) and the highest, at the hybrid Durango (18.23%). Again, it can be seen that the hybrid that gave the lowest yield, namely P9175 recorded the lowest grain moisture at harvest and the hybrid that gave the highest grain yield also had the highest grain moisture. When the P9175 hybrid was taken as a control, all other hybrids gave very significant positive differences. Within each irrigation regime, significant, distinctly significant and very significant positive differences were also obtained compared to the P9175 hybrid (Table 4).

Regarding the influence of irrigation regimes, this year, the lowest value of grain moisture at harvest was obtained for rainfed treatments and this parameter increased steadily for irrigated varieties before flowering, after flowering and

irrigated throughout the vegetation, with values between 0.70 and 0.50%.

These differences are very significantly positive (Table 4).

Table 3. The influence of the hybrid and the irrigation regime on yield in 2018

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 –rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.
P9175	11121	100	Mt		12323	100	Mt		10964	100	Mt	
Bellavista	11634	104	512		12034	97	-289		11779	107	814	
Durango	12098	108	976		13773	111	1449	*	12599	114	1635	**
Kashmir	12369	111	1247	*	13774	111	1450	*	12466	113	1501	*
Smaragd	12662	113	1541	**	13287	107	963		12672	115	1707	**
DL 5%=1139 kg/ha; DL 1%=1535 kg/ha; DL 0.1%=2038 kg/ha												
Hybrid	b4 – full irrigated				Comparisons between irrigation regimes							
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Irrigation regime	Yield, kg/ha	%		Diff., kg/ha	Sign.		
P9175	**12168**	**100**	**Mt**		**Rainfed**	**11977**	**100**		**Mt**			
Bellavista	12347	101	178		Stressed after flowering	13038	108		1061	***		
Durango	13895	114	1726	**	Stressed before flowering	12096	100		119			
Kashmir	13848	113	1679	**	full irrigated	13093	109		1116	***		
Smaragd	13209	108	1040									
DL 5%=1139 kg/ha; DL 1%=1535 kg/ha; DL 0.1%=2038 kg/ha					DL 5%=509 kg/ha; DL 1%=686 kg/ha; DL 0.1%=911 kg/ha							

Table 4. The influence of the hybrid and the irrigation regime on the grain moisture content at harvest in 2018

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 - rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	U,%	%	Diff., kg/ha	Sign.	U,%	%	Diff., kg/ha	Sign.	U,%	%	Diff., kg/ha	Sign.
P9175	**13.77**	**100**	**Mt**		**13.80**	**100**	**Mt**		**14.52**	**100**	**Mt**	
Bellavista	14.98	108.80	1.21	***	15.63	113.26	1.83	***	16.00	110.22	1.49	***
Durango	16.99	123.41	3.23	***	18.04	130.72	4.24	***	18.73	128.99	4.21	***
Kashmir	13.98	101.50	0.21		15.13	109.60	1.33	***	15.49	106.70	0.97	**
Smaragd	14.53	105.49	0.76	*	15.39	111.51	1.59	***	15.88	109.39	1.36	***
DL 5%=0.61 %; DL 1%=0.83 %; DL 0.1%=1.10 %												
Hybrid	b4 – full irrigated				Comparisons between irrigation regimes							
	U,%	%	Diff., %	Sign.	Irrigation regime	U,%	%		Diff., %	Sign.		
P9175	**15.04**	**100**	**Mt**		**Rainfed**	**14.85**	**100**		**Mt**			
Bellavista	16.57	110.20	1.54	***	Stressed after flowering	15.60	105.04		0.74	***		
Durango	19.17	127.47	4.13	***	Stressed before flowering	16.12	108.55		1.27	***		
Kashmir	16.16	107.41	1.12	***	Full irrigated	16.66	112.16		1.80	***		
Smaragd	16.34	108.66	1.30	***								
DL 5%=0.61 %; DL 1%=0.83 %; DL 0.1%=1.10 %					DL 5%=0.27 %; DL 1%=0.37 %; DL 0.1%=0.49 %							

In 2019, the Durango hybrid, which gave the highest yields in 2017 and 2018, recorded the lowest amount of grains per hectare, namely 9,228 kg. This yield was even lower than that obtained for the P9175 hybrid, which recorded the lowest values in the first two years of experimentation. This situation can be explained by the fact that this year there was a period of drought from the second half of June until the end of the maize vegetation period, at the beginning of September. The Durango hybrid, being the latest experimented hybrid, from the FAO 450 group, suffered the most due to the drought during this period because the flowers buds and, implicitly, the grain production was affected. However, even in this situation, the application of irrigation determined the increase of the yield, from 7,727 kg/ha to rainfed treatment, to 8,418 kg/ha to stressed after, 9,845 kg/ha to stressed before flowering and 10,923 kg/ha to full irrigated treatment. All these differences from irrigated varients are very significantly positive, which highlights the importance of irrigation. Another interesting fact recorded in 2019 was the very significant positive difference recorded by the Bellavista hybrid compared to the P9175 hybrid, namely 807 kg/ha. The other two hybrids, Kashmir and Smaragd, gave very high yields compared to the Durango and P9175

hybrids, with very significant positive differences (Table 5).

Irrigation regimes have been steadily increasing, from rainfed to stressed after flowering, stressed before flowering and full irrigated throughout the vegetation period, at rates of approximately 1,000 kg/ha, from 8,122 kg/ha to rainfed, up to 11,384 kg/ha for full irrigated treatment. These differences are very significant statistically, proving the importance of applying irrigation to maize (Table 5).

Table5. The influence of the hybrid and the irrigation regime on grain yield in 2019

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 - rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.	Yield, kg/ha	%	Diff., kg/ha	Sign.
P9175	**7700**	**100**	**Mt**		**8837**	**100**	**Mt**		**9751**	**100**	**Mt**	
Bellavista	8059	104	358		9631	108	794	*	10591	108	840	**
Durango	7727	100	26		8418	95	-419		9845	100	94	
Kashmir	8791	114	1090	**	9840	111	1002	**	10489	107	737	*
Smaragd	8332	108	631	**	9855	111	1018	**	10778	110	1027	**
DL 5%= 613 kg/ha; DL 1%= 827 kg/ha; DL 0.1%= 1098 kg/ha												
Hybrid	b4 – full irrigated				Comparisons between irrigation regimes							
	Yield, kg/ha	%	Diff., kg/ha	Sign.	Irrigation regime		Yield, kg/ha		%		Diff., kg/ha	Sign.
P9175	**10769**	**100**	**Mt**		**Rainfed**		**6578**		**100**		**Mt**	
Bellavista	12007	111	1237	***	Stressed after flowering		7634		116		1056	***
Durango	10923	101	153		Stressed before flowering		8324		126		1745	***
Kashmir	11245	104	475		full irrigated		9202		139		2623	***
Smaragd	11978	111	1208	***								
DL 5%= 613 kg/ha; DL 1%= 827 kg/ha; DL 0.1%= 1098 kg/ha					DL 5%= 274 kg/ha; DL 1%= 370 kg/ha; DL 0.1%= 491 kg/ha							

The lowest values of grain moisture at harvest were recorded, again this year, with the hybrid P9175 (10.01%), with very significant positive differences compared to all other hybrids investigated. Within each irrigation regime, there were only two situations when the differences were significant, namely, with full irrigated, between the hybrids Kashmir and P9175 and, respectively, between Smaragd and P9175.

The differences between the irrigation regimes were similar to those registered in 2018, namely, the humidity of the grains at harvest increased from the rainfed treatments (10.69%), constantly, to the full irrigated treatments (11.97%), with a rate of approx. 0.5%, considered very significant from a statistical point of view (Table 6).

Table 6.The influence of the hybrid and the irrigation regime on the grain moisture at harvest in 2019

Comparisons between hybrids at the same irrigation regime												
Hybrid	b1 - rainfed				b2 – stressed after flowering				b3 – stressed before flowering			
	U,%	%	Diff., kg/ha	Sign.	U,%	%	Diff., kg/ha	Sign.	U,%	%	Diff., kg/ha	Sign.
P9175	**9.36**	**100**	**Mt**		**9.82**	**100**	**Mt**		**10.16**	**100**	**Mt**	
Bellavista	11.77	125.76	2.41	***	12.15	123.75	2.33	***	12.54	123.46	2.38	***
Durango	10.84	115.75	1.48	***	11.74	119.57	1.92	***	12.41	122.18	2.25	***
Kashmir	10.73	114.66	1.37	***	10.91	111.10	1.09	***	11.18	110.04	1.02	***
Smaragd	10.73	114.61	1.37	***	11.13	113.32	1.31	***	11.23	110.59	1.08	***
DL 5%= 0.55 %; DL 1%= 0.75 %; DL 0.1%= 0,99 %												
Hybrid	b4 – full irrigated				Comparisons between irrigation regimes							
	U,%	%	Diff., %	Sign.	Irrigation regime		U,%		%		Diff., %	Sign.
P9175	**10.71**	**100**	**Mt**		**Rainfed**		**10.69**		**100**		**Mt**	
Bellavista	13.14	122.73	2.43	***	Stressed after flowering		11.15		104.31		0.46	***
Durango	13.04	121.80	2.34	***	Stressed before flowering		11.50		107.64		0.81	***
Kashmir	11.42	106.67	0.71	*	full irrigated		11.97		112.04		1.28	***
Smaragd	11.56	107.97	0.85	*								
DL 5%= 0.55 %; DL 1%= 0.75 %; DL 0.1%= 0,99 %					DL 5%=0.24 %; DL 1%=0.33 %; DL 0.1%=0.44 %							

CONCLUSIONS

Maize is one of the most important crops in the world. Climatic conditions play a decisive role in yield quantity.

The trial aimed to find out the influence of the hybrid and the irrigation regime on maizeyield.

The climatic conditions recorded in 2017 and 2018 determined the normal development of corn plants, leading to yields of over 13,000 kg/ha (13,510 kg/ha for the Durango hybrid).

Unfavorable climatic conditions in 2019determined the lowest yields in the three years of experimentation (9,228 for the Durango hybrid and 9,264 for the P9175 hybrid).

On average over the three years of experimentation, the lowest yield was obtained for the hybrid P9175, of 10,885 kg/ha and the highest, for the hybrid KWS Kashmir, of 11,995 kg/ha. Under the different climatic conditions of the three years of experimentation, the most stable yields were given by the hybrids KWS Smaragd (FAO 350) and KWS Kashmir (FAO 370).

Regarding the experienced irrigation regimes, the lowest production, on average over the three years, was obtained for rainfed treatment (10,121 kg/ha) and the highest, for full irrigated (12,744 kg/ha). The treatment of stressed after flowering and before flowering gave close results (11,723 and 11,897 kg/ha).

The lowest grain moisture at harvest was recorded in the earliest hybrid, in the FAO 320 group, namely P9175 (12.86%) and the highest, in the KWS Durango hybrid, the latest hybrid, in the FAO 450 group (16.04%).

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