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THE ANNUAL WEATHER EFFECT ON TWO MANLY USED MAIZE HYBRID YIELD IN HUNGARY

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Abstract. *In crop production the most modern hybrids are available for us, therefore the yield and yield stability is determined by the agro technology. The purpose of the experiment is to adapt the modern agrotechnology to the new type of hybrids. The long-term experiment was set up in 2015-2016 on chernozem soil in the Hajdúság (eastern Hungary). The plots were set up in 76 thousand ha^{-1} plant density. We examined some mainly use hybrids of Hungary. The conducted studies are the effect of annual weather for the yield. We use three different sowing date as early, average and late, and measure how many plant germinated during the germination process. In the experiment we observed the hybrids in 4 replication. The yield was measured buy a special plot harvester - the Sampo Rosenlew 2010 – what measured the weight of the harvested plot and also took a sample from it. We determined the water content of the samples. After we calculated the yield (t ha^{-1}) of each plot at 14% of moisture content to compare them. We evaluated the data using Microsoft Excel 2015. The annual weather in each crop year define the maize yield*

Keywords: annual weather, maize, yield

1. Introduction

Hungary climate all in all is optimal for maize production. From the ecological factors the rain has the highest effect on crop yield. Recently dry years more and more occur when the maize suffering significant yield loss [1]. The nowadays average temperature exceeded the average of many years and this is coupled with a lack of rainfall has a direct impact on the crop production [2]. As an effect of global warming, optimum sowing date of some arable plants what requiring high temperature can change in the future. Optimum sowing date is crucial from the aspect of adaptation to rapidly changing conditions in the case of maize yield, especially in dry years. With the decrease of fossil fuels, usage of maize as bioethanol is becoming an increasingly important topic. Therefore, the analysis of the nutritional parameters of maize is strongly reasonable and this factor is also affected by sowing date [3]. The climate has large variability and the biggest risk factor in crop production [4] Berzsenyi and Győrffy in a dry crop year get 3.83 t ha^{-1} and in a rainy year 6.0 t ha^{-1} yield. Thereby they called attention to the result of the weather yield decreasing ability in the crop year [5]. Pintér and Szibrik think the anuak weather the bigest influental factorof the yeald. The largest variability shown by the rain in the crop year [6]. Bocz believes that the performance of the maize determine by the ecology, characteristics of the plant

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and by fertilization [7]. According to [8] the maize is specific productive plant, essential to determine the optimum density because, the corn plant to produce 1 kg of dry material used for 300 liters of water. The missing part of the water stored in the soil cover of the plant. Therefore, it is important to determine the plant density [9]. Less than optimum or higher plant densities, both reduce the yield of the maize [10].

2. Materials and methods

The field research was carried out at Látókép research area of the University of Debrecen on chernozem soil. Soil of the research area is of good agricultural condition, medium hard soil. Water supplies of the soil are favorable. Examined hybrids were P9074, and the SY Octavius. The experiment was set in 76 thousand plants ha^{-1} plant density. We used three sowing dates. Early sowing date: April 1, Average: April 21, Late sowing: May 5. in 4 replication of each plot. The results were presented in the average of the replications. In both years the fore crop was winter wheat. The experiment was set in one nutrient level. The amount of N was 108 kg ha^{-1} (in Pétisó). We harvested the plot with a SAMPO plot harvester.

In the 2015 crop year the first half of March was especially cold, wintry weather conditions, however, subsequently be followed by relatively rapid warming. There was low precipitation in March. The dry weather continued in April. April temperature conditions were very similar to the March weather. First half of April with an especially cool weather, the second half was characterized by a slow warming. After May there was close average weather (Table 1).

Table 10) The amount of meteorological parameters in the examined crop years

Months		Apr	May	June	July	Aug	Sept	Oct	Total/ Average
Precipitation (mm)	30 year's average	42.4	58.8	79.5	65.7	60.7	38.0	31.8	**376.9**
	2015	21.9	52.9	60.5	35.6	84.0	48.9	86.6	**390.4**
	2016	14.4	69.2	146.3	84.6	71.7	63.4	52.6	**502.2**
Temperature (°C)	30 year's average	10.7	15.8	18.8	20.3	19.6	15.8	10.3	**15.9**
	2015	10.1	15.8	19.9	22.9	23.3	17.8	11.2	**17.3**
	2016	12.5	15.7	20.1	22.9	19.8	17.2	15.2	**17.5**

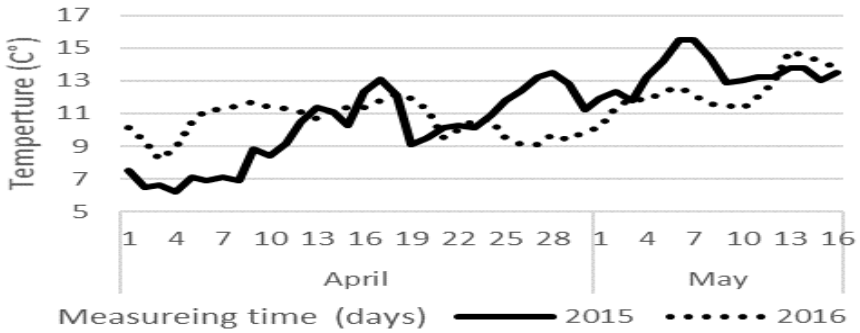

Fig. 1. Soil temperature in Debrecen 2015-2016.

In 2015 the soil temperature in the beginning of April was colder than it suitable for planting. In the next year the weather was much hotter at this time. After the middle of April the soil temperature is close the same in both year but in 2016 the end of April the weather cooled down and stay colder than in 2015 duaring the whole germination process (Figure 1).

In this experiment we measure the plants germination dynamics. After sowing we mark two meter long two row wide plots in every parcel and from the beginning of germination we count the plants. We do it every 3 day until the whole parcel germinated. We measured the amount of yield with a special plot harvester - the Sampo Rosenlew 2010 – what measured the weight of the harvested plot and also took a sample from it.

Results and discussion

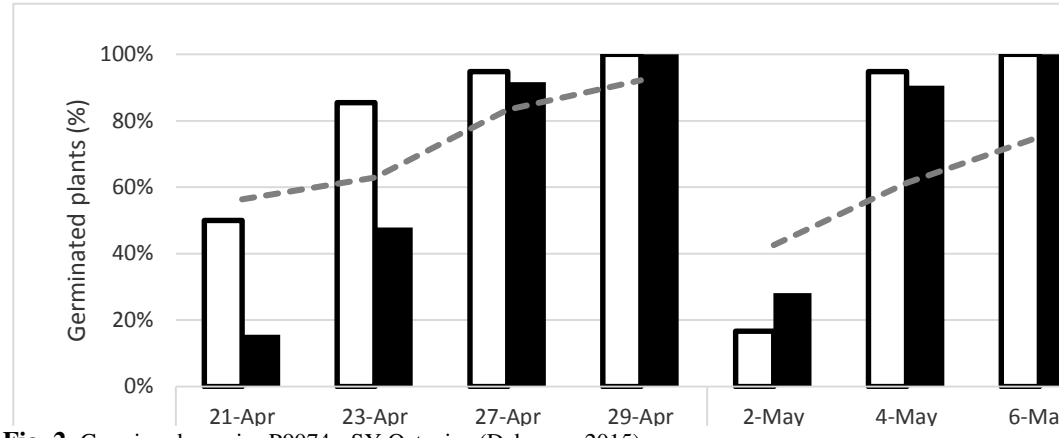

Fig. 2. Growing dynamics P9074 - SY Octavius (Debrecen 2015)

In the 2015 crop year, it can be observed at the first sowing date (5th April) that due to cold soil temperature the plants very slowly germinated, and slowly began to grow (Figure 2). After the temperature rise the average sowing date (21th April) it is more favorable for the plants as they receive bigger heat and they starts germination sooner and grow rapidly. At the third sowing date what was the late sowing (5th May) we examined the most intense germinating, as here, the temperature has exceeded the minimum level for the plants.

In 2015 at the first sowing date the P9074 hybrid has the best germination. This hybrid better tolerate the cold temperature. In the average and sowing the leading position is for SY Octavius but later the P9074 takes the lead. On the late sowing the best germinated hybrid is SY Octavius at the beginning. The P9074 hybrid prefer the warmer weather much more.

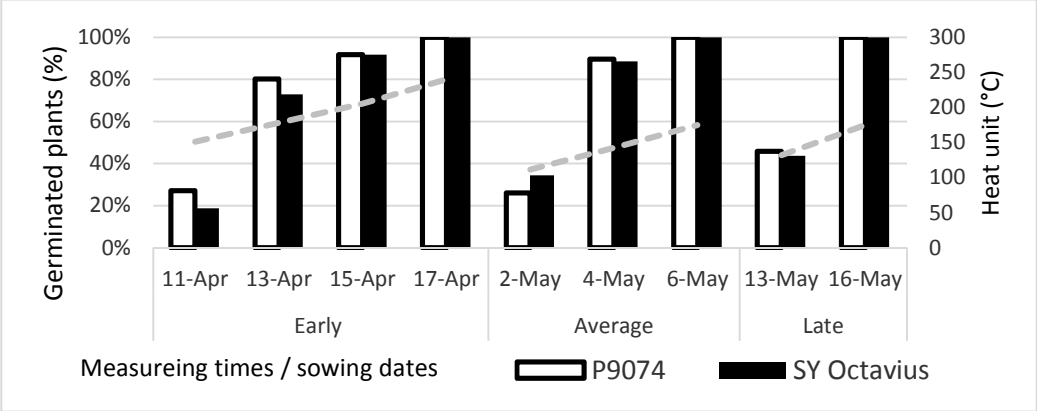

Fig. 3. Growing dynamics P9074 - SY Octavius (Debrecen 2016)

In 2016 the plants germinated sooner because in the second examination time we measure 74% germination (Figure 3). It's 20% bigger than in the last year. After this the temperature cooled down, so at the average sowing date (21th April) the plants as they receive normal heat, they starts germinating in the same time at the 2015 crop year. The tendency of germinating is close the same as in last year. The third sowing date was the late sowing date (5th May). In this case, we examined the most intense germinating, as here, the temperature has much more exceeded the minimum level for the plants. In the 2016 crop year the first sowing date (1th April) it can be observed (Figure 4) that due to warm soil temperature the plants was germinated 10 day earlier than in last year.

In 2016 cropyear the first sowing best hybrid is still the P9074. This hybrid was the best on the previous year. The weather in 2016 was warmer therefore hybrids take advantage to germinat faster. In the average sowing the best was the SY

Octavius at the begining but after the P9074 takes the lead. This hybrid was the best in the late sowing date, too. We obtained this hybrid prefer cooler weather much more.

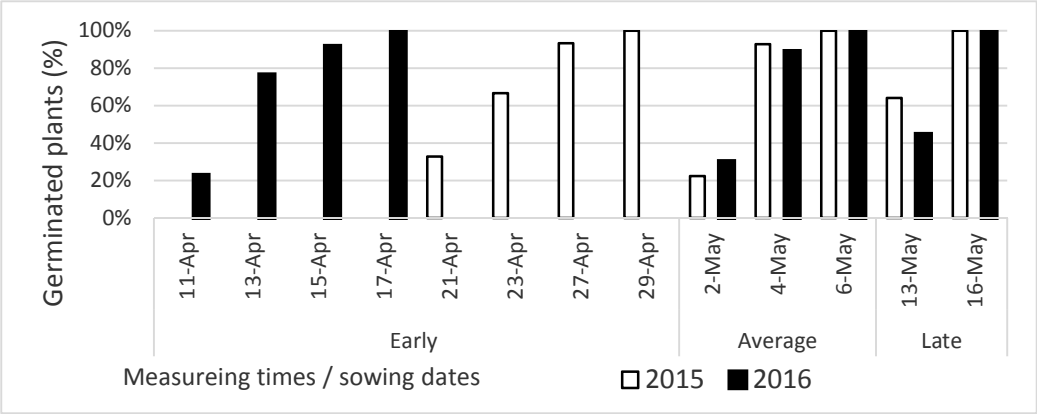

Fig. 4. Growing dynamics average of P9074 - SY Octavius (Debrecen 2015-2016)

Table 11) The amount of yield in 2015-2016 (Debrecen)

2015		
Sowing date	Hybrids	Yield t ha^{-1}
Early	P9074	13.42
	SY Octavius	12.46
Average	P9074	13.65
	SY Octavius	13.32
Late	P9074	12.78
	SY Octavius	13.98

2016		
Sowing date	Hybrids	Yield t ha^{-1}
Early	P9074	18.92
	SY Octavius	20.25
Average	P9074	19.83
	SY Octavius	22.04
Late	P9074	18.55
	SY Octavius	20.86

After the sowing dates reach the optimal water content we harvested the parcels. We measure the water content of each plot and measure the amount of yield. After we calculate the yield on equal water content what is 14%. In 2015 the P9074 produced the highest yield in the early and average sowing date. In the early it produced 13.42 t ha^{-1} and in the average it produced 13.65 t ha^{-1}. In this year the SY Octavius produced the top yield 13.98 t ha^{-1} in the late sowing date (Table 2).

In 2016 the SY Octavius has the highest ammount of yield in all the three sowing dates. It produced 20.25 t ha^{-1} in the early, 20.86 t ha^{-1} in the late. And produced their top yield in the average sowing 22.04 t ha^{-1}.

Conclusions

The long term experiment was set up at at Látókép research area of the University of Debrecen on chernozem soil. We use two top hybrid .The P9074 (FAO 310) and the SY Octavius (FAO 400) from different genotype. The hybrids was sown in 76 thousand ha^{-1} plant density. We use three different sowing date. Early, average and late. The early sowing date in the future will have a great role. Becouse the global warming change the sowing date of some plants. With using erlier sowing, result greater crop safety, becouse plants can avoid atmospheric drought duaring the summer. Both in dry and rainy crop year the early sowing produce close the same ammount of yield than the average sowing. All in all the average sowing date has the highest amount of yield. The late sowing was the second and the early sowing produced the less yield.

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