

AGRONOMIC IMPACTS ON MAIZE (*ZEAMAYS* L.) YIELD FORMATION

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Introduction

Some researchers - PETHE (1817), CSERHÁTI (1901) - brought the attention to the importance of sowing time even in the early 19th and 20th century. Earlier sowing and the use of sowing seed of good quality ensure higher and more safety yield. Moreover, maturation is due to happen earlier. I'SÓ (1959, 1969) and PÁSZTOR (1966) stated that two main factors affect the initial development of maize: precipitation and temperature. Earlier sowing resulted in slow emergence, however, yield was higher. Yields of hybrids at late sowing time were significantly lower. According to SÁRVÁRI (2005), hybrids with good resistance to cold at germination can be sowed 10-15 days earlier than the classical sowing time (15 April- 5 May). Evaluating the results of a ten-year long experiment, BERZSENYI and DUNG (2001) pointed out that environmental factors at the reproductive period of maize are more unfavourable when sowing at late or at very late time. SÁRVÁRI and FUTÓ (2001) found that the seed moisture content at harvest can be significantly lower at the early sowing time, thus the costs of drying can also be reduced.

Methods

In 2003 and 2004, the experiments were carried out near Hajdúböszörmény on humic gley soil. In 2005, the experiment was started in Debrecen on chernozem soil.

2003 was a very dry year. The amount of precipitation in the vegetation period of maize was 78.5 mm lower than the average and its distribution was also unfavourable. The monthly mean temperature was much higher in May, June and August than the 30-year average. Heat and draught have negatively affected the crop, which resulted in lower yields.

The amount of precipitation between April and September in 2004 was 93.2 mm higher than the 30-year average. Moreover, the distribution of precipitation was favourable. The monthly mean temperatures followed the trend of the 30-year average.

2005 was again a very wet year. The amount of precipitation in the vegetation period of maize was 152.2 mm higher than the 30-year average. The mean temperature was similar to the average measured for many years. Summer was somewhat colder, which also had an effect on the yields.

In 2003, four sowing times (12.04., 26.04., 05.05., 23.05.), while in 2004 and 2005 three-three sowing times (2004: 09.04., 24.04., 13.05., 2005: 08.04., 25.04., 02.05.) were applied respectively. The plant density was very low at third sowing time in 2005. The draught in June resulted that the soil was chapped, which reduced the developmental chance of the seedling. Therefore, most seeds could not emerge. Due to this fact, results of the third sowing time could not be evaluated. Nutrient supply was optimal in all three years. Harvest was performed on 02 October, 15 October and on 25 October in 2003, 2004 and 2005, respectively. Experiments were analyzed by analysis of variance.

Results and discussion

Results of the experiment in 2003 (Figure 1) show that hybrids with a shorter vegetation period, such as the PR38Y09, the PR38A67 and the PR37D25 had the highest yield at the late sowing time. On the contrary, hybrids with a longer vegetation period, for example the PR36M53 and the PR34B97 had the highest yield at the early sowing time. Hybrids with a longer vegetation period had the highest yields, however, their genetic potential could not be

expressed due to the droughty year. The PR34B97, the PR36N70 and the PR36M53 hybrids had the highest yields. Differences in the yield caused by the sowing time were significant in the case of the PR38A67 ($LSD_5\%=0.352 \text{ t ha}^{-1}$), the PR37D25 ($LSD_5\%=0.55 \text{ t ha}^{-1}$), the PR37M34 ($LSD_5\%=0.57 \text{ t ha}^{-1}$), the PR36M53 ($LSD_5\%=0.94 \text{ t ha}^{-1}$) and the PR34B97 ($LSD_5\%=0.75 \text{ t ha}^{-1}$) hybrids.

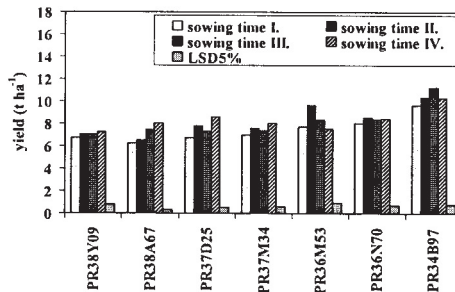


Figure 1: The yield of maize hybrids in

different sowing times, 2003.

Seed moisture content at harvest of each hybrid was less than 20% at all three sowing times. At the late sowing time only the PR36N70 and the PR34B97 hybrids had a higher than 20% seed moisture content at harvest. The favourable seed moisture content values of the hybrids were due to two main factors: the good moisture loss capacity of the hybrids and the droughty year.

In 2004, the yield of all hybrids was the highest at the second and third sowing time (Figure 2). The reason behind this fact is that 2004 was a very wet year. There was enough precipitation for the appropriate development of the hybrids. The effect of the wet year was to be seen on the yields, as well. The PR34H31 and the PR38B85 hybrids had the highest yields. Differences in the yields caused by the sowing time were significant in the case of the XO 902 P ($LSD_5\%=1.31 \text{ t ha}^{-1}$), the PR38B85 ($LSD_5\%=1.05 \text{ t ha}^{-1}$), the PR37D25 ($LSD_5\%=0.98 \text{ t ha}^{-1}$), the PR36K20 ($LSD_5\%=1 \text{ t ha}^{-1}$) and the PR34H31 ($LSD_5\%=0.92 \text{ t ha}^{-1}$) hybrids. In the wet year, the seed moisture content values at harvest were also higher. This value was mainly higher than 20% in the case of hybrids sowed at the first sowing time and higher than 30% in the case of hybrids sowed at the late sowing time.

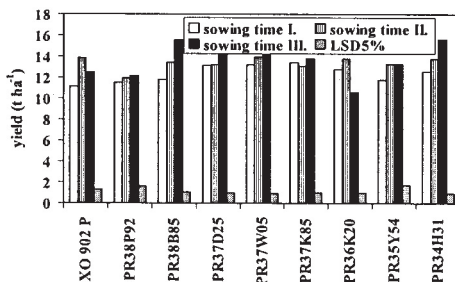


Figure 2: The yield of maize hybrids in

different sowing times, 2004.

In 2005, the yields of hybrids sowed at the first sowing time varied between 12-14 t ha^{-1} . The chilly summer did not favoured to the development and the production of hybrids sowed at the late sowing time (Figure 3). Unequivocal significant differences were found between the

yields of five hybrids: Szegedi 269 ($LSD_5\%=1.47 \text{ t ha}^{-1}$), the DK 440 ($LSD_5\%=0.57 \text{ t ha}^{-1}$), the PR37D25 ($LSD_5\%=2.02 \text{ t ha}^{-1}$), NK Cisco ($LSD_5\%=0.71 \text{ t ha}^{-1}$) and the Mv Maraton ($LSD_5\%=0.9 \text{ t ha}^{-1}$) at the first and at the second sowing time. The imago of the western corn rootworm (*Diabrotica virgifera*) caused significant losses in the yield of the PR34B97 hybrid. Being a late hybrid, the stigma of the PR34B97 hybrid remained tender for a long time, which served as a food-source for the imago. Thus, lower yields were due not only to the late sowing time, but to the large extent of imago damage as well.

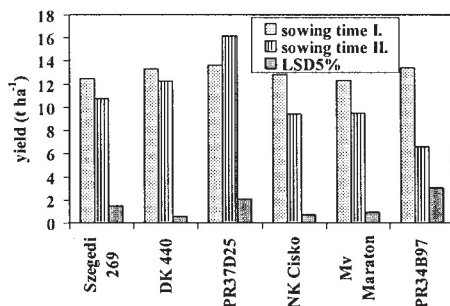


Figure 3: The yield of maize hybrids in

different sowing times, 2005.

The seed moisture content of the hybrids sowed at the first sowing time varied between 16-24%. These values were higher at the second sowing time. The PR34B97 hybrid had a low yield with high seed moisture content.

In 2005, LAI was also analyzed (Figure 4). At the first sowing time, the PR34B97 hybrid -the one with the longest vegetation period- had the largest LAI. The highest yield was obtained by this hybrid as well. At the second sowing time the LAI of the PR34B97 hybrid was the highest. However, the yield of this hybrid was the lowest at this sowing time. The main reason behind this fact is the damage of the corn rootworm western imago. The maximum leaf area value was somewhat lower than at the first sowing time. This can be one of the reasons of the lower yields of the Szegedi 269 and the NK Cisco hybrids.

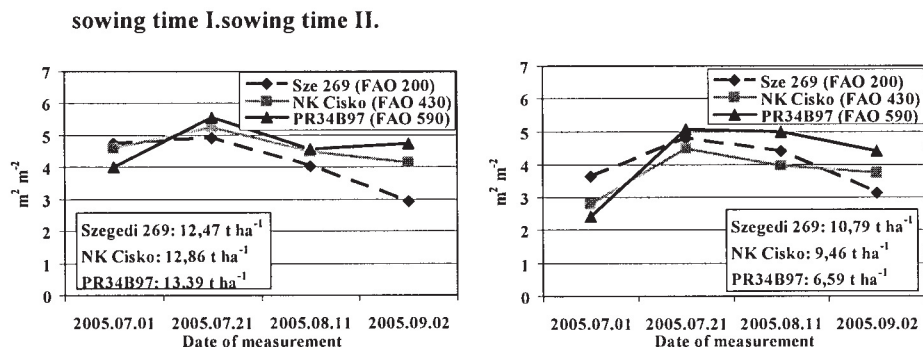


Figure 4: The tendency of leaf area index (LAI) in different sowing times, 2005.

Conclusions

The importance of the sowing time is well represented by the results of the three-year long experiment. Higher yields were obtained by hybrids at the early sowing time. Moreover,

hybrids had lower seed moisture content, as well. Therefore, costs of drying can be significantly reduced. Relationship was found between the sowing time and the LAI. In 2005, hybrids at the early sowing time had higher yields and higher LAI. Furthermore, it is very important to choose hybrids with a good Cold-test value and good moisture loss dynamics, as these traits play a fundamental role in the efficiency of production. However, these relationships are highly influenced by the year effect as well: mainly through the amount and the distribution of the precipitation in the vegetation period.

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