

EXAMINING THE EFFECT OF THE NUTRIENT SUPPLY AND TILLAGE ON THE YIELD OF MAIZE (*ZEAMAYS L*) AND ECONOMIC QUESTIONS OF CULTIVATION ON THE LOESS-PLATO OF HAJDÚSÁG

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Introduction

Hungary's greatest natural resource is the capacity of agricultural production. Agricultural production is an essential component of the economy. The efficient or inefficient operation of this sector cannot be disregarded by anyone in the society (Birkás 1995, Rajkainé *et al.* 2004). No economic activity, including agriculture, should be pursued by harming the environment (Nagy 1997). Throughout the history, agriculture has been providing livelihood for the population living in a specific area, while later it also ensured economic growth. These factors should be in harmony, at the same time production should preserve fertility by all means (Gyuricza 2001).

Presently, farming organisations are striving globally to reduce production costs along with preserving and improving environmental conditions (Megyes *et al.* 2005). Therefore, authors are recommending the application of preventive methods (Pakurár *et al.* 2004, Nagy *et al.* 2005, Sulyok *et al.* 2005).

Methods

During the examination of different tillage systems we were concentrating on the following:

- Examining the efficiency of different tillage systems.
- Evaluating the efficiency of different degrees of fertilisation.
- Examining the relationships of the tillage and fertilisation.

The examinations were carried out in:

- Polyfactorial, long-term experiment set up at the Látókép Experimental Station of Debrecen University, Center of Agricultural Sciences by the Department of Land Use and Rural Development

Time of examination: 2001-2004.

Three tillage systems were compared:

Winter ploughing, spring tillage, disk tillage

We have included nine experimental units every year into the model, which were repeated four times since the experiment covered four years. We have carried out our examinations in winter ploughing, spring ploughing and disk tillage treatments, on non-fertilised plots, and fertilized (120 kg N+PK and 240 kg N+PK) plots. Altogether, we have executed 36 different models (4 years x 3 tillage types x 3 fertilisation variations). We have considered similar production technology in the three tillage versions, in all four years. The material and supplementary sector expenditures were considered at price levels of 2004 in all four years.

Maize prices were determined in accordance with EU intervention prices in all four years. We could filter the effect of seasonality this way, since a great degree of changeability occurred in the examined period (e.g. 2003: 29000 HUF/tonnes, 2004: 17000 HUF/tonnes).

Results and conclusions

Yields were different in the examined years and specific treatments, but great diversity was also detected among the examined years (Figure 1.).

Altogether it can be stated that the highest yield increase compared to the control plot were achieved in the winter ploughing, 120 kg N+PK treatment. In years with good precipitation conditions the 240 kg N+PK treatments, both in winter and spring ploughing, resulted in further yield increase this was significantly lower, the principle of lowering output dominated. In droughty years, (2002, 2003) the 240 kg N+PK treatment resulted in yield depression, in the case of all three treatments, therefore its application is not recommended.

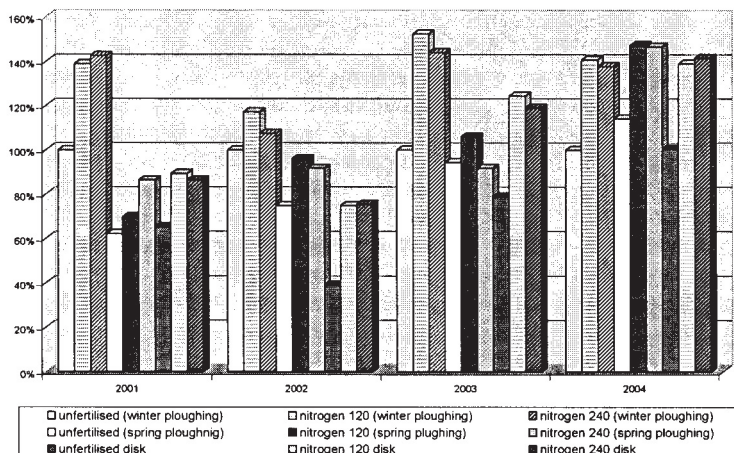


Figure 1. Effects of tillage and fertilization on the yield of maize in the Látókép polyfactorial, long-term experiment (100% the non-fertilised plots of winter ploughing)

The material and supplementary sector costs of specific treatments differ from each other, which can be explained by different fertiliser, plant protection and machinery costs. The data of winter ploughing control treatments were considered as a hundred percent and cost data of other treatments were compared to this (Figure 2.). The scale of material costs is primarily determined by fertiliser costs, thus the values of it increased in parallel with the applied fertiliser quantity. The scale of material costs was further increased by the fact that weed control was performed 4 times in this treatment and only twice in the winter ploughing treatment.

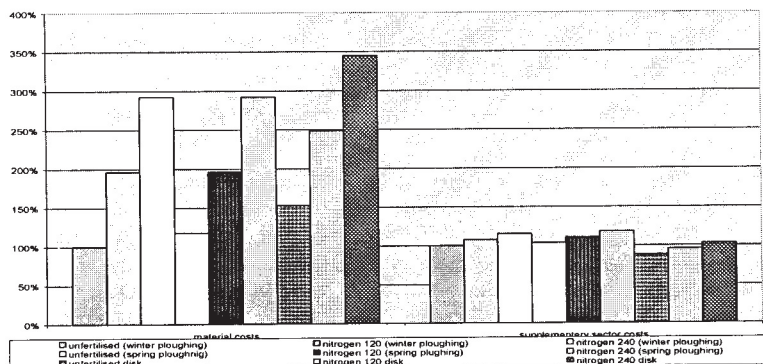


Figure 2. The material and machinery operation costs compared to the control plots of winter ploughing at Látókép (2004)

In winter ploughing, the 120 kg N+PK fertiliser dosage increased the value of gross margin in three years (2001, 2003 and 2004) compared to the unfertilised plot, while it resulted a 55% decrease in 2002. The favourable effect can be explained by the fact that yield increase was higher than the increase in expenditures, so the gap between gross margin and production costs widened. This favourable effect could not be detected in 2002, which is probably due to weather anomalies (little and not favourable distribution of precipitation). The 240 kg N+PK fertiliser dosage resulted gross margin depression in all years, resulting in unprofitable production in 2002 and 2003 (droughty years) closing the gap between gross margin and direct production cost. Gross margin was lower in spring ploughing between 2001-2003 than in the case of winter ploughing control plot. The examined value was also negative in 2002. Gross margin was higher in 2004 than the comparative basis. The 120 kg N+PK fertiliser dosage resulted in gross margin depression for the years of 2001-2003 in the case of spring ploughing, while in 2004 it increased gross margin by 30 %. The 240 kg N+PK fertiliser dosage reduced gross margin in all four years, so the application of this is not recommended. Gross margin was negative in the two droughty years (2002-2003) in spring ploughing and disk treatment. In winter ploughing treatment 120 kg N+PK dosage had favourable effect in all years, while the 240 kg N+PK treatment results gross margin depression (Figure 3.)

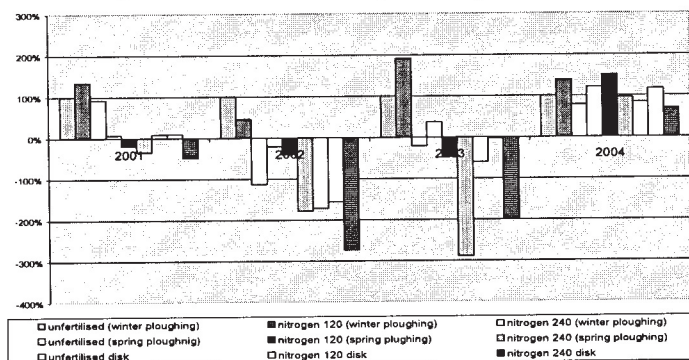


Figure 3. Gross margin of different treatments compared to the winter ploughing control plots in the Látókép experiment (2001-2004)

Acknowledgement

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References

- Birkás, M. (1995): Energiatakarékos és kímélő talajművelés GATE KTI, Egyetemi jegyzet, Gödöllő.
- Gyuricza, CS. (2001): A fenntartható talajhasználat alapjai, Akaprint Kiadó, Budapest.
- Megyes, A. – Nagy, J. – Rátonyi, T. (2005): Irrigation of maize (*Zea mays* L.) in relation to fertilization in a long term field experiment, DOI: 10.1556/Agr.53.2005.1.5.
- Nagy, J. (1997): A talajművelés, öntözés és a műtrágyázás kölcsönhatásának értékelése, akadémiai doktori értekezés, Debrecen.
- Nagy, J. - Rátonyi, T. - Sulyok, D. - Huzsvai, L. (2005): Effect of fertilization on the yield of maize (*Zea mays* L.) in different years, In: Pollution and water resources Columbia University Seminar Proceedings, Editor: George J. Halasi Kun, Volume XXXV. 2003-2004.
- Pakurár, M. - Nagy J. - Jagendorf, S. (2004): Fertilisation and irrigation effects on maize (*Zea Mays* L) grain production, *Cereal Res. Commun.* 32 (1) 151-158
- Sulyok, D. – Rátonyi, T - Huzsvai, L. – Fodor, N. (2005): A tápanyaggazdálkodás gazdaságossági vizsgálata a Hajdúsági Lőszháton, VII: Magyar Biometriai és Biomatematikai Konferencia, Budapest,
- Rajkainé Végh, K. – Szundy, T. (2004): Kukorica genotípusok vízellátottsága és vízhasznosítása, *Agrokémia és Talajtan*, Volume 53, 1-2