

EFFECT OF CROP ROTATION AND NUTRIENT SUPPLY ON THE YIELD OF MAIZE

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Introduction

Várallyay (1994) highlighted the significant differences of hydrological properties in Hungarian soils in his research work. In his opinion the water utilization of soil affected the predominance of water collection in the soil (Várallyay, 1997).

Suitable crop rotation is very important because of Hungary's drying climate, and the firstcrop exerts a large influence on the rate of weediness and the pullulation of pathogenic agents and insects (Menyhért, 1979; Széll, 2002; Berzsenyi, 1995; Sárvári 2004). The disadvantage of monoculture is that it does not allow the suitable series of other plants (Kismányoki, 1994). The finest firstcrop of maize is wheat (Bocz, 1974; Sárvári 1986; Pepó, 2004). In most cases the effect of climate exceeds that of fertilizer combinations (Nikolov-Sztamboliev, 1975). The difference among the effects of fertilizer doses have decreased and the interaction of nutrients (N-P-K) has come to the fore as a result of the cumulative effect of fertilizers (Látkovicsné, 1979).

Material and methods

A national long-term fertilizer trial in Hajdúböszörmény was carried out in 1967. Crop rotation was triculture (pea-winter wheat-maize-maize), biculture (winter wheat-maize-maize-winter wheat) and maize monoculture. Nutrient supply was N 50-250, P₂O₅ 50-200, K₂O 100-200 kg ha⁻¹ active agent besides control treatment. The tested hybrids in the trial were the following: Mv SC 580 in 1973-1978, Sze SC 444 in 1978-1993 and Pioneer SC 3732 since 1994. The size of the experimental plot was 54 m². We applied half of the nitrogenous fertilizer in autumn, the other half in spring and phosphate-potassium fertilizer was applied also in autumn.

The reaction of maize hybrids to fertilizers and their productivity were examined in 1995-2000. The lowest applied fertilizer doses, besides the control (without fertilizer), were N 40, P₂O₅ 25, K₂O 30 kg ha⁻¹ active agents; the highest dose was the fivefold of this amount. We tested 10 various hybrids, their own genetic characteristics and their breeding seasons. The size of the trial plot was 54 m². The applied agrotechniques were deep ploughing in autumn, chemical weed control and suitable production for farm technology.

Precipitation data are presented on *Figure 1*. In the investigated period the precipitation was substantially lower in 1973, 1975-1978, 1981-1984, 1986, 1988-1990, 1992-1997 and in 2000; there was more precipitation than the 30 years' average only in 1974, 1980, 1985, 1987, 1991, 1998, and 1999.

Factor 1. (26%): quantity of precipitation

- a, the critical period of maize (June-July-August)
- b, precipitation in the vegetation period (from April to September)
- c, the annual quantity of precipitation (from January to December)
- d, the quantity of precipitation in July and August

Factor 2. (19.93%)

- a, the temperature in August, September and May
- b, the quantity of precipitation in June

The difference of yield was 1.01 t ha^{-1} between the bi- and triculture, while it was 0.69 t ha^{-1} between mono- and triculture. Above environmental average (8 t ha^{-1}), the highest yield (14.3 t ha^{-1}) was reached in the case of triculture as a result of better conditions. The yield of biculture was the safest, while the yield of triculture changed (increased) in the highest degree under more favourable environmental conditions (*Figure 3-4.*).

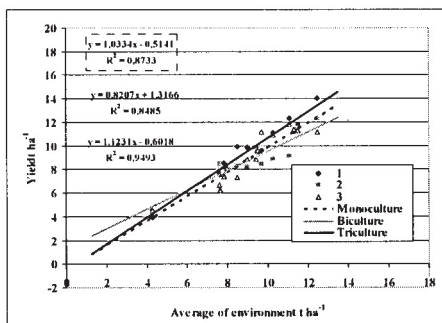


Figure 3.: Effect of crop rotation on the stability of maize yield (1973-1987)

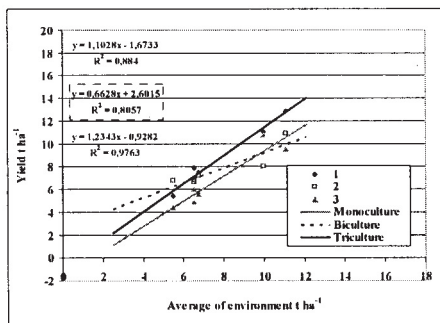


Figure 4 : Effect of crop rotation and NP treatment without K on the yield of maize (1973-1987)

Maize hybrids are very different in terms of productivity, their natural utilization of nutrition and their reaction to fertilizers. While in 1970-80 the agro-ecological optimum was 180 kg ha^{-1} of nitrogenous fertilizer, nowadays it is 120 kg ha^{-1} with the suitable rate of P, K fertilizers. Of course those hybrids are more valuable, which can reach high yields with low fertilizer doses or without fertilizers. Hybrids with better reaction to fertilizers have more favourable NRA (nitrate-reductor enzyme) capacities and higher root hair adsorption capacity in the root mass (*Figure 5.*)

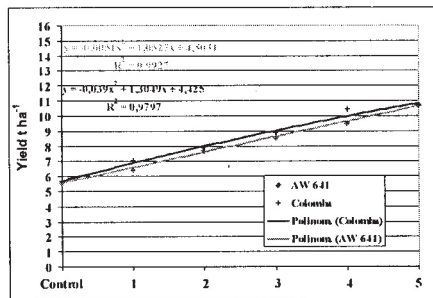
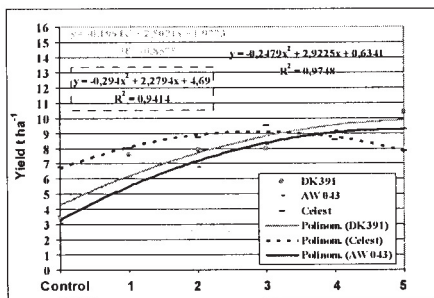


Figure 5.: Effect of fertilization on the yield of maize (2000)

The agro-ecological optimums of fertilizers are N 60-120, P_2O_5 40-75, K_2O 45-90 kg ha⁻¹ of active agent depending on the forecrop, seasonal effects and the hybrid. The optimal nitrogenous rate of hybrids with longer vegetation period is higher by 30-40 kg ha⁻¹ than that of early maturing hybrids in average and favourable seasons. The extra yield of hybrids with delayed maturity was 1.4 t ha⁻¹ in the average of several years. Those hybrid specific technologies of different intensity are recommended for application which are economical, essential and do not pollute the environment in the case of different hybrids.

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THE IMPACT OF WINTER WHEAT CULTIVATION PRACTICES ON THE QUALITY OF SOIL AND GRAIN

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Introduction

The demand of ecologic products in the world is rapidly expanding and that determines the increase of ecologic production areas in all the world and in Lithuania as well. Most often ecologic wheat, rye and triticale are grown. As during ecological farming synthetic fertilizers and pesticides influencing the harvest and quality of corn are not used, the studies of ecologic production soil and ecologic corn quality remain to be a very relevant problem (Mazvila et al, Pekarskas et al).

During the period of ripening of grain big quantities of nitrogen are necessary. The accumulation and spreading of nitrogen in wheat grain influences their harvest and quality. (Xu et al.). Grain supply rate of N the depends largely on mineralization, i.e. the microbial-mediated conversion of organic N to inorganic forms (NO_3^- and NH_4^+) that, in turn, is regulated by both abiotic and biotic factors (e.g. plants, soil animals and microorganisms (Tanja A. J. van der Krift et al.). For instance, reported seasonal changes in plant N uptake and soil N contents in a grazed tall fescue pasture and discussed the interaction between them (Kurokawa et al.).

The aim of the study has been to establish the influence of different forecrops to the accumulation of mineral nitrogen in the soil and change of indicators of winter wheat grain quality.

Methods

The research was carried out in Lithuanian Agricultural University Agroecologic Centre ecologic production farm in 2003-2004. In the farm loam of medium weight deeper gley sated *Endohypogleyi-Eutric Planosols* – *Ple-gln-w* prevail. Winter wheat was grown in different fields in two rotations. The rotation of the 1st rotation field: summer crops + perennial grass undersowing, perennial grasses of the 1st year of use, perennial grasses of the 2nd year of use, winter wheat. 2nd rotation: spring grain crops, leguminous crops or their mixtures with eared grains for seed or green fertilizer, spring grain crops + undersowing, perennial grasses of the 1st year of use, perennial grasses of the 2nd year of use, winter wheat. The chemical composition of winter wheat grain has been established in the Lithuanian University of Agriculture Experimental Station by computer infrared ray analyzer-spectrophotometer PSCO/ISI IBM-PC 4250. The soil samples for establishing nitrogen have been taken in autumn just before sowing of winter wheat and in spring at the beginning of winter wheat vegetation. The nitrate and ammonia nitrogen of the soil has been established by colorimeter method in Lithuanian Agricultural Cropping Institute Agrochemical Research Center.

Data have been processed by statistical program DISPER EXCEL 1.1.

Results and discussion

After different rotations different quantity of mineral nitrogen accumulated in the soil: In autumn the biggest quantities of mineral nitrogen were established after black fallow, oats and oats-peas mixture. In spring the biggest quantity of mineral nitrogen was established after black fallow. Comparing the accumulation of mineral nitrogen after wheat, buckwheat and barley it has been established that markedly more mineral nitrogen accumulated in the soil after wheat than after buckwheat and in comparison with barley essential differences of mineral nitrogen have not been established. Comparing the accumulation of mineral nitrogen after buckwheat and barley essential differences have not been established. After oats-peas,