EFFECT OF AGROTECHNICAL FACTORS ON THE YIELD AND QUALITY OF MILLET

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Abstract

The millet is a very special plant with good adaptation that gives the possibility for the late sowing and secondaryproduction. However the effects of late sowing modifies to the efficiency of the agrotechnological elements. The examinations – focused on this aspect – was conducted in the DU CAS RINY in the small plots in four replications in 2013. The largest effect was registrated in the sowing time of the examined factors (sowing time, nutrient supply, growing area). The effectiveness of the agrotechnological elements decreases under unfavourable circumstances caused by the late sowing.

Key words: millet, milling rate, nutrient supply, protein contetnt, sowing time

INTRODUCTION

Millet production was started in the early historical times. It is an indigenous Asian crop which was probably brought by the Celtics to Europe. After the fall of the Roman Empire, millet production started to prosper. Millet-pap used to be the main food in the Middle Ages several times.

The world’s food supply can be significantly improved with the further use of millet, as it is cheaper than traditional proteins. The role/significance of millet in human nutrition increased again in Europe and Hungary. In Hungary, millet is mainly known as a crop for pap production purposes, while also flour and distilling industry materials are produced from its yield. Currently, millet is produced on a small area, mainly in dual production to replenish perished crop areas or to utilise areas with groundwater infiltration which dry up late.

The significance of millet is further increased by climate change, as it needs warm weather to grow. Furthermore, millet could increase the diversity of field crop species. Based on the inflorescence of the produced millet, three variants are known (Schermann, 1967; Lazányi, 1997) as follows:

- millet with diverging panicle (*Panicum miliaceum var. effusum*)
- millet with contracted panicle (*Panicum miliaceum var. contractum*)
- millet with compact upright panicle (*Panicum miliaceum var. compactum*)

A minimum of 8-10 ^{o}C is necessary for the germination of millet (Antal, 1983). The effective heat sum need of millet is 1400 ^{o}C which is provided in Hungary. Also, this value will further increase due to global warming which makes it possible to produce varieties with longer growing season and potentially higher yield potential.

According to Bittera (1930), millet is a drought-tolerant crop. The drought tolerance of millet is shown by the lower water need in the first half of its development. Millet needs half as much water as wheat, maize, oat or barley during germination (Antal, 1992).

The water utilisation of millet is good, it takes up most of the water during panicling and flowering (Varga, 1966). Millet can be sown from the second third of May until 10th July. Row spacing is the same as that of cereals and sowing depth is 1-2 cm.

Millet van be harvested if its panicles are starting to yellow and if the seed is in the condition of wax ripeness, while its colour is typical for each variety. Millet ripening is imbalanced and its seeds are prone to falling; there fore, its harvesting has to be started when the first seeds are ripened.

After harvesting, yield is purified and the purified seeds are dried at $40^{o}C$ until the moisture content of the seed reaches 13%. Therefore, millet seeds preserve their germination ability for two years if stored in a dry, cold and well aired place.

MATERIAL AND METHOD

The aim of my examination is the quantification of the impact of sowing date, fertilisation and production area in terms of yield, protein content and milling output.

The first four months of 2013 was especially wet and the amount of precipitation was significantly higher than the multiple-year average. There was 80.3 mm rain in May, while the monthly mean temperature values were below the multiple-year averages in the first half of the year and in May. At the same time, the period between June-September was rather dry and hot, which had a negative impact on the development on the millet populations. In September, the monthly mean temperature was below the average which slowed down the ripening of millet. Altogether, it can be established that the weather in 2013 was extreme in the growing season of millet which made it possible to obtain average yield results in the experiment.

The soil of the experiment site has low plasticity (K_A=28), acidic character and weak water retaining ability. As a result of the unfavourable mechanical composition, the soil is subject to strong leaching and their macro- and micronutrient content is low. The physical soil type is sand, its water and nutrient management is more favourable than sand drifts and its clay content is also higher. The humus content of the soil is 1%.

The small plot experiment had a random block design. The uniform plot size was 2x10m and harvesting was performed on a 1.5x10 m area. During the establishment of the experiment, the standard production technological elements of millet were used. The following factors were used in the experiment:

sowing date (A):	a1, 12/06/2013	a2, 25/06/2013	a3, 03/07/2013
fertilisation (B):	Control N40P48K48	N80P72K72	N120P96K96
prod. area (C):	c1, 12 cm row sp.	c2, 24 cm row sp.	c3, 36 cm row sp.

The active ingredient amounts of fertiliser were applied based on NPK 8:24:24 and MAS 27:0:0 proportions. The variety used in the experiment was Biserka. The cluster of the plant has cylindrical shape, medium thickness and is 15-25 cm long. Its grain yield is round and cream white in colour. The stem rigidity and disease resistance of the variety are outstanding. It can be easily threshed and husked. The thousand grain weight of the variety is 6.7 – 7.0 g.

The statistical evaluation of results was performed with SPSS for Windows®, using two-way ANOVA and Tukey test.

RESULTS AND DISSCUSIONS

The yield obtained in the polyfactorial experiment was between 2.29-4.26 t ha^{-1}. Averaged over the treatments, there was clear, significant difference between yields of crops sown at different sowing dates.

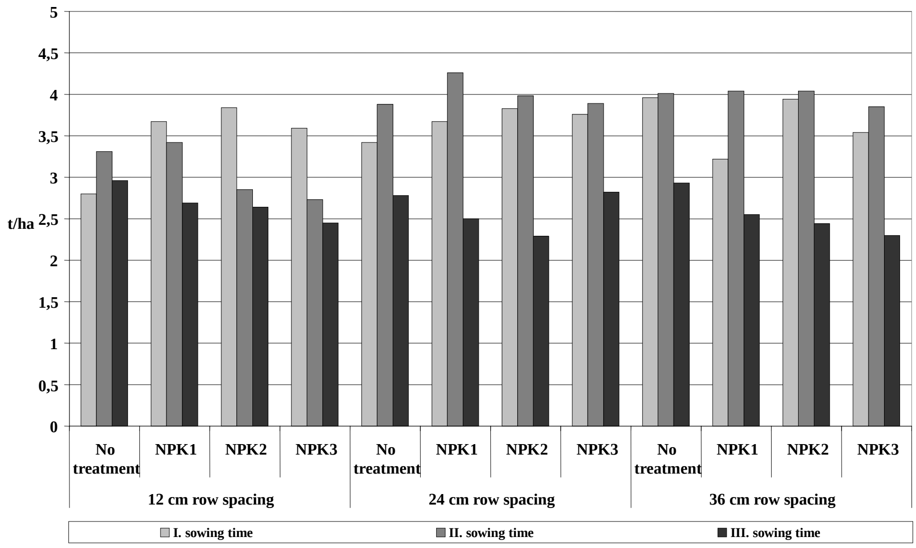

Figure1. The effect of sowing date, production area and nutrient supply on the yield of millet on acidic sandy soil
(Nyíregyháza, 2013)

There was slight yield reduction (181 kg ha^{-1}) between sowing dates a1-a2 and significant yield decrease in the case of the a3 sowing date compared to the other two sowing dates. In reference to the sowing area, there was also significant difference between the lowest (c1) and the higher row spacing values (c2, c3) in favour of the latter ones (Figure 1).

Based on the correlation analysis illustrated with curve fitting, it can be clearly established that the curve shows a yield peak at a lower nutrient level (NPK1) at the a2 sowing date. At the a1 sowing date, the nutrient reaction of the examined variety is characterised by a steeper slope and higher nutrient level. There is a negative reaction at the a3 sowing date which was clearly caused by delayed sowing and circumstances which are greatly different than optimal (Figure 2).

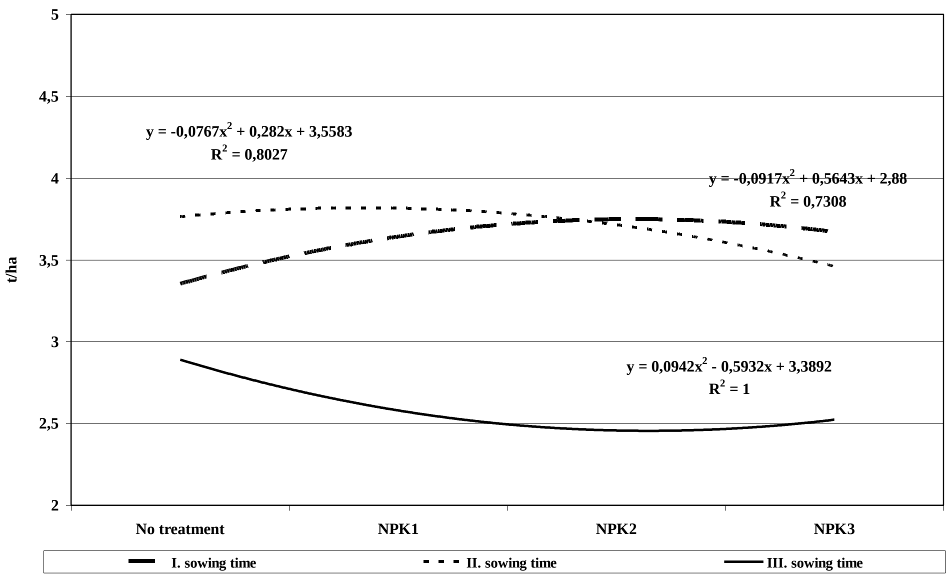

Figure 2. The effect of nutrient supply on the yield of millet on the acidic sandy soil (Nyíregyháza, 2013)

As regards protein content, there is a clear tendency depending on sowing dates. Higher protein content was measured in the case of the latest sowing date (a3), the main reason for which was that starch content is lower at an extremely late sowing date; therefore, it has a higher concentration in the grains. During the evaluation of the impact of nutrient supply on protein content, no clear correlation was observed between the examination circumstances in millet (Figure 3).

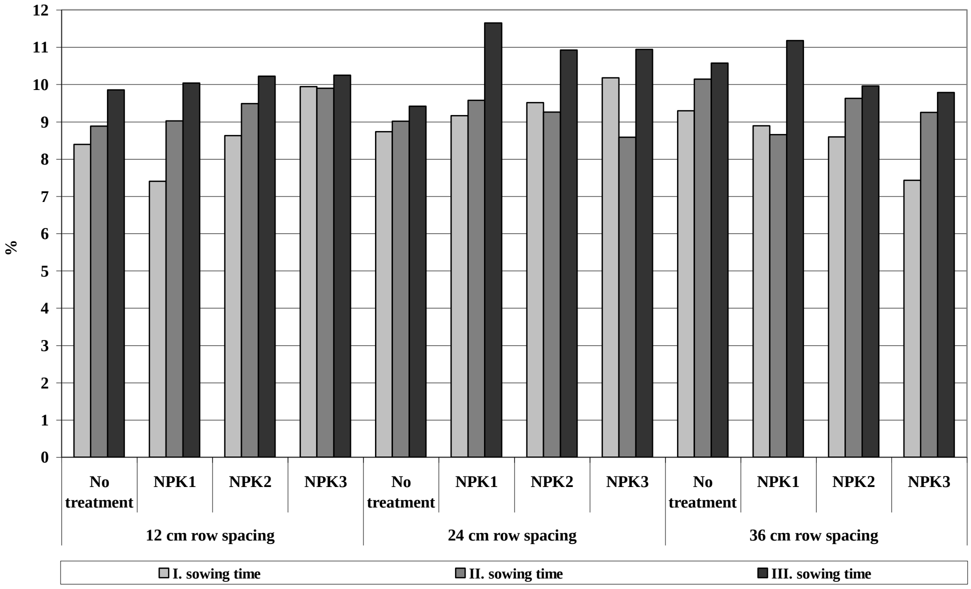

Figure 3. The effect of sowing time, growing area and nutrient supply on the protein content of millet on the acidic sandy soil (Nyíregyháza, 2013)

CONCLUSIONS

Millet production is about to prosper again in Hungary and in the world. Climate change caused by global warming is also favourable for millet production. In addition to increasing yield and yield safety, the biological resources of millet, as well as the correlation of the given variety and the various agrotechnical factors have to be further developed. According to our experimental data, there is a close correlation between sowing date and yield, but it can be clearly established that too late or too early sowing dates cause significant yield reduction, considering Hungary’s climate. In the future, it is necessary to further clarify the interactions between ecological, biological and agrotechnical factors in order to increase the yield safety of millet.

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