

## THE SWEET POTATO YIELD EFFECT OF CULTIVATION IN MONOCULTURE IN 2016-2022

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**Abstract.** *More and more people are growing sweet potatoes in Hungary, but no one has yet tested how long they can be grown successfully on the same soil type. This means the quantitative and qualitative variables of the yield. From 2016 to 2022, I planted sweet potato slips in the same area and after four years, the yields decrease significantly. To reduce problems caused by soilborne pathogens, a three to five year rotation of crops is recommended. In Deszk, we set up the experiment on a 300 m<sup>2</sup> area for all seven years. Based on clay loam soil. The area was fallowed for 5 years before 2016 and then planted with sweet potatoes for seven years. We always used the same field, so sweet potatoes were grown in monoculture. We also used the practices of growers in the area for soil preparation and the application of soil disinfectant. There was a significant difference in yields between seven years ( $p < 0.05$ ), with the highest yield (41.01 t/ha) in 2018, followed by 2016 (37.19 t/ha) and the lowest yield in 2022 (10.01 t/ha) ( $p < 0.05$ ). The total rainfall and average temperature of the 2017 growing season were not favourable, which was also reflected in the yield to a significant extent. The year 2019 was 30 t/ha, which can be considered as good results. From 2020 onwards, we have seen a continuous decrease in yields, which can be attributed to the effect of monoculture. The studies show that sweet potatoes can be grown successfully on clay loam soil for four years. In the following years the yield significantly decreased. Thus, it is advisable to set the field aside after four years. I recommend the use of ridges technology because using ridges technology the harvesting is much easier, there will be fewer damaged tubers and the tubers have more room to grow in the ridges. Soil-dwelling pests need to be controlled, as soil-dwelling pests can cause serious problems in crop quality. It is advisable to change soil disinfectants every two years so that soil-dwelling pests do not become resistant to the active ingredient.*

**Keywords:** *sweet potato, monoculture, ridges-technology, pests*

### INTRODUCTION

Despite being a crop of tropical-subtropical origin, sweet potato [*Ipomoea batatas* (L.) Lam.] is also grown in several areas under temperate climate – Hungary and numbers of European countries among them (MONOSTORI AND SZARVAS, 2015). In Hungary, the history of sweet potato naturalization is more than 100 years old. The first experiments were conducted in 1913 and 1914 on the lands of National Royal Hungarian Plant Production Experimental Station. These experiments with sweet potato were interrupted by the war (SURÁNYI, 1916). In 1949 and 1950 further experiments began with sweet potato in Experimental Farm of Fertőd. Based on three-year experiment results, sweet potato can be successfully grown in the ecological and agrotechnical conditions of our country. Other conclusions of these experiments were that the yields are largely affected by weather, and with correctly applied agrotechnical methods bigger yields can be reached than in the case of potato (PORPÁCZY, 1952). Compared to another important crops, like rice, wheat and maize cultivation, there are less available information and experiments about sweet potato cultivation technology (CLARK ÉS MOYER, 1988; JANSSON ÉS RAMAN, 1991; WOOLFE, 1992; ANDRADE ET AL., 2009). More and more people are growing sweet potatoes in Hungary, but no one has yet tested how long they can be grown successfully on the same soil type. This means the quantitative and qualitative variables of the yield. From 2016 to 2022, I planted sweet potato slips in the same area and after four years, the yields

decrease significantly. To reduce problems caused by soilborne pathogens, a three to five year rotation of crops is recommended (CLARK, 2013; BRANDENBERGER ET AL., 2014). Also, areas where chickweed is present should be avoided as there is no effective control of chickweed in sweetpotato and chickweed can be an intermediate host for pathogens and pests (Thompson et al., 2014). Rotating with other crops on a 3 or 4 year cycle is the standard procedure to prevent pest attack and disease organisms. The beneficial preceding and succeeding crops for sweet potato are corn and squash [1]. In our country is the best forecrop the rye and the green manure like mustard and facelia. The crop rotation is very important and also producing the largest annual yield. Also you can plant a green manure crop in an area before planting. Green manure crop is grown and incorporated into the soil immediately after flowering [2]. In rotational cycles in the tropics, sweet potato is often the leading crop, except for very fertile soils, where an excessive vegetative growth at the expense of storage root formation can occur (BARKER ET AL., 2009). Sweet potato is a common forecrop of rice, other recommended crops in the rotation are maize, sorghum, finger millet, beans, cowpeas, soybeans and sesame. On the other hand, root and tuber crops such as yams, cassava and potato should be avoided (KAPINGA ET AL., 2009). In tropical regions with fertile topsoil traditional winged bean - sweet potato rotation has been replaced by peanut - sweet potato rotation or maize - peanut intercropping system (KANUA AND RANGAT, 1989).

#### **MATERIAL AND METHODS**

In Deszk, we set up the experiment on a 300 m<sup>2</sup> area for all seven years. Based on a clay loam soil. The area was fallowed for 5 years before 2016 and then planted with sweet potatoes for seven years. We always used the same field, so sweet potatoes were grown in monoculture. We also used the practices of growers in the area for soil preparation and the application of soil disinfectant. In 2016, tillage started with ploughing and then rotational tillage was carried out in the experimental area in early March and mid-May each year. In 2016, the product used for soil disinfection was Kwizda Bora WP (microbial soil fertiliser: the product contains spores and mycelia of the hyperparasitic fungus *Beauveria bassiana*, which creates unfavourable conditions for the larvae of soil-damaging insects). From 2017 to 2019, Force 1.5 G (active ingredient: 15 g/kg tefluthrin) was used for soil disinfection, with an occasional application of 7 kg/ha before planting. The product contains spores of the fungus *Beauveria bassiana*. The product was applied to the field at 2 x 2 kg/ha. From 2016 to 2018, a nutrient trial was also set up in the field. In the nutrient supply experiment, NPK nutrients were applied 3 weeks after planting in the form of ammonium nitrat, superphosphate and potassium sulphate in a 4 replicate random block arrangement. Control plots received no nutrients. Treatment K1: 45 kg/ha of nitrogen, 90 kg/ha of phosphorus and 135 kg/ha of potassium were applied, and treatment K2: 67.5 kg/ha of nitrogen, 90 kg/ha of phosphorus and 180 kg/ha of potassium. From 2019 to 2022, 200 q/ha of chicken manure will be applied in the autumn. The planting dates are in late May and the harvest dates in late October each year.

## RESULTS AND DISCUSSIONS

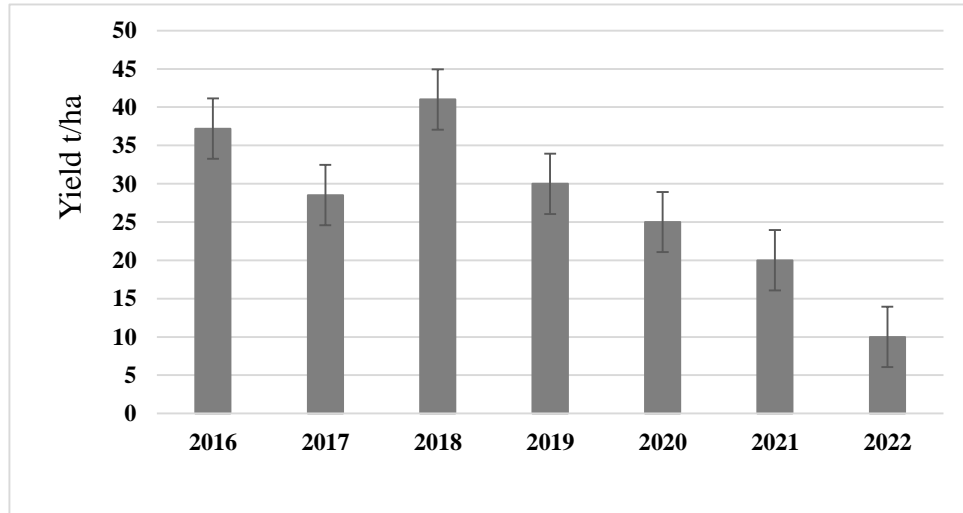


Figure 1. The effect of growing year on sweet potato yield (t/ha)  
(Deszk, 2016-2022)

There was a significant difference in yields between seven years ( $p < 0.05$ ), with the highest yield (41.01 t/ha) in 2018, followed by 2016 (37.19 t/ha) and the lowest yield in 2022 (10.01 t/ha) ( $p < 0.05$ ). The total rainfall and average temperature of the 2017 growing season were not favourable, which was also reflected in the yield to a significant extent. We can see that the year 2019 was 30 t/ha, which can be considered as good. From 2020 onwards, we have seen a continuous decrease in yields, which can be attributed to the effect of monoculture (*Figure 1.*)

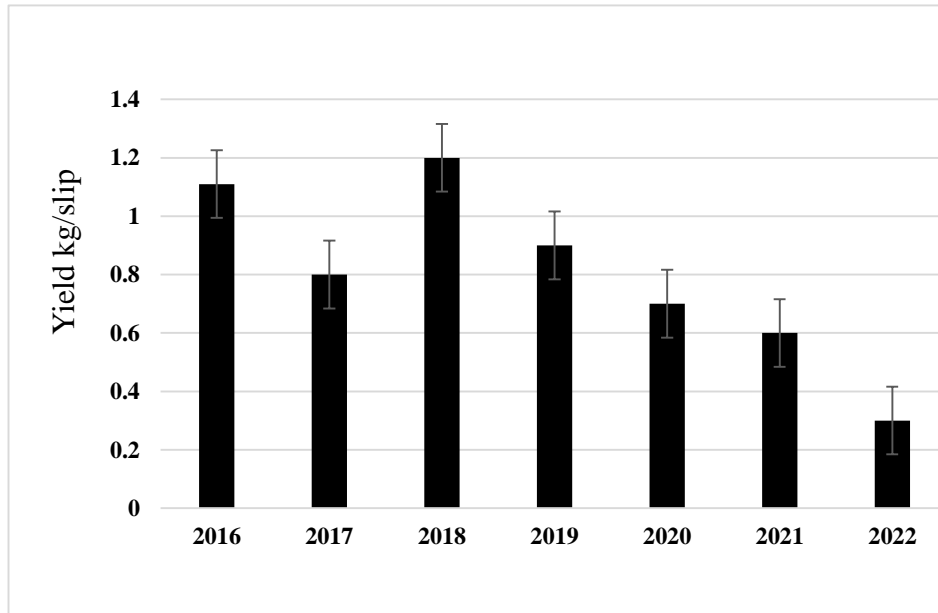


Figure 2: The effect of growing year on sweet potato yield (kg/plant)  
(Deszk, 2016-2022)

The average yield per m<sup>2</sup> is 1-2 kg, but this is influenced by a number of factors and can be higher in some places. It is not only biotic (living: animal pests, plant disease-causing fungi, viruses, bacteria) factors that cause problems in cultivation, but also abiotic (non-living: climatic conditions, natural disasters) factors. It is very important to observe the correct agrotechnical elements. In the case of sweet potatoes, the most important elements are: planting time, irrigation rate, timely application of nutrients, weed control. *Figure 2.* shows that the yield /slip datas also significantly decreased after 2020.

**Statistical methodology, one-way analysis of variance (ANOVA)**

Data were subjected to analysis of variance (ANOVA) using (*Table 1*). An F-test was performed to check whether the difference between the means of each group was significant. If this difference is significant, we reject the 0-hypothesis on the basis of the test used. The table illustrates that there is a significant difference between the results, as p-value < 1.09E-40 (p<0.05).

*Table 1*

Analysis of variance

SUMMARY

Groups	Item number	Amount	Average	Variance
Year	7	14133	2019	4,666667
tonn/ha	7	191,72	27,38857	108,7283
kg/plant	7	5,61	0,801429	0,094348

VARIANCIANALÍZIS

<i>Factors</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>	<i>F .</i>
Between groups	18760813	2	9380407	247963,6	1,09E-40	3,554557
Within groups	680,9358	18	37,82977			
Total	18761494	20				

**CONCLUSIONS**

The studies show that sweet potatoes can be grown successfully on clay loam soil for four years. In the following years the yield gradually decreased. Thus, it is advisable to set the field aside after four years. I recommend the use of ridges technology because using ridges technology the harvesting is much easier, there will be fewer damaged tubers and the tubers have more room to grow in the ridges. Soil-dwelling pests need to be controlled, as soil-dwelling pests can cause serious problems with crop quality. It is advisable to change soil disinfectants every two years so that soil-dwelling pests do not become resistant to the active ingredient.

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