ORGANIC AND MINERAL FERTILIZATION INFLUENCE UPON YIELD AND QUALITY OF POTATOES CULTIVATED IN TIMIS COUNTY

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Abstract. *The potato (Solanum tuberosum) is the fourth most important crop in the world, after wheat, rice and corn, and is a staple food for a large part of the population, being rightly considered the second bread of mankind. Along with its nutritional importance and culinary use, the potato is also appreciated as a raw material in the food and bakery industry, but also for its therapeutic effects. By using varieties with different vegetation periods, consumption is ensured throughout the year. The experiments aiming at the organic fertilization of the potato culture took place in Cralovăţ locality, Timis county. The potato crop was sown by hand, in bundles, and the treatments against pests were of ecological type, the potato fertilization being done with manure, sheep manure and complex mineral fertilizers. The highest yields of 26.6 t / ha of potatoes were determined by applying 20 t / ha of manure. Among the fertilization variants applied, for which the best quality indicators were determined, the manure variant in a dose of 20 t / ha was noted, the manure being a complex fertilizer that ensures the balanced nutrition of the potato.*

Key words: potato, organic fertilization, mineral fertilization, yield

INTRODUCTION

The potato is a very valuable vegetable whose importance has not been ignored over time. Today, approximately 1,000 varieties of potatoes are grown on large areas, on all continents, but especially in temperate areas. [Parvu, 1997; Radu et al., 1981]. The potato is a particularly important plant for human nutrition, animal feed and industrial processing. (Victor Stefan, 2005). Along with its nutritional importance and culinary use, the potato is also valued as a raw material in the food and bakery industry. (Imre-Otto-summary of doctoral thesis). In industry it is a valuable raw material, especially for the manufacture of alcohol, starch, dextrin and glucose. (Simona Nita, 2004).

The potato brings a series of health benefits, having the following properties: kidney stimulant, anti-inflammatory, removes excess fluids and salts from the body, diuretic, emollient, spasmolytic, cardiac tonic, digestive, anti-ulcer, regulates metabolism, detoxifying, cicatrizing (https:/ /jurnalspiritual.eu/cartoful-terapie-actiuni-proprietati/). If we look at the nutritional profile of a raw potato, we will see that it provides us with important nutrients: 51% of the recommended daily allowance (RDA) of vitamin C, 30% of the RDA of vitamin B6, 25% of the RDA of potassium, 12% of the RDA for magnesium, 9% of the RDA for iron, phosphorus, folic acid and zinc. (https://lataifas.ro/alimentatie-sanatoasa/158179/cartofii-au-proprietati-terapeutice-nebanuite/

Potatoes are a source of energy, minerals, proteins, fats and vitamins, the yield of the potato crop being mainly determined by its specific genetic background (Evans and Fischer 1999). The potential of potato yield is never fully achieved in natural production systems because biotic and abiotic factors interfere negatively with its crop, affecting plant growth and tuber development. To a certain extent, the negative effects of the impact of biotic and abiotic factors can be reduced by using balanced agronomic management strategies. In addition to variety selection, plant protection and continuous water supply, an important agronomic measure for potato production is proper nutrient management. A sufficient supply of nutrients fortifies the potato plant against adverse growing conditions, is crucial for obtaining a high

yield and is essential for the production of potatoes that meet the desired quality requirements (Koch et al., 2020).

MATERIAL AND METHODS

The research within the stated theme was carried out in an experimental field in Cralovaț locality, Timiș county in an experimental field located on a vertical preluvosol.

For the experiment we used the Carrera potato variety, an early variety of very large sizes, between 55 and 65 mm, oval in shape, the color of the peel is light yellow, the color of the flesh is light yellow, which does not fade after cooking. The field experience is of the monofactorial type, with 3 repetitions and 3 variants. The length of the plot is 15 sq.m., the width of the plot is 3 sq.m., the surface of one variant is 45 sq.m., the surface of 3 variants is 135 sq.m., and the surface of the entire field experimental is 405 square meters.

The potato crop was sown manually, in bins, the maintenance work was also carried out manually, and the treatments against pests were ecological, the land was fertilized with manure (20t/ha), sheep manure (250t/ha). ha) and complex fertilizers (N100P80K0: 500kg/ha).

Following the experiments, we determined the production of potatoes, the amount of nitrites, nitrates and the amount of potassium in the potato tuber, starch, raw protein, potassium and magnesium. The experiments once carried out were kept under observation under the aspect of changes appearing in the plant. From the field experiments, plant samples were collected for laboratory analysis in order to diagnose the changes that occurred as a result of the applied treatments.

The methods of analysis in the laboratory are the ones currently used:

- Total nitrogen was determined by the Kjeldhal method.

The method is based on the fact that organic substances, by boiling with concentrated sulfuric acid in the presence of a catalyst (mixture of potassium sulfate and copper sulfate), decompose into their component elements in different forms: carbon in the form of carbon dioxide, hydrogen and oxygen in water, and the nitrogen is quantitatively transformed into ammoniacal nitrogen;

- Raw protein was determined by calculation: PB(%)=Nt*Fc.

K and Mg were determined by atomic absorption spectrometry.

Working method:

Weigh out 0.5 – 1g of finely ground plant material and insert into a porcelain capsule. Place the capsule in the calcination furnace and gradually increase the temperature to 550°C. At this temperature, leave the capsule in the oven for five hours. After the expiration of the time, open the oven door, with caution, to cool the sample. When cooled, carefully remove the capsule from the oven and dissolve the ash in 2 ml of 2N HCl, mixing well with a glass rod. After 10 – 15 minutes, it is introduced into a 50 ml volumetric flask and brought to the mark with deionized water. Stir for 30 minutes, then filter.

The concentration of potassium is directly read from the filtrate, by emission, with the atomic absorption spectrophotometer, at a wavelength of 766 nm and Mg at a wavelength of 285.2 nm

Determination of starch - polarimetric method

The method includes 2 stages. In the first step, the sample is treated with diluted HCl. After sedimentation and filtration, read the optical rotation of the solution with a polarimeter. In the second step, the sample is extracted with 40% ethanol. After acidifying the extract with hydrochloric acid, the sample is filtered and the optical rotation is read again. The starch content is obtained by making the difference between the 2 readings, multiplied by a known factor.

RESULTS AND DISCUSSIONS

In 2012, the highest values of raw protein, starch and potassium content of potato tubers were determined in the variant in which 40 t of manure/ha was applied, followed by the variant fertilized with 40 t of manure/ha . In the case of magnesium, the highest value in tubers was determined after the application of sheep manure in doses of 40t/ha (table 1)

Table 1

Chemical composition of potato tuber 2012

Fertilisation	Raw protein%	Starch %	K mg/100g	Mg mg/100g
N0P0K0	0.95	14.2	325	14.4
N100P80K0	2.10	16.3	348	16.8
Cow manure 20t/ha	2.75	17.2	489	17.8
Cow manure 40t/ha	3.27	19.5	578	22.1
Sheep manure 20t/ha	2.45	18.4	500	19.4
Sheep manure 40 t/ha	2.98	19.2	550	24.5

Compared to 2012, there is an increase in the values of the analyzed quality parameters, the maximum values being determined for the same experimental variants. The high values determined in the second year of experience, in all fertilization options, can be attributed to the more favorable climatic conditions, which determined the accumulation of potassium and magnesium in the tubers, which in turn leads to the accumulation of raw protein and starch .

Table 2

Chemical composition of potato tuber 2013

Fertilisation	Raw protein%	Starch %	K mg/100g	Mg mg/100g
N0P0K0	1.05	13.9	310	15.0
N100P80K0	2.44	15.8	327	17.3
Cow manure 20t/ha	2.97	17.7	479	18.0
Cow manure 40t/ha	3.51	21.2	565	21.3
Sheep manure 20t/ha	2.73	19.5	510	19.9
Sheep manure 40 t/ha	3.07	20.6	561	25.5

In the experimental year 2013, potato yield is higher compared to the experimental year 2012, being between 12.7 and 26.2 t/ha. In this experimental year, the fertilization variant N100P80K0 stands out, for which the maximum production was obtained, followed by the variants fertilized with cattle manure. The maximum value of the crop, obtained in the N100P80K0 variant, can be explained by the contribution of the residual effect of the application of cattle manure in 2012, as it is known that the potato uses the nutrients from cattle manure more efficiently in the second. year of application.

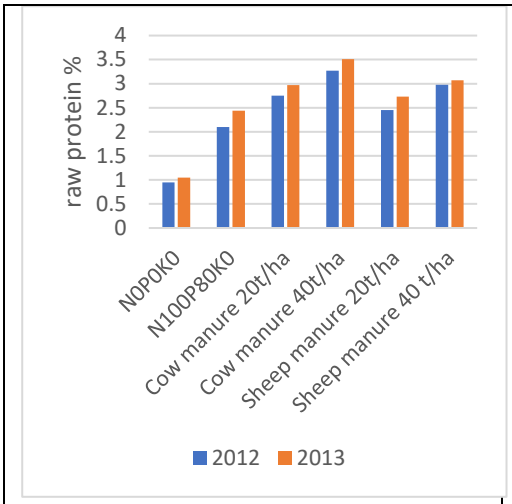

Fig.1. Fertilization influence on raw protein content of potato tubers

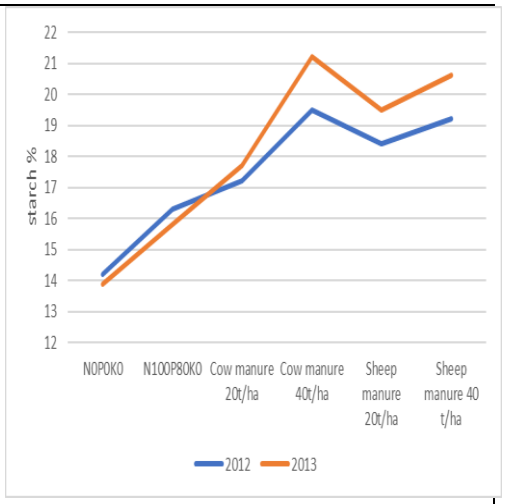

Fig.2. Fertilization influence on starch content of potato tubers

Both in the case of protein and in the case of starch, it can be observed that in both years of experience the highest values were determined when cow manure was applied in doses of 40 t/ha and 20 t/ha, respectively.

The lowest values, compared to the control sample, were determined when the mineral fertilizer with phosphorus and potassium was applied. Similar experiments, carried out by naumann and collaborators, show that the production of amides is increased when applying large amounts of N fertilizers, but the transformation of amides into proteins is reduced when there is a deficiency of K.

The higher the ratio between the macroelements N/K, with the greater is the risk of acrylamide formation. Decreasing the ratio by decreasing the nitrogen supply and increasing the K supply instead reduces the risk of acrylamide formation.

K is involved in many physiological processes, including enzyme activation processes, and K deficiency can cause the accumulation of low molecular weight compounds, including soluble sugars, organic acids, or amino acids, and decreased synthesis of large substances. molecular weight compounds such as proteins, starch or cellulose (Wang et al. 2013).

Numerous studies show that K is necessary for starch synthase activity. Therefore, a K deficiency can limit starch formation. From figures 3 and 4 it can be seen that the potassium content of potato tubers varies between 317 and 572 mg/100 g, the maximum being obtained when applying the fertilizer with the highest potassium content. The magnesium content of tubers is between 14 and 22 mg/100 g.

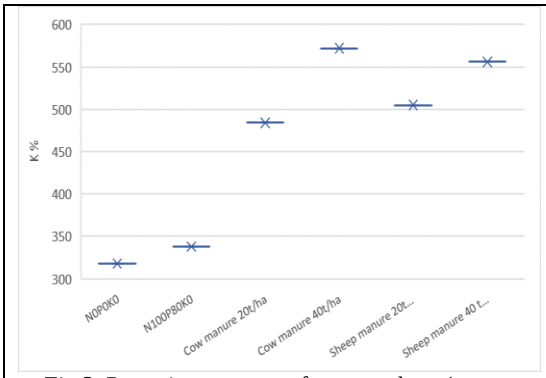

Fig.3. Potassium content of potato tubers (average values)

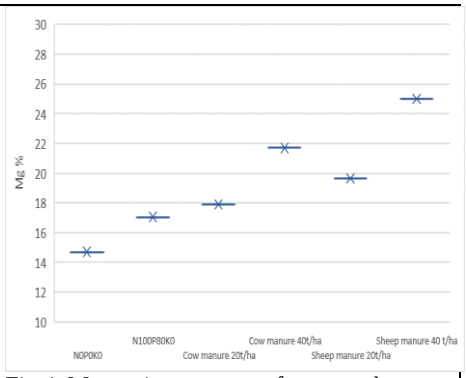

Fig.4. Magnesium content of potato tubers (average values)

K and Mg are essential macronutrients for plant growth and are required for a multitude of processes in plant metabolism.

Among all the macronutrients, potassium (K) is found in the highest amounts in potato tubers, representing approximately 400 mg per 100 g of fresh weight (White et al. 2009), being one of the most important nutrients affecting the quality of the tuber potatoes.

K plays an important role in enzyme functions, for example, the stimulation of starch synthase for starch synthesis, a sufficient supply of K being necessary for high biomass production and leaf surface development. Mg deficiency can lead to stunted growth and stunting of potatoes. Mg together with K participates in similar physiological processes - for example, in the regulation of cation-anion balance - and as an osmotically active ion in the regulation of cell turgor (Marschner 2011).

CONCLUSIONS

The physico-chemical characteristics of the vertical preluvosol from Cralovat are favorable for potato cultivation, and fertilization, especially with organic fertilizers, has led to quantitative and qualitative increases in tuber production. The cumulative effect of organic fertilizers applied in the first year of experience and mineral fertilizers applied in the second year resulted in higher and higher yields.

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