FERTILIZATION OPTIMIZATION IN THE CASE OF THE *PRODUCTIV* POTATO VARIETY THROUGH THE REFINEMENT OF THE ROMANIAN CHEMICAL FERTILIZERS IN THE TARGU SECUIESC DEPRESSION

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Abstract. Profitable potato cultures cannot be developed without chemical and/or organic fertilization. The fertilization must assure the best possible valorization of the intensive varieties' production potential under the ecological conditions existing in the cultivation region.

The experiments took place at the Potato Research and Cultivation Station Targu Secuiesc in the period 2005-2007.

Our research proposed this approach to the aspects of potato fertilization in the case of the Productiv variety, created at the Potato Research and Cultivation Station Targu Secuiesc.

To achieve a higher production level, 7 levels of fertilization and 3 types of fertilizers were studied, representing N:P:K rates of 1:0:0 (ammonium nitrate), 1:1:0 (Complex 20:20:0), respectively 1:1:1 (Complex 15:15:15).

The highest and most stable productions are achieved by adding nitrogen in doses of 150-200 kg active substance / ha, and the presence of phosphorus and potassium up to these levels provides a maximum production at the application of the binary fertilizer, Complex 20:20:0, as well as at the application of the fertilizer Complex 15:15:15.

Keywords: potato, variety, fertilization, nitrogen doses.

INTRODUCTION

The profitable potato crops, thanks to high yields, cannot be conceived without chemical/organic fertilization [2, 3].

The fertilization must ensure the high utilization of yield potential of intensive varieties in the ecological condition of cultivation area. Besides of the achievement of yield level, the nutritive elements influence the resistance to diseases as well as the quality of yield, although the unilateral fertilization with high quantity of nitrogen can produce sensitiveness of plants [5, 6].

The specially papers, regarding fertilization of potato in different climatic and soil spotlight big and sometime contradictory differences between rates and quantity of nutritive elements to achieve of certain level of yield [4, 7].

In the first period after plantation, until a foliage surface of approx. 200 cm2 is formed, the potato plant extracts the nutritive elements necessary to its growth from the mother tuber in a proportion of 96% and only in a proportion of 4% from the soil, through its radicular system [9, 11].

At the beginning the assimilation of the nutritive elements from the soil is much reduced, but this process intensifies rapidly, reaching its highest level at the beginning of flowering, when the accumulation of dry substances is the most intense [7, 11].

According to the type of fertilizer, the applied dose and the assimilation rhythm of the rates among the main nutritive elements it is achieved the fertilization optimization through the optimization of accumulations [8, 10].

MATERIALS AND METHODS

The experiments were carried out in the period 2005-2007, at the Targu Secuiesc Potato Research Station.

Experimental variants that were tested are presented in Table 1.

Table 1. Experimental factors.

Factor A – type of fertilization (NPK rate)	Factor B - Nitrogen level (kg active substance /ha)
b1- Ammonium nitrate (1:0:0)	c1 – N0
b2- Complex 20:20:0 (1:1:0)	c2 – N50
b3- Complex15:15:15 (1:1:1)	c3 – N100
	c4 – N150
	c5 – N200
	c6 – N250
	c7 – N300

The *Productiv* variety

It is a variety created by the Station for Research and Development of Potato Targu Secuiesc.

It belongs to the middle-late varieties with a growth during autumn and winter, as well as for processing.

The tubers have oval shape, with yellow skin and flesh (Fig. 1).

It is the variety with resistance to cist nematodes, and leaf roll virus, with moderate resistance to late blight and Y virus.

The yield capacity is 40-50 t/ha.

It has very good cooking quality (B class) with pretability for consumption during and winter period, as well as for processing.

Figure 1. The *Productiv* variety – potato tubers.

Fertilizers applied in the experiment

Ammonium nitrate it has got 33.0-34.5% nitrogen content, most frequently of 33.5%. It appears in the form of a crystallized or granulated salt of white, sometimes pink-yellowish color, it is water-soluble and very hygroscopic. It can be applied on every type of soil, but with restrictions on soils with an acidic reaction.

The Complex Fertilizer 20-20-0 it is a mineral compound that contains two nutritive elements: nitrogen and phosphorus. The identification code of these fertilizers is conventionally based on the individual size of the components. This type of fertilizer contains 20% nitrogen and 20% phosphorus.

The Complex Fertilizer 15-15-15 it is a mineral compound that contains three nutritive elements: nitrogen, phosphorus and potassium. This type of fertilizer contains 15% N, 15% P_2O_5 and 15% K_2O.

- The administration of chemical fertilizers was carried out at the preparation of the germination bed
- The location of the experiment according to the method of subdivided plots in three repetitions
- The calculation and interpretation of results was carried out according to the method of variance analysis, and for the appreciation of the significance of differences it was used the test of multiple comparisons [1].
- **Observations were carried out during the vegetation period with reference to:**
  - the date of the main agrophytotechnical works carried out
  - the dates of the main phenophases
  - the number of planting holes in the two middle rows
  - the harvest was carried out according to variants and repetitions
    - number and tuber weight > 2.3622 inches
    - number and tuber weight 1.1811 inches - 2.36 inches
    - number and tuber weight < 1.1811 inches

RESULTS

The influence of the NPK rates on the production in the case of the *Productiv* variety

In the Table 2 are presented the yield results of *Productiv* variety at different NPK ratios. It was not founded significant differences between different N:P:K ratios of the following fertilizers, ammonium nitrate, N:P:K 20:20:0 and N:P:K 15:15:15 on the yield of this variety (Table 2).

Table 2. Variation amplitude of the productions realized at different N:P:K rates in the case of the *Productiv* variety.

NPK rate	Average ± Standard deviation	Minimum	Maximum	Coefficient of variation CV (%)
1:0:0	28.06± 6.30	17.5	41.8	22.4
1:1:0	28.90± 7.14	19.2	44.5	24.7
1:1:1	28.94± 7.03	18.2	43.2	24.3
Total	28.64± 6.73	17.5	44.5	23.5

The influence of the nitrogen doses on the tuber production in the case of the Productiv variety

The increase of the N rates to N100-N150 had a good influence on the increase of average yield till 34-35 t/ha, constant yield during of the 3 years of experiment (CV = 5.0-12.3%). The increase of N rate of the unfavorable conditions for the use of fertilizers in some years (CV= 30.3% at N200) – Table 3.

Table 3. Variation amplitude of the production realized at different nitrogen doses in the case of the *Productiv* variety.

N doses kg active substance /ha	Average ± Standard deviation	Minimum	Maximum	Coefficient of variation CV (%)
0	22.27 ± 3. 44	18.2	27.4	15.5
50	29.13 ± 3.05	25.1	32.3	10.5
100	34.04 ±1.71	30.7	36.9	5.0
150	34.98 ±4.29	29.2	41.9	12.3
200	31.14 ±9.42	21.1	44.5	30.3
250	25.70 ±6.57	17.5	32.1	25.6
300	23.23 ±1.83	20.6	27.0	7.9
Total	28.64 ±6.73	17.5	44.5	23.5

The interaction between nitrogen levels and the different N:P:K rates on the total production in the case of the *Productiv* variety in the years 2005, 2006 and 2007

Comparing the yield of different years there are differences between N ratios for the highest yields. In the year 2005 (Fig. 2) with highest yields has been obtained over the 40 t/ha at N200, with only nitrogen, at N150-200 with nitrogen and phosphorus, as well as nitrogen, phosphorus and potassium.

In the year 2006 (Fig. 2) the maximum yield of 35 t/ha has been achieved with 100-150 kg/ha indifferent of N ratios, and after the increasing of the N level the potato yield decreased.

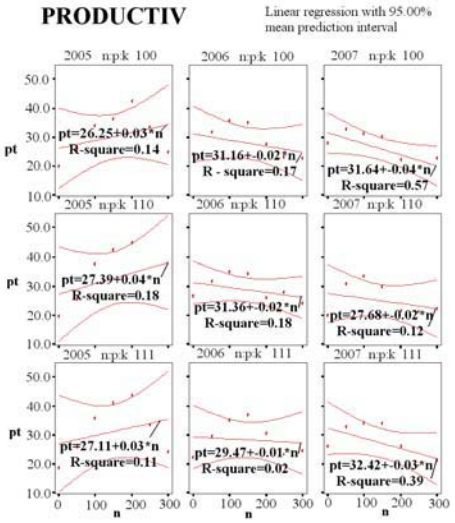

Figure 2. Correlations between the nitrogen levels at different N:P:K rates in the case of the *Productiv* variety in the three experimental years.

In the year 2007 the utilization of the N is much poor. The maximum yield was achieved at N50-150; the yield of potato in 2007 was much lower than the other years.

The regression curves (Fig. 3 & 5) shows strong relationships between the N rates and the yields of *Productiv* variety for all N:P:K ratios. Analyzing the ordering of the regression curves it is found the high utilization of it in the presence of P or P and K between 150 and 200 kg N/ha.

According to Fig. 4, the regression curves for different N:P:K ratios in 2006 do not indicate differences of N efficiency. Generally speaking it is found weaker relationships between N rates and yield levels.

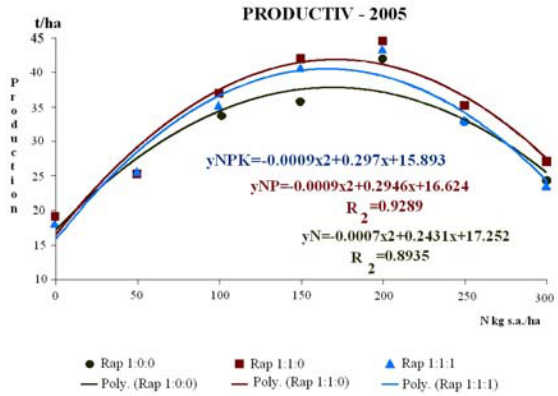

Figure 3. The nitrogen level′s influence on the production at different N:P:K rates in the year 2005 in the case of the *Productiv* variety.

The relationship between N and yields are weak in 2007. It is remarkable the decrease of yields even at low rates of fertilizers (Fig. 5).

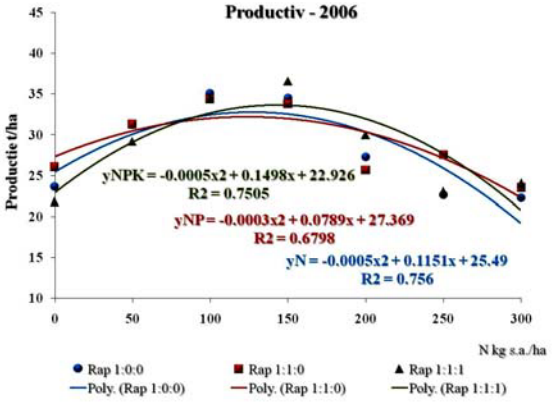

Figure 4. The nitrogen level′s influence on the production at different N:P:K rates in the year 2006 in the case of the *Productiv* variety.

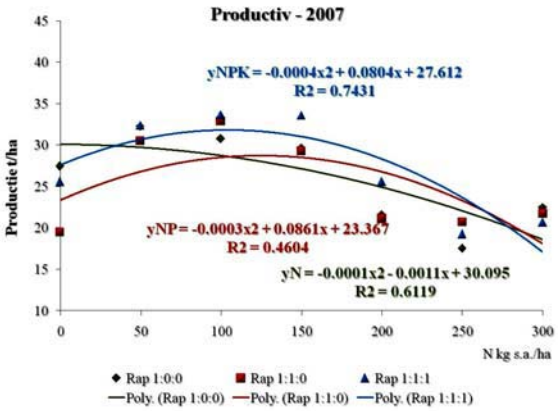

Figure 5. The nitrogen level′s influence on the production at different N:P:K rates in the year 2007 in the case of the *Productiv* variety.

DISCUSSIONS

The application of technologies specific to the pedoclimatic and social-economic conditions and the achievement of major efficiencies require every technological sequence to be carried out considering the plant's needs for vegetation factors and their influence on the production's development, respectively the immediate economic consequences and the long-term ones, as well. Modern cultivation technologies must ensure a high production and profitableness, as well as the protection of the environment and the product [13].

The obtained productions are determined directly by the variety, the pedoclimatic conditions of the experimental years, the way in which the N:P:K fertilization was carried out, the size of the planting material, the planting technology sequences and the applied fitosanitary control [14, 15].

The *Productiv* variety has lower demand of fertilizers comparing with *Luiza* variety, the maximum level of N and the level of N:P and N:P:K which limits the yield is N100-N150 kg a.i./ha [12].

In the case of the *Luiza* variety the highest and the most stable productions are obtained by the application of the nitrogen in doses of 150 – 200 kg active substance/ha, and the presence of the phosphorus and the potassium up to these intervals results in a maximum production both at the application of the binary fertilizer Complex 20:20:0 and that of the fertilizer Complex 15:15:15. Under these circumstances of optimization of the potato production, in the case of the *Luiza* variety it is obtained the higher rate (91%) of commercial production [12].

The highest yields of *Productiv* variety are achieved at 1:1:1 rapport of N:P:K and the optimum doze of N is N150-200 kg a.i./ha. Even in the lower favorable years it comes out that it is a strong relationship between the rates of N and potato yields at all studied N:P:K rapport which remain a high utilization of N in presence of P and K between the optimum rates.

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