

## RESEARCH ON ORGANIC POTATO CULTIVATION

**Imre Albert Otto**

*University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture;  
3-5Manastur St., 400372 Cluj-Napoca, Romania;*

**Abstract.** *In the experimental field from Luna de Sus (Cluj county) there have been conducted the following studies: the suitability of four potato varieties (Adora, Desirée, Rustic and Santé) to organic cultivation; agronomic solutions to improve yields level (planting material pre-germination, weed control use in crop works); different factors influence on yields stability and economic efficiency (climate conditions, genetic features, applied technology); the crop sequence and crop rotation; potato's vegetation cycle in the specific climate conditions; influence of organic fertilizers on plants growing and yields; influence of different methods in diseases, pests and weeds control. The 2008-2009 farming season main conclusions are as following: Santé variety has had the best behavior, being considered the most suitable variety to organic farming. EUROBIO 26, Azotofertil, Ecofertil P and Biomit Plusz biofertilizers are able to substitute the solid and liquid manure. In the same time, they have proved to be effective in disease control. The impact of biofertilization has been observed even on weeds incidence: the average weeds number has significantly decreased. Very few disease attacks have been observed and been kept under control using NeemAzal and copper hydroxide treatment. The maximum yields have been obtained in the "on soil + in green fertilization" scheme for all varieties. The cost-benefit analysis shows Adora variety to have the best economic efficiency.*

**Keywords:** organic potato, yield, biofertilization.

### INTRODUCTION

#### *The potato's role as food supply*

Taking account of the economic importance of potato, the general trend – both in conventional and organic farming – is to obtain increased and stable yields. Potatoes represent a great hope in solving the nowadays food crisis, knowing that the food resources and the global potential for new feed solutions are not enough balanced with the food demand of more than 6 billion people living the Earth today. Potatoes, together with wheat, corn and rice, are staple foods for human kind.

Potatoes rank the fourth place in human consumption after wheat, rice and corn. It can be consumed fresh or in frozen or dried way. There are listed over 360 cooking recipes (CATELLY, 1988).

The early maturing varieties have more nutritional value because of the time period when they are available on the market. In that time there is a shortage in high energetic vegetables so that potatoes supply the organism with needed nutrients. The human body gains energy from potatoes faster than from meat or fats. More over, potatoes are very fast and easily cooked in many ways.

The potato varieties under cultivation in Romania have a rough protein content of 2-4%. The most valuable varieties are those containing less starch (12,5 to 17,0%) because of the higher protein content. Potatoes are a B1, B2, PP and C

vitamins source, along with the important mineral content (kalium, phosphorus, natium, calcium, iron) (Fitotehnie L.S. Muntean and colab.).

The quantity of dry matter obtained is about 7-8 to/ha. The protein yield is twice compared to wheat, 1,3 higher compared to rice and 1,1 higher compared to corn. 200 grams of boiled potatoes are ensuring 16-18% of the Protein Daily Value because of the high content in valuable proteins. The essential amino acids content makes potatoes equal to meat or eggs. In addition, potatoes have enough vitamin content, even higher than rice or white bread.

Romania ranks third place in Europe and ninth overall in potato cultivated acreage. Over 97% of this area is private farmland, of which 58% households, and about 2,6% is state property (companies and research institutes) (DRAICA, C. 1999, 2000).

Through it's complexity, potato cultivation stands as reference standard for the technical and technological development of agriculture in certain regions. The statistics on potato yields shows our country in 35-40 place among the 45 most important potato producing countries in the world.

#### ***Trends in potato cultivation***

Based on scientific data and field research, the goal nowadays is to propose a crop sequence which enhances soil fertility and ensures high economic efficiency.

Moreover, the experts' target is to deliver the farmers a set of agro technical integrated measures (soil tillage, optimal planting period, planting density, in green fertilization using permitted organic fertilizers) meant to enhance steady and higher yields.

This goal can be fulfilled through:

- high ecological plasticity, high starch, protein and vitamins content varieties cultivation;
- preference for rip-roaring and diseases resistant plants over the biological yield potential;
- introducing high yields potential and better nutrients using capacity varieties.

Increasing the average yields is the certain way to enable producing potatoes higher quantities. At the present, the average yield stands around 20-30% of the genetic potential of the cultivated varieties. This potential goes up to 70-80 to/ha, even 100 to/ha nowadays.

#### ***Trends in organic potatoes cultivation research***

The Romanian researchers' objectives are connected to the global trend. It's about creating new varieties in order to rise up the genetic potential, to enhance diseases, pests and different stress conditions plants resistance. Some results have been already reached in our country, and researches are still ongoing.

Nowadays, another stated goal of the researchers is to deliver better quality and more tasty potato varieties, both for domestic consumption and industrial purpose.

On short term, as well as on long term, modernizing the potato technology has a few targets:

- to obtain steady yields through achieving the genetic yield potential even in limitative environment conditions;

- to increase more and more the genetic yield potential in best environment conditions;
- to improve the quality and nutritive value stability.

Improving the nowadays varieties' genetic yield potential (the maximum theoretical yield calculated on photosynthesis and breather losses data basis) needs to concentrate the mindfulness in optimizing the physiological process of plant growing (Austin, 1978).

The yield potential depends on the interaction of three basic physiological processes: photosynthesis, breath and growth substances usage. Therefore the yield potential improvement depends on the exploitation of the genetic differences between these three actions.

## MATERIAL AND METHOD

### *Research objectives*

According to the general research trend regarding the potato yields improvement, on the experimental field from Luna de Sus (Cluj county) there have been conducted the following studies:

- the suitability of four potato varieties to organic cultivation
- testing some of the most appropriate agronomic solutions recommended by the specialty literature, such as: the pre germination of the planting material, the use of the weed curry in preparing the germinating layer and other cultural works
- the influence of different factors on the yields stability and economic efficiency: the climate conditions, the genetic features of the planting material, the applied technological measures
- the crop sequence and crop rotation in order to achieve the optimum soil fertility preservation and economic efficiency
- the vegetation cycle in the regions' specific climate conditions
- the influence of organic Azotofertil and Biomit Plussz fertilizers on plants growing and yields
- the influence of different methods for pests and weeds control.

### *Factors and graduations:*

1. The (A) factor: potato variety, with the following graduations:

- a<sub>1</sub> – Adora (The Netherlands)
- a<sub>2</sub> – Desirée (The Netherlands)
- a<sub>3</sub> – Rustic (Romania, the NIRDPSB Brasov)
- a<sub>4</sub> – Santé (The Netherlands)

2. The (B) factor: fertilization, with the following graduations:

- b<sub>1</sub> – soil fertilization, in spring time, before planting, with phosphate fertilizer EURO BIO 26 (150 kg/ha) and Azotofertil biofertilizer (5 l/ha)
- b<sub>2</sub> – soil fertilization, in spring time, before planting, with phosphate fertilizer EURO BIO 26 (150 kg/ha) and Azotofertil biofertilizer (5 l/ha) + in green fertilization, on bud stage, with Ecofertil P (5 l/ha) and Biomit Plussz (3 l/ha) biofertilizers

b<sub>3</sub> – in green fertilization, on bud stage, with Ecofert P (5 l/ha) and Biomit Plussz (3 l/ha) biofertilizers

b<sub>4</sub> – without fertilization

3. The (C) factor: pests treatment, in green, when there are L1 stage maggots, with the following graduations:

c1 – NOVODOR (4 l/ha)

c2 – NeemAzal (2 l/ha).

## CONCLUSIONS

In the 2008-2009 farming season, the following conclusions have been withdrawn:

1. The four potato varieties have proved the genotype specificity during the vegetation cycle period. Adora variety has had the shortest vegetation period, followed by Rustic variety, Santé and Desirée variety. Santé variety has had the best behavior, being considered the most suitable variety to organic farming.

2. As regarding the EUROBIO 26, Azotofertil, Ecofert P and Biomit Plussz fertilizers influence, we consider Santé variety to give the best reaction to this factor, its' yield exceeding with 5015 kg/ha the own witness yield. We consider these biofertilizers to be able to substitute the solid and liquid manure mostly in an appropriate crop sequence. In the same time, they have proved to be effective in disease control.

3. The impact of biofertilization has been observed even on weeds incidence: the average weeds number has significantly decreased. The annual dicotyledonous weeds have the major participation with 16,1% from the total weeds number.

4. The specific weather conditions, with high temperatures, have hindered the diseases spreading. Very few attacks have been observed and been kept under control using NeemAzal. Special attention has been granted to late blight (*Phytophthora infestans*) and early blight (*Alternaria porii* f. *Sp. Solani*). These two problem diseases have been solved using the copper hydroxide treatment.

5. Through the Dincan test it has been established the variety – fertilization interaction impact on yield level. The maximum yield has been observed to Santé variety in the on soil + in green fertilization scheme (29.867 kg/gha), followed by Adora variety (25.650 kg/ha), Rustic variety (24.808 kg/ha) and Desirée variety (23.097 kg/ha) - in the same fertilization scheme.

6. The cost-benefit analysis shows Adora variety to have the best economic efficiency even it's yield was over taken by Santé variety. This was the result of the higher market price (1,8 RON/kg) which has determined Adora variety to bring the highest revenue (30.805 RON/ha).

## REFERENCES

1. Albert I., 2002, *Este rentabilă cultivarea grâului spelta!*, Revista Bioterra IV, 4, 13-16

2. Albert I., 2008 *Date experimentale privind cultura găului de toamnă în sistem ecologic* Revista Bioterra X, 2, 10-13
3. Apahidean M., Bodis A., Albert I., 2005, Cultivarea ecologica a legumelor, Rd. Risoprint Cluj Napoca pg. 10-16
4. Ardelean M., 1984 , Tehnică experimentală, Îndrumător de lucrări practice, Tipo Agronomia, Cluj – Napoca
5. Fițiu A., Morar G. și colab., 2003, *Fertilizarea în agricultura ecologică*, vol. *Tehnologii în agricultura ecologică*, Ed. Risoprint, Cluj- Napoca;
7. Luca E., Vârban D.I., Mihai Gh., Bodis A., Albert I., 2005 *Tehnologii ecologice pentru cultura plantelor*, Ed. Risoprint, Cluj- Napoca.pg. 5-15
10. Morar G., 2003 *Sisteme de agricultură și culturi de câmp*, Ed. AcademicPres, Cluj Napoca;
11. Muntean L.S. , 1993 , Fitotehnie , vol. I , Tipografia Universității de Științe Agricole, Cluj-Napoca pg., 10-75
13. Muntean L.S., Știrban M., Luca E., Fițiu A., Munteanu L., Munteanu S., Albert I., 2005, *Bazele agriculturii ecologice*, Ed. Risoprint, Cluj NapocaPg., 7-92
16. Rusu T., Albert I., Bodiș A., 2007, *Ecotehnica culturilor de câmp*, Ed. Risoprint, Cluj- Napoca pg. 5-71
17. Sin,Gh., 2000, *Tehnologii moderne pentru cultura plantelor de câmp*. Editura Ceres, București.
19. Toncea I., 1999, *Agricultura ecologică în contextul agriculturii durabile*. Simpozion ASAS „Agricultura Durabilă- Performantă”;
20. Toncea I., R. Stoianov, 2002, *Metode ecologice de protecția plantelor*, Ed. Științelor Agricole, București;