

THE INFLUENCE OF THE ECOLOGICAL CONDITIONS ON CERTAIN TECHNOLOGICAL MEASURES REGARDING THE CULTIVATION OF THE POTATO IN THE MOUNTAIN AREA OF THE SIBIU COUNTY

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Abstract. In order to successfully grow potatoes in the Sibiu County, the particularities of the ecological conditions in relation with the requirements of the crops and the crop management measures necessary for their corrections must be known in view of realizing an adequate technology for obtaining certain economic productions. This study highlights the favorable factors and the least favorable factors for the cultivation of the potato, but, especially, the extent to which the unfavorable conditions influence the technology of these crops in the mountain and sub-mountain area of the Sibiu county.

Keywords: productivity, potato crops, the mountain and pre-mountain area of the Sibiu county

INTRODUCTION

The potato is considered to be a very demanding plant in what concerns its requirements relating to the ecological conditions. The production of tubers and its quality, as well as a series of crop management measures and, in the end, the cost of the production, are influenced, to a great extent, by the climatic conditions and the conditions of the soil. It is highly important to know the influence of these conditions on the production of crops in relation with their requirements and the crop management measures necessary for their correction.

MATERIAL AND METHOD

To shed some light upon the climatic parameters and their influence on the cultivation of the potato, the meteorological data of the units from the mountain and submountain area of the Sibiu county were used, as well as some of the works with a specific content.

RESULTS AND DISCUSSIONS

The climate conditions in relation with the requirements of the potato.

Solar radiation reaches total values of more than 113-111 kcal/ sq. cm, depending on the altitude, the annual maximum value of the nebulosity is reached in December (9.5-7.1 tenths of celestial vault) and the annual minimum is recorded in August (3.7-7.1). Referring to the duration of the sun's shining, the multi-annual average in the April-September period at 500 m is of 1252.7, which represents 70% from the annual amount, respectively 1016.6 hours at 1300 m, which represents 60% from the annual amount. All these provide favorable conditions of light for an intense accumulation of production, for a quite long period, especially between an altitude of 500-900m.

The temperature of the air. In spring, together with the intensifying of the solar radiation, the temperature of the air becomes positive, recording an increase by 10-11°C as opposed to the winter months. As of the months of April, the sub-mountain area warms up quite a lot, recording higher temperatures than in the piedmont area. Thus, the thermal conditions become favourable for potato planting.

The average temperature of the spring months is of 7.1°C at 500m, respectively 5.7°C at 1000 m. In the summer, as a result of the increase of the solar radiation values (over 15.0 kcal/ /cm²), the air temperature records the highest values (more than 17°C at 500 m, respectively 13,9°C at 1000 m). The conditions of light and temperature, in the summer, allow for an intense photosynthesis process.

In autumn, as the intensity of the solar energy flux is reduced and the number of the covered days increases (8-10 days monthly at 500 m), the temperature of the air begins to decrease, recording values of 8.6°C at 500 m, respectively 6.3°C at 1000 m. In the month of October, together with the decrease in temperature, the danger of hoarfrosts appears as well. In this regard, it is recommended to harvest the potato until 1st October, the latest, in the piedmont area, respectively, 10th October in the higher mountain area.

The minimum and maximum absolute temperatures. The minimum absolute temperatures, in the analyzed period (1930-1974) reach negative values for 10-11 months per year. No negative values were recorded in the months of June (+1,8°C), august (3,4°C) at an altitude of 500 m respectively the month of July (+1,3°C) at an altitude of 1300 m. The maximum absolute temperature appears in the lower mountain area, as of the month of March (30,6°C) until the month of October (32,5°C), and in the higher area in the month of April (22,2°C) until the month of September (26,4°C), precisely in the period when the potato tubers are bound, when they are formed and when their growth intensifies. The highest frequency of the dates when the absolute maximum temperatures are produced is recorded in the months of July-August, months in which the intense growth of production predominates and the starch accumulates. The values registered in the lower mountain area are above the potato's limit of tolerance (27°C), the harmful effect of this phenomenon is, however, reduced because the duration of these periods is shorter.

Frost. The first days in which the minimum temperature of the air drops below zero degrees appear in the month of September, the frequency of the days with frost is of 0.5 days/month at an altitude of 500m, and at 1300 m it is of 1.7 days/month. The frequency of the days with frost evidently increases during the month of October when, in average, 6.3 days/month are produced at 500 m, respectively 9.8 days/month at 1300 m. In the month of March these days are quite numerous, on average 18.6 days at 500 m, 24.7 days at 1300 m. In the month of April, 6 days of frost are recorded at 500 m, respectively 16.2 days at 1300 m. According to these values, it is recommended that the planting of the potato to be realized during the first half of the month of April in the lower mountain area, respectively after the 10th of May in the higher mountain area. The month of May marks the end of the period in which days with frost are still likely to occur at 500 m, respectively, the month of June at an altitude of more than 1300 m. In these months, under exceptional cases, days with frost can still be recorded, especially as rime, which are very dangerous since the potato is growing and its foliage might freeze completely or partially.

The annual number of the summer days. This decreases by the altitude, at 500 m 60 days are recorded, and at 1300 m the average is of 4,3 days, showing that in the

high mountain area of Sibiu County, summer is chilly without high maximum temperatures. The tropical days, in which the maximum temperature is higher or equal to 30°C are very rare. The number of the summer days is recorded in the March-October period, at 500 m, respectively May-October period, at 1300 m. The frequency of the summer days in the July-August months reaches values of 17.8-16.3 days at 500 m, respectively 1.2 -1.8 days at 1300 m. It can be said that up to 1000 m, in these months with temperatures that are higher than 25°C, the conditions for growing and developing the potato plant are not adequate. If drought appears, as well, certain negative repercussions occur on the production from the perspective of quality and quantity.

The duration of the interval with daily average temperature higher or equal to 5°C is of 225-116 days, depending on the altitude. In this period, the cultivation of the potato is not possible since, at 5°C, in spring, it is not possible to plant, and in autumn, the potato cannot be harvested or handled in any way at temperatures below 10°C. The temperature range in which we can talk about the vegetation of the potato is that in which the medium temperatures of the air are maintained at values that are equal to or higher than 10°C. According to this range, it is recommended that in the submountain area (500-700 m), the potato to be planted around the dates of 15-20 April, and in the higher area (800-1000m) around the date of 10th May, when the danger of frost has already passed.

The duration of the period with temperatures higher than 10°C, of 170 days at 500 m, respectively 136 days at 1000 m, allow the cultivation of the certain varieties of potato with different periods of vegetation (90-140 days) for any locality from the mountain area of the Sibiu County, with the mention that the late or early hoarfrosts that might halt the good execution of the vegetation should be taken into account.

Monthly precipitations. The months of April and September record the lowest quantities of water in the potato's growing period. This means that, during the planting and harvesting period, there are fewer rainy days, therefore, there are better working conditions, while in the months of May, June and July, the quantity of precipitations is higher, which means more favorable conditions for the growth and development of the potato, but also the maintenance works become more difficult to perform. The relatively large number of rainy days from spring negatively influences the conditions of planting, ridge ploughing and the process of chemical weeding by herbicides, and those from June-July and August create favorable conditions for the late blight attack and it makes it difficult to perform the treatments for combatting the late blight and the Colorado potato beetle. The reduced number of rainy days from the month of September creates favorable conditions for the harvesting of the potato.

The hail. The maximum frequency of the days with hailstones is signaled in the months of May and June, when 1-3 days with hail is/are recorded. The period in which cases of hail is recorded is April-August. When it pours in large quantities, hail is one of the most dangerous meteorological phenomena during vegetation, since it can destroy the foliage of the potato in a proportion of 30-80% or even completely.

As a result of the destruction of the foliage, the production can decrease by 30-40% along the fact that the wounded leaves and stalks sensitize the plant to the attack of the diseases (Ionosi S.;Craciun Ana, 1993).

Hoarfrost. Over the course of the year, the most frequent hoarfrosts are produced in the months of October-November (10-20 days/month) at the altitude of 500 m,

respectively from the half of the month of September (1.5 days/month) at 1300 m altitude.

The latest hoarfrosts appear in the months of April in the lower areas, respectively in the month of May (1.5 days/month). The hoarfrosts that appear in the months of April and May can be very dangerous for the potato, partially or totally destroying its foliage, in the period after springing and until the formation of tubers, determining the belatedness of tuber formation and the beginning of growing, therefore, the accumulation of production.

The early autumn hoarfrosts in the month of September (1, 5 days) can destroy the foliage of the late varieties before their maturity or they can surprise the tubers that were harvested and which have not been transported in the field.

Dew. If all the other phenomena analyzed above are produced in a relatively reduced number of days, the dew has a greater frequency, being thus one of the most typical meteorological phenomena which appear in the mountain area of the Sibiu County. The largest number of the days with dew is in the months of July, August and September (19-20) days, and the lowest number is in April (5,4) and October (12 days). The mornings in which vegetation in these parts of the area is abundantly covered in droplets of water are not rare, and the soil is humid as if it were after a lesser rain. This quantity of water may contribute in certain period with drought in maintaining the turgescence of the plants and even to an additional supply of water for the potato especially that, the maximum of frequency of this phenomenon is produced in the months with more drought (July-September), but it is, at the same time, disadvantageous by the fact that it creates conditions that are favorable to the infection with late blight. A stronger and more frequent late blight attack along the reduction of the production and of the starch content leads to an increase of the production costs.

II The edaphic conditions in relation with the requirements of the potato.

In the pre-mountain field, as well as on the mountain slopes, the soils formed on proluvial-skeletal deposits are strongly influenced by the crystalline schists of the Cibin Mountains, high acidity, coarse texture and the presence of the skeleton. These are brown-acidic soils which are characterized by Class VIth, respectively IXth degree of favorability for the potato crops.

In the mountain area, the process of acidification is very advanced, Bhs or Bs horizons that contain a moderate type of hummus or a gross hummus that is very poor in substances that can be assimilated by the plants. The type of soil is brown-acidic cryptosporadic or ferriluvic, with a skeleton of a clay-sandy texture.

On the mountain peaks, the erosion in time lead to the apparition of the hard rocks at the surface, therefore it leads to lands that are not adequate for vegetal production. For these types of soils, anti-erosional measures are recommended, such as terraces, crops with grassy ridges to prevent the phenomenon of erosion, the application of the amendments in quantities of 3 t/ha and the N.P.K-based fertilizers.

In what concerns the spontaneous vegetation on the pastures from the depression species of *Trifolium*, *Lolium*, *Agrostis*, *Festuca* and *Carex* appear; on the mountain pastures there are cereal crops that form weakly productive associations and which are poor from the perspective of the quality of pastures. These plants are ecological indicators, representing moderate and strongly acidic soils. The land is covered in agricultural cultures of which the higher weight is held by the potato, the small-grain cereals and forage plants. By way of the anthropic influence, the first and most important

one being the deforestation of the natural vegetation and the grubbing up of the vegetation from the area suffered great modifications firstly in the circuit of raw materials within the ecosystem.

The vegetal mass from these lands returns to the soil only to a small extent, therefore, there is an export of chemical elements and organic matter that is not compensated naturally. By using large and repeated quantities of nitrogen fertilizers, in the last period, in very many lots the acidity in the tilled layer has increased. In order to restore and to maintain the balance of the organic matter in the soil, especially in the case of the potato crops, an optimal fertilization with mineral and organic fertilizers is recommended.

CONCLUSIONS

The ecological conditions studied in relation with the requirements of the potato impose the following technological measures:

1. Because of the shorter vegetation period (136 days) at altitudes higher than 1000 m, the cultivation of late varieties is not recommended (for safety) due to the late and early rimes.

2. Soil works (tillage + fertilization) can be executed over the course of a longer period of time, as of 20th September, in the 500-900 m areas, but only in conditions of optimal humidity. In the areas exceeding 900 m, the period for performing these works is lower due to the cooling of the weather and the precipitations in the form of snow (23rd September- 20th October).

3. The high number of rainy days (11.4- 500 m and 15.5-1000 m) require for the soil works, in spring to begin with a few days before planting and they shall be performed in flux, without taking more than 4-5 days. Thus, the compaction of the soil will be avoided.

4. The plantation of the potato may begin around the date of April, 15th, at 500 m, respectively 10th May at 800-900 m and it must be completed within 5-6 days, at the most.

5. The rather high number of rainy days in the month of May (in average 15 days- 500 m), respectively June (16.6- 17 days at 700-1000 m) prevents the performance of the ridge ploughing and the process of chemical weeding by herbicides in optimal conditions. These works must be completed within 2-3 days, when the temperature of the soil allows for their execution, in good conditions, but before the springing of the plants.

6. The high number of days with precipitations (rain, dew, mist) from the vegetation period allow for the early triggering of the late blight attack and they keep the integrity of the foliage and the production in a constant danger. The treatments must be performed at all times, so that the foliar surface area to be protected at all times and, if possible, in the same day. In such conditions, around 7-10 treatments are imposed depending on the area (except in the years with draught).

7. The early autumn hoarfrosts that appear in the second half of the month of September (1,5 days/month) may destroy the foliage of the semi-late varieties before they reach maturity (800-1000 m) or they may surprise the tubers that were harvested but which were not transported from the field (600-800 m). The storage of the tubers must be made in protected spaces and the capitalization must be made in a very short

period of time, especially if the storage conditions are not optimal. It is recommended to extend the semi-early varieties that proved their superiority (Roclas, Runica, Christian, Escort) for the 800-1000 m area.

8. In order for the soil to become practicable for the cultivation of the potato (800-1200 m), anti-erosional measures are recommended such as terraces, crops with grassy ridges, in order to prevent the phenomenon of erosion, as well as the application of the amendments in amount of 3t/ha and of the organic fertilizers in a dosage of 30-40t/ha in order to neutralize the pH value of the land.

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