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A Study Of The Growth And Developmental Traits Of The Potato Cultivar 'Sylvana' Under The Environmental Conditions Of Adjara

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ABSTRACT. The tuber crop Solanum tuberosum, commonly known as potato, holds considerable importance in the realm of food production due to its nutritional and economic potential. The prominence of the potato crop can largely be attributed to the versatile application of its tubers, which can be processed into a wide range of globally recognized products. The nutritional composition of potatoes, which includes carbohydrates, proteins, vitamins, and other vital substances required for the healthy functioning of the human body, is subject to variation. These fluctuations are governed by factors such as the plant's genotype and the specific soil and climatic conditions of the cultivation region. The current study is focused on 'Silvana', a potato cultivar of significant economic potential that was introduced in Georgia. This cultivar can adapt to the varying altitudinal conditions of Adjara, making it a compelling subject for scientific investigation. This research examines the bio-morphological attributes of the 'Silvana' cultivar, its unique growth and developmental patterns, and its cultivation prerequisites in the environmental conditions of Adjara. The distinctiveness and originality of this study stem from its pioneering exploration of these facets of the 'Silvana' cultivar within the unique environmental context of Adjara.

Keywords: Potato, Sylvana, Phenology, Agrotechnology, Plant Growth

INTRODUCTION

The cv. Sylvana (Solanum Tuberosum Sylvana) is characterized as a mid-early cultivar. Developed through meticulous selective breeding by Dutch horticultural experts, with the aim of ensuring adaptability across diverse environmental conditions. Subsequently, it was envisioned to establish Silvana as an eminent choice in culinary applications. The cultivar has garnered commendable reviews, attributable to its impressive yield potential and favourable organoleptic properties [1].

The vegetation period for this particular species extends from 90 to 100 days. Throughout this growth phase, the plant typically produces between 8 to 12 tubers. The tubers exhibit smooth, yellowish skin. The morphology of the tubers is primarily round-oval, and their weight typically ranges from 90 to 150 grams [2].

The plant is tall, upright, with massive stems and abundant foliage. The onset of the flowering phase is closely associated with the maturation of the plant's tubers. The flowers are usually pinkish or purple. Although the root system is strong, timely weed management is highly recommended to prevent any detrimental impact on the plant's overall vitality and health [3].

The yield of Silvana per hectare ranges from 170 to 370 centners, of which an estimated 85-91% attains a market-ready state. It should be emphasized that this cultivar demonstrates excellent tolerance to mechanized harvesting, transportation, and storage processes [4].

Significantly, this potato variety exhibits high resistance to both potato warts and the golden nematode. Moreover, it shows a moderate level of resistance to Phytophthora infestans and common scab, further enhancing its agricultural viability [7].

The mature tubers are characterized by their palatable flavour and high nutritional value, making them an integral component of various culinary applications such as salads, fries, and purees. Notably, their physical attributes, including colour and shape, maintain consistency throughout the cooking process.

The tuber of Sylvana comprises approximately 20% dry matter and a starch content ranging between 13.5% and 15.5%. Optimal storage conditions entail a dry, adequately ventilated environment with a temperature maintained around +5°C. Tubers that are firm and devoid of any physical damage can be preserved for an extensive period, potentially up to six months, under these specified conditions. Importantly, these storage conditions ensure that there is no decrement in their nutritional value and organoleptic properties. [5].

The groundwork for potato cultivation ought to be initiated during the fall season. It is imperative that the designated planting plot be meticulously cleared of any intrusive weed species, followed by a process of soil homogenization. The soil should then be amended with a judicious mix of both mineral and organic fertilizers to enhance its nutritional profile, thereby optimizing the conditions for growth. Prior to planting, it is crucial to rigorously inspect the seed potatoes to ensure their quality. Tubers demonstrating deformities or visible signs of damage should be systematically culled from the planting stock to prevent potential adverse effects on crop health and yield. Moreover, to expedite the process of embryo formation, the tubers should be subjected to a controlled warming regimen, elevating their temperature to approximately $+12^0$C [6, 8].

Plant cultivation initiates subsequent to the establishment of suitable meteorological conditions, specifically when the soil has attained the necessary thermal conditions. The spatial arrangement of plants should adhere to a specified structure, with an interrow spacing of no less than 25 cm and an interrow distance of at least 75 cm. Overly deep planting is not advised, as this can lead to prolonged germination periods for potatoes.

The initial process of pinching is conducted once the plant attains a height within the range of 18 to 20 centimetres. This practice is crucial as the action of truncating the shoots stimulates the growth of diminutive tubers.

In order to prevent potato diseases, regular fertilization of the inter-rows is essential. It is also crucial to apply suitable pesticides to the plants while adhering strictly to the prescribed dosages and usage guidelines of these substances. Potassium fertilizers play a significant role in maintaining the health and quality of the produce. Therefore, it is recommended that these fertilizers are applied prior to the harvesting period or that the dosage is increased by 15% during the final application. The latter strategy helps to prevent the blackening and damage of potatoes, which can occur when the tubers come into contact with one another during harvesting. The optimal period for harvesting is typically in late August or early September. During this time, the weather conditions are usually dry and sunny, which is ideal for this process [6].

MATERIALS AND METHODS

The study centered around the cultivation of Silvana plants, was conducted in a selection of distinct locations, each chosen for its unique geographical and soil attributes. The first plot was the village of Okruashvili, located in the municipality of Khulo within the region of Adjara. This location, elevated at an altitude of 1200 meters, is distinguished by its fertile soil composition. Additionally, the research extended to Beshumi, an area situated at an elevation of 1900 meters. This plot was chosen due to its characteristic mountain-meadow soil type. Lastly, the study incorporated data from the experimental collection plot of the Kobuleti Phytopathology and Biodiversity Research Institute. This plot is located in Gelauri, a mere ten kilometres from the sea, and is characterized by its predominant red soil.

It is well-established that the potato plant demonstrates optimal growth and productivity in mountainous regions, resulting in an abundant yield of high-quality produce. Conversely, the productivity of this crop exhibits a noticeable decrease when cultivated in plain terrain, yielding a relatively lesser harvest.

In our study, we selected three distinct locations characterized by varying climatic and soil conditions. The primary aim of this selection was to investigate the growth and development characteristics of the Silvana cultivar when cultivated under identical growth conditions. Consequently, we strategically timed the planting of the Silvana plants to coincide with the onset of favorable climatic conditions within each respective zone.

In the context of our experimental design, we selected 100 tubers of the Silvana cultivar for each of the three proposed treatments. These tubers, of medium size and cultivated during the spring season, were planted in predefined holes. The configuration of each hole provided a feeding area of 50 cm by 25 cm, with a depth ranging from 10 to 15 cm.

After the germination phase of the potato plant, an initial tillage process was carried out to optimize soil moisture levels and ensure proper aeration. This was followed by a secondary tillage, during which a layer of soil was applied, maintaining a depth of approximately 15-20 cm. Under specific circumstances, such as periods of rapid plant growth, an additional soil application may be considered

essential. This secondary soil application, if required, should be performed no later than the onset of mass flowering.

In order to optimize plant growth and development, organic and inorganic fertilizers were incorporated into the soil both prior to planting and throughout the vegetative period. The primary classes of fertilizers administered were burnt manure and NPP (comprising Nitrogen, Phosphorus, and Potassium). Vegetative feeding was initiated when the plants reached a stature of 12-15 centimeters, and a subsequent feeding round was executed immediately prior to the commencement of mass flowering. This time point is critical in the plant life cycle, as it corresponds to a peak in the demand for nutrients. During this phase, a specific fertilizer, Tsuntsukhi, was utilized. Irrigation practices were strategically implemented according to necessity, largely during periods characterized by relative dryness.

In the study, three distinct experimental setups were established, each beginning its planting phase when the average atmospheric temperature consistently fell within the range of 10 to 15 degrees Celsius. The seed stock for the experiment was meticulously selected, comprising only Silvana potato tubers that were healthy, free of physical damage, of medium size, and exhibiting either spring growth characteristics or full germination. Each tuber used in the study weighed approximately 40-60 grams.

According to the research conducted, the stages of phenological development of all examined plant cultivars were recorded throughout the entire vegetative period (Table 1). The recorded stages included significant milestones such as the dates of planting, initiation of germination, the onset of the flowering phase, peak flowering period, emergence of the first tuber, withering of the plant, and the final stage of harvesting. In addition to this, the biometric attributes of the plants and the characteristics of the tubers were recorded (Table 2). Notable among these were the plant size, monitored across various vegetative periods and expressed in centimeters, and the mean tuber mass, which was quantified in grams.

In conditions characteristic of elevated mountainous regions, potato tubers were planted at a depth ranging between 10 and 12 centimetres. Conversely, in the region of Gelauri, which is characterized by a relatively higher humidity level, the planting depth was slightly reduced, ranging from 8 to 10 centimeters.

REULTS AND DISCUSION

In the study, as summarized in Table 1, tubers were shown in Okruashvili village on April 5th, which coincided with the commencement of favourable climatic conditions. Sprout growth was observed to commence in the first ten days of May, followed by more prevalent sprouting in the subsequent ten-day interval. The phase of flowering was initiated in the second ten-day period of June, characterized by extensive blossoming in the third ten-day period of the same month. This latter phase also marked the beginning of tuber emergence. The harvesting process was carried out at the conclusion of August, aligning with the beginning of widespread wilting among the plants.

In the research carried out in Beshumi, the commencement of the planting process was postponed until May 21st, at which point the average air temperature reached 12-15°C, and 8-12°C at night. The emergence of sprouting was documented on June 3rd, followed by the onset of extensive flowering, which was observed in the early part of August. The occurrence of widespread wilting is a common indicator of tuber maturation and harvesting period. Consequently, the harvesting phase was scheduled for the middle of September.

In the research conducted within the Gelauri region, Silvana tubers were planted on March 10th during the early spring, in plots that had been previously prepared and fertilized. Germination of the tubers was initially observed in the first ten days of April, with an approximate 75% germination rate recorded by mid-April. The latter part of June marked a significant phase in the growth cycle, with the

Table 1. Phenological Observations of the Potato Cultivar Sylvana

The name of option	Planting time	Germination		Flowering		The beginning of tuber	Withering of plants		
		The beginning 10%	Full 75%	The beginning 10%	Full 75%		The beginning 10%	Full 75%	Harvesting
Khulo, village Okruashvili	5 April	I -ten days of May	II - ten days of May	II -ten days of June	III - ten days of June	III - ten days of June	I - ten days of August	III - ten days of August	III - ten days of August
Mountain Beshumi	21 May	II - ten days of June	III - ten days of June	III - ten days of July	I - ten days of August	I - ten days of August	III - ten days of August	II - ten days of September	II- ten days of September
Kobuleti, Gelauri	10 March	I - ten days of April	II - ten days of April	I - ten days of May	III – ten days of June	II - ten days of July	II - ten days of August	III - ten days of August	III - ten days of August

onset of massive flowering and the emergence of tubers occurring in the third ten-day period of that month. The plant wilting phase commenced in the second ten-day period of August, culminating in complete wilting by the third ten-day period of the same month. The harvesting process was subsequently conducted at the end of August.

In the present study, observations were conducted across three distinct variants. It was found that the onset of flowering typically occurred approximately 60 days post-plantation. Simultaneously, the initiation of tuber development was observed at the stage of a flower bud's emergence and persisted into the early phases of flowering. Notably, the above-ground components of the plant die after 100 to 120 days, coinciding with the completion of tuber maturation. These findings contribute to a comprehensive understanding of the growth timeline and developmental stages of the plants under investigation.

In examining the yield across three distinct regions, it was observed that Beshumi and Khulo produced the highest tuber yields, with Beshumi yielding approximately 200 kg and Khulo approximately 150 kg. This contrasts with the yield observed in Kobuleti, which was significantly lower, averaging around 40 kg. This decrease in yield was attributed to unfavourable meteorological conditions prevalent in the region during the study period.

In addition to conducting phenological assessments, we undertook biometric evaluations of the plants cultivated across all three distinct locations. These evaluations entailed the documentation of plant height, measured in centimetres, both at the beginning and end of the growing season. Furthermore, the Silvana tubers harvested were quantitatively assessed through weight measurements.

Table 2: Biometric Measurements of the 'Silvana' Potato Variety (2020-2023)

№	Variants	Height of plants in centimeters		The average weight of tubers in gram
		The beginning of growing season	The end of growing season	
1	Beshumi	10-15 cm	90 cm-1 m	600-700 g
2	Khulo	10-13 cm	90 cm-m	300-500 g
3	Kobuleti	8-9 cm	70-80 cm	90-180 g

In the data presented in Table 2, an examination of the Beshumi and Khulo variants reveals that the three-year average sprout height at the onset of vegetation is approximately 10-15 cm. At the end of the vegetation period, the sprout height in both these variants reached one meter. Conversely, in the case of the Kobuleti-Gelauri variant, the situation is comparatively distinct. At the end of the vegetation period, the sprout height in this variant only reached a range of 70-80 cm, marking it as relatively low in comparison.

In the comparative analysis of the average mass of the tubers, measured in grams, a significant distinction is observed between the highland and lowland variants. Specifically, the tubers of the Beshumi and Khulo variants exhibit a substantial size, with a mass ranging approximately from 300 to 700 grams. This represents a three to four-fold increase in size compared to the tubers of the Gelauri variant.

With respect to pest-related diseases, comprehensive fundamental research has not been conducted in this area yet. However, preliminary observations indicate that the Silvana cultivar demonstrates a reduced susceptibility to pest infestation, particularly under high mountain conditions. Further investigations into this issue are currently underway.

CONCLUSION

The insights garnered from the studies allow us to draw the following conclusions:

1. The potato cultivar "Sylvana" demonstrates exceptional adaptability to the specific soil and climate conditions found in the high-altitude regions of Adjara. The phenological phases of this cultivar develop optimally under such conditions, resulting in plentiful harvests of superior quality.

2. Studies executed on selected plots in Khulo and Beshumi provide robust evidence supporting the cultivation of "Sylvana" in these areas. The potato plants manifested a high yield, boasting healthy tubers with an average weight ranging between 300 and 700 grams. It is noteworthy that in Beshumi, the yield per hectare, in certain instances, reached an impressive 35 tons.

3. A significant observation is the decreased vulnerability of "Sylvana" when cultivated in high-altitude regions, to pests and diseases. This characteristic, coupled with their high yield, posits them as an economically feasible option for cultivation.

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კარტოფილის ჯიში „სილვანას“ ზრდა-განვითარების თავისებურებების შესწავლა აჭარის პირობებში

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მცენარეთა დაავადებათა მონიტორინგის, დიაგნოსტიკისა და მოლეკულური ბიოლოგიის დეპარტამენტი, ფიტოპათოლოგიისა და ბიომრავალფეროვნების ინსტიტუტი, ბათუმი, შოთა რუსთაველის სახელმწიფო უნივერსიტეტი, ბათუმი, 6010, საქართველო

ანოტაცია

როგორც ვიცით ბოსტნეულ კულტურებს შორის, კარტოფილს თავისი კვებითი და ეკონომიური მნიშვნელობით ძალიან დიდი ადგილი უკავია სასურსათო წარმოებაში, რასაც უპირველეს ყოვლისა განაპირობებს მისი ტუბერების მრავალმხრივი გამოყენება, რომლის გადამუშავების შედეგად მიღებული პროდუქტები ფართოდაა ცნობილი; კარტოფილის კვებით ღირებულებას განსაზღვრავს ნედლეულში ნახშირწყლების, ცილების, ვიტამინების და სხვა ნივთიერებების შემცველობა, რომლებიც აუცილებელია ადამიანის ორგანიზმის ნორმალური ფუნქციონირებისთვის. ეს ღირებულება კი იცვლება მცენარის ჯიშის, ადგილმდებარეობის, ნიადაგურ-კლიმატური პირობების გავლენით.

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საკვანძო სიტყვები: კარტოფილი, სილვანა, ფენოლოგია, აგროტექნოლოგია, ვეგეტაცია.