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Professional paper

EVALUATION OF MORPHOBIOLOGICAL AND PRODUCTION INDICATORS OF SWEET POTATO (*Ipomea batatas poir*) IN THE AREA OF MYZEQE, LUSHNJE

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Abstract

Sweet potato (*Ipomea batats Poir*) is one of the plants with a special chemical composition that is most complete in nutritional value for people of different ages, especially for the ages of childhood and old age. It is an excellent food for people who have stomach problems and who have poor metabolism and stomach problems. Sweet potatoes are rich in starch, sugars, proteins, vitamins, and chemical elements such as potassium, iron, magnesium, and others. In contrast to the potato, there is much less solanine.

Two sweet potato cultivars were included in the study: Beauregard, Pepita, and Convingation. Seedlings were obtained in Ioannina from the AGRIOS company, Greece, and planted in Divjaka in sandy soils suitable for sweet potato cultivation. Biometric measurements were performed on all three cultivars for morphological and production indicators: Number of shoots/plant, length of shoots/plant (sum), longest shoot, shortest shoot, number of leaves/plant, leaf color, flower color, leaf shape, tuber shape, tuber skin color, tuber pulp color, bud placement on tuber, production/plant (Kg/plant), number of tubers/plant, average tuber weight kg, weight of largest tuber (kg), weight of smallest tuber kg, Yield Kv/ha. Samples were taken from the manufactured products, and chemical analyses were performed at the ATTC (Agricultural Technology Transfer Center) in Lushnje.

Keywords: *Sweet potato, shoots, flower, leaves, shape, production, tuber, yield*.

1.Introduction

Sweet potato is a relatively new and not widely grown plant. It has been spreading in recent years due to its nutritional value and specific uses. This study provides data on three sweet potato cultivars that were field-experimented in Sulzotaj municipality, Divjakë, to determine their best suitability and the best and highest yielding cultivar.

2. Material and methods

2.1. The aim of the study: The study of potato cultivars to determine the best cultivar for the agroecological and soil conditions of Lushnja was carried out in Sulzotaj, Divjaka.

To achieve the goal and objectives of this scientific study, an experiment was set up with three sweet potato cultivars: Convingation, Pepita, and Beauregard. The experiment was set up with three variants and four repetitions. The variant was designed with dimensions of 7 m x 2.4 m = 16.8 m2. The soil was tilled at a depth of 31-35 cm. It was fertilized with organic fertilizer 300 kv/ha, 2 kv/ha potassium sulfate, and 80 kg/ha urea. The pre-plant was carrots. During the vegetation period, several treatments were carried out: supplementary fertilization with ammonium nitrate twice at 70 kg/ha, five irrigations were carried out with drip tubes and were accompanied by liquid fertilizers. It was not affected by various diseases (late blight and powdery mildew). It was treated only with gastrotox because snails appeared with and without shells.

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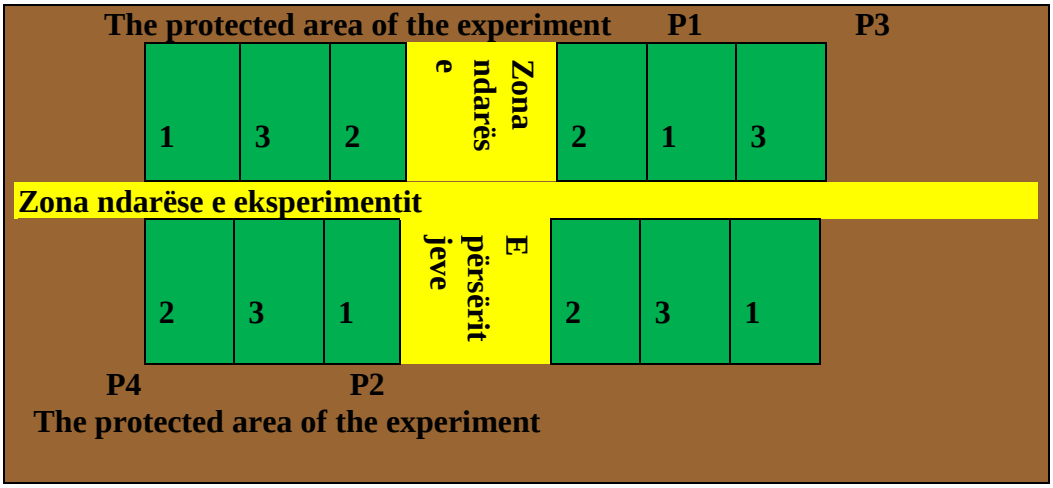


Scheme No.1: Setting up the experiment

The following indicators were evaluated:
1. Study of morphological and productive indicators of some sweet potato cultivars.
2.1. The field experiment was carried out during the period May-September 2022, in Sulzotaj, Divjakë municipality: Three sweet potato cultivars were included in the study, namely, Beauregard, Pepita, and Convingaton. The harvest was carried out on September 28, 2022.

2.2. Objectives:

1. Evaluation of the morphological and productive indicators of the cultivars
2. Determination of the best cultivar
3. Perform chemical analyses of the tubers.

2.3. Morphological indicators

1. Number of shoots/plants
2. Length of shoots/plant (sum)
3. Longest shoot
4. Shortest shoot
5. Number of leaves/plants
6. Leaf color
7. Flower color
8. Leaf shape
9. Tuber shape
10. Tuber skin color
11. Tuber pulp color
12. Bud placement on the tuber

2.4. Production indicators

1. Production/plant (Kg/plant)
2. Number of tubers/plants
3. Average tuber weight kg
4. Weight of the largest tuber kg
5. Weight of the smallest tuber kg
6. Yield Kv/ha

3. Methods used for chemical analysis of sweet potatoes

3.1. Dry matter
By drying in a thermostat until constant weight.

3.2. Ash S SH ISO 5520:2001
Water-soluble ash. Combustion in a muffle at a temperature of 550 ^{0}C.

3.3. Determination of titratable acidity according to S SH ISO 750:2001.

3.4. Determination of fat with a Soxhlet apparatus. S SH 2228/5:87
This method is based on the repeated extraction of a certain amount of material (previously dried at a temperature of 105-110^{0}C) using organic solvents, in our case, petroleum ether, since, unlike carbohydrates, fats are not soluble in water but in organic solvents.
After the extraction is complete, the distillation process continues to remove as much solvent as possible from the fat in the pot. The solvent is completely evaporated in a thermostat with a temperature below 100^{0}C.
The crystallizer with fat, after cooling in a desiccator, is weighed accurately on an analytical balance.

3.5. Determination of protein by the Kjeldahl method.
The method consists of chopping and homogenizing the sample and disaggregating the material with concentrated sulfuric acid.
After combustion, distillation is performed, and then titration with HCl.

3.6. Determination of starch by acid hydrolysis.
Starch molecules are broken down by the action of HCl into glucose molecules, and this is determined by acid hydrolysis.
For this, 4 g of material is usually taken and transferred to a 300 - 400 ml Erlenmeyer flask, washing it with 150 ml of 1% HCl. It is closed with a stopper that has a refrigerant tube in the middle and heated in a water bath for three hours. Finally, a test is made for the end of starch hydrolysis with KJ. After the end of hydrolysis, the resulting solution is neutralized with 10% NaOH. In an alkaline environment, sugar decomposes. By neutralizing the solution, albumins are precipitated; for this purpose, lead acetate is gradually added to the flask according to the probable content of albuminous matter. After the precipitation of the lead acetate extract is completed, the solution is filtered with a double-density filter and used for the determination of glucose according to the Bertrand or cyanide method.

3.7. Determination of Phosphorus
The wet material is burned in a muffle at 550 - 600 °C until it becomes ash, and this is digested with HCL, thus the organic phosphorus passes into solution in the form of phosphoric acid. With this solution, the phosphorus is determined by the phosphomolybdate method.
The standard phosphorus solution is prepared by building the standard scale.

3.8. The determination of cellulose is done by taking 2-3 g of ground material, which we transfer to a 400 - 600 ml beaker, to which we add 1.25% H2SO4, letting it boil, and occasionally adding water to prevent the increasing of acid concentration that is boiling on the cellulose.
Then, boiling is done with 1.25% NaOH. Finally, the filter is rinsed with ethyl alcohol or ether. To determine pure cellulose, protein and ash are subtracted from crude cellulose. The difference gives the pure cellulose.

4.Results and interpretation

4.1. Climatic conditions of Lushnja

The climatic indicators of Lushnja are the average of values over fifty years.

3. 1.1. Temperatures

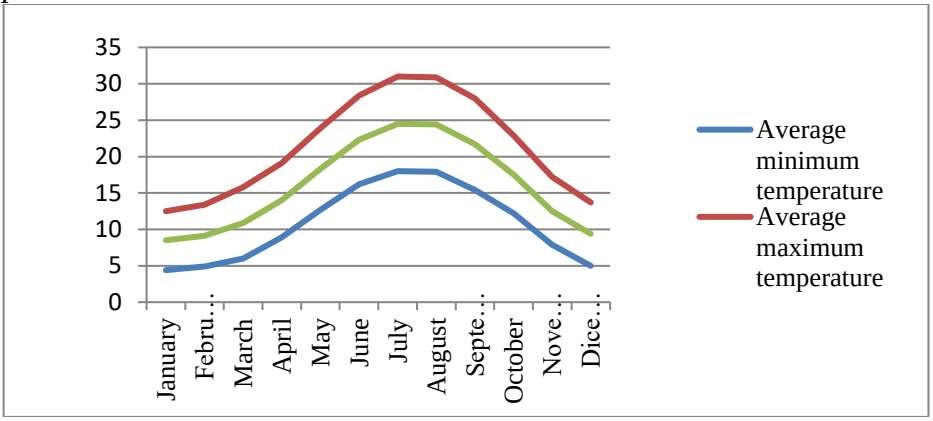


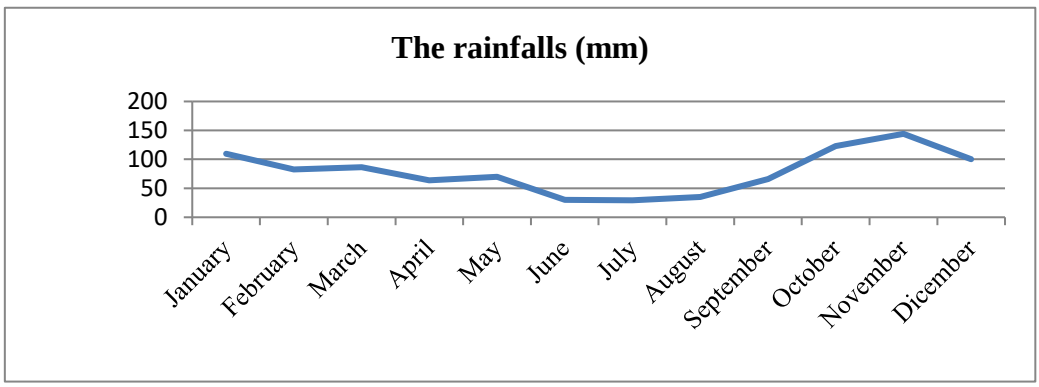
Chart No. 1 Monthly trend of long-term average temperatures in Lushnje

The annual temperature trend is suitable for potato growing in the Myzeqe area. One concern is the summer period with temperatures above 300 °C, which is prolonged, causing plant stress. Due to the conditions of decreasing temperature in autumn, plant growth begins to be inhibited, reducing production in the third harvest and significantly reducing the quality of the product. To better clarify the impact of temperatures, we are presenting the annual regime

Table No. 1 Average annual regime in Lushnje.

No.	Indicators	Long-term average
1	Annual average temperature	16.1
2	Minimum average annual temperature	10.7
3	Maximum average annual temperature	21.5
4	Days with a temperature. $> 7^0$ C	338.4
5	Days with temperature. $<0^0$ C	14.3
6	Days with temperature > 30 °C	61.5
7	Annual rainfall amount (mm)	936.7
8	Maximum 24-hour rainfalls (mm)	131.6
9	Rainy days per year	107.4
10	Annual solar radiation (hours)	2675.4

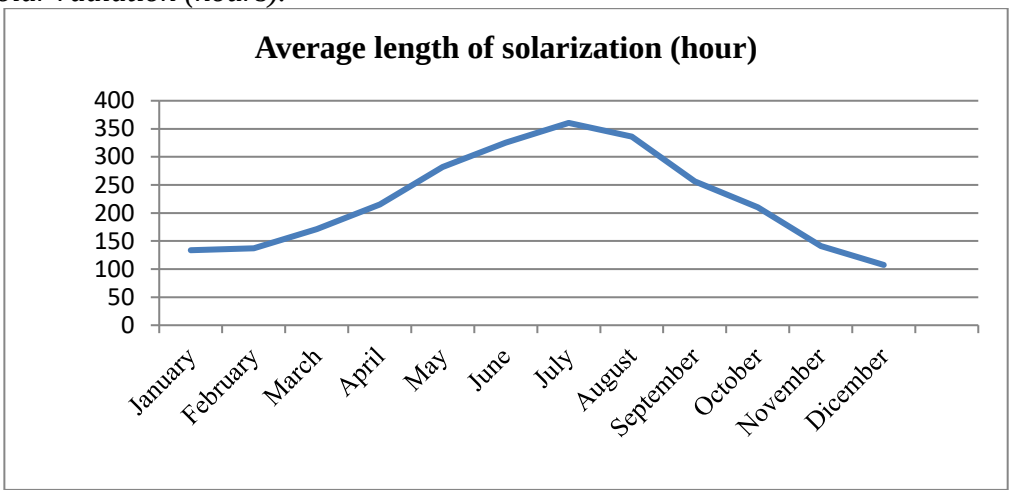
3.1.2. Rainfalls



Graph No. 2. Monthly rainfall trends in Lushnje.

The precipitations have an abnormal distribution compared to the needs of the plant, so during the period June-August, there is a water shortage for the potato. This has led to four irrigations, especially during May and June.

3.1.3. Solar radiation (hours).



Graph No. 3. Monthly progress of solar radiation (hours) in Lushnje.

Sunlight is suitable for sweet potato cultivation. For normal development, 2200-2300 hours of sunlight are needed. This requirement is well met in the conditions of Myzeqe, positively affecting the quality and chemical composition of the sweet potato tuber.The soil in which the experiment was set up was analyzed, and the indicators are: aqueous pH 6.95, saline pH 6.7, K.E. 0.100, Humus 2.2 %, Nitrogen 0.14 %, Phosphorus ppm 11.6, Potassium ppm 13.27, CaCO3 1.64 %, sand 36.6 %, loam 31.3 % and clay 32.1 %. They are suitable soils for sweet potato cultivation.

3.2. Morphological indicators

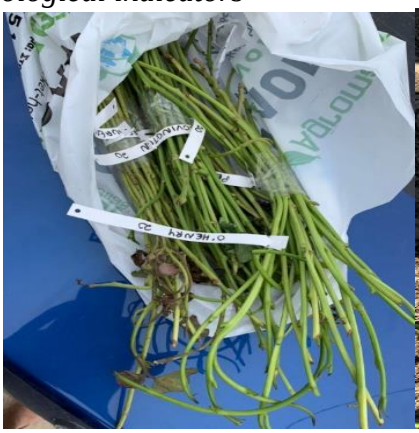


Photo No. 1: Packaging of seedlings

Photo No. 2: Planting the seedlings and trading

Among the morphological indicators, the indicators planned in the scientific methodology were evaluated.

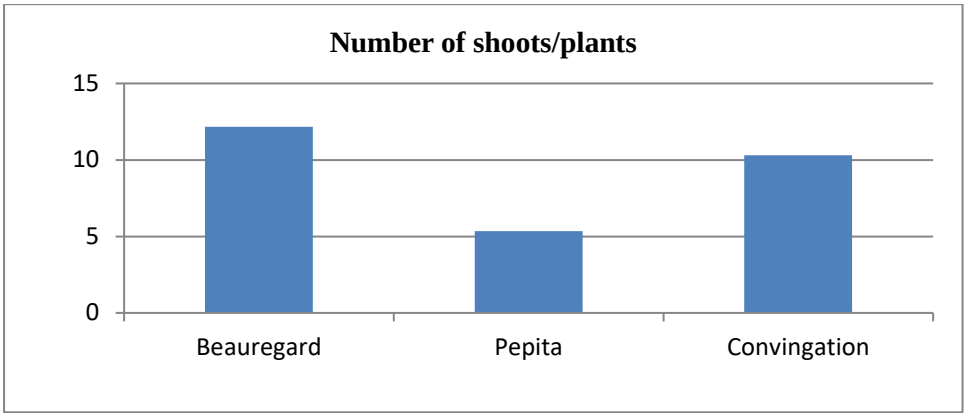


Chart No. 4 Number of shoots per plant

The Beauregard cultivar has the highest number of shoots, and the Pepita cultivar has the lowest.

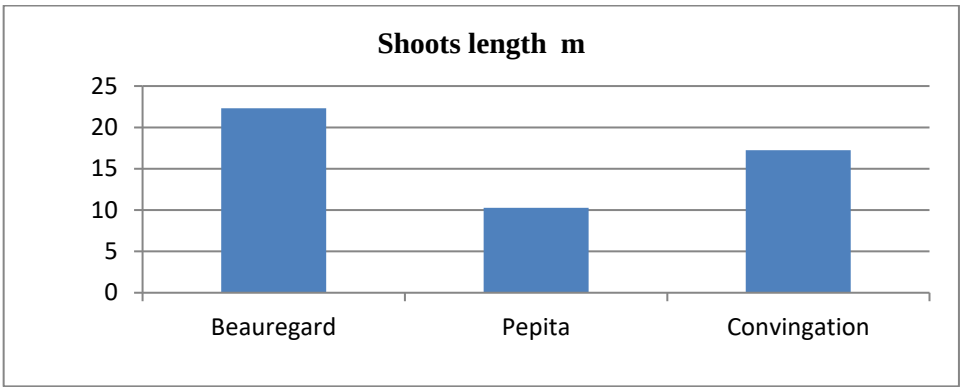


Chart No. 5 Shoots length m

The Beauregard cultivar has the longest shoot length, and the Pepita cultivar has the shortest, while the Convingation cultivar has a longer shoot length than the Pepita and a shorter shoot length than the Beauregard.

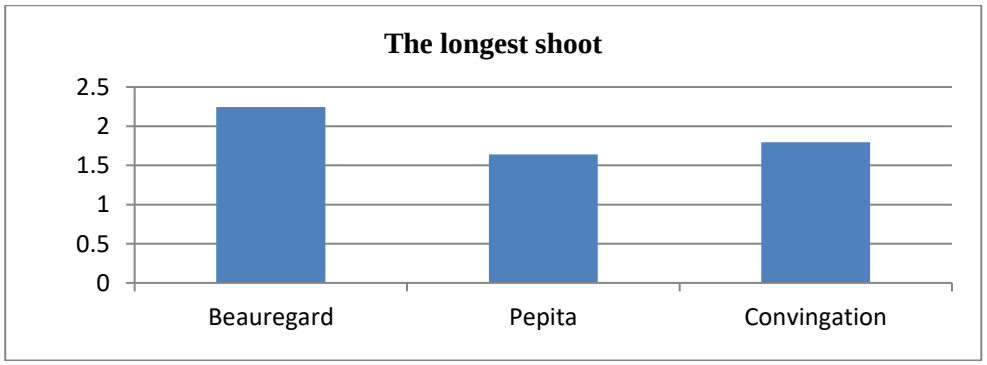


Chart No. 6 The longest shoot m

The longest shoot is in the Beauregard cultivar, while the other two cultivars have shorter and approximately the same shoots.

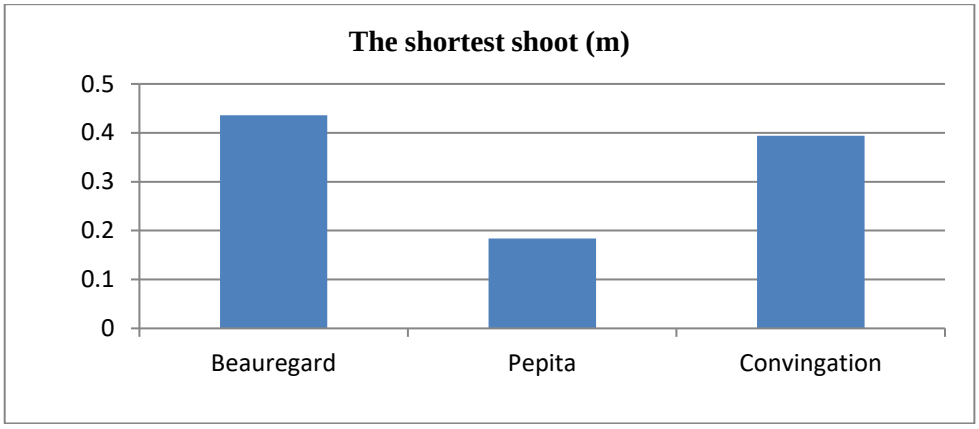


Chart No. 7 The shortest shoot (m)

The shortest shoot is in the Pepita cultivar, while the other two cultivars, Beauregard and Convingation, have the shortest shoot, almost equal to 0.4 m.

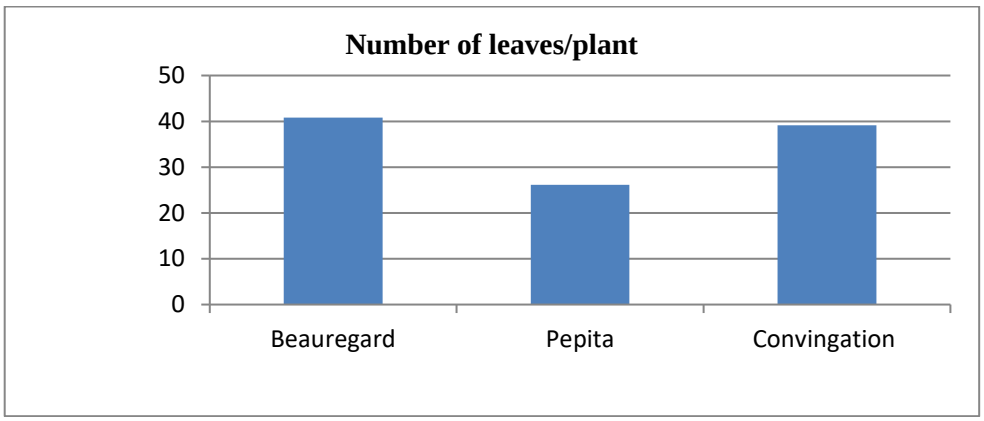


Chart No. 8 Number of leaves/ plant

The number of leaves per plant varies, being highest in the Beauregard and Convingation cultivars, while the Pepita cultivar has a much lower value.

Table No. 2 Color of the leaf

No.	Cultivars	Color of the leaves
1	Beauregard	Green
2	Pepita	Light green
3	Convingaton	Green with light purple veins

The leaf color shows variations as in the table, but it should be noted that they are difficult to distinguish.

Table No. 3 Color of the flower

No.	Cultivars	Color of the flower
1	Beauregard	Light purple
2	Pepita	Light purple
3	Convingaton	Dark purple

The flower color is almost the same, only in the Convingation cultivar it is darker.

Table No. the 4 The shape of the leaf

No.	Cultivars	The shape of the leaf
1	Beauregard	Heart shape
2	Pepita	Heart shape
3	Convingaton	Elongated and larger heart shape

The leaf shape is similar, only the Convingation cultivar is larger and longer.

Table No. 5 The shape of the tuber

No.	Cultivars	The shape of the tuber
1	Beauregard	Elliptical
2	Pepita	Elliptical
3	Convingaton	Stub-conical

The shape of the tuber is almost the same, elliptical, only in the Convingation cultivar it is truncated and easily distinguished.

Table No. 6 The color of tuber skin

No.	Cultivars	The color of tuber skin
1	Beauregard	Light purple
2	Pepita	Light brown
3	Convingaton	Bold purple

The color of the tuber skin is differentiated, and cultivars are accurately distinguished.

Table No. 7 The color of tuber pulp

No.	Cultivars	The color of the tuber pulp
1	Beauregard	Beige
2	Pepita	Beige
3	Convingaton	Bold purple

The color of the tuber pulp is also a very clear characteristic and allows for immediate differentiation and distinction of cultivars.

Table No. 8 Placement of buds on the tuber

No.	Cultivars	Placement of buds on the tuber
1	Beauregard	Superficial
2	Pepita	Superficial
3	Convingaton	Superficial

The placement of the buds is superficial, which facilitates the work and mechanization of sweet potato peeling and increases the coefficient of use.

3.3. Production indicators

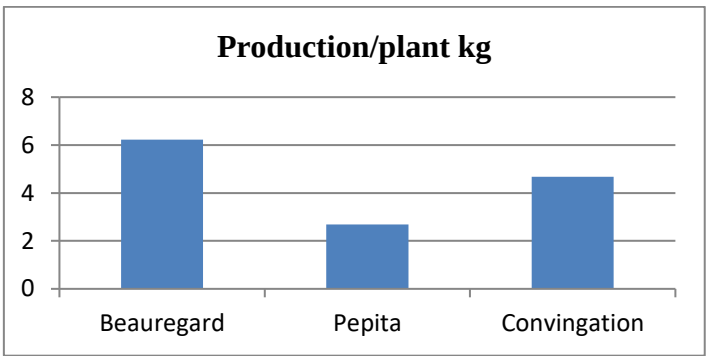


Chart No. 9 Production per plant kg

Production per plant is higher at 6 kg/plant in the Beauregard cultivar and lower in two.

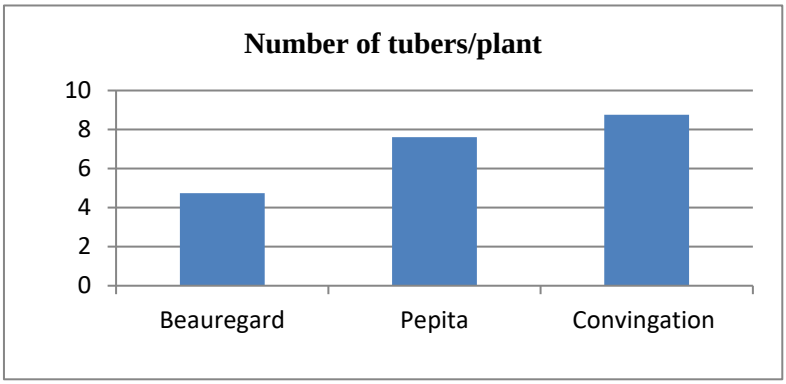


Chart No. 10 Number of tubers per plant

The number of tubers per plant is the inverse of the weight of tubers per plant and the weight of the largest tuber. The Beauregard cultivar has the lowest number of tubers per plant, and the other two cultivars have the highest number

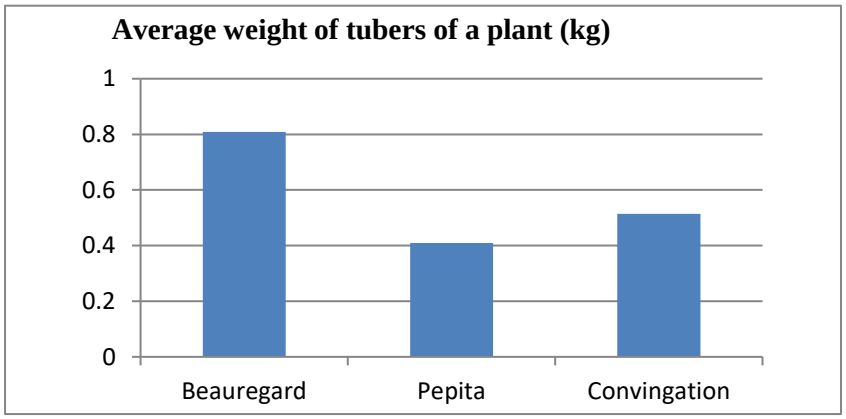


Chart No. 11 Average weight of tubers of a plant (kg)

The weight of a tuber is also an important indicator in the analysis of sweet potato cultivars. The Beauregard cultivar has the highest weight.

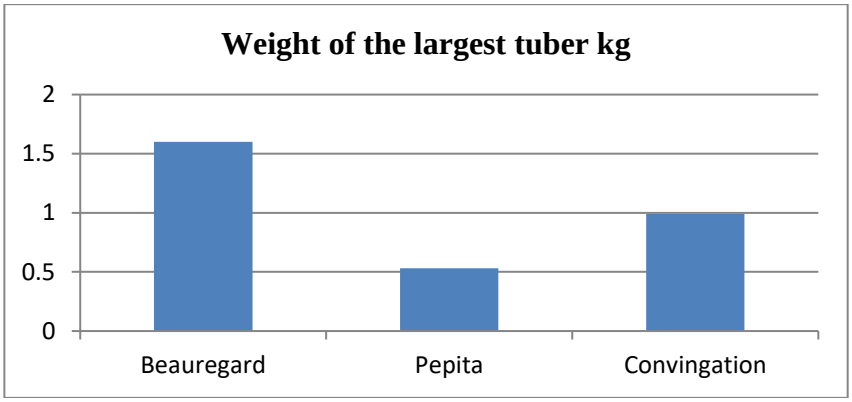


Chart No.12 Weight of the largest tuber kg

The weight of the largest tuber is in the Beauregard cultivar and the smallest in the other two cultivars.

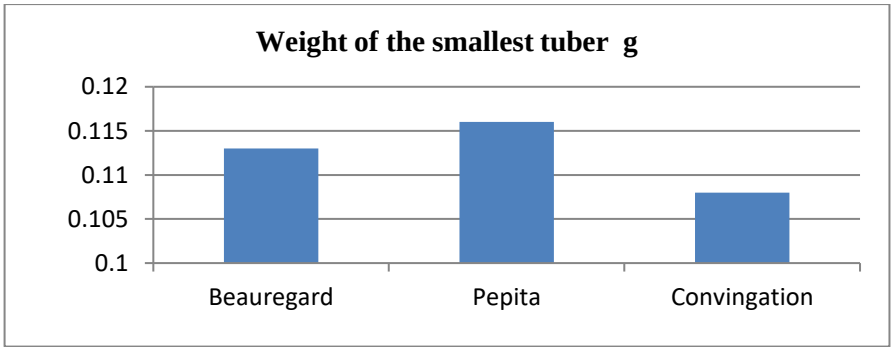


Chart No. 13 Weight of the smallest tuber g

The largest weight of the smallest tuber is in the Pepita cultivar and the smallest in the Convingation cultivar.

3.4. Chemical analyses

Table No. 9 Chemical analysis indicators

Nr	The name of the analysis	Methods/ Reference	Cultivars		
			Convingation	Pepita	Beauregard
1	Dry matter %	80-100° C	27.43	23.88	24.45
2	Water %	Drying	72.67	76.12	75.55
3	Ash %	Combustion at 500 °C	1.82	1.16	1.18
4	Proteins %	Kjeldahl	7.17	7.79	6.74
5	Acidity %	Volumetric	0.33	0.19	0.2
6	Fats %	Soxhlet	0.07	0.05	0.07
7	Crude cellulose%	Sharer	0.84	0.92	0.88
8	Starch %	By acid hydrolysis	6.8	7.6	6.6
9	Reducing sugar %	Fehling	1.1	2.7	2.6
10	Phosphorus mg	Spectrophotometer	47	49	50

From the chemical analysis table, it results that the cultivars present differences in some chemical indicators and specifically:

Dry matter is highest in the cultivar Baeuregard and lowest in the other two cultivars.

Ash is the same in all three cultivars.

Fats are approximately 0.05% in pepita and 0.07% in the other two cultivars.

Starch is different, and pepita has the highest content with 7.6%, and the other two cultivars have the lowest value.

The sugars are different and specifically 1.1% in the cultivar Baeuregard, and the other two cultivars have a higher content of almost 2.3 times more. This is the analytical indicator that

distinguishes between sweet potato cultivars. Soft pulp cultivars have higher sugar content up to 9%, and hard pulp cultivars have lower sugar content up to 5%. But cultivars with hard pulp give higher yield and store better, while cultivars with soft pulp give lower yield, are affected by diseases, and are difficult to store.
The phosphorus content is the same, and there are no differences between cultivars.

3.5. The yield kv/ha

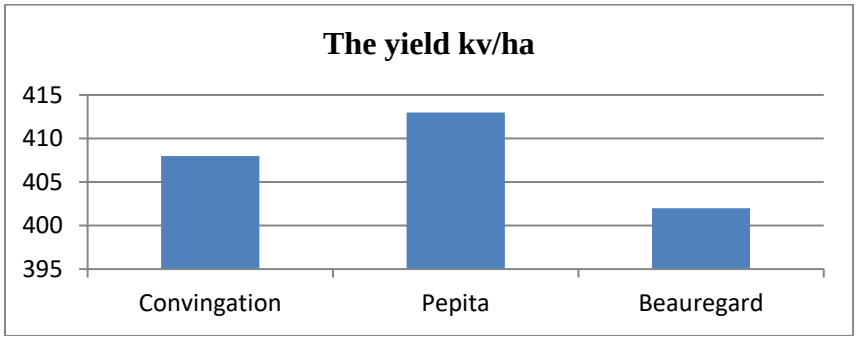


Chart No. 14 The yield kv/ha

The highest yield was given by the Pepita cultivar with 413 kg/ha, and the lowest was given by Convingation, which gave a yield of 17 kg/ha less.

4. Conclusions and recommendations

From the analysis of morphological and production indicators, as well as adaptation to climate and soil, we can draw several conclusions, among which we will mention:

A. Conclusions

1. The leaf color varies slightly between cultivars. It is green with dark or light shades. They are cultivars of the same group and very similar.
2. The sweet potato has two leaf shapes: coltsfoot and palmate (fig leaf-like). The coltsfoot shape is more resistant to blight. All three cultivars have a coltsfoot leaf shape.
3. The number of tubers per plant is again different, with the Convingation cultivar having the highest number, but Beauregard having the lowest number.
4. The Pepita cultivar has the largest tuber, with almost 30% of tubers weighing the most. The Beauregard cultivar has the lowest weight of large fruits.
5. The same pattern continues, with Pepita having the highest weight of the smallest tuber and Convingaton having the lowest weight.
6. The highest yield was given by the Pepita cultivar with 413 kv/ha, and the lowest was given by Convingation, which gave a yield of 17 kv/ha less.
7. Cultivars have differences in chemical composition and specifically: the highest cellulose content is in the Convingation cultivar with 27.43%, and the lowest cellulose content is in the Pepita cultivar with 23.78%, which also has better digestibility qualities.
8. They have differences in protein content, with the Pepita cultivar having the highest content at 7.79% and Beauregard having the lowest at 6.74%.
9. There are no changes in phosphorus content, while starch content is higher in the Pepita cultivar by 7.6%

10. They present differences in the content of pentosans (sugars), and specifically, the Pepita cultivar has 2.7%, and Beauregard, which has 2.3 times more sugars than Convingation.

B. Recommendations

From the analysis of all indicators and mainly in the realized yield, we recommend that in extensive cultivation, the Pepita cultivar be planted, which has a higher yield and a better combination of chemical composition.

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