

## STUDY ON THE FRUIT MORPHOLOGY AND AGRONOMIC CHARACTERISTICS OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) VARIETIES WITH DETERMINATED AND UNDETERMINATED GROWTH

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### INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) belongs to the family *Solanaceae*. It is one of the world's major vegetables with a total area and production of 4.4 million ha and 115 million metric tons, respectively. As it is a relatively short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing daily. Numerous varieties of the tomato plant are widely grown in temperate climates across the world, and the fact that it is a species with preadaptability for cultivation in greenhouses allow the production of tomatoes throughout all seasons of the year. Its position in the whole world is after potato and sweet potato both in area and production.

There are varieties of tomatoes with with determinated and undetermined growth and typically grow to 1–3 meters (3–10 ft) in height.

Since 2011, a trend has been observed to reduce red-cultivated areas, which has resulted in production falling year by the year. In our country, tomatoes are grown primarily in open fields, even though an increase in protected areas (greenhouses and tunnels) has been observed in recent years. According to Eurostat statistics, in 2015 the total area cultivated with tomatoes in Romania reached 24.300 hectares, which represents 9.5% of the EU area allocated to this crop. From this point view, we are ranked third in the EU-28 hierarchy, after Italy (107.200 ha) and Spain (58.200 ha). This proves that Romanian farmers have a low capacity to obtain yields comparable with the one obtained by other farmers from EU. In the same reference year, the average yield per hectare was around 19.1 tons, while the European average is some 69 tons per hectare.

In many developing countries, the traditional local populations continue to supply a large part of the agricultural production, even after emergence of the modern varieties. The explanation consists in a better yield, bigger stability, high resistance against biotic and abiotic stress factors, and lower need of inputs recorded in the old populations and local varieties. The

need of preservation of the vegetal resources and local varieties is found in memorandums, international treaties, EU directives, national and regional laws (Maxim et al., 2010). In last decades, the preoccupations of the European and worldwide researchers, in the field of preservation of agro-biodiversity have been intensified.

The potential benefits of the reach genetic diversity within an agro-ecosystem refer to: satisfaction of the market requirements, supplying population with a more diversified diet, superior quality of products, that could compensate lower production, reducing their genuine diversity and knowledge, preferences for certain combinations of vegetal material and circuit of element in nature, increase of the efficiency of biological fixation of the atmospheric molecular nitrogen, increase, by long term, of the agro-ecosystem stability in conditions of global climatic changes. The genetic erosion in cereals and vegetables is an alarming issue, including tomatoes. Even from the date of their introducing in Europe, in XVI century, the number of the tomato varieties and landraces rapidly increased up to the development of the intensive agriculture. According to the study performed by the Rural Advancement Foundation Department of Agriculture (USDA) in 1903, many local populations and varieties were lost. This list contains 10,000 varieties cultivated in entire world.

Our research aiming towards the identification of the tomato varieties that are most suitable for cultivation in our pedo-climatic conditions, was performed in 2019 at Vegetable Research and Development Station Bacău and focused on 50 varieties with determined and undetermined growth.

### MATERIAL AND METHODS

The study was accomplished at Vegetable Research and Development Station Bacău, during 2019 year, in greenhouse conditions. The assortment of cultivars is represented by 50

varieties and local population, each cultivar receiving an unique identification code.

In 2019 in spring, tomato seedlings were obtained through pot sowing. The seedlings were planted at the beginning of May, in greenhouse. During the vegetation period, periodic observations on the resistance to pests and diseases and the suitability for cultivation in protected areas were accomplished.

Typical crop maintenance steps were followed, according with the tomatoes technology of cultivation. The fruits were harvested when physiological maturity was achieved.

The qualitative and quantitative determinations traced the descriptors elaborated by IPGRI ( The International Institute for Plants Genetic Resources) with some changes. The following parameters were determined:

- type of growth of tomato plants;
- morphological and agronomical traits (size, shape, fruit uniformity, colour);
- fruit weight, height and diameter,
- fruit content in dry matter.

In order to make the measurement of the size of the fruit, the calliper has been used.

At physiological maturity, the fruits were harvested and the seeds extracted and prepared for short and long time storage.

The dry matter has been determined by refractometer HI 96801, the height and diameter of the fruit have been determined by measurement using the callipers and the weight has been determined using the balance Kern.

## RESULTS AND DISCUSSIONS

From the total of 50 studied tomato cultivars, 26 proved to be cultivars with undetermined growth. Regarding the colour of fruits, from the 50 studied varieties, 48 were red, one yellow - fig 1., and one orange - fig 2.



Fig 1. Yellow tomatoes fruit



Fig. 2. Orange tomatoes fruit

As shown in fig. 3, as far as the color of fruit is concerned, we do not have a great variety, 96% varieties are red, one has a yellow color and a variety has an orange color.

Regarding the type of growth as high in figure number 4, the difference in the number of varieties with determined growth and varieties with undetermined growth was not large.

From the total of 50 studied tomato cultivars, 52% were proofed to be cultivars with undetermined growth and 48% were cultivars with determined growth (fig. 4).

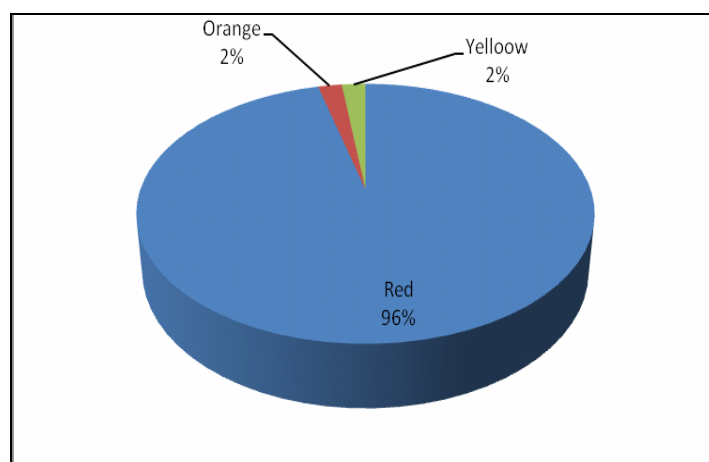


Fig. 3. Tomato variety, fruit color

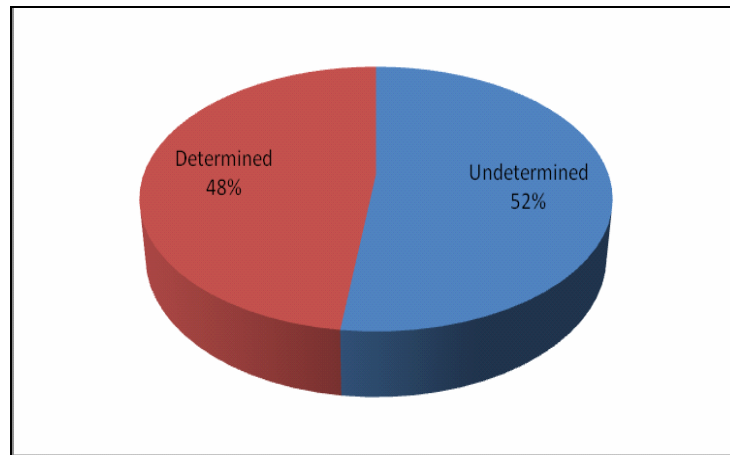


Fig. 4. Tomato variety, type of growth

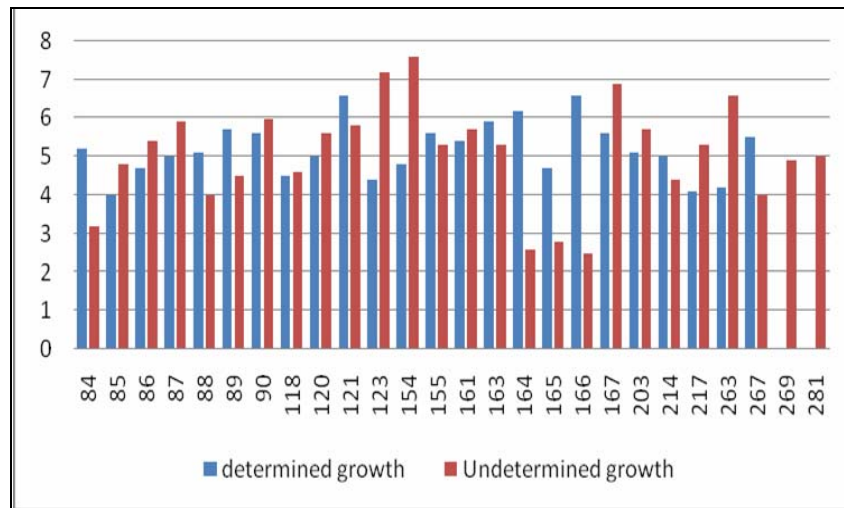


Fig. 5. Height of tomato fruit

Fruits of the variety number 154, of the undetermined growth, were the highest of 7,6 cm height, compared with the variety number 84 and still with undetermined growth which had only 3.2 cm. From cultivars with determined growth, the fruit of the highest height was of the variety number 182, which was 6,6 cm compared with the variety number 261, which recorded the lowest value of 4,1 cm.

The biggest fruits were recorded in undetermined growth: 89, 90, 121, 161, and 167.

The biggest diameter of plants with undetermined growth, 9.1 cm was registered on fruit variety number 89 and the smallest diameter of 2.7 cm was registered on variety number 164. For determined growing plants, the biggest diameter of 7.2 cm was registered on fruit variety number 97 and the smallest diameter of 3.6 cm was registered on variety number 261.

The highest weight of the varieties with undetermined growth was recorded in the number 121 variety, the weight of which is 254 grams, compared with the number 123, which is 44 grams.

For the varieties with determined growth the highest fruit weight was registered on variety number 124, weighting 214 grams, compared to variety number 261 which weighted 36 grams.

The determination of dry matter is very important because it helps us to know whether a variety is good for industrial processing or not. The highest value of dry matter has been determined at a variety with undetermined growth: 87 and 269.

For undetermined growing plants, the highest value of the dry matter was registered under variety number 87, the lowest value of the variety was number 155. The highest value of the dry matter in plants with determined growth, was registered under variety number 277, the lowest value of the variety was numbers 181 and 201 (Figures 5, 6, 7, 8 and 9).

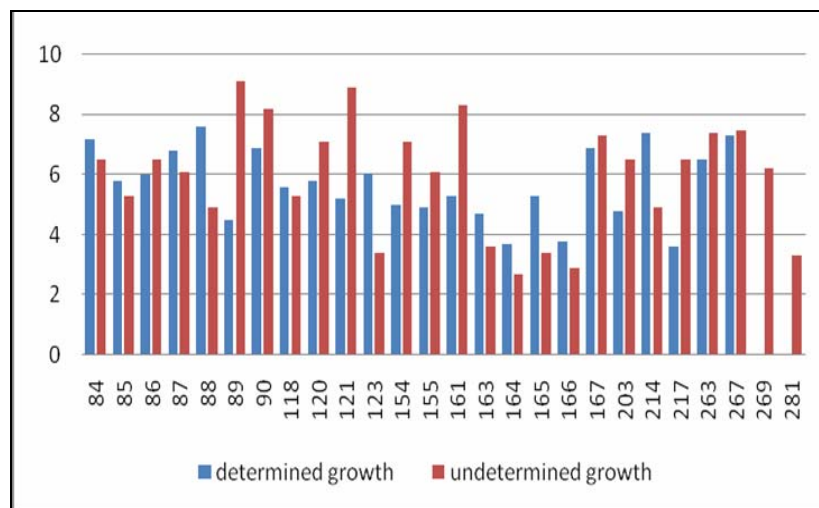


Fig. 6. Tomato fruit diameter

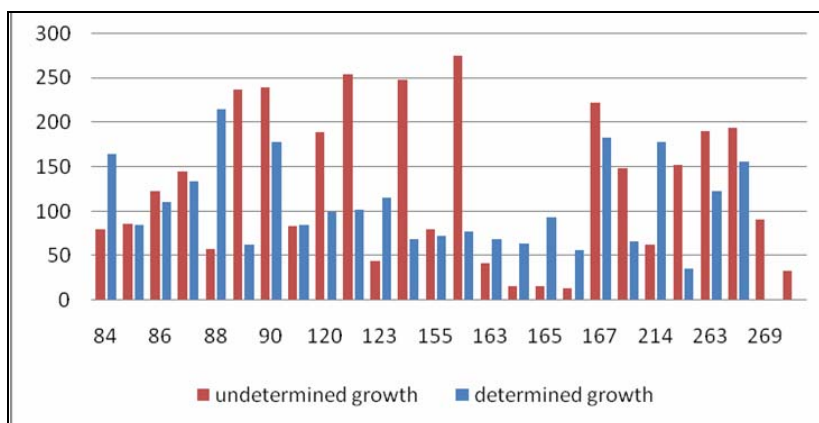


Fig. 7. Tomato fruit weight

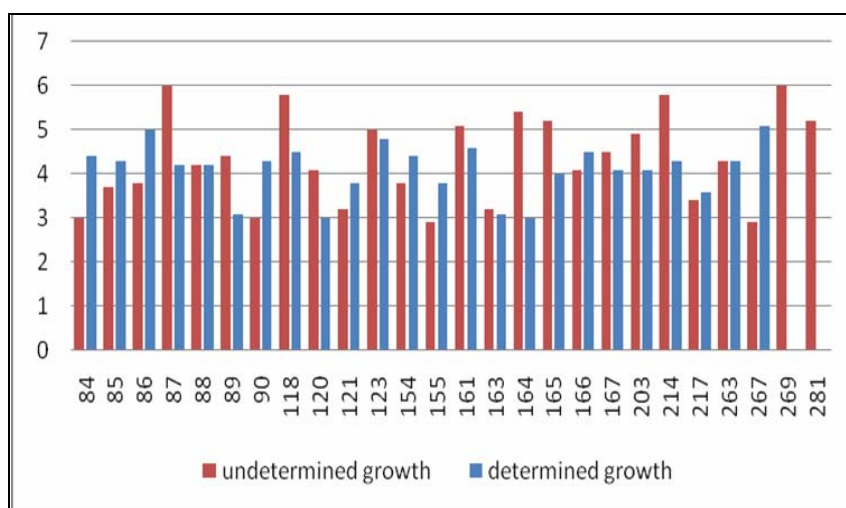


Fig. 8. Tomato dry matter

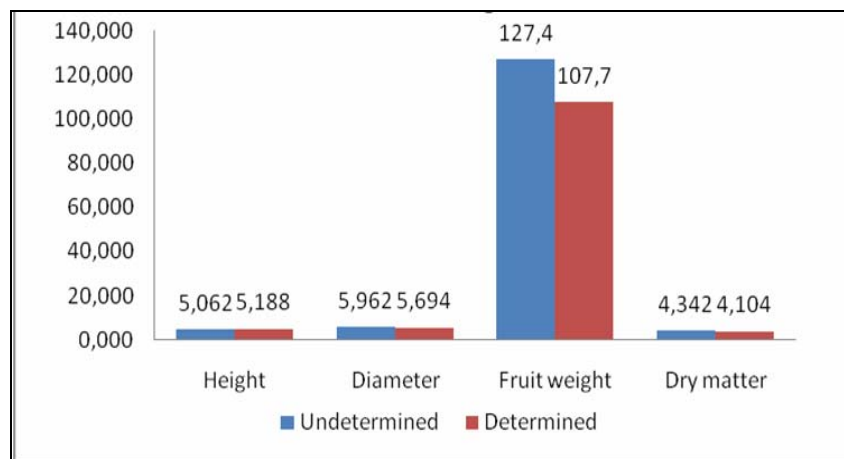


Fig. 9. Difference between undetermined and determined growth

As previously shown by the data presented in the present paper, the differences between these 2 types of growth are obvious, the tomatoes with undetermined growth are more valuable than the ones with determined growth. On conclude that the varieties of tomatoes with undetermined growth are more valuable than the ones with determined growth both in fruits diameters and dry substance. Only in height the varieties with undetermined growth registered lower values - as it can be observed in the chart below.

### CONCLUSIONS

The screening of 50 varieties was focused on biometric measurements on phenotype characteristics, such as fruit weight, height, diameter, the content in dry matter and type of growth of tomato plants cultivated in greenhouses.

Our study revealed the fact that from the 50 tomatoes cultivars tested, 26 (52%) proved to be cultivars with undetermined growth and 24 (48%) with determined growth.

We identified that variety with the biggest weight is variety number 121 with undetermined growth. The variety number 87 has a undetermined growth and its dry matter value is the biggest.

The biggest diameter of plants with undetermined growth, 9.1 cm was registered on fruit variety number 89.

As previously shown by the data presented in the present paper, the differences between these 2 types of growth are obvious, the tomatoes with undetermined growth are more valuable than the ones with determined growth. Although the difference between the number of varieties with determined growth and varieties with an undetermined growth was not large, the results from the parameters analyzed showed quite large differences in the varieties with these types of growth

The seeds from all 50 varieties were kept accordingly at the

### ABSTRACT

Agricultural biodiversity is an essential element of biodiversity highly threatened now-a-days by the environmental stresses and consumers pressure. Thus, a knowledge-based understanding and conservation is a crucial condition for the future of food security. The assortment of tomatoes genotypes offers a gene pool for future breeding as it may contain traits that can be useful for the development of new varieties and hybrids with enhanced quantitative and qualitative features. In this study, a screening of 50 varieties and local population of tomato was achieved. These varieties were cultivated in greenhouse, one of the objective of study being the identification of plant type of growth and the differences between them from morphological, physiological and agronomical point of view. The paper presents the results of the biometric measurements on phenotype characteristics, such as fruit weight, height, diameter, the content in dry matter and type of growth of tomato plants cultivated in greenhouses.

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