

***Benincasa hispida* - THE MAIN RESULTS OF THE CULTIVATION OF THIS PLANT IN ROMANIA**

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Abstract

The experimental research regarding the cultivation of Benincasa hispida (commonly known like winter melon, wax gourd or ash gourd) in Romania was for the first time conducted in the '60s. Over time, the proprieties of this plant were analysed by various researchers but until present didn't exist a scientific result regarding the commercial cultivation of this plant in our country. To support the research regarding the cultivation of BHS in Romania we conducted in the last two years an experimental field to observe the adaptation of this plant to the local agropedoclimatic conditions. The research was carried out in an ecological field from south of Romania from a plain area. The results obtain demonstrate that the plant has adapted to the climatic condition from the 2012-2013 period and our main conclusion is that BHS can be grown in our country with good technological performances.

Key words: wax gourd, field cultivation, production.

INTRODUCTION

The higher temperature form last decades and the process of land degradation form south of Romania are phenomenon which demand the identification of new solutions to prevent the future dangers of desertification. One of these solutions can be the introduction in culture of plants that maintain the soil quality and which are resistant to drought like *Benincasa hispida* (BHS) (Morton J.F., 1971).

In Romania this plant was for the first time mentioned in our literature by Maier in the '50s (Maier, 1955) and the first experiments were conducted in the '60s (Chirilă et al., 1961). Also, in the '90s a research regarding the animal wound healing proprieties of this plant (Ioniță, 1994) was conducted. This research came to completes the present evidence from international literature regarding the important proprieties of fruit extracts that can be used in the treatment of gastric ulcer (Grover et al., 2001), obesity (Kumar and Vimalavathini, 2004) etc.

BHS is originated from the Asian region and has been cultivated since ancient times in China, Japan, Java, Australia and Southeast Asia (De Candolle, 1959). In fact, some papers

place this plant in China during the period 400-500 BC and asserts that the characteristics of conservation (over six months) determined the wide spread of this plant (Walters and Decker-Walters, 1989) so in the present it can be currently found in all tropical areas of Asia, the Caribbean, including the United States.

BHS is a plant with a "very large fruit which by maturity lost its hairs and develops a waxy coat", fruit which is known for his medicinal proprieties: "anti-inflammatory, demulcent, diuretic, expectorant, febrifuge, laxative and tonic, etc" (Dobre, 2013). The fruit is a delicate food, slightly and similar with cucumber (De Noter R., 1923) which can be preserved a long time due to the waxing coating (Vilmorin-Andrieux, 1925). This fruit presents according to the National Nutrient Database for Standard Reference: carbohydrate factor – 3.57; fat factor – 8.37; protein factor 2.44; nitrogen to protein conversion factor – 6.25 (USDA, 2013). Regarding the general requirements for cultivation of this plant we mention the necessity for a soil with a pH of 5.5-6.8 and a medium temperature during the growth period of 25-30⁰C (Morton, 1971). Actually, the agricultural technology is similar with those specific for melon or gourd, like cucumber or

zucchini which are the main plant from cucurbitaceous family cultivated in our country.

MATERIALS AND METHODS

The present paper makes a short review of the experiment conducted in the '60 in the greenhouses and glazing unit of Agronomic Institute "Nicolae Bălcescu" and concentrate on the results obtained during the field research experiment from 2012-2013 of our team from University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The first experiment took in consideration 9 plants, from which 3 were planted in greenhouse and 3 in a glazing unit (Chirilă et al., 1961). The second experiment consisted in the organic cultivation of 50 nests with approximately 6-8 seeds per nest, on a surface of 150 m² from NARDI Fundulea. Following the first experiment, in the field cultivation we didn't use any fertilizers, we didn't applied any irrigation measures and the pollination was made by the bees (like in the glazing unit).

The experiment used a round variety of wax gourd, respectively Hybrid Wonder Wax seeds. These were sown in the both years of experiment on the same organic field and in the second year (2013) we utilized in addition the seeds resulted from 2012 (Table 1).

Table 1. Soil proprieties

Parameter	MU	Value
pH		6.37
Nt	%	0.175
Pmobile	%	58
Kmobile	%	310
Corganic	%	1.86
Humus	%	3.20
Cu	mg/kg	21
Zn	mg/kg	72
Mn	mg/kg	676

Source: NARDI Fundulea

The main characteristics of the experiment are the following:

- the sown surface was of 150 m² (100 m x 1.5 m);
- the day of sown in both years was 7 of May;
- were formed 50 nests; in 2012 were utilized only purchased seeds; in 2013 in 25 nests were utilized in addition seed from the production of previous year;

- the germination period was of 14-21 days, during which the climatic conditions were the following (Figures 1, 2 and 3) (NARDI Fundulea Station):

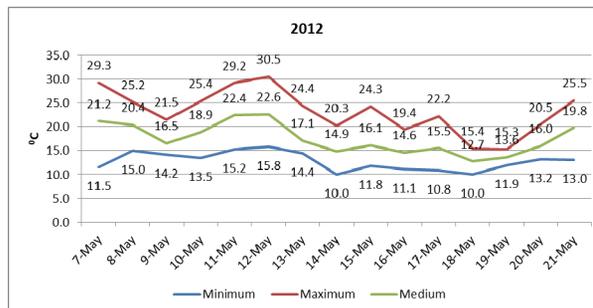


Figure 1. Daily temperature in the germination period - 2012

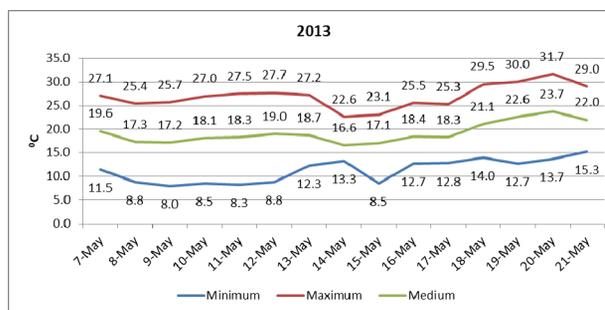


Figure 2. Daily temperature in the germination period - 2013

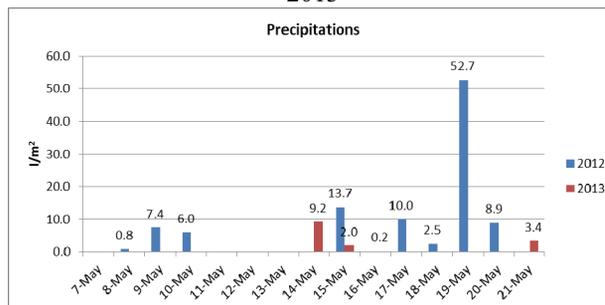


Figure 3. Precipitations in the germination period

The paper includes the measurements and the analyses performed during and after the each experiment.

RESULTS AND DISCUSSIONS

Cultivation of BHS in greenhouses and glazing unit - review of the experiment from 1960

The experiment used an oblong variety of wax gourd with seed from south of China. The plants were sown in pots on 25 of March and were transplanted on 12 of May in greenhouse and on 19 of May in glazing unit. In the greenhouse the temperature was maintained at

30-35⁰C, the flowers were artificially pollinated and the fruits were supported by racks.

In the glazing unit the plants were affected by the climatic conditions, the pollination was made by bees and the vegetation period was lower than in greenhouse (Table 2).

Table 2. Development of plants - greenhouse and glazing unit

	Greenhouse	Glazing unit
Number of plants	3	3
Vegetation period (days)	196	167
Stem's growth rate until the first female flower (cm/day)	7.86	0.77
Number of days between sowing and the moment of the first female flower	65	69
Stem's length at harvest (m)	12	3

Source: Chirilă, 1961

The plants from glazing unit were affected by climatic conditions and only two vines had fruits, respectively 5 fruit with an average weight of 3.596 kg. In greenhouse were obtained 11 fruit with an average weight of 4.509 kg. All the fruit were harvested between 8th of September and 7th of October. The fruits harvested later than others resisted only 30-45 days more.

The main results of the experiment are presented in the following table:

Table 3. Development of plants - greenhouse and glazing unit

	Greenhouse	Glazing unit
Number of fruits	11	5
Total weight of fruits (kg)	49.600	17.980
Average production per plant (kg)	16.533	5.993
Average weight of fruits (kg)	4.509	3.596
Maximum weight of fruits (kg)	7.850	6.510
Average dimension of fruits (cm)		
-length	46.86	36.70
-diameter	15.55	13.00
Maximum dimension of fruits (cm)		
-length	55.00	53.00
-diameter	18.00	18.00

Source: Chirilă, 1961

The main observations of the experiment are:

- in the first period of growth the fruit had a higher growth rate (2 cm in length in 24 hours);
- when the fruit reach over 30 cm in length there are around 7 days in which they are covered with wax (after that the growth rate was slower);
- from a 40 cm length fruit the wax quantity collected reach 1.050 g at

harvest time and at 2.420 g after one month from harvest;

- the insects that attacked the fruits perished in contact with the wax;
- the edible part of fruit was at harvest time of 68% and at 104 days from harvest of 63%;
- after 104 days after harvest the lost in weight was of 14%;

The fruits presented the following chemical characteristics: 94.6-96% water; 1.28-1.84% sugar; 3.05-3.4 grades acidity; the presence of vitamin C at 100-150 days after harvest (2.2-2.3 mg/100 g).

Cultivation of BHS in an open field - experiment during 2012-2013

Both experiments were commenced at the same date, namely on 7th of May of each year. The important dates in our experiment during the vegetation period are (Table 4, Figure 3):



Figure 3. Pictures from the field experiment

Table 4. Development of experiment

	2012	2013
Day of sowing	7 of May	7 of May
First germination	21 of May	18 of May
The first flower	17 of July	20 of July
Day of first fruit observed	23 of August	27 of August
Day of harvest	8 of October	28 of Septembre

The development rhythm of plants was almost similar during the vegetation periods: 2012 - 15 days germination period, 57 days until the first flower, 37 days until the first fruit and 46 days until harvest; 2013 - 12 days germination period, 63 days until the first flower, 38 days until the first fruit and 32 days until harvest. We must mention that in 2013, due to the lower temperatures expected for October, we decided to harvest before the fruits be affected by frost. During the experiment, we observed that the drier conditions from 2012 were better suitable for the plant growth until the first fruit was observed (Table 5). For example, in 2013, only 80.4% from the nests developed full grown plants and the number of plants was lower. However, the precipitations permitted a better development of fruits, in 2013, the number of plants without fruits or with immature fruits being of only 30.4% compared to 2012 when this percentage reached 46.6%. The fruits obtained have a cucumber flavour, only 13 kcal/100 g, sugar 1.93 g/100, glucose 0.95%, fructose 0.97% and protein 0.23 g/100 g (ICA Research and Development Laboratory).

Table 5. Measurements in the field

	2012	2013
Number of nests that sprung	43	46
Dimension of flower at 75 days after germination (approx.)	8 cm female 6 cm male	8 cm female 6 cm male
Number of nests with growth plants	43	37
Number of plants	163	115
-nests with 1 plant	5	3
-nests with 2 plants	3	10
-nests with 3 plants	10	42
-nests with 4 plants	16	60
-nests with 5 plants	1	0
-nests with 6 plants	4	0
-nests with 7 plants	3	0
-nests with 8 plants	1	0
Minimum length of a vine (m)	1.86	2.1
Maximum length of a vine (m)	5.8	6.7
Number of immature fruits	17	0
Number of nest without fruits (mature of immature)	10	13
Number of nest with only immature fruits	4	0
Number of plants without fruits or with immature fruits	46.6%	30.4%

Actually, in 2013, there were obtained almost the same amount of fruits, but they had a higher average weight (with 23.8%) and the total production reached 155.76 kg, compared to 2012 when the production was of only 120.6 kg. In these conditions we estimate a possible yield for BHS of 8-10 tonnes per hectare (Table 6):

Table 6. Production of wax gourd

	2012	2013
Number of mature fruit	70	73*
Total production (kg)	120.6	155.76
Minimum weight of a fruit (kg)	0.28	0.56
Maximum weight of a fruit (kg)	5.18	5.05
Average weight of a fruit (kg)	1.723	2.134
Estimation of yield per hectare (kg)	8040	10384
Estimation of production value for export (FOB price - 5\$/kg) (USD)	40200	51920
Estimation of production value on internal market (average price - 6 RON/kg) (RON)	48240	62304

*in addition were 7 fruits that were damaged by rabbits

These productions permitted us to estimate that on the vegetable market, the value production can vary from 40 to 52 thou USD at FOB price (if we decide to export) and between 48-62 thou RON (if we decide to sell on internal market).

CONCLUSIONS

The main conclusion of our field experiment is that the *Benincasa hispida* can be cultivated on the open fields from south of Romania with good technical and economical performances. We want to point out that in the growth period the lack of precipitations has to be compensated with irrigation measures to assure a better yield per hectare. BHS is not a pretentious culture and can be growth like cucumber or melons, and is resistant to drought and insect attacks. Also, the plant didn't developed any disease specific to cucurbitaceae family from our country.

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