

# PERFORMANCE AND QUALITY OF DIFFERENT FRUIT PUMPKIN VARIETIES IN TERMS OF ORGANIC VEGETABLE GROWING

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*The results of the economic and biological testing of two Cucurbita species: Buttercup squash (Cucurbita maxima Duch. – Zhdana, Yuvilei, Slavuta, Poliovyhka) and Butternut squash (Cucurbita moschata Duch. ex Poir. – Dolia, Yanina, Hileia, Dyvo) for the organic production.*

*The earliest ripening varieties with high yield and quality fruit which are suitable for use in organic horticulture are chosen by the results of the studies.*

**Key words:** winter squash, species *Cucurbita maxima* Duch., *Cucurbita moschata* Duch. ex Poir., phenological phases, earliness, organic vegetable growing.

Complex environmental situation encourages people to choosing organic foods grown without using chemicals that may harm their health. In addition, the Law of Ukraine "On the production and circulation of organic agricultural products" № 20-21 on 09.01.2014 claims organic vegetable and melon growing to be current in our country [7].

At the end of the last century by Council Regulation (EEC) 2092/91 on June 24, 1991 were first developed principles of organic vegetable production at the level of economy, which in order to control diseases, pests and weeds have to combine the following measures [8]: selection of appropriate vegetable crops and their varieties;

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implementation of appropriate crop rotation; mechanical cultivation measures; protection of natural pest enemies; weed burning .

Therefore, the immediate task is to optimize growing technology elements through the selection of species, varieties and assessment of their suitability for organic farming. The choice of species and varieties is central in solving organic production problems.

Among vegetables winter squash has prospects for use in organic vegetable growing. It is resistant to diseases and pests, and due to the rapid growth of stems and leaf surface of squash plants the growth and development of weeds are inhibited. A well-developed root system allows growing and obtaining relatively high yields even in poor soils.

Squash is a good forecrop for most vegetables (except *Cucurbitaceae*) for organic vegetable production [1]. The wide diversity of species and varieties allows using its fruits in cooking, diet and preventive nutrition and seeds for getting high-quality oil, which is an important source of Ukrainian exports. It is also a valuable raw material for canning, cooking and pharmaceutical industry [2, 3].

**The purpose of the research** is selection of pumpkin varieties suitable for cultivation by the technologies of organic vegetable production.

**Material and methods research.** Research was conducted during 2013-2014 in the experimental field of the Department of Horticulture Separated subdivision of NULES of Ukraine “Agronomic Research Station”. They were studied two *Cucurbita* species: Buttercup squash from giant pumpkins type (*Cucurbita maxima* Duch.) – Zhdana (control), Yuvilei, Slavuta, Poliovychka and Butternut squash (*Cucurbita moschata* Duch. ex Poir) – Dolia (control), Yanina, Hileia, Dyvo. (drawing 1, 2, 3 )



Drawing. 1. Pumpkin *Cucurbita maxima*, *Duch.* varieties Slavuta and Zhdana

Experiment was conducted according to the methods of research in vegetable and melon growing [4].



Drawing. 2. Pumpkin *Cucurbita moschata*, *Duch.* variety Dolia

The experiment was repeated three times with randomized block design. An accounting area was 80m<sup>2</sup>.



Drawing. 2. Pumpkin *Cucurbita moschata*, Duch . varieties Dyvo and Hileia

Layout of plants was  $140 \times 140$  cm. Gardening was performed by generally accepted technology of pumpkin growing. Biometric measurements were performed on typical five plants in two reps; harvest accounting was done at the end of the growing season. The number and weight of standard and non-standard fruits; yield structure (percentage of standard fruits); average weight of standard fruit; fruit marketability were determined by GOST 3190-95 "Fresh Food Pumpkins" [6], the degree of ripeness was measured on the first fruit of the main stem. Mathematical processing of the obtained data was performed according to the method by B. A. Dospheov [5].

**Research results.** During the research weather conditions were favorable for winter squash development; however the second half of May 2014 was characterized by moist cool weather that affected the duration of phenological phases and fruit ripening (Table 1).

## 1. Main phenological phases of squash winter development, 2013-2014.

Variety	The duration from germination to flowering female flowers, days			The duration from germination to maturation, days		
	2013	2014	average in 2013- 2014	2013	2014	average in 2013- 2014
<i>C. maxima</i> Duch.						
Zhdana (C)	43	54	48	115	117	116
Yuvilei	46	55	50	125	127	126
Slavuta	43	55	49	124	125	124
Poliovychka	46	58	52	117	123	120
<i>C. moschata</i> Duch. ex Poir						
Dolia (C)	46	55	50	95	97	96
Yanina	53	60	56	104	107	105
Hileia	53	60	56	111	115	113
Dyvo	53	62	57	100	103	101

Analysis of the duration of period "germination – flowering of female flowers" indicates that the species *C. maxima* creates female flowers faster than *C. moschata*. This is due to the different requirements of species to temperature conditions. The lowest duration was observed on the control variety Zhdana – 48 and Slavuta – 49 days, it was longer for the variety Poliovychka – 52 days.

For *C. moschata* species the least period duration was found in the control variety Dolia – 50 days and the longest one in Dyvo variety (57 days).

It was found that earliness was influenced by specific characteristics of plants. In particular, the most early-season varieties proved to be those of *C. moschata* species with shorter growing season duration 96-113 days: Dolia – 96 and Dyvo – 101 days, Hileia variety took longer for ripeness – 113 days. Among the varieties of *C. maxima* species were Zhdana – 116 days and Poliovychka – 120 days.

During the years of research *C. moschata* varieties were more productive than *C. maxima*. In addition, they have a larger share of commodity fruits (Table 2).

## 2. Productivity and its structure in winter squash species (2013-2014).

Variety	General productivity, t/ha			Output of commodity fruits, in average for 2013-2014.	
	2013	2014	average for 2013-2014	t/ha	%
<i>C. maxima</i> Duch.					
Zhdana (C)	19.0	36.6	27.8	25.0	90.0
Yuvilei	22.3	36.3	29.8	26.3	88.2
Slavuta	18.1	32.0	25.0	22.2	89.0
Poliovychka	34.0	35.0	34.5	31.0	90.0
<i>C. moschata</i> Duch. ex Poir					
Dolia (C)	26.0	47.3	36.6	32.2	88.0
Yanina	22.0	37.3	29.6	25.0	84.4
Hileia	29.5	15.3	22.4	15.0	67.0
Dyvo	30.3	46.6	38.4	35.2	91.6
LSD (0.05)	4.7	3.7			

Productive varieties of *C. moschata* species were Dyvo (38.4 t/ha) and Dolia (36.6 t/ha), *C. maxima* – Poliovychka (34.5 t/ha) and Yuvilei (29.8 t/ha). High yield of commodity fruits had *C. maxima* species, especially varieties Poliovychka (90%) and Zhdana (90%), *C. moschata* – Dyvo (91.6%) and Dolia (88%).

Important features that affect productivity are size of fruits and their number per plant. Analysis of average weight and average number of fruits per plant showed that the studied species significantly differed among themselves (Table 3).

3. The average weight of the fruit and their number per plant in varieties of different winter squash species, 2013-2014.

Variety	Average weight, kg			Average fruit number per plant, units		
	2013	2014	average for 2013–2014	2013	2014	average for 2013-2014
<i>C. maxima Duch.</i>						
Zhdana (C)	4.3	6.4	5.3	1.3	1.2	1.2
Yuvilei	5.2	7.3	6.2	1.5	1.0	1.2
Slavuta	4.4	6.1	5.2	1.3	1.4	1.3
Poliovychka	5.8	6.8	6.3	1.1	1.4	1.2
<i>C. moschata Duch. ex Poir</i>						
Dolia (C)	3.3	7.4	5.3	1.2	2.0	1.6
Yanina	4.2	5.8	5.0	1.6	1.2	1.4
Hileia	4.6	4.0	4.3	1.2	1.0	1.1
Dyvo	5.7	8.8	7.2	1.1	1.0	1.0

The highest average fruit weight was observed in *C. maxima* species, especially in varieties Poliovychka – 6,3 kg and Yuvilei – 6,2 kg.

In *C. moschata* species the biggest fruits had varieties Dyvo – 7.2 kg and Dolia – 5.3 kg. The average fruit weight significantly affected the overall productivity of winter squash varieties.

By the number of formed fruits there was found no significant difference between varieties. Quite polycarpous were *C. Maxima* variety Slavuta (1.3 pc.) and *C. moschata* variety Dolia (1.6 pc.).

The studied species significantly differed among themselves by biochemical parameters. This is due to specific features of varieties and weather conditions during the growing (Table 4).

4. Biochemical parameters of pulp for varieties of different pumpkin species  
(average in 2013-2014)

Variety	dry matter,%	total sugar, %	carotene mg /100g	vitamin C, mg/100g	nitrate content, mg/kg
<i>C. maxima</i> Duch.					
Zhdana (C)	13.5	8.3	10.6	18.2	89.2
Yuvilei	13.6	8.5	11.1	14.7	123.4
Slavuta	16.4	9.7	6.4	21.3	91.1
Poliovyhka	12.0	7.4	7.0	23.3	99.0
<i>C. moschata</i> Duch. ex Poir					
Dolia (C)	11.6	6.5	8.3	6.3	116.6
Yanina	8.3	4.6	6.2	5.0	93.4
Hileia	8.5	5.4	7.3	5.7	83.0
Dyvo	9.3	6.7	11.1	5.6	109.1

Over the years of research the most valuable appeared to be *C. maxima* species, namely varieties: Yuvilei and Slavuta, in fruits of which it is accumulated dry matter – 13,6 and 16,4%; total sugars – 8,5 and 9,7 %; carotene – 11,1 and 6.4 mg/100 g; Vitamin C – 14,7 and 21.3 mg/100 g.

Among *C. moshata* species the most valuable appeared to be varieties Dyvo and Dolia, which accumulated vitamin C – 5,6 and 6,3 mg/100 g; total sugars – 6,7 and 6,5%; dry matter – 9,3 and 11,6 %; carotene – 8,3 and 11,1 mg/100 g.

Low nitrate level was found in varieties Zhdana, Slavuta and Hileia (89,2; 91,1 and 83,0 mg/kg respectively). All other varieties had nitrate levels in the normal range (up to 200 mg/kg).

### Conclusions

1. The most early-season varieties proved to be those of *Cucurbita moschata* species with the least growing period duration (96-101 days), namely: Dolia – 96 days and Dyvo – 101 days, and the varieties of *Cucurbita maxima* species, Zhdana – 116 days and Poliovychka – 120 days.

2. The high yield varieties proved to be Poliovychka – 34,5 t/ha and Dyvo – 38,4 t/ha, which is connected to their multiple fruits – 6,3 kg and 7,2 kg respectively.

3. It was found correlation between the average fruit weight and the total productivity of the studied species. Relative multiple fruits had varieties Slavuta (1.3 pc) and Dolia (1.6 pc).

4. According to the biochemical content, valuable varieties proved to be those of *Cucurbita maxima* species – Yuvilei and Slavuta, which synthesized dry matter – 13,6 and 16,4%, total sugars – 8,5 and 9,7%, carotene – 10,6 and 11,1 and 6,4 mg/100 g, and vitamin C - 14.7 and 21.3 mg/100 g

5. The most valuable *Cucurbita moschata* varieties appeared to be Dyvo and Dolia with vitamin C – 5,6 and 6.3 mg/100 g, total sugars – 6,7 and 6,5%, dry matter – 9,3 and 11,3%, and carotene - 8.3 and 11.1 mg / 100 g.

6. In terms of complete absence of use of synthetic nitrogen and organic fertilizers, nitrate accumulation was within normal limits (200 mg/kg).

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## **ПРОДУКТИВНІСТЬ І ЯКІСТЬ ПЛОДІВ У СОРТІВ ГАРБУЗА В УМОВАХ ОРГАНІЧНОГО ОВОЧІВНИЦТВА**

***В.В. Кокойко***

Наведено результати господарсько-біологічної оцінки двох видів гарбуза: великоплідного (*Cucurbita maxima* Duch. - Ждана, Ювілей, Славута, Польовичка) та мускатного (*Cucurbita moschata* Duch. ex Poir. - Доля, Яніна, Гілея, Диво) в умовах органічного виробництва.

За результатами проведених досліджень підібрано найбільш скоростиглі з високою урожайністю та якістю плодів сорти, які придатні для використання в органічному овочівництві.

**Ключові слова:** *гарбуз, видів Cucurbita maxima Duch., Cucurbita moschata Duch. ex Poir., фенологічні фази, скоростиглість, органічне овочівництво.*

## **ПРОИЗВОДИТЕЛЬНОСТЬ И КАЧЕСТВО ПЛОДОВ У СОРТОВ ТЫКВЫ В УСЛОВИЯХ ОРГАНИЧЕСКОГО ОВОЩЕВОДСТВА**

***В.В. Кокійко***

Приведены результаты хозяйственно- биологической оценки двух видов тыквы крупноплодной (*Cucurbita maxima. Duch.* - Ждана, Ювильей, Славута, Польовичка) и мускатной (*Cucurbita moschata. Duch.* - Доля, Янина , Гилея , Дыво) в условиях органического производства.

По результатам проведенных исследований подобрано наиболее скороспелые с высокой урожайностью и качеством плодов сорта, пригодные для использования в органическом овощеводстве.

**Ключевые слова:** *тыква, видов Cucurbita maxima Duch., Cucurbita moschata Duch. ex Poir., сорт, фенологические фазы, скороспелость, органическое овощеводство*