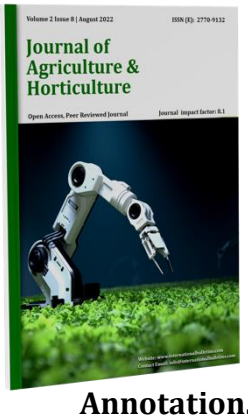

PHYSICAL PARAMETERS OF SEED FRUITS, QUANTITY AND QUALITY OF SEEDS OF SQUASH VARIETY ORBITA

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Annotation. In this study, the physical parameters of seed fruits of squash such as weight, length, width, pulp and peel thickness, and seed placenta weight were analyzed. Thirteen fruit samples were investigated and correlations were found between their physical characteristics and seed number. The results show that fruit weight has a direct effect on fruit productivity: larger fruits contain more seeds and have greater pulp weight. A positive correlation between the mass of seed placenta and the number of developed seeds was also found. At the same time, the thickness of the cortex remains unchanged and has no effect on other parameters. This study can be useful for breeders and agronomists in selecting the most productive squash varieties for further seed production.

Keywords: seed fruits, squash, fruit weight, number of seeds, seed placenta weight, pulp thickness, seed production, productivity, physical parameters, correlation.

Introduction. Seed production of squash plays an important role in ensuring stable yields and improving crop efficiency. Seed quality and quantity depend directly on the physical characteristics of seed fruits, such as their weight, size, pulp and rind thickness, and seed placenta weight. The study of these parameters provides a better understanding of the factors that influence plant productivity and quality seed yields.

In recent years, there has been a growing interest in the optimization of agricultural technologies, including the breeding of squash and other vegetable crops. Research in this area is aimed at increasing yields and improving seed quality, which plays an important role in sustainable agricultural development.

These studies investigated the effect of pollen number and plant spacing on pumpkin seed yield and quality. Nascimento et al. (2011) and Lima et al. (2003) found that increasing pollen number significantly increased seed yield per fruit and per area [7, 8]. However, Cardoso (2003) did not report significant differences in fruit and seed yield under different pollen loads [5]. Regarding seed quality, Nascimento et al (2011) observed no significant effect of pollen quantity except for lower germination at very low quantities [8]. Cardoso (2003) observed higher seed quality with natural pollination compared to hand pollination [5]. Lima et al (2003) found that greater plant spacing increased fruit and seed yield per plant but had no effect on seed yield per area [7]. They also reported that hand pollination using whole anthers gave similar results to natural pollination in terms of seed yield and quality. Overall, these studies indicate that pollen quantity and plant spacing can affect pumpkin seed yield with different effects on seed quality.

These studies investigate the factors affecting seed and fruit quality in pumpkin varieties. Gupta et al. (2023) investigated the effect of fruit load management and postharvest ripening on seed production of summer pumpkin. They found that limiting fruit to 2 per plant and providing 20-30 days of postharvest ripening improved seed quality and yield. This was

attributed to better assimilate distribution and longer delivery period. The study also observed changes in enzyme activity and malonic dialdehyde content during the treatments which affected seed quality [6].

One of the most important aspects is to analyze the effect of fruit weight and size on seed yield. For example, Ivanov et al. (2020) showed that larger squash fruits have better seed characteristics such as higher seed yield and seed weight. Fruit weight was found to have a direct effect on seed quantity and quality, which is supported by a number of similar studies conducted on other crops such as pumpkin and cucumber [1].

Another important area of research concerns the relationship between the weight of the seed placenta and the number of developed seeds. Sidorov (2019) proved that a heavier seed placenta contributes to an increase in the number of developed seeds, which is associated with better nutrition and fruit development. This is consistent with the data obtained in a study of squash, where placenta weight was positively correlated with the number of seeds and their mass [4].

In addition, an important aspect is the study of the effect of fruit pulp and peel thickness on overall productivity. Several studies, such as the work of Petrov (2018), found that thicker fruit pulp contributes to better seed development, but the thickness of the peel has no significant effect on seed productivity [3].

Thus, literature review shows that weight, size and other physical parameters of squash seed fruits play a key role in the formation of seed quality and quantity. This is confirmed by numerous studies conducted on squash and other similar vegetable crops, which indicates common patterns in seed production.

Research methodology. The experiments were conducted in 2022-2023 at the experimental plot of the Research Institute of Vegetable, Melon Crops and Potato in Tashkent region of Uzbekistan.

Seed yield was determined according to the methodology of V.F. Belik (1992) “Methods of experimental work in vegetable and melon growing”. Fruits were harvested to determine seed yield in the phase of biological ripeness, when they had rough hard bark. Determination of seed yield from fruits and seed yield was carried out in each variant in 4-fold repetition, where 20 fruits were taken, fruit weight was determined, from which seeds were extracted and after drying the number and weight of seeds were determined. Then seed yield was determined by the weight of fruits and seeds.

The promising squash variety Orbita served as an object of research. The variety Orbita, bred by analytical selection from the sample 0044SQ high-yielding, with non-traditional rounded fruits.

The scheme of plant placement is ribbon two-line according to the scheme (140+70)/2x50 cm. The area of the accounting plot was 21 m2. 40 plants were placed on each plot.

Research results. An important aspect of the study is to analyze the correlation between the physical characteristics of fruits and their seeds. This helps to identify the relationship between fruit size and weight and the number of developed seeds, which is a key indicator for assessing seed productivity. In this study, seed fruits of zucchini were analyzed to identify these relationships.

The weight of seed fruit was measured and it was determined that the average fruit weight is 1469 g, with a minimum value of 720 g and a maximum of 2312 g. The scatter of

data is quite large, which is confirmed by the standard deviation of 408.3 g. And the correlation shows that the weight of the fruit is related to the number of seeds and pulp weight. The larger the fruit, the greater its weight and number of seeds (Table 1).

Table 1.

Characterization of squash seed fruits and their physical parameters (2022-2023)

Variable quantity	Mean value of variables	Standard deviation	Minimum	Maximum
Seed fruit weight, g	1469	408,3	720	2312
Seed fruit height, cm	10,8	1,02	9,5	12,7
Seed fruit width, cm	17,7	1,6	14,5	20,4
Seed fruit flesh thickness, cm	1,8	0,3	1,3	2,1
Seed fruit rind thickness, cm	2	0	2	2
Weight of fruit pulp, g	1208	330,5	589	1806
Weight of seed placenta, g	190	67,1	122	369

Seed fruit height and seed fruit width of the studied squash fruits were determined. The average fruit height is 10.8 cm, with a minimum value of 9.5 cm and a maximum of 12.7 cm. The standard deviation is relatively small at 1.02 cm, indicating that there is little variation in height among fruits. And the correlation taller fruits may contain more seeds, but the relationship with seed weight is not always direct. The mean fruit width is 17.7 cm, with a variation from 14.5 cm to 20.4 cm. The standard deviation is 1.6 cm. Correlation when measuring fruit width, it was found that wide fruits tend to contain more seeds and pulp, which is related to the total fruit weight.

Measurement of seed fruit pulp thickness showed that the average pulp thickness was 1.8 cm, varying from 1.3 cm to 2.1 cm. The standard deviation was 0.3 cm, indicating little variability, and the correlation established showed that thicker pulp is often found in larger fruits and is related to fruit weight. Also, seed fruit crust thickness (cm) was measured and it was found that fruit crust thickness remained constant in all measurements at 2 cm. The standard deviation is 0 indicating that there is no variation. The crust thickness does not affect other fruit parameters, as it remains the same.

The results of fruit pulp and seed placenta weight measurement showed that the average pulp weight is 1208 g, ranging from 589 g to 1806 g. The standard deviation is 330.5 g, and heavier pulp indicates larger and more productive fruits, with more seeds. The average seed placenta weight is 190 g, ranging from 122 g to 369 g. The standard deviation is 67.1 g. Fruits with heavier placenta contain more seeds, which is also related to total fruit weight.

Seed statistics including several variables: mean of variables, standard deviation, minimum and maximum.

The mean value shows the typical value of each variable for a group of the obtained fruits mean values. The results showed that: average seed length is 1.98 cm, this value varies from minimum (1.8 cm) to maximum (2.2 cm); average seed width is 0.95 cm, with a minimum of 0.9 cm and a maximum of 1 cm; seed weight at the time of extraction average is

53.12 g, with a range from 23 g to 93.1 g; average number of developed seeds is 196.23 pcs, this value varies from 59 to 400 pcs; average undeveloped seeds were 31.46 pcs. , with a minimum of 1 and a maximum of 152; average weight of developed seeds was 35.2 g, minimum - 11.85 g, maximum - 60.6 g; average weight of undeveloped seeds was 7.2 g, with a range from 0.03 g to 17.2 g; average total seed weight was 35.88 g, with a range from 11.92 g to 61.4 g; weight loss averaged 17.24 g, with a range from 3.3 g to 36.56 g (Table 2).

Table 2.

Physical characteristics of seed fruits of squash variety Orbita (2022-2023)

Variable quantity	Average of variables	Standard deviation	Minimum	Maximum
Seed length, cm	1,98	0,1	1,8	2,2
Seed width, cm	0,95	0,05	0,9	1
Seed weight at the time of fruit extraction, g	53,12	25,75	23	93,1
Number of developed seeds, pcs	196,23	108,38	59	400
Number of undeveloped seeds, pcs	31,46	52,3	1	152
Weight of developed seeds, g	35,2	16,7	11,85	60,6
Weight of undeveloped seeds, g	0,72	0,39	0,03	1,72
Total weight of seeds, g	35,88	16,97	11,92	61,4
Weight loss during seed drying, g	17,24	10,81	3,3	36,56

The standard deviation shows the scatter of data: in seed length the deviation is 0.01 cm and indicates a small variability in seed length; in seed width the standard deviation is 0.05 cm indicating a small variability; in seed weight at the time of extraction the deviation is 25.75 g indicating a significant difference in seed weight; in the number of developed seeds the standard deviation is 108.38 pieces, which also indicates a high variability in the number of developed seeds; in the number of undeveloped seeds the deviation is 5.23 pieces, indicating less variability; in the weights of developed and undeveloped seeds the deviation is 25.75 g indicating a high variability in seed weight, which also indicates a high variation in the number of developed seeds; in the number of undeveloped seeds, the deviation is 5.23 pieces, indicating less variability; in the weights of developed and undeveloped seeds, the standard deviation of the weight of developed seeds is 16.7 g, undeveloped seeds - 3.9 g; in the total weight of seeds, the deviation of 16.97 g indicates significant variation in the total weight of seeds.

The minimum and maximum values of the data give an idea of the range of each variable: seed length from 1.8 to 2.2 cm; seed width from 0.9 to 1 cm; seed weight from 23 to 93.1 g; number of developed seeds - minimum 59 pcs, maximum 400 pcs; number of

undeveloped seeds - minimum 1 pc, maximum 152 pcs; weight of developed seeds - minimum 11.85 g, maximum 60.6 g; total weight - minimum 11.92 g, maximum 61.4 g; weight loss - minimum 3.3 g, maximum 36.56 g.

Conclusion

1. Seed fruit weight is directly correlated with pulp and seed placenta weight. Larger fruits contain more seeds and have higher pulp mass.

2. Fruit length and width also affect the number of seeds, but this relationship is less pronounced than fruit mass.

3. Peel thickness does not change, so it has no effect on seed production.

4. Seed length and width: these parameters vary only slightly, indicating relative uniformity in seed size.

5. Number of developed seeds and their weight: there is a direct relationship - the more developed seeds, the higher their total weight.

6. Number of undeveloped seeds: in some fruits the number of undeveloped seeds is relatively high (up to 152 seeds), which may influence the total seed yield.

7. Seed weight at the time of extraction and total weight: the higher the seed weight at extraction, the higher the total weight after drying.

8. Weight loss on drying: larger seeds lose more weight on drying, which may indicate a higher moisture content in more developed seeds.

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