

## AVAILABILITY AND QUALITY OF ORGANIC SEED OF SOME VEGETABLES

### Summary

*Ecological seed is very necessary, but its quality is often much lower than of conventional seeds. The aim of the study was to compare the sowing value of organic seeds of different vegetable species with their conventional equivalents. The research was carried out on the seeds of lettuce, cucumber, spinach and beet from PlantiCo (Zielonki, Poland). The seeds were sown under laboratory conditions in the containers lined with blotting paper and on Petri dishes to observe the course of germination and in soil to observe the emergence process. The weight of one thousand seeds of each species and type was estimated, and the price-seed ratio in the package was established. In general, conventional seeds were characterized by a higher sowing value and a mass of thousand seeds as compared to their organic equivalents. The differences in quality depended on the species. The quality of organic lettuce seeds was the lowest. There was also a high percentage of damages seeds of organic cucumber (10%).*

**Key words:** organic seeds, lettuce, spinach, cucumber, red beet

## DOSTĘPNOŚĆ I JAKOŚĆ EKOLOGICZNEGO MATERIAŁU SIEWNEGO NA PRZYKŁADZIE WYBRANYCH GATUNKÓW WARZYW

### Streszczenie

*Ekologiczny materiał siewny jest bardzo poszukiwany, lecz jego jakość często odbiega od wartości siewnej nasion konwencjonalnych. Celem badań było porównanie wartości siewnej nasion ekologicznych różnych gatunków warzyw i ich konwencjonalnych odpowiedników. Badania przeprowadzono na nasionach sałaty, ogórka, szpinaku i buraka ćwikłowego firmy PlantiCo (Zielonki, Polska). Nasiona wysiano w laboratorium w pojemnikach wyłożonych bibułą i na szalkach Petriego, aby zaobserwować przebieg kiełkowania oraz w gruncie w celu obserwacji wschodów. Dodatkowo oszacowano masę tysiąca nasion każdego gatunku i rodzaju oraz ustalono stosunek ceny do ilości nasion w opakowaniu. Na ogół nasiona konwencjonalne charakteryzowały się wyższą wartością siewną i masą tysiąca nasion w porównaniu do swoich ekologicznych odpowiedników. Różnice w jakości zależały od gatunku. Najniższa była jakość ekologicznych nasion sałaty. Zaobserwowano duży odsetek uszkodzeń nasion ekologicznych ogórka (10%).*

**Słowa kluczowe:** nasiona ekologiczne, sałata, szpinak, ogórek, burak ćwikłowy

### 1. Introduction

Ecological seeds are those that were obtained from plants sown and grown in ecological conditions, during the last growing season in the case of annual plants, and in two cultivated seasons in the case of biennial and perennial crops [3, 4].

Chemical plant protection cannot be used in the production process of organic seeds. The lack of seed dressing causes large losses during field emergence. Plants are exposed to competition with weeds, pest attacks and diseases. Chemical protection, however, can be replaced by a biological one [5].

Production costs are also a serious problem. Organic seeds are much more expensive than conventional ones [2]. Moreover, the sowing rate in organic cultivation is higher. This can be illustrated by the example of onions. Yield per hectare is 50% lower for organic seeds. Therefore, more seeds are needed to obtain the same amount of product [8].

EU law allows the use of conventional seed in organic farming in the case of unavailability of ecological material [1]. Farmers in Poland often apply to the State Plant Health and Seed Inspection Service for a derogation, explaining that no company offers organic seeds of varieties with specific properties. According to the law, they are allowed to use untreated conventional seeds on their organic farms. Such actions result in a decrease in the demand for organic seeds despite the increase in organic food production [7].

In Poland in the years 2008-2010 4 companies offered organic seeds for sale. In 2014, only two of them had organic seeds in their offer. Most farmers have stopped buying organic seeds for conventional varieties. This is related to the lack of ecological varieties with resistance or tolerance to certain pests and diseases, such as downy mildew, caused by fungi, whose disputes are spread by the wind [7]. The lack of genetically resistant varieties results from the fact that many seed producers focused on the quantity and not on the quality of seeds. When organic seeds entered the market, there was a need to change priorities in creating new varieties suitable for organic farming.

### 2. Material and methods

The material used for experiments included conventional and organic seeds of: lettuce (variety Królowa Majowych), cucumber (variety Soplica), spinach (variety Greta) and red beet (variety Czerwona Kula) from Polish seed company PlantiCo.

#### 2.1. Laboratory experiment

100 seeds of each species and type (ecological and conventional) were counted in 3 replications. Prior to the experiment, all seed samples were weighed using a laboratory scale. The damaged seeds of organic cucumber were sepa-

rated and weighed in order to calculate the percentage of damaged seeds. Seeds of cucumber, spinach and red beet were sown in plastic containers lined with filter paper, and lettuce on Petri dishes. Each container dipped with 23 ml of distilled water (60% hydration) and each Petri dish with 1 ml of water. Daily observations were carried out. Germinated seeds were counted and removed.

Pieper Coefficient and germination ability coefficients were calculated and statistical analysis of the obtained results was made.

Pieper coefficient - average time of germination / emergence in days.

$$P = \frac{\sum (d_n \times a_n)}{\sum a_n},$$

where:

$d_n$  - the day number counting from sowing,

$a_n$  - number of seeds germinating on a given day.

The low value of this coefficient indicates the high vigor of seeds and rapid germination or field emergence.

Germination (emergence) uniformity - the same formula as for the Pieper coefficient is used, the only difference is that the first day  $d_1$  is the one in which the first sprouts / seedlings appeared. It does not matter how many days after sowing germination / emergence began. The low value of the coefficient indicates more even germination or field emergence.

## 2.2. Field experiments

100 seeds of each species and type (ecological and conventional) were sown in 3 replications in the field in Izbica near Serock (Masovian district).

Daily observations were carried out. Emerging seedlings were counted.

Pieper coefficients and field emergence rate were calculated and statistical analysis of the results was prepared.

## 3. Results

Table 1 presents seed weight per package, price of package and price for 10g of seeds. Organic seeds were more expensive than conventional ones. This difference varied from 1,8 times higher price in red beet to 3,5 times in cucumber.

Table 1. Seed weigh in relation to the price

Tab. 1. Masa nasion w stosunku do ceny

Reproduction system	Species	Seed weight per package [g]	Price of package [PLN]	Price for 10 g [PLN]
Organic	lettuce	0,5	2,5	50,00
Conventional		1,0	1,7	17,00
Organic	spinach	8,0	2,5	3,13
Conventional		12,0	1,8	1,50
Organic	cucumber	2,0	4,2	21,00
Conventional		5,0	3,0	6,00
Organic	red beet	10,0	2,5	2,50
Conventional		12,0	1,7	1,42

Source: own work / Źródło: opracowanie własne

1000 seed weight is one of the parameters describing sowing value. Only organic lettuce seeds were heavier than conventional ones. In case of other species conventional seeds were heavier, for cucumber even twofold comparing to organic equivalent (tab. 2).

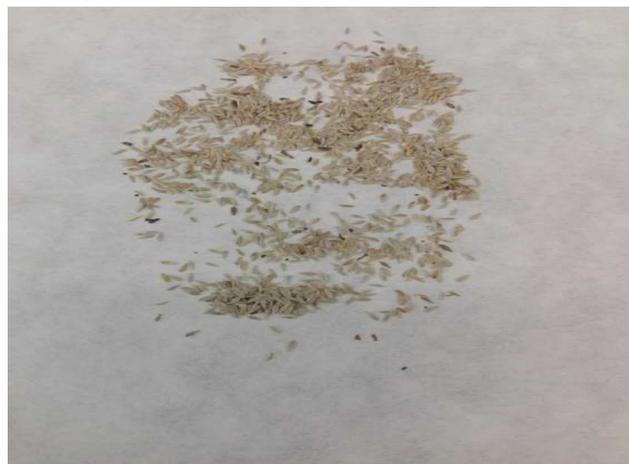
Table 2. 1000 seed weight depending on the reproduction system

Tab. 2. Masa tysiąca nasion w zależności od systemu reprodukcji

Species	Mean 1000 seed weight [g]	
	Organic	Conventional
lettuce	1,1	0,8
spinach	8,8	11,6
cucumber	12,1	23,3
red beet	12,4	17,4

Source: own work / Źródło: opracowanie własne

Organoleptic observation of seeds showed the presence of numerous impurities in organic parsley seed lot (Fig. 1) and damaged cucumber seeds in organic seed lot (Fig. 2). Conventional seeds didn't contain visible contaminations or broken seeds.



Source: photo / Źródło: fot. Monika Ostrowska

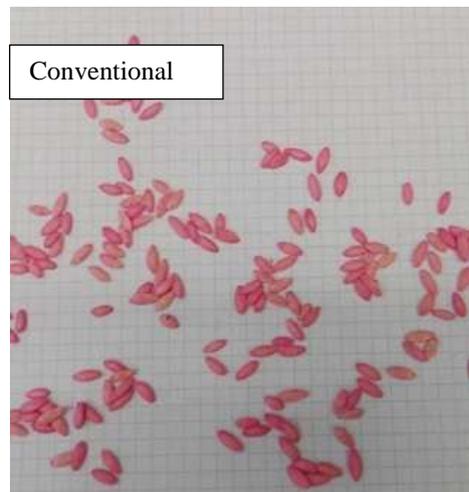
Fig. 1. Contaminated organic lettuce seed lot

Rys. 1. Zanieczyszczenia w próbce nasion sałaty ekologicznej

Conventional seeds germinated in higher percent than their organic equivalents, but only for lettuce and spinach differences were significant (Fig. 3). The largest difference in germination ability was observed for lettuce – more than 8%. Germination ability of spinach was in general lower – below 90%.

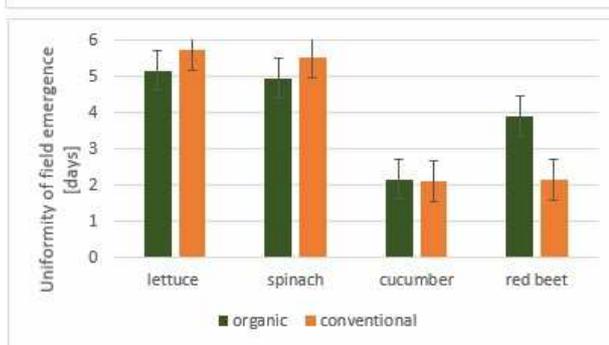
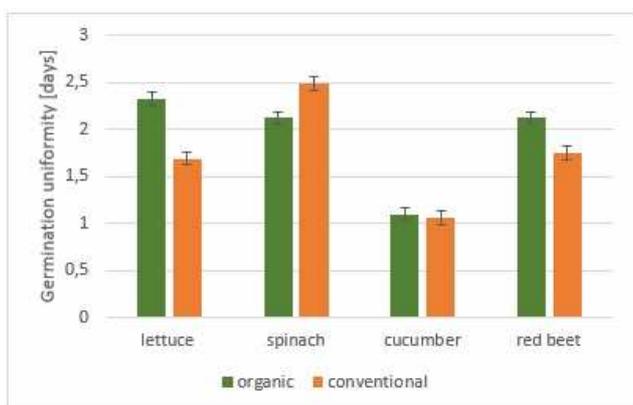
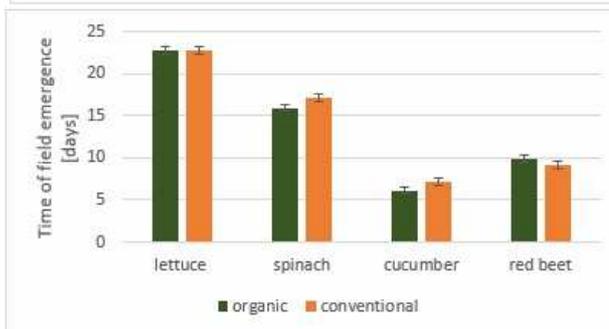
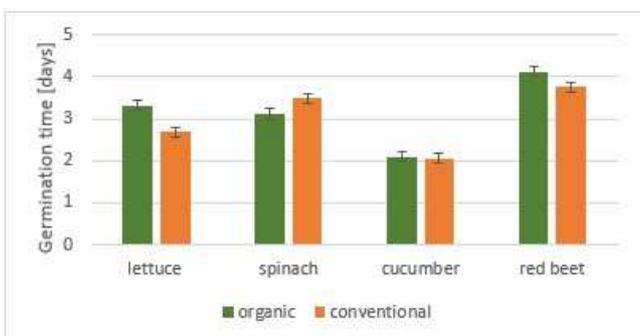
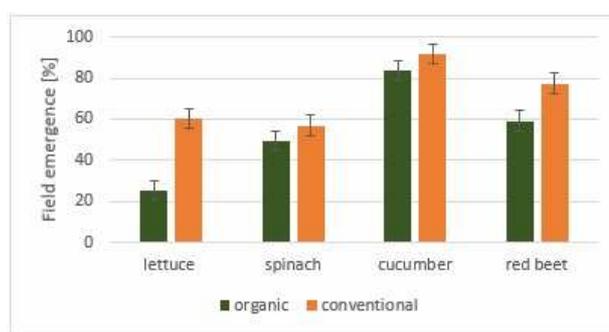
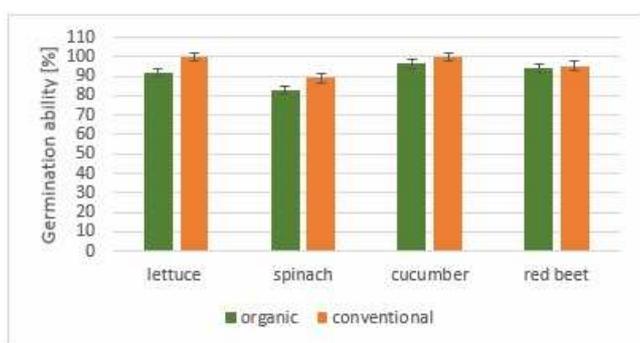
Organic seeds of lettuce and red beet germinated slower than conventional ones (Fig. 3). The reverse situation took place in case of spinach – organic seeds germinated quicker than conventional ones. The reproduction system had no influence on germination time of cucumber seeds. The same relationships occurred in case of germination uniformity (Fig. 4).

Field emergence rate of conventional vegetables was better than of organic ones. But only for lettuce and red beet those differences were large and significant (35 and 18% respectively).



Source: photo / Źródło: fot. Monika Ostrowska

Fig. 2. Cucumber seeds: organic (left) and conventional (right)  
 Rys. 2. Nasiona ogórka z uprawy ekologicznej (z lewej) i konwencjonalnej (po prawej)



Source: own work / Źródło: opracowanie własne

Fig. 4. Rate (%), mean time and uniformity (days) of field emergence

Rys. 4. Połowa zdolność wchodów (%), średni czas i równomierność wschodów polowych (dni)

Fig. 3. Germination ability 7 days after sowing [%], germination time and uniformity (Pieper's Coefficient – days)  
 Rys. 3. Zdolność [%], szybkość i równomierność kiełkowania (Współczynnik Piepera – dni) po 7 dniach od wysiewu

There were no significant differences in speed and uniformity of field emergence between organic and conventional seed lots with one exception. Organic spinach emerged earlier for more than 1 day comparing to the con-

ventional one. Even one-day acceleration of plant development is of great importance for future yield and its quality.

#### 4. Discussion

Organic seeds offered by PlantiCo sometimes show unfavorable features like contaminations (as in the case of lettuce), mechanical damage (cucumber), uneven size (spinach). They cost more for a weight unit comparing to conventional seeds. In most cases (spinach, cucumber, beet) conventional seeds are heavier than organic seeds. Seedlings of organic and conventional seeds of the same varieties began to appear at a similar time. The lettuce was the least beneficial in the laboratory experiment. It showed a lower germination ability and its seeds sprouted more slowly and less evenly than a conventional equivalent. On the other side organic spinach germinated very well. Its seeds germinated faster and with greater uniformity compared to the conventional ones. Also in the field organic spinach seedlings emerged earlier. In both laboratory and field experiments, the organic cucumber did not show any significant differences compared to conventional seed.

Similar conclusions were drawn by Szafirowska. Organic and conventional seeds did not differ from each other in terms of germination parameters [6]. In the field experiment, no significant differences were observed between the compared batches of spinach seeds. In the case of organic beetroot seeds, the field emergence rate was higher, however the uniformity of emergence was lower both in the field experiment and in the laboratory experiment compared to conventional seed material.

#### 5. Conclusions

In general, conventional seeds showed higher sowing value and mass of a thousand seeds compared to organic ones.

#### *Own Research Fund / Badania własne*

The lowest quality of organic seeds was observed for lettuce and red beet. Spinach and cucumber organic seeds quality was comparable to conventional ones.

Organic seeds are more expensive than conventional ones due to higher costs of production and lower seed yield. Their price is from 1,8 to 3,5 times higher comparing to conventional ones.

Some of the tested organic seeds were contaminated (lettuce) or damaged (cucumber - 10% of broken seeds), despite of the higher price.

#### 6. References

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