

Evaluation of Chinese Radish under Organic Growing Conditions

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Abstract: Radish production can be expanded due to the suitability of the crop in terms of its health benefits and a relatively short growing season. There are many different forms originating from different parts of the world. Some of the Oriental species are becoming better known nowadays. This work is focused on Chinese radish cultivars which can be potentially grown under organic conditions of the Czech Republic. This study evaluated vitamin C content and yield of Chinese radish.

Key words: Chinese radish, vitamin C, yield, quality evaluation, organic farming.

Introduction

Radish cultivation has a long history. Today, the cultivated radish is distributed worldwide and shows large morphological and agro-environmental variations (Kaneko and Matsuzawa 1993). The Chinese radish (*Raphanus sativus*. L. var. *longipinnatus*) is also known as Daikon, Japanese radish, Oriental radish, and winter radish. Some cultivars form large round to top-shaped roots, while others are elongated and cylindrical in shape (Stephens 1994). Chinese radish is a cool season vegetable belonging to the family Brassicaceae. The origin of cultivated Chinese radish is not clear. The Mediterranean region and China are considered their place of origin as wild ones grow in these areas. In Asia, particularly in Japan and China, Chinese radish is one of the major vegetables (Fang 1996).

Radish can be eaten raw, cooked or pickled. Some types are stored for winter use, while others are preserved by salting and drying. Radish leaves, stems, seed pods and seedlings are also valued as vegetable. Radish is also used in local medicine (Larkcom 1991). Chinese radish contains a fair amount of vitamin C as well as various minerals.

Vitamin C is considered the most important vitamin in horticultural crops. Its generic term is used for all compounds exhibiting the biological activity of L-ascorbic acid (Lee and Kader 2000).

There are many health benefits of radish. It can stimulate appetite or help with respiratory or digestive problems (Petříková 2006). Radish production and consumption in the Czech Republic have not been sufficient. The objective of this work was to support the interest in this remarkable vegetable species through testing of the possibility of its production under organic growing conditions and determination of the nutritional value (vitamin C) of selected radish cultivars.

Material and Method

The plants used in this study were grown under organic conditions in an open field located at the Horticultural Faculty in Lednice (Location: 48°47'54.502" N, 16°48'0.39"E, Czech Republic) during summer 2008. The seeds were sown directly to the field on 22 July and harvest followed after 60 days. Spacing was 0.45 x 0.20 m. There were three replications with at least 35 plants in each. No fertiliser or pesticides were used during cultivation. The crop was covered with polypropylene non-woven cover to prevent damage from pests. The field was under irrigation.

The Chinese radish cultivars used were 'Red Meat' and 'Miyashige'. For comparison the Czech radish variety 'Jarola' was chosen.

'**Red Meat**' or watermelon radish is a Chinese radish of a round shape and a red-colored flesh and green shoulder. It is juicy and sweet tasting. '**Miyashige**' is a medium-size white root with a green neck. '**Jarola**' is a European variety of Daikon type with white root and greenish neck for year-round sowing, resistant to bolting.

Quality parameters such as root diameter, shape and degree of damage were used to classify the cultivars into three groups (according to the Czech standard CSN463127):

class I – root diameter at least 4 cm, compact root without any damages and defects

class II – root diameter at least 4 cm, light shape defect, small cured cracks in the skin

Non-standard (further as NES) – root diameter less than 4 cm, shape defect, cracks in the skin, untypical habit.

The radish cultivars were tested for ascorbic acid levels. Ten grams of radish were homogenised in a blender with oxalic acid, and samples were prepared for analysis. The analyses were performed by RP-HPLC in a LCO-101 column at 254 nm using a UV-VIS detector. The amount of ascorbic acid was expressed as mg.1000 g⁻¹ of fresh weight.

Result and discussion

Table 1 shows average total yields (all quality levels) and marketable yields recalculated for one hectare, and average weight of one radish. The following data show 'Jarola' to be the most performing cultivar, and 'Red Meat' to be the less performing cultivar under given conditions.

Tab. 1. Average weight of radish and total yield recalculated to one hectare

Cultivar	Total yield (t.ha ⁻¹)	Marketable yield (t.ha ⁻¹)	Average weight (g)
Miyashige	38	28	344
Jarola	47	25	424
Red Meat	28	27	250

However, for such consideration, comparison of marketable yield (class I) is of higher importance. Figure 1 shows % shares of each quality class recalculated for weight.

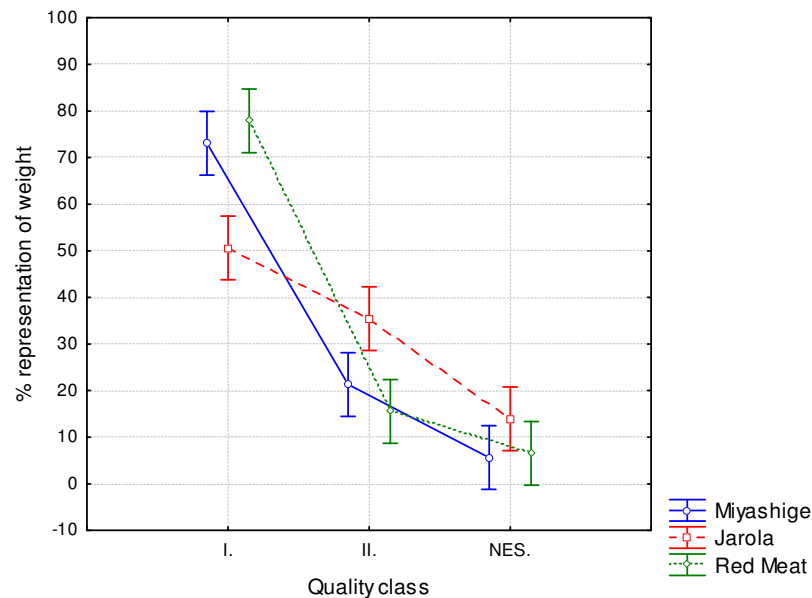


Fig. 1. Quality class for all radish cultivars - % representation of weight

It is statistically significant (*) that cvs. 'Miyashige' and 'Red Meat' have higher quantity (% of weight) in class I compared to cv. 'Jarola'. 'Jarola' has statistically higher (*) quantity (% of weight) in class II compared to 'Red Meat'. This suggests that cv. 'Jarola' has produced a higher total yield (t.ha⁻¹) but a smaller quantity (% of weight) in class I which is more important for the market.

Cv. 'Red Meat' has a different root shape. It is not so cylindrical and long as 'Jarola' and 'Miyashige', but rather round in shape. Due to this morphological

difference, it was more likely to have 'Red Meat' over to 40 mm in diameter, being the threshold for classification. However, Standards do not define any other specifications for quality classification of such type of radishes.

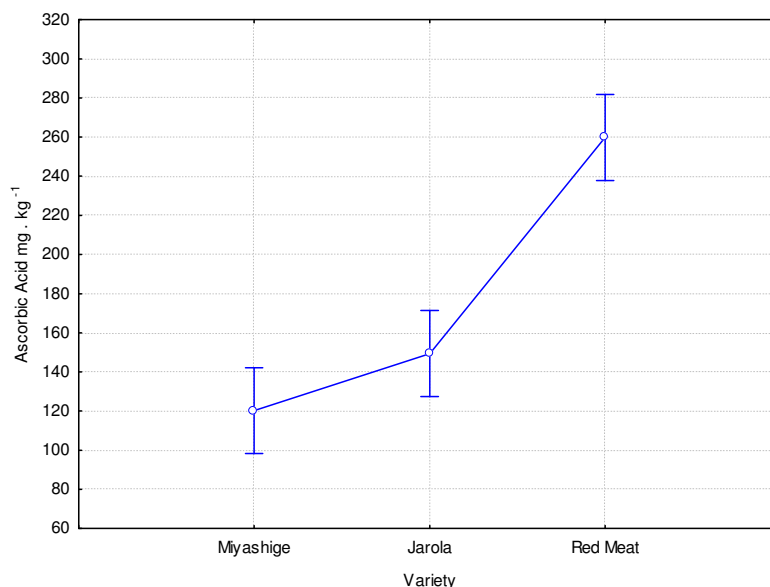


Fig 2. Ascorbic acid level in radish cultivars

The average level of ascorbic acid (vitamin C) was found to be 120 mg.1000 g⁻¹ in 'Miyashige', 149 mg.1000 g⁻¹ in 'Jarola' and 259 mg.1000 g⁻¹ in 'Red Meat'. The ascorbic acid level of 'Red Meat' was statistically higher (**) compared to others and was in line with those reported by Fang (1996) or USDA (2008) for Oriental radish. The amount of ascorbic acid in 'Miyashige' and 'Jarola' was lower and close to those reported by USDA (2008) for European radish type. Differences between all cultivars with standard deviation are shown in Figure 2.

Conclusion

This study suggests that the radish cultivars tested are suitable for organic growing conditions. Cultivar 'Jarola' has the highest total yield but the lowest marketable yield. 'Red Meat' and 'Miyashige' have the highest marketable yield. The highest amount of ascorbic acid was found in cv. 'Red Meat'. Further studies can focus on evaluating the performance under conventional conditions as compared to organic growing conditions.

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References

- Fang C.W. (1996): Chinese Radish Yield Response to Potassium. *AVRDC - The World Vegetable Center* [online]. [ref. 2009-06-10]. Available at: <[http://www.arc-avrdc.org/pdf_files/Tanwenfang2\(15-N\).pdf](http://www.arc-avrdc.org/pdf_files/Tanwenfang2(15-N).pdf)>.
- Kaneko Y., Matsuzawa Y. (1993): Radish. In Genetic improvement of vegetable crops. Edited by G. Kalloo and B.O. Bergh. Pergamon Press, Oxford, U.K., 487-510 pp.
- Larkcom J. (1991): *Oriental Vegetables*. John Murray Publishers Ltd., London.
- Lee S. K., Kader A. A. (2000): Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biol. Technol.*, **20**(3): 207-220.
- Petříková K. (2006): *Zelenina: pěstování, ekonomika, prodej*. 1. vyd. Profi Press., Praha.
- Stephens J. M. (1994): Radish Chinese. *Horticulture Science Department, Florida Cooperative Extension Service* [online]. [ref. 2009-05-15]. Available at: <<http://edis.ifas.ufl.edu/pdffiles/MV/MV12000.pdf>>.
- USDA National Nutrient Database for Standard Reference [online]. 2008 [cit. 2009-04-05]. Available at: <<http://www.nal.usda.gov/fnic/foodcomp/search/index.html>>.

ISPITIVANJE DAIKON ROTKVICE U USLOVIMA ORGANSKE PROIZVODNJE

- originalni naučni rad -

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Rezime

Zbog svojih zdravstvenih koristi i relativno kratkog vegetacionog perioda, rotkvica je pogodna za proširenje proizvodnje. Postoji mnogo različitih vrsta rotkvice poreklom iz različitih delova sveta. Neke orijentalne vrste stiču sve veću popularnost. U ovom radu razmatraju se sorte daikon rotkvice koje se mogu uvesti u organsku proizvodnju u Republici Češkoj. U radu je ispitivan sadržaj vitamina C i prinos rotkvice.