



## EFFECT OF SOWING RATE ON QUALITY CHARACTERISTICS OF YIELD OF ONION CV. 'ROSA LUNGA DI FIRENZE'

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### Abstract

The experiment was conducted in the years 2007-2009. The aim of the study was estimation of the effect of sowing rate (6, 8, 10, 12 i 14 kg·ha<sup>-1</sup>) on the quantity and quality of the yield of onion cv. 'Rosa Lunga di Firenze'. On the base of obtained results it was proved that used in the experiment sowing rates did not differ significantly the quantity of yield of onion cv. 'Rosa Lunga di Firenze'. However, it was noted that the highest participation of bulbs of the least diameter was obtained when the highest sowing rate was used. Sowing rate of 14 kg·ha<sup>-1</sup> had also an influence on decrease of single bulb weight of bulbs <2 cm in diameter and on decrease of single bulb weight and diameter of bulbs 2-4 cm in diameter. Moreover, it was found that yield of onion cv. 'Rosa Lunga di Firenze' was characterized by a high content of mineral compounds.

**Key words:** *Allium cepa* L., 'Rosa Lunga di Firenze', sowing rate, yield quality

### INTRODUCTION

The *Allium* genus has more than 600 species. The species are widely cultivated throughout the world; most grow in moderate and dry climate zones (Meer et al., 1997). Common onion (*Allium cepa* L.) is one of the most economically important species of the onion family vegetables (Mierzwiński, 2003). It is well known and very popular crop used in food industry (Wielgosz, 2004). Onion is very nutritious and health benefits vegetable. It provides our diet with large amounts of vitamins C, B<sub>1</sub>, B<sub>2</sub>, PP and pro-vitamin A (Hojden, 1997). Moreover, onions are characterized by a high content of calcium, potassium, copper and iron (Kot and Buliński, 1988). There are hundreds of varieties and cultivars of onion grown in the world. Though, it was found that most of consumers make a choice in accordance with the taste and health beneficial properties of the onion (Vaughan and Geissler, 2001). From this point of view it is important to choose for onion growing a proper cultivar, best climate and soil conditions and suitable crop management treatments (Korszikow et al., 1985; Gruszecki and Tendaj, 2001). Cultivar 'Rosa Lunga di Firenze' form long onions, with small diameter, pink skin, delicate flavor and little pungency. It is usually consumed raw, together with

different dishes. The cultivation period from sowing to harvest lasts about 80 days. This cultivar is not suitable for long-term storage. Even though the seeds of cv. 'Rosa Lunga di Firenze' are available, there is still lack of knowledge of growing methods of this cultivar, especially regarding the sowing rate. The rate of seeds recommended for shallot cultivation is significantly higher in comparison with the recommendations for common onion. The sowing rate for shallot cultivar 'Creation F<sub>1</sub>' amounts 12-17 kg·ha<sup>-1</sup> (Odmiany warzyw, 1995), and that is much higher than the rates recommended for common onion. The onion seeds should be characterized by a high levels of germination that will bring a high plant density and a high quantity of the yield (Tendaj et al. 1997).

The aim of the conducted experiment was the estimation of the effect of sowing rate on the quantity and quality of yield of onion cv. 'Rosa Lunga di Firenze'.

## **MATERIAL AND METHODS**

### **Plant Material and Growth Conditions**

The experiment was conducted in the years 2007-2009 in the Department of Vegetable Crops of Agricultural University in Szczecin. In the study the effect of sowing rate on quantity and quality of the yield of onion cv. 'Rosa Lunga di Firenze' grown in the climatic conditions of Western Pomerania was estimated.

The following sowing rates were applied: 6, 8, 10, 12 and 14 kg·ha<sup>-1</sup>. The experiment was set in one-factorial, randomized block design with four replications. Seeds were sown in the field in the first decade of April into rows at 20 cm distance. Mineral fertilization was quantified according to the results of the chemical analysis of the soil samples and supplemented to the level of 150 mg N-NO<sub>3</sub>, 75 mg P<sub>2</sub>O<sub>5</sub> and 175 mg K<sub>2</sub>O per 1 dm<sup>3</sup>. During the growing season, the crop management treatments were carried out. These included mainly weeding and irrigation. In order to protect the plants from fungal diseases, mainly from powdery mildew of onion (*Peronospora destructor* Casp.), they were sprayed with Bravo 500 SC (2.0 l·ha<sup>-1</sup>), Ridomil MZ 72 WP (2.25 kg·ha<sup>-1</sup>) and Gwarant 500 SC (2.0 l·ha<sup>-1</sup>).

### **Quantity and quality yield measurements**

The onion was harvested once, in August. The yield was sorted into three classes depending on bulb diameter: <2, 2-4 and >4 cm. Moreover, after the harvest, quality measurements of the following features were taken: mean weight, and horizontal and vertical diameter of bulbs for each class.

### **Mineral Analysis**

In raw plant material the content of dry matter (drying at 105°C to constant weight) was assessed. In dried plant material the following mineral elements were determined:

- total nitrogen with Kjeldahl's method,
- phosphorus with colorimetric method,
- potassium, sodium and calcium with flame photometry method,



- copper, iron and magnesium with flame spectrophotometry of atomic absorption method (ASA) (Krełowska-Kułas 1993).

### Statistical Analysis

The results of the study were subjected to an analysis of variance which was performed with Program AWAR (Filipiak and Wilkos, 1995), made by Department of Applied Informatics, Institute of Soil Science and Plant Cultivation in Puławy. The means were separated by the Tukey's test at  $p=0.05$ .

## RESULTS AND DISCUSSION

The results of the yielding of onion cv. 'Rosa Lunga di Firenze' according to the sowing rates analyzed in the experiment were presented in Table 1. In the first year of the study the yield of the smallest onions (with diameter  $<2$  cm) was significantly higher when sowing rate amounted  $14 \text{ kg}\cdot\text{ha}^{-1}$  – by  $5.07 \text{ t}\cdot\text{ha}^{-1}$  in comparison with the least sowing rate. In the next two years of the study there were no significant differences noted for the mentioned above rate of sowing. On average for all of the years of the study the results were similar to the first year of the experiment – the yield of the onions with diameter  $<2$  cm was the highest when the highest sowing rate was used. In the case of yield of onions of diameter 2-4 cm, only in the year 2008, it was proved that it was higher when sowing rate amounted  $12 \text{ kg}\cdot\text{ha}^{-1}$ . However, there was no significant effect of sowing rate on the yield of onions of diameter  $>4$  cm noted. The results of the study carried out by Tendaj et al. (1997) confirmed that the yield of the small bulbs had increased in accordance with the increase of sowing rate. The least yield of the smallest onions, independently on the sowing rate was obtained in the first year of the study – by  $5.57 \text{ t}\cdot\text{ha}^{-1}$  in comparison with the year 2008 and by  $2.47 \text{ t}\cdot\text{ha}^{-1}$  comparing with the last year of the experiment. There was no significant effect of the sowing rate on the quantity of the total yield of onion found. On average, the total onion yield varied from  $14.48$  to  $16.98 \text{ t}\cdot\text{ha}^{-1}$ . Similar results for shallot cv. Creation F<sub>1</sub> were shown by Piusińska-Siedlecka and Tendaj (2000) – mean yield for the study years amounted  $14.91 \text{ t}\cdot\text{ha}^{-1}$ , and for onion by Gruszecki and Tendaj (2001) -  $21.6 \text{ t}\cdot\text{ha}^{-1}$ .

Used in the experiment sowing rates had significant effect on the quality features of onions (Table 2). In the case of the smallest onion class and sowing rates of  $12$  and  $14 \text{ kg}\cdot\text{ha}^{-1}$ , the onions were characterized by the least unit weight but only in comparison with the least sowing rate. Regarding onions of diameter 2-4 cm, significantly higher unit weight was assessed when the least sowing rate was used.

Table 1

The effect of sowing rate on the yield of onion cv. 'Rosa Lunga di Firenze'

Sowing rate (kg·ha <sup>-1</sup> )	Yield (t·ha <sup>-1</sup> )															
	2007			2008			2009			2007-2009						
	1	2	3	Total	1	2	3	Total	1	2	3	Total				
6	6.36	5.42	2.22	14.0	2.06	2.82	7.17	12.05	6.0	7.61	4.40	18.01	4.81	5.28	4.60	14.69
8	7.96	4.35	2.62	14.93	2.08	2.39	7.79	12.26	5.31	6.98	3.64	15.93	5.12	4.57	4.68	14.37
10	8.11	2.7	1.46	12.27	2.06	3.59	8.60	14.25	5.06	7.17	5.13	17.36	5.08	4.49	5.06	14.63
12	9.3	3.61	1.65	14.56	2.12	6.70	6.09	14.91	4.50	8.27	4.91	17.68	5.31	6.19	4.22	15.72
14	11.43	3.26	1.96	16.65	3.03	3.48	9.06	15.57	5.86	5.89	4.19	15.94	6.77	4.21	5.07	16.05
Mean	8.63	3.87	1.98	14.48	2.27	3.80	7.74	13.81	5.35	7.18	4.45	16.98	5.42	4.95	4.73	15.09
LSD <sub>α=0.05</sub>	2.861	n.s.	n.s.	3.221	n.s.	2.31	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1.85	n.s.	n.s.	n.s.

1 – onions of diameter &lt;2 cm; 2 – onions of diameter 2-4 cm; 3 – onions of diameter &gt;4 cm

Table 2

Quality characteristics of the yield of onion cv. 'Rosa Lunga di Firenze' (mean for the years 2007-2009)

Sowing rate (kg·ha <sup>-1</sup> )	Onion unit weight			Onion horizontal diameter (cm)			Onion vertical diameter (cm)		
	Onions of diameter (cm)			Onions of diameter (cm)			Onions of diameter (cm)		
	<2	2-4	>4	<2	2-4	>4	<2	2-4	>4
6	10.6	52.3	107.9	1.97	3.16	4.45	6.57	7.26	4.46
8	9.8	49.0	103.0	1.75	3.14	4.24	6.46	6.99	4.37
10	8.7	49.7	103.1	1.64	3.05	4.64	6.83	6.63	3.32
12	7.9	48.8	104.0	1.61	2.95	4.87	6.36	6.46	3.96
14	7.6	48.3	105.4	1.44	2.08	4.08	6.29	9.09	2.83
Mean	8.92	49.62	104.68	1.68	2.88	4.46	6.50	7.29	3.79
LSD <sub>α=0.05</sub>	2.45	1.46	n.s.	n.s.	0.991	n.s.	n.s.	n.s.	n.s.



Moreover, onions of the mentioned above size class were characterized by significantly higher diameter when seeds were sown at 6 and 8 kg·ha<sup>-1</sup>, but only in comparison with the highest sowing rate. Also, Jadczyk and Żurawik (2004) proved in their experiment the significant effect of sowing rate on the yield quantity and quality features of plants of Japanese bunching onion.

The yield of onion cv. 'Rosa Lunga di Firenze' was characterized by a high content of dry matter, macro- and microelements (Table 3). Similar results for shallot grown for bunching harvest were shown by Orłowski et al. (2005), and for underground bulbs of top onion by Orłowski and Jadczyk (2003).

**Table 3**

**Content of dry matter , macro- and microelements in the yield of onion cv. 'Rosa Lunga di Firenze'**

Year of the study	Dry matter (%)	g·kg <sup>-1</sup> DM				mg·kg <sup>-1</sup> DM			
		N	P	K	Na	Ca	Mg	Fe	Cu
2007	29.19	15.7	5.11	14.8	0.15	2.77	0.97	350.0	11.5
2008	24.14	15.3	5.46	15.3	0.17	3.20	1.03	500.0	11.0
Mean	26.66	15.5	5.28	15.05	0.16	2.98	1.00	425.0	11.25

### CONCLUSIONS

1. Used in the experiment sowing rates had no significant effect on the yielding of onion cv. 'Rosa Lunga di Firenze'. However, the highest yield of the smallest onions was obtained when the highest sowing rate was used.
2. The highest sowing rate had a significant effect on decrease of the unit weight of onions of diameter <2 cm, as well as on decrease of the unit weight and diameter of onions of diameter 2-4 cm.
3. Yield of onion cv. 'Rosa Lunga di Firenze' was characterized by a high content mineral compounds.

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