A Possibility to Improve the Onion (*Allium Cepa* L.) Culture Technology by Direct Sowing

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ABSTRACT

The paper presents the results obtained after performing studies in the north-west part of the country, on two varieties of onion: Density 4 and Ramata rossa di Milano, direct seeded in two epochs at two densities of 2 cm and 4 cm between plants and 25 cm between rows. The majority of the plants obtained by direct sowing in autumn epoch issued floriferous stems and the culture was compromised in terms of production of bulbs. Plants obtained by direct sowing in spring epoch in both varieties and seeding densities normally developed, yielding an average of 54.12 t/ha for Density 4 to a density of 1 million pl/ha, and 51.31 t/ha at a density of 2 million pl/ha. Ramata Rossa di Milano obtained an average yield of 51,07 t/ha at a density of 1 million pl/ha and 58.38 t/ha at a density of 2 million pl/ha. Average production for the variety Density 4 to a density of 1 million pl/ha is higher than the average production at a density of 2 million pl/ha. Ramata rossa di Milano variety, at a density of 2 million pl/ha, the average yield was higher than average production at a density of 1 million pl/ha**.**

Keywords: *direct sowing, onion-yield, onion variety, plant density*

INTRODUCTION

The desire to obtain higher yields, led to the improvement and development of agro-technical measures that can modify and influence environmental conditions so as to ensure optimal conditions for plant growth. It is mandatory for the grower to know the environmental natural conditions of the area where they.

Continuous population growth requests obtaining greater and higher quality crops yields. In the measures that may lead to increased agricultural production, particularly important are those which refers to introduction aside unproductive land and increase production per a surface unit. Solving these problems is based primarily on knowing how important soil is for agricultural production (Blaga *et al.*, 2005).

The share of vegetable consumption in human nutrition has been growing and healthy eating have to include vegetables and fruits. Recently, we have seen that the standard of living is measured in the amount of vegetables that you consume (Bayer CropScience, 2014).

Onion is a profitable crop in terms of achieving a normal production. To achieve profitable crops of onions requires a certain level of production, which is estimated at 15-20 t/ha for direct sown onions and 20-25 t/ha of seedling onions. (Apahidean, 2009; Ciofu, 2003; Dina, 1979). It is generally estimated that by direct sowing the production costs are with 32% lower than the other methods of culture (Butnariu *et al*., 1992).

Popandron conducted a study in 2007 that showed that onion production is strongly influenced by used variety. Thus in this study were taken into consideration 15 varieties of onions. Production ranged from 82 t/ha to 54 t/ha.

The yields obtained in another study conducted in southern Italy by Caruso in 2010-2011 and co-workers was between 44.3 t/ha and 60.0 t/ha. The yields obtained ranged due to planting date and sowing density.

The general recommendations on plant density for onion are very different, depending by the author and experimental conditions. Some authors recommend that the minimum density of onion plants, to ensure normal production should be between 35-40 plants/mp (Bălaşa, 1973). Krug *et al*. (1986), Chaux and Foury (1995), recommend densities up to 150 plants/mp for common varieties and 80-100 and plants/mp for hybrids. Apahidean *et al*. (1996) after conducting a study on the onion culture, concluded that at an optimal water supply, the increasing plant density from 50 to 80 plants/mp led to a yield increase of 13.3% at Wolski variety and of 24.0% at the variety Red of Turda.

MATERIALS AND METHODS

In this research, two onion cultivars were used as biological material, the variety Density 4 and Ramata Rossa di Milano variety. Density 4, tardy variety with good resistance to drought and storage. The bulb is large, slightly elongated spherical, sharp to the top, golden colour, sweet taste, slightly spicy. The storage capacity and onion mildew (*Peronospora destructor*) resistance is also very good. It is suitable for fresh consumption, for storage, in food industry and for obtaining culinary spices (Figure 1).

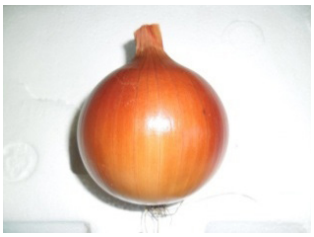

Fig.1. Density 4 variety bulb.

Fig.2. Ramata Rossa di Milano variety bulb.
(source: Căprariu, 2013, Gherla)

Ramata Rossa di Milano, tardy variety, productive, with vigorous growth, large bulbs, elongated, tapering backwards, crimson red color both outside and inside. Storage capacity is very good being suitable for fresh consumption and storage (Figure 2).

Regarding the method of work to achieve the research objectives, comparative experiments in the field were organized, which were polifactorial. The focus was on three factors: variety, sowing time and plant density, each with two graduations.

Factor A – variety
a1 - Density 4;
a2 - Ramata Rossa di Milano;

Factor B – sowing time
b1 - Spring epoch (February - March);
b2 – Autumn epoch (August - September);

Factor C – plant density
c1 – 1 million pl./ha;
c2 – 2 million pl./ha.

From the combination of experimental factors resulted eight experimental variants located in subdivided blocks, each variant had 3 repetitions (Table 1).

Total surface of experimental plots, is 14 sqm with a length of 10 m and a width of 1.4 m, and the whole experience occupied an area of 336 sqm.

The average amounts of seeds used were 4 kg/ha to a density of 1 million pl/ha and 8 kg/ha to 2 million pl/ha.

The plant density was achieved by weeding out when the plants had 2-3 leaves.

The experiment was conducted in Gherla town which is located in northwest Transylvania Plateau, on the Someşul Mic River, at the contact area between the Transylvanian Plain and Someş Plateau approximately at 47° N and 24° NE.

Gherla town has a temperate climate influenced by the hills that are nearby and without a big influence of the oceanic air masses. The average annual rainfall in the Carpathian foothills of the plateau varies between 600 and 700 mm.

The soil where were placed the experiences, is loam-clay with high humus content, poor alkaline reaction, very favourable for vegetable crops.

The thermal regime is characterized by average annual temperatures around 8°C. Early

frosts were reported in mild-September (17.IX.) and the latter frosts at the end of April (22.III.). Average duration without frosty temperatures is 180 days.

RESULTS AND DISCUSSION

In 2013 the average yield on experience was 37.76 t/ha. Under the unilateral influence of variety of bulbs on production (Table 2), the variety Ramata Rossa di Milano recorded a production increase of 4.39 t/ha, significantly distinct versus variety Density 4, considered control. If the average experience is considered control, the difference recorded by the two varieties is 2.20 t/ha, positive for Ramata Rossa di Milano and negative for Density 4. Difference in statistically significant.

The variants sown in autumn obtained a much lower yield than the ones sown in spring. The spring epoch obtained an average yield of 53.72 t/ha and the autumn epoch registered an average yield of 21.80 t/ha. The difference obtained was of 31.92 t/ha, that shows that the autumn culture was compromised. The main cause of low yield obtained is the very high percentage of plants that formed floriferous stems (Table 3).

Tab. 1. Experimental variant at Gherla, 2013-2015

Variant	Variety	Sowing time	Density (million pl/ha)
V1-a1b1c1	Density 4	Spring epoch	1
V2-a1b1c2	Density 4	Spring epoch	2
V3-a1b2c1	Density 4	Autumn epoch	1
V4-a1b2c2	Density 4	Autumn epoch	2
V5-a2b1c1	Ramata rossa di Milano	Spring epoch	1
V6-a2b1c2	Ramata rossa di Milano	Spring epoch	2
V7-a2b2c1	Ramata rossa di Milano	Autumn epoch	1
V8-a2b2c2	Ramata rossa di Milano	Autumn epoch	2

Tab. 2. Unilateral influence of the onion variety on the obtained yield at Gherla, 2013

Variant / Variety	Average yield t/ha	Average yield %	Differences t/ha	Significance	Relative yield (%)	Differences t/ha	Significance
Density 4 (Mt.)	35.57	100.0	-	-	94.2	-2.20	o
Ramata rossa di Milano	39.96	112.3	4.39	**	105.8	2.20	*
Average (Mt.)	37.76	-	-	-	100.0	-	-
DL/*LSD* (p 5%)			1.39			1.39	
DL/ *LSD* (p 1%)			3.20			3.20	
DL/ *LSD* (p 0,1%)			10.19			10.19	

Tab. 3. Unilateral influence of the sowing time on the obtained yield at Gherla, 2013

Variant / Sowing time	Average yield t/ha	Average yield %	Differences t/ha	Significance	Relative yield (%)	Differences t/ha	Significance
Spring epoch (Mt.)	53.72	100.0	-	-	142.3	15.96	***
Autumn epoch	21.80	40.6	-31.92	ooo	57.7	-15.96	ooo
Average (Mt.)	37.76	-	-	-	100.0	-	-
DL/LSD (p 5%)			0.35			0.35	
DL/ LSD (p 1%)			0.58			0.58	
DL/ LSD (p 0,1%)			1.09			1.09	

Analyzing the unilateral influence of plant density per unit area on the production of bulbs (Table 4), it can be observed that the experimental variants with higher density (2 million pl/ha) recorded a production increase, significantly distinct versus experimental variants with a density of 1 million plants/ha, (control) due to the higher number of bulbs per unit area, even if the average weight of the bulb was lower at the variants with a higher density.

The combined influence of the variety and the sowing date on bulbs yield (Table 5) shows that the highest level of yield, 54.73 t/ha, was obtained by the variety Ramata Rossa di Milano sown in spring. The Density 4 yield was also higher in the spring, but lower in comparison with Ramata Rossa di Milano with 2.01 t/ha.

In autumn epoch, thanks to lower percentage of plants that have issued floriferous steam Ramata Rossa di Milano obtained an yiled with 6.77 t/ha higher than the variant considered control.

The yields obtained in another study conducted in southern Italy by Caruso in 2010-2011 and co-workers was between 44.3 t/ha and 60.0 t/ha. The yields obtained ranged due to planting date and sowing density.

An average for the entire experience, Density 4 recorded the highest yield at a density of 1 million plants/ha. The obtained difference was statistically assured like very significant (2.76 t/ha).

Ramata Rossa di Milano has achieved the highest level of yield at a density of 2 million plants/ha, with a highly-significant difference of 4.85 t/ha, (Table 6).

Bulbs production was favored by the increase of plant density only in spring epoch, which registered a growth of 4.1%, (Table 7).

Tab. 4. Unilateral influence of the plant density on the obtained yield at Gherla, 2013

Variant	Average yield		Differences t/ha	Significance	Relative yield (%)	Differences t/ha	Significance
Plant density (million. pl/ha)	t/ha	%					
1 (Mt.)	37.24	100.0	-	-	98.6	-0.52	ns
2	38.28	102.8	1.04	**	101.4	0.52	ns
Average (Mt.)	37.76	-	-	-	100.0	-	-
DL/LSD (p 5%)			0.66			0.66	
DL/ LSD (p 1%)			0.97			0.97	
DL/ LSD (p 0,1%)			1.45			1.45	

Tab.5. The combined influence of the variety and the sowing time on the obtained yield at Gherla, 2013

Experimental Variant		Average yield		Differences t/ha	Significance	Relative yield (%)	Differences t/ha	Significance
Variety	Sowing time	t/ha	%					
Density 4	Spring (Mt.)	52.71	100.0	-	-	98.1	-1.01	ns
Ramata rossa di Milano	Spring	54.73	103.8	2.01	*	101.9	1.01	ns
Average (Mt.)		53.72	-	-	-	100.0	-	-
Density 4	Autumn (Mt.)	18.42	100.0	-	-	84.5	-3.39	oo
Ramata rossa di Milano	Autumn	25.19	136.8	6.77	**	115.5	3.39	**
Average (Mt.)		21.80	-	-	-	100.0	-	-
DL/*LSD* (p 5%)				1.42			1.42	
DL/ *LSD* (p 1%)				3.19			3.19	
DL/ *LSD* (p 0,1%)				9.88			9.88	

Tab.6. The combined influence of the variety and the plant density on the obtained yield at Gherla,2013

Experimental Variant		Average yield		Differences	Significance	Relative yield	Differences	Significance
Variety	Plant density	t/ha	%	t/ha		(%)	t/ha	
Density 4 (Mt.)	1	36.95	100.0	-	-	103.9	1.38	**
Density 4	2	34.18	92.5	-2.76	ooo	96.1	-1.38	oo
Average (Mt.)		35.57	-	-	-	100.0		
Ramata rossa di Milano (Mt.)	1	37.53	100.0	-	-	93.9	-2.42	ooo
Ramata rossa di Milano	2	42.38	112.9	4.85	***	106.1	2.42	***
Average (Mt.)		39.96	-	-	-	100.0	-	-
DL/*LSD* (p 5%)				0.94			0.94	
DL/ *LSD* (p 1%)				1.37			1.37	
DL/ *LSD* (p 0,1%)				2.05			2.05	

Tab. 7. The combined influence of the plant density and the sowing date on the obtained yield Gherla, 2013

Experimental Variant		Average yield		Differences	Significance	Relative yield	Differences	Significance
Plant density	Sowing time	t/ha	%	t/ha		(%)	t/ha	
1	Spring (Mt.)	52.59	100.0	-	-	97.9	-1.13	o
2	Spring	54.85	104.3	2.25	***	102.1	1.13	*
Average (Mt.)		53.72	-	-	-	100.0	-	-
1	Autumn (Mt.)	21.89	100.0	-	-	100.4	0.08	ns
2	Autumn	21.72	99.2	-0.17	ns	99.6	-0.08	ns
Average (Mt.)		21.80	-	-	-	100.0	-	-
DL/*LSD* (p 5%)				0.94			0.94	
DL/ *LSD* (p 1%)				1.37			1.37	
DL/ *LSD* (p 0,1%)				2.05			2.05	

Tab. 8. The combined influence of the experimental factors on the obtained yield at Gherla, 2013

Experimental Variant			Average yield		Differences	Significance	Relative yield (%)	Differences	Significance
Variety	Sowing time	Density (million pl/ha)	t/ha	%	t/ha			t/ha	
Density 4	Spring epoch	1 (Mt.)	54.12	100.0	-	-	102.9	1.53	ns
Ramata rossa di Milano	Spring epoch	1	51.07	94.4	-3.05	o	97.1	-1.53	ns
Average (Mt.)			52.59	-	-	-	100.0	-	-
Density 4	Spring epoch	2 (Mt.)	51.31	100.0	-	-	93.5	-3.54	oo
Ramata rossa di Milano	Spring epoch	2	58.38	113.8	7.08	**	106.5	3.54	**
Average (Mt.)			54.85	-	-	-	100.0	-	-
Density 4	Autumn epoch	1 (Mt.)	19.77	100.0	-	-	90.4	-2.11	o
Ramata rossa di Milano	Autumn epoch	1	24.00	121.4	4.33	**	109.6	2.11	*
Average (Mt.)			21.89	-	-	-	100,0	-	-
Density 4	Autumn epoch	2 (Mt.)	17.06	100.0	-	-	78.6	-4.66	oo
Ramata rossa di Milano	Autumn epoch	2	26.38	154.6	9.32	***	121.4	4.66	**
Average (Mt.)			21.72	-	-	-	100.0	-	-
DL/*LSD* (p 5%)					1.63			1.63	
DL/ *LSD* (p 1%)					3.11			3.11	
DL/ *LSD* (p 0,1%)					7.97			7.97	

Under the combined influence of the three experimental factors (Table 8), the highest production was obtained by Ramata Rossa di Milano in spring epoch, at a density of 2 million plants/ha. The obtained yield was of 58.38 t/ha, with a difference of 4.26 t/ha comparing it with the control. The difference was statistically assured as distinctly significant.

The yield obtained at the variant sown in autumn, was much lower than the ones sown in spring. Comparing the yields obtained by the variants, it can be observed that Ramata Rossa di Milano, at a higher density, registered the highest production.

CONCLUSIONS

Plants obtained by direct sowing in the autumn epoch have issued floriferous steam, both cultivars, and both sowing densities, so the culture was compromised in terms of production of bulbs. Plants obtained by direct sowing in spring epoch in both varieties and sowing densities were normally developed, yielding an average of 54.12 t/ha for variety Density 4, to a density of 1 million pl/ha, and 51.31 t/ha at a density of 2 million plants/ha. The variety Ramata Rossa di Milano obtained an average yield of 51.07 t/ha at a density of 1 million plants/ha and 58.38 t/ha at a density of 2 milion plants/ha. The highest percentage of first quality of the yield was at varieties, Density 4 and Ramata Rossa di Milano, sown in spring epoch at a density of 1 million pl/ha.

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