Volume 15(1), 147- 150, 2011
JOURNAL of Horticulture, Forestry and Biotechnology

Improvement the growing technology of table potato by optimization the nutrition space

Nemes Zsuzsanna[1]*, Baciu Anca[1], Motica R.[1], Mike Luiza[1]

[1]Potato Research and Development Station, 55 Ady Endre Str., zip code: 525400, Targu Secuiesc, Romania, tel.: 0040267363755, fax: 0040267361770

*Corresponding author. Email: scdc@clicknet.ro

Abstract It is hard to appreciate the optimal density because the potato is that plant which can easily adapt to different forms and shapes of nutrition areas and assimilation. It can be even stated that there is no generally valid optimal planting density as there are no varieties of equally tubers in the nest or equal shapes of the bushes formed of different tubers. Planting the unsized tubers (30-55mm) is a wrong practice which will lead to the inequality of the culture (as density, line distribution and springing moment), to the growth of blankness in the culture, increasing the planting norms and the expenses. To contribute to the improvement of technology to cultivate consumption potato we have proposed some highly topical objectives. To achieve the proposed research objectives it was conceived this experience in the conditions of experiencing field between 2006-2008.These objectives have considered factors and graduations which target the elements of perfecting the cultivation technology of the consumption potato in the conditions of the Targu Secuiesc basin. These elements of technology refer to biological factors represented by the created soil or adapted to the pedoclimatical conditions of the area which are represented by density and size of the planting material.

Key words

potato, density, optimization, soil, technology

The planting density of potato must choose, first of all, for regarding of crop and improving the quality of yield and less for the level of yield. At present, the distance of planting between rows in Romania is 70-75 cm. In the most of countries in Europe, the planting machinery is designed for these distances with multiple possibilities to regulate the distance between tubers on the row.

The passing to larger distance between rows required intensively researches for establishing the optimum distance for planting (1, 4).

The promotion of some technologies to specific conditions and obtaining of maximum efficiency requires as each technological measure must be applied taking into account the plants requirements, the vegetation factors, the soil and climate influence, and the influence of these on yield formation and economical result on short and long term (2).

The modern growing technologies must to supply a high productivity and efficiency beside of environment protection (3, 5).

Material and Method of Research

Experimental factors:
Factor A: years of experimental: a_1 – 2006, a_2 – 2007, a_3 – 2008
Factor B: density of planning: b_1 – 53300 pl/ha, b_2 – 65000 pl/ha
Factor C: size of planted tubers: c_1 – < 30mm, c_2 – 30 – 45mm, c_3 – 45 – 55mm, c_4 – >55mm.
Biological material: *Redsec*, medium late variety, created by Station of Research and Development of Potato, Tg. Secuiesc.
The placing of experiment has been done, by subdivision plats with 3 repetitions, in non irrigated condition.
During vegetation period the following observations have been done:

- Date of the main agrotechnical measures.
- Date of the main growing stages.
- Number of plants on the 2 rows in the middle.
- Harvesting on variants and repetitions:

- Number and weight of tubers > 60 mm;
- Number and weight of tubers 30 – 60 mm;
- Number and weight of tubers <30 mm;

Calculation and interpretation of results was done by method of variable analysis, and for the assessment multiple comparison (Duncan).

Table 1

Climatic conditions in experimental years 2006-2008 during the potato′s vegetation period

Month	Air temperature (°C)				Precipitation (mm)			
	Average				Average			
	Annual			MMA	Annual			MMA
	2006	2007	2008		2006	2007	2008	
April	8.4	9.2	9.2	8.0	40.0	47.2	34.4	38.5
May	14.5	13.7	12.9	13.0	24.0	-	37.6	70.8
June	15.7	16.7	21.4	16.2	119.0	105.4	21.4	84.0
Julie	18.9	18.8	22.0	17.9	110.4	42.8	63.4	78.7
August	18.2	18.7	22.7	17.4	139.2	160.2	152.8	62.7
September	13.5	13.4	13.7	13.3	70.2	55.4	74.0	45.3
AVERAGE	**14.8**	**15.08**	**16.9**	**14.5**	**X**	**X**	**X**	**X**
AMOUNT	**X**	**X**	**X**	**X**	**502.8**	**411.0**	**383.6**	**380.0**

Source: Weather Statio of Tg.Secuiesc

Result and Discussions

The influence of planting density and seed size calibration on tuber yield > 60 mm, in non irrigated condition

During the research period (2006–2008), the average tuber yield over 60 mm was 13.9 to/ha, with any significantly difference between years (Table 2).

The lower density (53300 plants/ha) was more favorable for higher yield (16.5 to/ha) beside 11.3 to/ha at higher density (65000 plants/ha) with significantly difference between them.

The effect of planting density had significantly differences in two of three years (2006 and 2008 opposite of 2007). The some yield over 60 mm was for both planting densities.

However the tuber yield over 60 mm obtained at different seed size had not significantly difference it comes out that an easy increase of big tuber yield at smaller seed size.

Table 2

The influence of the density and the planting material's size on the production of tubers larger than 60 mm, in the case of the REDSEC variety (Tg. Secuiesc, average values 2006-2008)

Density thousand planting holes/ha	Calibration (mm)	Tuber production > 60 mm							
		2006		2007		2008		Average 2006-2008	
		t/ha	Duncan test	t/ha	Duncan test	t/ha	Duncan test	t/ha	Duncan test
53.3	<30	13.1	DEF	17.8	CD	13.1	DEF	14.6	B
	30–45	11.9	EF	20.4	BC	13.2	DEF	15.2	B
	45–55	14.4	DEF	25.9	A	14.1	DEF	18.2	A
	>55	15.0	DEF	24.4	AB	14.6	DEF	18.0	A
Average		**13.6**	**B**	**22.1**	**A**	**13.7**	**B**	**16.5**	**-**
65.0	<30	14.0	DEF	6.9	GH	15.0	DEF	11.9	C
	30–45	10.3	FG	12.0	EF	13.4	DEF	11.9	C
	45–55	11.0	EFG	6.6	GH	13.8	DEF	10.4	C
	>55	12.2	EF	4.4	H	16.8	CDE	10.9	C
Average		**11.9**	**B**	**7.5**	**C**	**14.5**	**B**	**11.3**	**-5.2^{O}**
***	**1**	**13.5**	**ABC**	**12.4**	**BC**	**14.0**	**ABC**	**13.3**	**A**
	2	**11.1**	**C**	**16.2**	**A**	**13.3**	**ABC**	**13.5**	**A**
	3	**12.7**	**ABC**	**16.2**	**A**	**13.9**	**ABC**	**14.3**	**A**
	4	**13.6**	**ABC**	**14.4**	**ABC**	**15.4**	**AB**	**14.5**	**A**
Average		**12.8**	**A**	**14.8**	**A**	**14.2**	**A**	**13.9**	

LSD (year) – 4.1 t/ha
LSD (density) – 1.2 t/ha
LSD (year*density) – 2.8 t/ha
LSD (calibration) –1.8 t/ha
LSD (density*calibration) - 2.6 t/ha
LSD (year*density*calibration) – 4.0 t /ha

Differences of yield caused by seed size was demonstrated by lower density, where by using smaller tubers than 30 mm or 30-45 mm was obtained lower yield (14.6-15.2 to/ha), beside by using seed size of 40-55 mm or over 55 mm with an yield around 18 to/ha (Table 2).

The influence of planting density and seed size calibration on tuber yield of 30-60 mm in non irrigated condition

The average tuber yield of 30-60 mm (Table 2) was between 13.2 and 14.8 to/ha with any statistically difference. A higher yield of 4.9 to /ha was influenced by increase of planting density from 53300 plants/ha to 65000 plants/ha (Table 3).

Table 3

The influence of the density and the planting material's size on the production of 30-60mm tubers, in the case of the REDSEC variety
(Tg. Secuiesc, average values 2006-2008)

Density thousand planting holes/ha	Size (mm)	Production of 30-60 mm tubers							
		2006		2007		2008		Average 2006-2008	
		t/ha	Duncan test	t/ha	Duncan test	t/ha	Duncan test	t/ha	Duncan test
53.3	<30	10.0	GHI	4.2	J	11.8	FGH	8.7	D
	30–45	16.0	BCDEF	6.5	IJ	14.0	CDEFG	12.19	C
	45–55	13.9	CDEFG	7.9	HIJ	14.2	CDEFG	12.0	C
	>55	18.6	ABC	6.2	IJ	17.5	ABCD	14.3	BC
Average		**14.6**	**B**	**6.3**	**C**	**14.4**	**B**	**11.7**	**-**
65.0	<30	12.4	DEFGH	20.1	AB	11.9	EFGH	14.8	BC
	30–45	17.3	ABCDE	20.9	AB	15.9	BCDEF	18.0	A
	45–55	17.5	ABCD	16.9	BCDEF	16.0	BCDEF	16.8	AB
	>55	11.9	EFGH	22.4	A	16.7	BCDEF	17.0	AB
Average		**14.8**	**B**	**20.1**	**A**	**15.1**	**B**	**16.6**	**+4.9**
***	<30	**11.2**	**D**	**12.2**	**BCD**	**11.9**	**CD**	**11.7**	**B**
	30–45	**16.6**	**A**	**13.7**	**ABCD**	**14.9**	**ABCD**	**15.1**	**A**
	45–55	**15.7**	**AB**	**12.4**	**BCD**	**15.1**	**ABC**	**14.4**	**A**
	>55	**15.2**	**ABC**	**14.5**	**ABCD**	**17.1**	**A**	**15.6**	**A**
Media		**14.7**	**A**	**13.2**	**A**	**14.8**	**A**		

LSD (year) - 2.6 t/ha
LSD (density)–0.8t/ha
LSD (year*density) – 2.0 t/ha
LSD (calibration) – 1.8 t/ha
LSD (density*calibration) - 2.6 t/ha
LSD (year*density*calibration) - 4.6 t/ha

Regarding the effect of seed size, the lower yield (11.7 to/ha) was obtained at planting of small tubers, comparatively with 16.6 to /ha (the average of all seed size.)
The level of tuber yield of 30-60 mm for both planting densities was significantly lower when used small tubers (< 30 mm) were.

The influence of the planting density and the size of the planting material on the average number of tubers per planting hole in non irrigated condition

The average number of tuber of *Redsec* variety was 8.5 tuber / planting hole, as average of 3 years (2006-2008). The number of tubers at *Redsec* variety is very constant in the combination with the experimental factors (Table 4).

Table 4

The influence of the density and the planting material's size on the average number of tubers / planting hole, in the case of the *REDSEC* variety (Tg. Secuiesc, average values 2006-2008)

Density thousand planting holes/ha	Size (mm)	Average number of tubers / planting hole							
		2006		2007		2008		Average 2006-2008	
		Nr.tub./ plant. hole	Duncan test	Nr.tub./ plant. hole	Duncan test	Nr. tub./ plant. hole	Duncan test	Nr.tub./ plant. hole	Duncan test
53.3	<30	7.5	EFG	6.6	G	8.3	DEFG	7.5	C
	30–45	9.3	BCDE	6.5	G	8.6	CDEF	8.1	BC
	45–55	9.4	BCDE	7.9	EFG	10.3	ABCD	9.2	A
	>55	10.6	AB	7.6	EFG	10.3	ABC	9.5	A
Average		**9.2**	**A**	**7.1**	**C**	**9.4**	**A**	**8.6**	**-**
65.0	<30	7.1	FG	8.7	BCDEF	7.1	FG	7.6	C
	30–45	8.8	BCDEF	8.9	BCDEF	8.8	BCDEF	8.8	AB
	45–55	8.1	EFG	8.7	BCDEF	7.7	EFG	8.1	BC
	>55	8.2	EFG	11.3	A	9.0	BCDEF	9.5	A
Average		**8.0**	**B**	**9.4**	**A**	**8.1**	**B**	**8.5**	**-0.1**
***	<30	**7.3**	**D**	**7.6**	**CD**	**7.7**	**CD**	**7.5**	**C**
	30–45	**9.0**	**AB**	**7.7**	**CD**	**8.7**	**ABC**	**8.5**	**B**
	45–55	**8.7**	**ABC**	**8.3**	**BCD**	**9.0**	**ABC**	**8.7**	**B**
	>55	**9.4**	**AB**	**9.4**	**AB**	**9.7**	**A**	**9.5**	**A**
Average		**8.6**	**A**	**8.3**	**A**	**8.8**	**A**	**8.5**	

LSD (year) – 0.9t/ha
LSD (density) – 0.3t/ha
LSD (year*density) – 0.8t/ha
LSD (size) – 0.6t/ha
LSD (density*size) – 0.9t/ha
LSD (year*density*size) – 1.0t/ha

It is any difference between the planting densities. But however in two of three years, the number of tubers was higher at low density than high density, but with any significance. The relationship between seed size and number of tuber/ planting hole. In the case of using at planting tubers of 40-55 mm and tuber over 55 mm, the number of tubers formed/ planting hole, the difference between seed sizes was much stronger at lower density (Table 4), where the larger nutrition space has an influence on tuberization.

Conclusions

- The utilization of tubers with different sizes for planting could influence the yield at lower density only. The planting of tubers over 55 mm is recommended at a lower density and the planting of small tubers must be planted at higher density. The tuber yield of be planted at a higher density. The tubers yield of 30-60 mm is not influenced by relation between planting density x seed size in the limit of study factors.
- The planting density must be established in the aim of high efficiency and quality of tuber size according to consumer requirements and less for higher total yield. The planting density must be a main factor to maintain a constant yield, between 53300 and 65000 plants/ha.
- The nutrition space for table potato could be optimized by harmonious joining of seed tubers planting density. In the limits of 53300-65000 plants/ha the nutrition is optimal and the yield capacity is regulated for the same tuber yield for consumption.

References

1.Ianosi, S. (1994) – Densitatea culturii şi norma de plantare la cartof, Cartoful în România, vol. 4., nr. 2, p. 14 – 17.

2.Ianosi, S. (1995) – Norma de plantare la cartof , Cartoful în România, vol.5, ian – mart. p. 20 – 24.

3.Ianosi, S. (2002) – Bazele cultivării cartofului pentru consum, Edit. Phoenix Braşov, ISBN: 973-8416-04-3.

4.Tsahkna A., (2008): The potato varieties in various and weather conditions. Annals of National Institute of Research and Development for Potato and Sugar Beet (INCDCSZ Brasov), supplement (2008). 17th triennial conference of the European Association for Potato Research, Brasov, I.S.S.N. 1016-4790: 424-428.