

THE ASPECTS CONCERNING THE INFLUENCE OF SOME CHARACTERISTICS OF THE EPIGEE PHYTOMASS ON THE POTATO RATED CAPACITIES

ASPECTE PRIVIND INFLUENȚA UNOR CARACTERISTICI ALE FITOMASEI EPIGEICE ASUPRA RANDAMENTELOR DE CARTOF

BODEA D.

Agricultural Research and Development Station of Suceava

Abstract. *In the experiment structure, for emphasize of interrelations between some characteristics of epigee phytomass and the tubers rated capacities, six potato cultivars belonging earlier (Ostara and Magic), semi earlier (Astral and Rapsodia) and semi later (Sante and Desirée) groups were included. The biggest tuber numbers/hole was registered at cultivars Rapsodia and Desire(13) and smaller at the earlier cultivars. The number of the tubers/hole was correlated significant ($r=0,92$) with number of the main stems. In the comparison with earlier cultivars the tubers dominance at the formatting of the epigee phytomass, it was accomplished 10 days delayed at the semi earlier cultivars, and 20 days delayed at the semi later cultivars. The biggest tuber rated capacities were registered at the cultivar Rapsodia. It observed that between the tubers rated capacities and the main characteristics of the epigee phytomass (the total weight, maximum leaf surface, cumulated leaf index and the net assimilation rate) there are the most favourable reporting.*

Rezumat. *Pentru evidențierea unor interrelații dintre unele caracteristici ale fitomasei epigeice și randamentele de tuberculi, în structura experiențelor au fost incluse șase soiuri de cartof aparținând grupelor timpurii (Ostara și Magic), semitimpurii (Astral și Rapsodia) și semitârzii (Sante și Desirée). Numărul tuberculilor a fost mai redus la soiurile timpurii, iar dintre soiurile testate, Rapsodia și Desire au avut cel mai mare număr la cuib (13). Numărul acestora s-a corelat satisfăcător ($r=0,92$) cu cel al tulpinilor principale. Comparativ cu soiurile timpurii, dominanța tuberculilor la alcătuirea fitomasei epigeice s-a realizat mai târziu cu zece zile la cele semitimpurii și cu douăzeci de zile la cele semitârzii. Cele mai mari randamente de tuberculi s-au înregistrat la soiul Rapsodia, la care între acestea și principalele caracteristici ale fitomasei epigeice (greutatea totală; suprafața foliară maximă, indicele foliar cumulat și rata asimilației nete) au existat cele mai benefice raportări.*

The major influences on the rated capacity at the surface unit, have been place during formation and tubers growing stages. The tubers formation is preceded by stolons appearance, which can be recorded sometimes at 60 days after planting, (IANOȘI S., 1994) and other time, during realization of one leaflets index, on 1,5-2,0 (BIANU T., 1996, PLĂMĂDEALĂ B., and colab., 1999). From physiological point of view, as consequence of presence of important active photosynthetic surface have been place a high carbohydrates transfer to the stolons primordies. After a radia expansion period of the stolons, their thickness and a good supply with carbohydrates, in order to maintain the tubers process, have been place, their migration to the top of the stolons (MOKRONOSOV T.A., 1990). At the end of this phenophase follow the first stage of the tubers growing, which depended by the carbohydrate, hormones, macro and micro elements contents, so

that, to be capable to maintain the mitotic division. *PETERSON L.R., and colab. (1985)*, say that the tubers growing in this manner have been until they have a diameter on 30 mm and the middle weight is 30-40 gr.

The increase of the nutritive substances proportions for tubers growing (*MORBY J., MI-THORDE F.L., 1975*), constituted the main support for stage covering by intensive tubers growing. These processes are accomplished only by cellular extensions (*COUTREZ – GEERINCK DANIELLE; 1972, PETERSON L.R., 1985*). Often, the biggest tubers growing rates it overlapped with the stage when it realized the largest leaf surface actively photosynthetic (*BURTON W.G., 1989*). After touching of a maximum accumulating rates, function by genetic structure of the cultivars, it follow a new stage on progressive senescence of the leafs, which is reflected through continuous diminishing of the tubers growth rate and finalising of some physico chemical characteristics of the whole tuber (*MAC KERRON D.L., DEVIES M.V., 1986, SRUIK C.P., WIERSWMA G.S., 1999*).

BIOLOGIC MATERIAL AND RESEARCH METHOD

In the experiments structure, for emphasize of some aspects concerning the influence of some characteristics of epigee phytomass upon tubers rated capacities, six potato cultivars belonging earlier (Ostara and Magic), semi earlier (Astral and Rapsodia) and semi later (Sante and Desirée) groups were included. We selected these cultivars because there are some differences among them, referring to characteristics of the phenotype. The field design was realized after blocks method in three replications. All crop measures in according with adequately technology of the Suceava Plateau conditions, were accomplished.

RESULTS AND DISCUSSIONS

Referring to the middle number of the tubers/hole (table 1) we observed some aspects. The relatively stability of tubers number, 10 days later at the semi earlier cultivars and 20 days later at the semi later cultivars was accomplished, in comparison with earlier cultivars. Concerning the tubers number, among the three precocity groups there are not big differences. Thus at the earlier cultivars 8-9 tubers/hole, 11 tubers/hole at cultivar Astral were harvested. The biggest tubers number/hole at the cultivar Rapsodia (semi earlier cultivar) and Desiree (semi later cultivar) were harvested. The cultivars Sante and Astral had in more stages approximately the same number of tubers/hole. Almost the cultivar Sante had a good capacity for tuberization until the end of the July. This characteristic there is at the cultivars Rapsodia and Desiree, too. The tuberization was accomplished with more intensity, when the plants realized the leaflet index on 1,3-1,5, in comparison with the stage when the leaflet index was 0,3-0,4. Concerning the dependence of the tubers number by the stolons number (maximum number) can not be pointing out the interrelations on proportionality, because the correlation coefficient is only 0,746. The correlation coefficient on 0,923** shows a bigger dependence of the tubers number by the main stems. The data from the table 1 emphasize that the maximum number of the stolons was registered in the stage when their tuberization was very slowly. It is necessary to mention that the untuberized stolons numbers, which maintained more stages, was bigger then the tubers number/hole (2,5-3,0 times).

Table 1

**The dynamic of the stolons and tubers number/hole
(average of the years 1997 and 1999)**

Cultivar	Vegetation period															
	10		20		30		40		50		60		70		80	
	No. stol	No. tub.	No. stol.	No. Stol	No. stol.	No. sto.	No. stol.	No. Stol	No. stol.	No. stol	No. stol.	No. Stol	No. stol.	No. Stol	No. stol.	No. stol
Ostara	4	-	15	-	22	6	17	7	13	8	12	8	8	8	-	8
Magic	6	-	19	-	27	7	24	8	21	9	18	9	12	9	-	9
Astral	6	-	21	-	31	9	27	10	24	10	20	11	12	11	-	11
Rapsodia	9	-	23	-	30	9	33	10	26	12	22	12	16	13	-	13
Sante	8	-	18	-	27	8	30	9	27	11	22	11	16	12	-	12
Desirée	9	-	20	-	29	9	32	11	29	12	24	12	18	13	-	13
DL 5 %	2	-	2	-	4	1	5	1	5	1	3	1	3	2	-	2

The cultivars Rapsodia and Desiree have the same characteristics, concerning the middle tubers number/hole, the dynamic of the stolons tuberization and the transformation percentage of the stolons in the tubers (37-38%). The tubers weight in the epigee phytomass after 30 vegetation days, at the earlier cultivars was on 1,4 times bigger in comparison with the tubers weight realized by the semi earlier cultivars and on 2 times in comparison with registered values at the semi late cultivars (table 2). Also, from the table 2, it observed that the tubers percentage registered at the earlier cultivars, in a certain stage, it was registered after 10 days at the semi earlier cultivars and after 20 days at the semi later cultivars.

Table 2

Participation of the tubers to the making of the epigee phytomass (%)

Cultivar	Vegetation period							
	30	40	50	60	70	80	90	100
Ostara	30	39	45	57	68	80	-	-
Magic	24	40	45	56	66	80	-	-
Astral	20	32	37	46	54	64	77	-
Rapsodia	18	33	41	47	55	64	78	-
Sante	14	23	34	41	49	59	68	79
Desirée	15	24	36	42	45	53	65	81

Making up the variation series with registered values at „n” days of vegetation of the earlier cultivars, n + 10 days at the semi earlier cultivars and n +20 days at the semi later cultivars, the variability coefficients (S%) have values between 0,01 and 0,2.

The evaluation method of the T. K.Goluvko (1986) was confirmed only at the earlier cultivars, because the tubers weight must represent 70% from the whole phytomass. In Suceava conditions during experiments, in order to accomplish the above condition, the semi earlier cultivars have to grows another 10 days and the semi later cultivars another 20 days (70 days from the germinating). The middle weight of the tubers/hole was 565 -686 g at the earlier cultivars, 721 -784 gr. at the semi earlier

cultivars and 669-758 gr. at the semi later cultivars (table 3). The yield crop of the cultivar Sante was over fulfilled by the cultivars Ostara and Astral until the second stage on harvesting (40 days of vegetation) and by cultivar Magic until fifty stage (70 days of vegetation). Also, the cultivar Desirée accomplished the same yield crop like cultivar Sante, but after 60 days of vegetation was over fulfilled by the cultivar Sante.

Table 3

**The evolution of the weight tubers – g/shrub
(average of the years 1995-1999)**

Cultivar	Specification	Days of vegetation							
		30	40	50	60	70	80	90	100
Ostara	Average	99	208	304	424	491	565	-	-
	Diference	44***	69 ***	22	19	-53	-81	-	-
Magic	Average	93	252	383	545	624	686	-	-
	Diference	38***	113 ***	101***	140***	80*	40	-	-
Astral	Average	78	191	292	415	546	667	721	-
	Diference	23 **	52 ***	10	10	2	31	1	-
Rapsodia	Average	75	200	342	472	601	706	784	-
	Diference	20 **	61***	60 **	67**	57	60	64	-
Sante	Average	55	139	282	405	544	646	720	758
	Diference	Standard							
Desirée	Average	56	132	276	388	475	549	623	669
	Diference	1	-7	-6	-17	-69 ⁰	-97 ⁰	-97 ⁰	-89 ⁰

At the plants maturity, the smallest weight tubers/hole was registered at the cultivar Ostara (565 g), followed by Magic and Desirée (686 g and respectively 669 g). The cultivars Astral (721 g), Sante (758 g) and Rapsodia (784 g) registered the biggest yields. After 30 days from the germinating it registered a middle weight of one tuber on 96 g at earlier cultivars, on 77 g at semi later cultivars. The included period between 30 and 50 days of vegetation, through a rapidly development of the tubers, especially at the semi later cultivars (5,13 times at Sante and 4,93 times at Desirée) are manifested. A rapidly grows rhythm at the cultivar Rapsodia (4,56 times) and Magic (4,12 times), was registered.

During period 50 – 70 days of vegetation the growing of the weight tubers was diminished at all cultivars. After 50 days of vegetation the most important grows of the tubers were registered at the cultivars Sante (1,92 times), Astral (1,86 times), Rapsodia (1,75 times) and Desirée (1,72 times).

The analyzes of the decades rhythm emphasize that, 75-80% form the annual yields, after 60 days of vegetation, at the cultivars Ostara and Magic, after 70 days of vegetation for cultivars Astral and Rapsodia and after 75-80 days of vegetation for cultivars Sante and Desirée, were registered. The data from the table 4 emphasize the possibility of the rated capacities dependence by the earlier stages. Generally the contoured tendencies after 30 days of vegetation was kept with a significant fidelity not only after 10 days ($r = 0,846$ ***), and after 20 days ($r=0,648$ ***). This temporary

correlation between tendencies in years 1998, 1999, was more significant at the cultivars Magic and Sante.

Table 4

The induction of the initial rated capacity upon rated capacities registered after 40-50 days of vegetation („r”)

Specification		Rated capacities	
		40 zile	50 zile
Years	1995	0,616	0,168
	1996	0,578	0,626
	1997	0,783	0,626
	1998	0,968 **	0,794
	1999	0,977 **	0,774
	1995-1999	0,846 **	0,648 **
Cultivars	Ostara	0,849	0,805
	Magic	0,951 *	0,990 ***
	Astral	0,768	0,739
	Rapsodia	0,259	0,326
	Sante	0,816	0,993 ***
	Desirée	0,632	0,774

The net assimilation rate represent the division between final yield and leaf surface of one shrub after 30 days from the germinating. The biggest values of the net assimilation rate (ran) were registered at the cultivars Ostara and Magic (table 5). The cultivars Magic and Desiree have a different net assimilation rate but these cultivars have the same yield level (686 g and respectively 669 g/hole), that mean the „ran” depended by not only the epigee phytomass and by his influence upon the crop biology.

Table 5

The dependence of the net assimilation rate (r.a.n) by the used cultivars¹⁾

Cultivar	Years					Average		
	1995	1996	1997	1998	1999	r.a.n.	Differences	Significances
Ostara	19,7	16,7	14,2	20,1	27,3	19,6	6,7	***
Magic	18,0	19,8	20,0	19,1	23,0	20,0	7,1	***
Astral	12,7	17,5	15,8	13,8	13,7	14,7	1,8	
Rapsodia	13,3	17,2	16,7	15,5	16,9	15,9	3,0	
Sante	11,5	13,1	10,8	15,1	14,2	12,9	Mt	
Desirée	11,6	13,2	10,2	12,7	13,5	12,0	-0,9	
DL 5 %	2,4	1,3	1,8	1,4	2,8	3,0		

1) – the rated capacity (g.) at 1² on leaf surface, cumulated by one shrub, after 30 days of vegetation.

The data from the table 6 emphasize that the biggest rated capacity of the tubers was registered when this indicator was influenced by more characteristics of the crop yield. Thus, at the cultivar Rapsodia, all four characteristics had a significant contribution to accomplishing of the biggest yield of tubers. But at the cultivar Ostara the smallest rated capacity of the tubers was registered, any characteristics of the crop did not correlate with the yield potential.

Table 6

The influences of some characteristics of the green phytomass upon the tubers rated capacities of one shrub („r”)

Cultivar	Correlated characteristics			
	Phytomass total weight	Leaflet index cumulated ¹⁾	Net assimilation rate ²⁾	Leaf surface/shrub ³⁾
Ostara	-0,09	0,23	0,53	0,16
Magic	0,68	0,91 *	0,83 *	0,61
Astral	0,89 *	0,99 **	0,15	0,33
Rapsodia	0,93 **	0,99 **	0,99 **	0,97 **
Sante	0,85 *	0,74	0,74	0,88 *
Desirée	0,93 ***	0,86 *	0,79	0,71
Average	0,34	0,76 ***	-0,02	0,38 *

1) – after 30 days of vegetation; 2) – the yield registered after 30 days of vegetation; 3) – maximum.

CONCLUSIONS

- The tubers number/hole was smaller at the earlier cultivars. The biggest tubers number/hole had the cultivars Rapsodia and Desirée (13).
- The tubers numbers/hole was correlated significant with number of the main stems ($r=0,92$).
- In comparison with earlier cultivars, the tubers dominance to making of the epigee phytomass was accomplished, 10 days later at the semi earlier cultivars and 20 days later at the semi later cultivars.
- The biggest yield tubers were registered, at the cultivars Rapsodia and Sante, (784 g and respectively 758 g/hole).
- During years 1995-1999 the most intensively rhythm by tubers growing in the stage from 30 to 50 days of vegetation, was registered.
- The relative rhythms variability by decades growing of the tubers is due of the particularity of the tested cultivars (62-94%) and in a smaller manner (8-31%) is due meteorological conditions.
- The biggest rated capacities of the tubers were registered at the cultivar Rapsodia, because of the good correlations between rated capacities of the tubers and the main characteristics of the epigee phytomass (total weight, leaf surface, leaflet index and the net assimilation rate) .

REFERENCES

1. **Bianu T., 1996** – *Cercetări privind influența caracterelor morfologice asupra producției de cartof. Teză de doctorat.* Universitatea de Științe Agricole Cluj-Napoca.
2. **Burton W.G., 1989** – *The potato (ed.m)*, London. Longman scientific and technical.
3. **Coutrez Geerinck Danielle, 1972** - *Incubation de tubercules de Solanum tuberosum et consommation d' oxygene de leurs tissus centreux.* Annales de physiologie vegetale de l'Universite de Bruxelles, vol. 17, p. 69-82.
4. **Ianoși S., 1994** – *Dinamica de acumulare a producției de cartof.* Cartoful în România, vol. 4, nr. 3, p. 28-30.
5. **Mac Kerron D.K.L., Davies H.V., 1986** - *Markers for maturity and senescence in the potato crop.* Potapo research , vol.29, 427-436.
6. **Morby J., Mlithorde F.L., 1975** - *Crop physiology – some case histories.* Solanum tuberosum L. Cambrige University press.
7. **Plămădeală B. și colab., 1996** - *Ghid practic de protecție a cartofului.*