THE TREATMENT EFFECT OF PLANT METABOLITES AND BIOINSECTICIDES ON PONTE AND YOUNG LARVAE'S OF COLORADO POTATO BEETLE

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Abstract

In the first years after the appearance of the Colorado potato beetle, the used insecticides were very efficiently, in most countries this pest becoming of minor importance. The situation has changed dramatically in the mid-50s after development of resistance phenomenon. Due to the use of more intense and in the same time the utilization of increasing amounts of insecticides, have been observed negative side effects of chemical treatments. Because of this, in recent years in the control schemes against the Colorado potato beetle it was included a number of biological products that have a role just counteract the negative effects of synthetic insecticides. A number of commercial bioinsecticides such as Laser 240 SC resulted in 100% mortality in few hours after application, NeemAzal T/S also causes higher mortality than 80-90% and a strong ovicidal action. Even if some plant extracts are not like commercial bioinsecticides or synthetic insecticides, they are a viable alternative to eradicate pests of potato crops.

Key words: plants extract, bioinsecticides, mortality

Control of the Colorado potato beetle population is achieved preponderant with chemical insecticides that besides the economic aspects determine a number of drawbacks risk to human health and the environment. As an alternative to synthetic insecticides, one of the existing concepts of control it refers to the use of insecticides derived from various plants and microorganisms.

Lack of protection strategies against Colorado potato beetle, can decrease the tuber yield up to the compromise of the crop, even this crop, benefited of other technological measures on high level. The main causes that lead to obtaining yields at modern cultivars under biological potential can be poor knowledge of seed health problems and neglect prevention and control of major pests and pathogens which affect this crop (Domnica Placinta, 2006).

Taking into consideration the maintaining of the current protection level of against pests of potato is made up with a consumption of synthetic insecticides, the gradual replacement with biologic products is an alternative to concerns that consider both environmental protection and consumer health.

MATERIAL AND METHOD

In order to verify the bioinsecticides effectiveness on eggs and larvae of Colorado potato beetle, in year 2007, the experimental plots were located, using three modern varieties of potato: Loyal, Magic and Sante. They were placed in randomized blocks in three replications. Colorado potato beetle larvae counting were done on five clumps marked in the middle of the plot, and treatments were performed on whole variant. We have tested two commercial bioinsecticides Laser 240 SC and NeemAzal T / S and 12 plants extract metabolites used alone or in various combinations.

The larvae on ages L1 and L2 were monitored for a period of seven days, aiming mortality rate, the level of their attack and the emergence of new individuals clutch submitted. From time to time on each potato plant, the larvae number before treatment, and after treatment it performed. The planting potato tubers it was done by hand, the distance between plants in a row was 0.3 m and between rows 0.7 m Between variables were allowed the isolation space of 1.40m The treatments applying was made with hand pumps with a capacity of 0.5liters, the quantity of product being reduced and difficult to implement with the portable pump. For natural metabolites fixation on leaf it was used 0.1% solution of glue. The products tested were assessed by the percentage of mortality of pest.Metabolic extracts were made from dried ground plants, using 25 g/L of cold water, stirred during 24 hours. After filtration it was obtained a plant extract with a concentration of 10%.

RESULTS AND DISCUSSIONS

In Tables 1, 2 and 3 are presented the results concerning the mortality of first two stage larva's at Colorado beetle function by used products for this purpose at three potato varieties: Loyal, Magic and Sante.

Table 1

The larva's mortality of Colorado potato beetle (L_1 and L_2) at modern variety Loial

Var.	The tested products	The larva's mortality (%)							
		The days number after treatment							
		1 day		2 days		4 days		7 days	
		%	dif.	%	dif.	%	dif.	%	dif.
1	NeemAzal T/S 2,5 l/ha	52	St.	58	St.	91	St.	78	St.
2	NeemAzal T/S 3 l/ha	62	10 xxx	74	16 xxx	93	2	91	13 xxx
3	Laser 240 SC, 80 ml/ha	100	48 xxx	100	42 xxx	100	9 x	100	22 xxx
4	*Artemisia absinthium* L.	6	-46 ooo	4	-54 ooo	5	-86 ooo	28	-50 ooo
5	*Aristolochia clematitis* L.	6	-46 ooo	21	-37 ooo	21	-70 ooo	70	-8 o
6	*Urtica dioica* L.	32	-20 ooo	10	-48 ooo	17	-74 ooo	52	-26 ooo
7	*Adonis vernalis* L.	0	-52 ooo	4	-54 ooo	9	-82 ooo	19	-59 ooo
8	*Tanacetum vulgare* L.	21	-31 ooo	15	-43 ooo	14	-77 ooo	1	-77 ooo
9	*Sambucus ebulus* L.	25	-27 ooo	46	-12 ooo	28	-63 ooo	7	-71 ooo
10	*Athyrium filix-femina* (L.) Roth.	0	-52 ooo	18	-40 ooo	13	-78 ooo	25	-53 ooo
11	*Artemisia absinthium* L. + *Adonis vernalis* L.	1	-51 ooo	14	-44 ooo	5	-86 ooo	24	-54 ooo
12	*Artemisia absinthium* L. + *Tanacetum vulgare* L.	29	-23 ooo	5	-53 ooo	4	-89 ooo	14	-64 ooo
13	*Sambucus ebulus* L. + *Athyrium filix-femina* (L.) Roth.	5	-47 ooo	10	-48 ooo	4	-89 ooo	21	-57 ooo
14	*Aristolochia clematitis* L. + *Tanacetum vulgare* L.	0	-52 ooo	6	-52 ooo	5	-86 ooo	0	-78 ooo
15	*Tanacetum vulgare* L. + *Sambucus ebulus* L.	10	-42 ooo	5	-53 ooo	42	-51 ooo	85	7 x
	DL 5%		5		6		6		6
	DL 1%		6		9		9		8
	DL 0,1%		8		11		12		10

The Laser 240 SC product, has a maximum effect from the first day, the values remain high throughout the period of observation at all three varieties. Instead the bioinsecticides on basis **neem** causes a slower effect of larval mortality, so that at the variety Loyal the larval mortality in the lowest dose (2.5 l / ha) was in the first day of 52%, increase slightly after two days and only after four days produced an efficiency of 91%. While the amount of product increases with 0.5 l/ha, the percentage mortality of larva's increases with a certain percentage.(*tab. 1*). The metabolic extracts determine a mortality of larva's between 0-85%, it was remarked the combination consisting of *Tanacetum vulgare* L. + *Sambucus ebulus* L. when the larva's mortality was 85%, followed by *Aristolochia clematitis* L. and *Urtica dioica* L with 70 and 52 % larva's mortality after seven days to the treatments application.

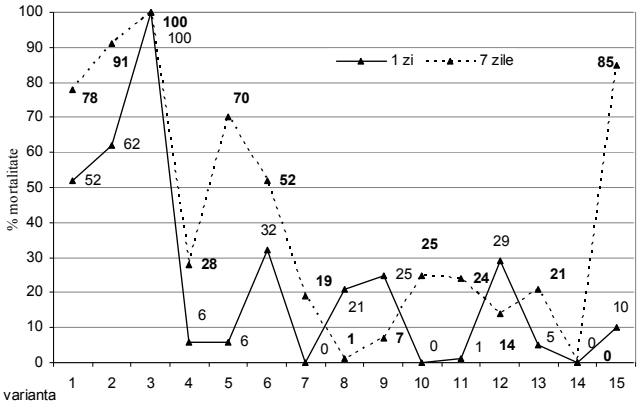

Figure 1 **Dynamics of larval mortality L_1 and L_2 at cultivar Loyal**

Table 2

The larva's mortality of Colorado potato beetle (L_1 and L_2) at modern variety Magic

Var.	The tested products	The larva's mortality (%)							
		The days number after treatment							
		1 day		2 days		4 days		7 days	
		%	dif.	%	dif.	%	dif.	%	dif.
1	NeemAzal T/S -2,5 l/ha	45	St.	62	St.	84	St.	88	St.
2	NeemAzal T/S -3 l/ha	61	26 xxx	76	14 xxx	91	7	92	4
3	Laser 240 SC -80 ml/ha	99	54 xxx	100	38 xxx	100	16 xx	100	12
4	*Artemisia absinthium* L.	4	-41 ooo	2	-40 ooo	3	-81 ooo	22	-66 ooo
5	*Aristolochia clematitis* L.	5	-40 ooo	16	-46 ooo	11	-73 ooo	63	-25 ooo
6	*Urtica dioica* L.	23	-22 ooo	15	-47 ooo	16	-68 ooo	47	-41 ooo
7	*Adonis vernalis* L.	1	-44 ooo	4	-58 ooo	9	-75 ooo	20	-63 ooo
8	*Tanacetum vulgare* L.	15	-30 ooo	17	-45 ooo	16	-68 ooo	6	-82 ooo
9	*Sambucus ebulus* L.	23	-22 ooo	50	-12 oo	31	-53 ooo	8	-80 ooo
10	*Athyrium filix-femina* (L.) Roth	1	-44 ooo	13	-49 ooo	12	-72 ooo	22	-62 ooo
11	*Artemisia absinthium* L. + *Adonis vernalis* L.	1	-44 ooo	10	-52 ooo	12	-72 ooo	19	-69 ooo
12	*Artemisia absinthium* L. + *Tanacetum vulgare* L.	25	-20 ooo	6	-56 ooo	6	-78 ooo	17	-71 ooo
13	*Sambucus ebulus* L. + *Athyrium filix-femina* (L.) Roth.	6	-39 ooo	13	-49 ooo	10	-74 ooo	16	-72 ooo
14	*Aristolochia clematitis* L. + *Tanacetum vulgare* L.	1	-44 ooo	12	-50 ooo	2	-82 ooo	8	-80 ooo
15	*Tanacetum vulgare* L. + *Sambucus ebulus* L.	12	-33 ooo	9	-53 ooo	53	-31 ooo	80	-8 ooo
	DL 5%		5		7		9		12
	DL 1%		7		9		12		16
	DL 0,1%		10		12		16		21

At the Magic variety, the product NeemAzal T / S with two doses 2.5 and 3.0 l / ha, in the first two days, induces a lower mortality in comparison with variety Loyal, but increases in the last day of monitoring. At the dose of 2.5 l/ha of *neem*, the mortality rate of Colorado beetles potato larvae at variety Magic was 10 percent higher than the Loyal (*tab. 2*). Plant extracts efficacy ranged from 6-80% in the last day, standing out with the highest percentage of dead larvae, the extract made from *Tanacetum vulgare* L. + L. *Sambucus ebulus Aristolochia clematitis* L. causes a mortality of larvae on 63%, less than 7 percents in comparison with variety Loial (*fig.2*).

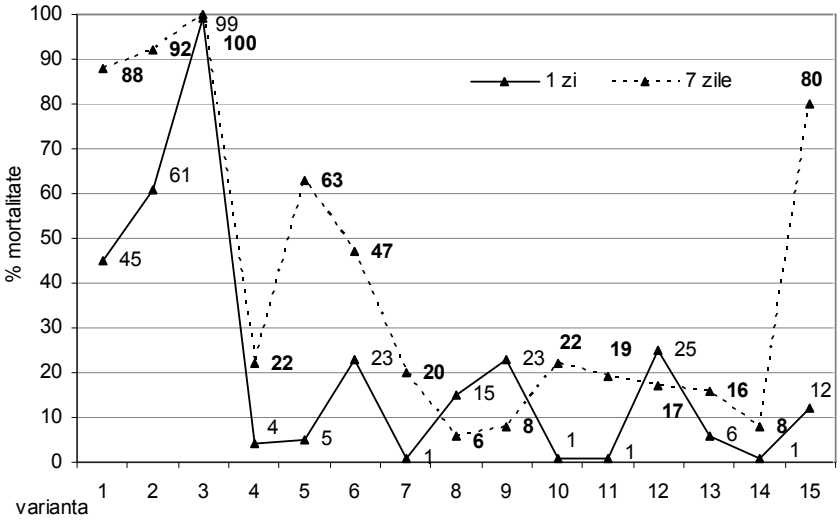

Figure 2 **Dynamics of larval mortality L_1 and L_2 at cultivar Magic**

Table 3

The larva's mortality of Colorado potato beetle (L_1 and L_2) at modern variety Sante

Var.	The tested products	The larva's mortality (%)							
		The days number after treatment							
		1 day		2 days		4 days		7 days	
		%	dif.	%	dif.	%	dif.	%	dif.
1	NeemAzal T/S -2,5 l/ha	46	St.	59	St.	84	St.	83	St.
2	NeemAzal T/S -3 l/ha	59	13 xxx	77	18 xxx	92	8 x	93	10 x
3	Laser 240 SC -80 ml/ha	98	52 xxx	100	41 xxx	100	16 xxx	100	17 xxx
4	*Artemisia absinthium* L.	3	-43 ooo	4	-55 ooo	2	-82 ooo	21	-62 ooo
5	*Aristolochia clematitis* L.	6	-40 ooo	17	-42 ooo	15	-69 ooo	72	-11 o
6	*Urtica dioica* L.	29	-17 ooo	9	-50 ooo	14	-70 ooo	49	-34 ooo
7	*Adonis vernalis* L.	0	-46 ooo	2	-57 ooo	11	-73 ooo	22	-61 ooo
8	*Tanacetum vulgare* L.	16	-30 ooo	17	-42 ooo	20	-64 ooo	7	-76 ooo
9	*Sambucus ebulus* L.	22	-24 ooo	57	-2	24	-60 ooo	9	-74 ooo
10	*Athyrium filix-femina* (L.)Roth.	4	-42 ooo	16	-43 ooo	14	-70 ooo	24	-59 ooo
11	*Artemisia absinthium* L. + *Adonis vernalis* L.	0	-46 ooo	10	-49 ooo	12	-72 ooo	19	-64 ooo
12	*Artemisia absinthium* L. + *Tanacetum vulgare* L.	30	-16 ooo	14	-45 ooo	9	-75 ooo	15	-68 ooo
13	*Sambucus ebulus* L. + *Athyrium filix-femina* (L.) Roth.	4	-42 ooo	13	-46 ooo	17	-67 ooo	25	-58 ooo
14	*Aristolochia clematitis* L. + *Tanacetum vulgare* L.	0	-46 ooo	2	-57 ooo	8	-76 ooo	2	-81 ooo
15	*Tanacetum vulgare* L. + *Sambucus ebulus* L.	8	-38 ooo	9	-50 ooo	48	-36 ooo	82	-1
	DL 5%		**5**		**6**		**6**		**9**
	DL 1%		**7**		**8**		**8**		**12**
	DL 0,1%		**9**		**10**		**11**		**16**

At the variety Sante an ascendant increase in larvae mortality was registered in seven days at bioinsecticides NeemAzal at both doses, the amount of 3.0 l/ha achieved the highest percentage of larvae destroyed (after seven days) at the varieties studied (93%) .

Concerning the extracts of plants (variants 4-15), larval mortality is lower than the other some products during the whole period of 7 days. In variant 6 (*Urtica dioica* L.) after seven days of treatment, occurring significant differences of larvae mortality depending on the variety, so at the variety Loyal, larvae mortality is 52% (*fig. 1*), at the variety Magic, 47% (*fig. 2*) and at Santa 49% (*fig. 3*). It is noted, as previous varieties the extracts made from *Aristolochia clematitis* L. the larvae mortality rate of 72% and mixture between *Tanacetum vulgare* L. + *Sambucus ebulus* L., after seven days determined a larvae mortality of 82% (*fig. 3*)

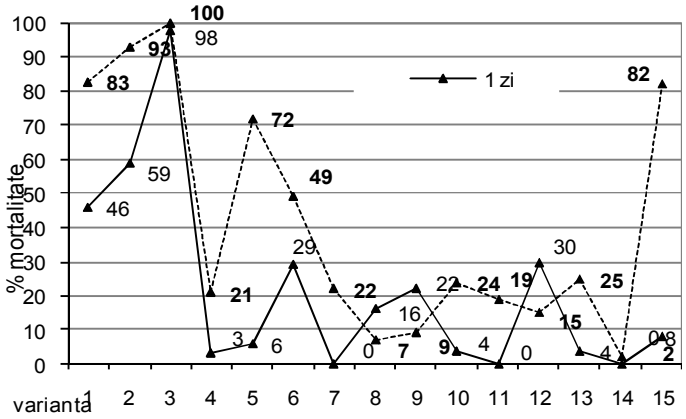

Figure 3 **Dynamics of larval mortality L_1 and L_2 at cultivar Sante**

The mortality of Colorado potato beetle larvae percentage, in treated variants with NeemAzal T / S is directly related to the treatment, even if we can not say with certainty that their death occurred due to the exhaustion of internal resources while not consumed food or as ingested insecticide toxicity. From a practical stand point, what matters is the effect itself, i.e. harmful population decrease even if their death does not occur immediately. Research shows that larvae age on L3-L4 are less sensitive to azadirachtin, knowing that the toxic effect of a substance

depends on the ratio of the amount of product intake and body weight (Olenici et al., 2006).

In the optimal temperature and humidity conditions for feeding, Colorado beetle larvae caused an attack level between 0 and 85% for variants that had a huge load ponte. In the variant treated with Laser 240 SC hatching eggs from spawns was 0 as in the variants treated with NeemAzal T / S the percentage of hatch was very low, so that the degree of attack on all three varieties was up to 15 % (*fig. 4*)

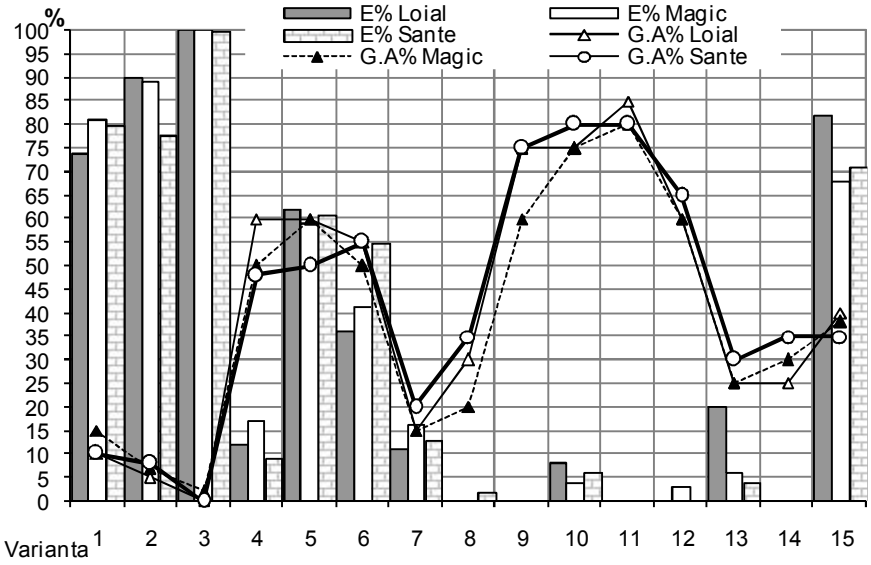

Figure 4 **Expression of the attack degree and its effectiveness after seven days of treatment**

From the results of mortality, which refers to the plant extracts were found notable differences can be explained by the fact that aqueous extracts from plants have not kept fully effective by keeping in refrigerated conditions, whereas from up extraction of metabolic substances until treatment application, they were kept in the refrigerator. Thus, if the other control experiments, the extract derived from *Artemisia absinthium* L. had an efficiency of over 50%, in this case, it drops to 28% for the variety Loyal and 21-22% in the other two varieties.

In this experience we noted the harvest increase, obtained in three varieties (Loyal, Magic and Sante), after treatment application, at the time of the larvae apparition of the first two ages. Only the first treatment was performed in
the above variants, the second intervention was made with Laser 240 SC product.

As regards the effects of treatments for the control of Colorado potato beetle larvae on tubers yield, as shown in table 4, the highest yields were obtained at all three varieties when we used the products Laser 240 SC and NeemAzal T/S and NeemAzal T/S at a dose of 3 l/ha from commercial bioinsecticides group and in the combination of extracts obtained from *Aristolochia clematitis* L. + *Tanacetum vulgare* L. (variant 14) and *Tanacetum vulgare* L. + *Sambucus ebulus* L. (variant 15) from the metabolic extracts group. Mention that the two variants larval mortality occurred after almost a week, but the larvae did not consume leaves after treatment, as shown in figure 4 where the degree of attack was greatly diminished, that the yield of these variants was very good. Some data given in table 4 suggest the possibility that some plant extracts to exert negative influences on the leaves. Thus extracts of *Adonis vernalis* L. and *Tanacetum vulgare* L. (variants seven and eight) a very long period had negative traits upon tubers growing, so reducing tuber yield was 46-55% in the treated plot, when we use the product Laser 240 SC. Among the varieties tested the most sensitive cultivar proved the cultivar Loial, to the significant reductions in tuber production recording the losses of 55-57% when we used the extracts *Adonis vernalis* L. and *Urtica dioica* L., on 58% when we used the extract of *Tanacetum vulgare* L. + *Sambucus ebulus* L. and 45-49% when we used the extracts from *Sambucus ebulus* L. and *Tanacetum vulgare* L.. I tis necessary to mention that the diminishing of yields at the variety Loial with 58% when it used as a source of metabolites *Sambucus ebulus* L. + *Athyrium filix-femina* (L.) Roth (variant 13).

In addition to those mentioned in Sante variety – i.e. variants seven and eight it is necessary to mention the phytotoxic extracts of *Adonis vernalis* L. and mixture of *Sambucus ebulus* L. + *Athyrium filix-femina* (L.) Roth, inductions which materialized through harvest reductions of 40% and 45%.

Table 4

The variation in tuber yield function by product used and cultivated modern varities

Var.	The tested product	Modern varieties					
		Magic		Sante		Loial	
		q/ha	dif.	q/ha	dif.	q/ha	dif.
1	NeemAzal T/S 2,5 l/ha	188,3	-98,3 ooo	194,6	-107,7 ooo	194,0	-90,6 ooo
2	NeemAzal T/S 3 l/ha	266,6	-20,0 oo	292,3	-10 o	242,7	-41,9 ooo
3	Laser 240 SC 80 ml/ha	286,6	mt	302,3	mt	284,6	mt
4	*Artemisia absinthium* L.	226,3	-60,3 ooo	236,6	-65,7 ooo	205,0	-79,6 ooo
5	*Aristolochia clematitis* L.	229,6	-57,0 ooo	235,0	-67,3 ooo	188,3	-96,3 ooo
6	*Urtica dioica* L.	229,0	-57,6 ooo	238,0	-64,3 ooo	123,6	-161,0 ooo
7	*Adonis vernalis* L.	152,6	-134,0 ooo	164,6	-137,7 ooo	128,3	-156,3 ooo
8	*Tanacetum vulgare* L.	147,6	-139,0 ooo	146,3	-156,0 ooo	145,0	-139,6 ooo
9	*Sambucus ebulus* L.	190,6	-96,0 ooo	189,0	-113,3 ooo	157,3	-127,3 ooo
10	*Athyrium filix-femina* (L.) Roth	177,3	-109,3 ooo	162,0	-140,3 ooo	170,0	-114,6 ooo
11	*Artemisia absinthius* L+ *Adonis vernalis*L.	183,0	-103,6 ooo	188,3	-114,0 ooo	168,0	-116,6 ooo
12	*Artemisia absinthium* L. + *Tanacetum vulgare*	250,3	-36,6 ooo	236,6	-65,7 ooo	189,6	-95,0 ooo
13	*Sambucus ebulus* L. + *Athyrium filix-femina* (L.)Roth	182,3	-104,3 ooo	166,0	-136,3 ooo	119,0	-165,6 ooo
14	*Aristolochia clematitis* L. + *Tanacetum vulgare*	269,6	-17,0 o	282,6	-19,7 ooo	234,3	-50,3 ooo
15	*Tanacetum vulgare* L.+ *Sambucus ebulus* L.	276,6	-10,0	292,3	-10,0 o	293,3	8,7
16	The untreated standard	104,6	-182,0	100,0	-202,3	83,3	-201,3 ooo
DL 5%		**13,5**		**7,4**		**13,5**	
DL 1%		**18,1**		**10,0**		**18,1**	
DL 0,1%		**24,1**		**13,3**		**24,1**	

CONCLUSIONS

At the product Laser 240 SC, the effect was maximum from the first day, the values remain high throughout the period of observation in all three varieties.

At bioinsecticides NeemAzal T/S with two doses of 2.5 and 3.0 l /ha, at the beginning mortality is about 50%, increase until 85-90% during the first four days and it maintain high after seven days in all tested cultivars.

Concerning the extracts efficacy, the larval mortality is lower than commercial bioinsecticides throughout the period of seven days. In variant six (*Urtica dioica* L.) significant differences of larva's mortality occurring after seven days depending on the cultivar, so at the cultivar Loial, the mortality is 52%, at the cultivar Magic is 47% and at Sante is 49%.

Artemisia absinthium L. had an efficacy of 28% at the cultivar Loial and 21-22% for the other two cultivars. The variants treated with *Aristolochia clematitis* and with mixture of *Tanacetum vulgare* L. + *Sambucus ebulus* L. had a high efficiency.

The biggest tuber yields were obtained in all three cultivars when we used the products Laser 240 SC and NeemAzal T / S in a dose of 3 l / ha of commercial bioinsecticides group and with combination of extracts obtained from *Aristolochia clematitis* + *Tanacetum vulgare* L. (variant 14) and *Tanacetum vulgare* L. + *Sambucus ebulus* (variant 15) from the metabolic extracts group.

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