

# RESEARCHES REGARDING THE EFFECT OF SOME ECOLOGICAL PRODUCTS ON GRAFTING SUCCESS AT SOME PEAR AND PLUM CULTIVARS

## CERCETĂRI PRIVIND EFECTUL UNOR PRODUSE ECOLOGICE ASUPRA PROCESULUI DE PRINDERE LA ALTOIRE LA UNELE SOIURI DE PĂR ȘI PRUN

**CAULET Raluca<sup>1</sup>, PANDELEA A.<sup>1</sup>, PANEA Teodora<sup>2</sup>**

<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine of Iași, Romania  
Centrul de Cercetare Dezvoltare pentru Biostimulatori „Bios” Cluj

**Abstract:** *This paper study influence of ecological products treatments on some fruit tree species grafting success. Rootstocks from species pear and plum were grafted in 2008-2010 with scions of pear (Curé, Williams and Compesse) and plum (Stanley, Pescăruș and Tuleu gras) which had different grafting compatibility degrees. In grafting moment treatments with ecological products P1 and P2 were made. Biometric measurements concerned grafting success (%), trees length, average number of shoots/tree, stem diameter above and below grafted point, scion: rootstock diameter ratio. Results made in evidence a positive influence of treatments with both ecological products in grafting moment, especially when P2 was used.*

**Key words:** ecological products, incompatibility, scion, rootstock, grafting

**Rezumat:** *Lucrarea studiază influența aplicării tratamentelor cu produse ecologice asupra procesului de prindere la altoire la unele specii pomicele. Portaltoi din speciile păr și prun au fost altoiți pe parcursul anilor 2008-2010 cu soiuri de par, (Curé, Williams și Compesse de Paris) și prun (Stanley, Pescăruș și Tuleu gras) ce prezintă diferite grade de compatibilitate la altoire. În timpul altoirii au fost aplicate tratamente cu două produse ecologice P1 și P2 în zona de altoire. Masuratorile biometrice au vizat procesul de prindere la altoire, înălțimea pomilor, numărul mediu de lăstari pe pom, diametrul pomilor, raportul dintre diametrul altoiului și cel al portaltoiului. În urma determinărilor efectuate s-a constatat o influență pozitivă a aplicării tratamentelor cu cele două produse ecologice, în special în cazul utilizării produsului P2.*

**Cuvinte cheie:** produse ecologice, incompatibilitate, soi, portaltoi, altoire

## INTRODUCTION

High quality nursery trees are essential for success in production systems where early production is the prime goal. Many papers focus on this problem in order to understand the mechanisms of graft development, referring to both cytological and biochemical responses occurring at an early phase in response to grafting, as well as to the consequences of these events on the future graft response. Incompatible grafts can grow for several years without any external symptom of incompatibility indicating the presence of functional vascular connections (Errea and Felipe, 2001). For this reason, the delayed appearance of the symptoms increases the time required for detection of graft-compatibility and

slows down new rootstock selection programs. The aim of this study is to determine the effect of treatment with some ecological products on grafting success at some rootstock scion combination with different compatibility degrees.

## MATERIAL AND METHOD

To perform the experiment, three pear cultivars Curé, Williams and Compessee de Paris, grafted on *Pyrus sativa* and *Cydonia oblonga* and three plum cultivars Stanley, Pescăruș and Tuleu gras grafted on *Prunus domestica* and *Prunus cerasifera* were used. The experiment was conducted in the "V. Adamachi" didactic farm of the University of Agricultural Sciences and Veterinary Medicine Iasi from 2008 to 2010. Rootstocks were planted at a spacing of 0.9 x 0.2 m and budded by chip budding method.

At the grafting moment treatments with ecological products P1 and P2 (produced by Institute for Research and Development for bio-stimulators Bios Cluj) were made, by applying the product around the grafted area.

Biometric measurements made on grafted trees concerned grafting success (%), trees length, average number of shoots / tree, stem diameter above and below grafted point, scion: rootstock diameter ratio. The results were statistically interpreted by variance analysis method. The trial consisted of three replicates with 50 trees in each. Variance analysis of main quality traits was done.

## RESULTS AND DISCUSSIONS

A first aspect of this study was the analysis of the grafting success which had a higher percentage when grafting was made on *Pyrus sativa* and *Prunus domestica*. Also, an increasing of the grafting success percentage at the variants treated with ecological products, comparing with control (untreated), especially when Product 2 was used (tab. 1) has been observed.

Table 1

Average of the grafting succes percentage at some pear and plum cultivars with different grafting compatibility degrees

Rootstock/scion	V1- untreat (control)	V2 – treat. with P1	V3 – treat. with P2	Limit differences		
				DL 5%	DL 1%	DL 0,1%
Curé/ <i>Pyrus sativa</i>	84,56	91,7 <sup>(x)</sup>	93,59 <sup>(xxx)</sup>	2.33	4.57	7.98
Curé/ <i>Cydonia oblonga</i>	82,38	89,2 <sup>(x)</sup>	89,88 <sup>(xx)</sup>	2.52	4.97	8.68
Williams/ <i>Pyrus sativa</i>	83,85	91,0 <sup>(x)</sup>	91,82 <sup>(xx)</sup>	3.54	6.96	12.15
Williams/ <i>Cydonia oblonga</i>	75,88	82,1 <sup>(x)</sup>	82,94 <sup>(xx)</sup>	2.50	4.97	8.68
Compessee de Paris/ <i>Pyrus sativa</i>	84,01	90,9 <sup>(x)</sup>	91,99 <sup>(xx)</sup>	2,21	3,27	3,89
Compessee de Paris/ <i>Cydonia oblonga</i>	75,12	81,2 <sup>(x)</sup>	81,88 <sup>(xx)</sup>	2,35	3,48	4,14
Stanley/ <i>Prunus sativa</i>	87,49	94,66 <sup>(x)</sup>	96,86 <sup>(xxx)</sup>	1.32	2.58	4.51
Stanley/ <i>Prunus cerasifera</i>	85,65	90,96	92,75 <sup>(xx)</sup>	1.12	2.19	3.82
Pescăruș/ <i>Prunus sativa</i>	89,01	93,99	96,89 <sup>(x)</sup>	1.74	3.38	5.90
Pescăruș/ <i>Prunus cerasifera</i>	78,29	81,58	83,11	1.23	2.39	4.17
Tuleu gras/ <i>Prunus sativa</i>	88,13	92,62	93,76	1.15	2.19	3.82
Tuleu gras/ <i>Prunus cerasifera</i>	77,63	81,67	81,85	1.43	2.78	4.86

Scion length was measured three times during the vegetation period in May, July and October, and variations had been observed due to rootstock, and treatment variant (tab. 2).

Table 2

**Scion length at some pear and plum cultivars with different grafting compatibility degrees**

Rootstock / scion	Scion average length (cm)			Limit differences		
	MAY					
	V1-untreat (control)	V2 – treat. with P1	V3 – treat. with P2	DL 5%	DL 1%	DL 0,1%
Curé/ Pyrus sativa	57,86	66,64 <sup>(xxx)</sup>	67,12 <sup>(xxx)</sup>	1.85	3.67	6.42
Curé/ Cydonia oblonga	48,42	55,45 <sup>(xxx)</sup>	55,97 <sup>(xxx)</sup>	1.48	2.93	5.13
Williams/ Pyrus sativa	51,63	58,06 <sup>(xx)</sup>	58,60 <sup>(xx)</sup>	1.81	3.59	6.28
Williams/ Cydonia oblonga	43,37	48,23 <sup>(xx)</sup>	48,31 <sup>(xx)</sup>	1.81	3.59	6.28
Comtesse de Paris/ Pyrus sativa	56,62	63,22 <sup>(xx)</sup>	64,09 <sup>(xx)</sup>	1.4	2.78	4.86
Comtesse de Paris/ Cydonia oblonga	50,05	55,20 <sup>(xx)</sup>	55,86 <sup>(xx)</sup>	1.66	3.29	5.76
Stanley/Prunus sativa	55,30	61,95 <sup>(xx)</sup>	63,10 <sup>(xxx)</sup>	1.70	3.37	4.49
Stanley/Prunus cerasifera	61,99	69,03 <sup>(xx)</sup>	71,23 <sup>(xxx)</sup>	1.83	3.62	4.83
Pescarus/Prunus sativa	52,97	59,18 <sup>(xx)</sup>	60,65 <sup>(xxx)</sup>	1.99	3.94	5.25
Pescăruș/Prunus cerasifera	65,35	72,53 <sup>(xx)</sup>	73,98 <sup>(xx)</sup>	1.76	3.47	4.63
Tuleu gras/Prunus sativa	53,58	59,83 <sup>(xx)</sup>	60,89 <sup>(xx)</sup>	1.50	2.97	3.96
Tuleu gras/Prunus cerasifera	61,03	67,57 <sup>(xx)</sup>	67,83 <sup>(xx)</sup>	1.21	2.39	3.18
	JULY					
	V1-untreat (control)	V2 – treat. with P1	V3 – treat. with P2	DL 5%	DL 1%	DL 0,1%
Curé/ Pyrus sativa	132,22	144,41 <sup>(x)</sup>	147,2 <sup>(xx)</sup>	1.5	2.99	5.23
Curé/ Cydonia oblonga	110,27	119,48 <sup>(x)</sup>	121,54 <sup>(xx)</sup>	1.65	3.29	5.76
Williams/ Pyrus sativa	115,44	126,90 <sup>(x)</sup>	128,36 <sup>(xx)</sup>	1.91	3.81	6.66
Williams/ Cydonia oblonga	95,18	104,01 <sup>(x)</sup>	105,42 <sup>(xx)</sup>	2.04	4.07	7.12
Comtesse de Paris/ Pyrus sativa	126,26	138,53 <sup>(x)</sup>	141,54 <sup>(xx)</sup>	2.5	4.98	8.72
Comtesse de Paris/ Cydonia oblonga	110,04	119,26 <sup>(x)</sup>	121,12 <sup>(xx)</sup>	2.32	4.62	8.09
Stanley/Prunus sativa	124,30	139,86 <sup>(xx)</sup>	141,75 <sup>(xxx)</sup>	2.76	5.45	7.27
Stanley/Prunus cerasifera	140,32	155,25 <sup>(xx)</sup>	156,48 <sup>(xx)</sup>	2.76	5.46	7.29
Pescarus/Prunus sativa	119,48	132,19 <sup>(xx)</sup>	135,2 <sup>(xx)</sup>	2.66	5.27	7.02
Pescăruș/Prunus cerasifera	145,73	157,81 <sup>(x)</sup>	164,32 <sup>(xx)</sup>	2.86	5.66	7.55
Tuleu gras/Prunus sativa	119,96	131,39 <sup>(x)</sup>	136,25 <sup>(xx)</sup>	2.58	5.10	6.80
Tuleu gras/Prunus cerasifera	133,63	145,55 <sup>(x)</sup>	148,15 <sup>(xx)</sup>	2.55	5.05	6.73
	OCTOBER					
	V1-untreat (control)	V2 – treat. with P1	V3 – treat. with P2	DL 5%	DL 1%	DL 0,1%
Curé/ Pyrus sativa	192,36	199,03	206,94 <sup>(x)</sup>	4.25	8.46	14.80
Curé/ Cydonia oblonga	162,61	175,65 <sup>(x)</sup>	178,10 <sup>(x)</sup>	2.75	5.47	9.58
Williams/ Pyrus sativa	171,32	181,71	181,85	3.45	6.87	12.02
Williams/ Cydonia oblonga	164,33	170,72	172,48	2.35	4.68	8.19
Comtesse de Paris/ Pyrus sativa	182,45	195,44 <sup>(x)</sup>	197,32 <sup>(x)</sup>	4.51	8.97	15.71
Comtesse de Paris/ Cydonia oblonga	165,02	173,37	175,90	4.86	9.67	16.93
Stanley/Prunus sativa	203,29	216,27	216,31	3.53	6.99	9.32
Stanley/Prunus cerasifera	199,06	210,31	213,97 <sup>(x)</sup>	3.06	6.06	8.08
Pescarus/Prunus sativa	205,96	215,62	220,17	4.07	8.05	10.73
Pescăruș/Prunus cerasifera	173,51	179,75	185,14	4.17	8.25	11.00
Tuleu gras/Prunus sativa	190,69	204,80 <sup>(x)</sup>	207,64 <sup>(x)</sup>	4.37	8.64	11.52
Tuleu gras/Prunus cerasifera	167,41	175,13	180,12 <sup>(x)</sup>	3.96	7.84	10.45

Analyzing this scions length at compatible and incompatible combination of pear/quince we didn't observe significant variations of this parameter, values recorded being contiguous. But in case of plum, incompatible association scion /rootstock (Pescarus/P. cerasifera and Tuleu gras/P. cerasifera) had smaller values than compatible association, which can suggest an accentuation of incompatibility at this species. Rootstock influence has been observed at all the studied species. Grafting on *Pyrus sativa* and *Prunus domestica* lead to the obtaining of vigorous trees, with longer shoots, than grafting on *Cydonia oblonga* and *Prunus cerasifera*. Since the starting of the vegetation period an intense growing of shoots at variants treated with Product 2 has been observed, especially when grafting was made on *Pyrus sativa* and *Prunus domestica*. During the vegetation period differences become smaller, although at the end of growing period treated variants recorded higher values of scion shoots than untreated variants.

Scions branching degree is influenced mostly by rootstock, which becomes responsible of the individual length of the shoots and angle, influencing in a great measure trees habitat. These trees give fruit earlier, and this fact has a significant influence on branches by modifying the branching angle.

Regarding average number of shoots/tree, results revealed a distinct influence of rootstock. At pear trees a higher featuring degree was recorded at variants grafted on *Pyrus sativa*, but in case of plum trees a better ramification degree was recorded at trees grafted on *Prunus cerasifera* (tab.3).

Table 3

Average number of shoots/tree at some pear and plum cultivars

Rootstock / scion	V1- untreat (control)	V2 – treat. with P1	V3 – treat. with P2	DL 5%	DL 1%	DL 0,1%
Curé/ <i>Pyrus sativa</i>	6,08	6,11	6,1	0,25	0,37	0,44
Curé/ <i>Cydonia oblonga</i>	4,73	4,74	4,7	0,45	0,67	0,79
Williams/ <i>Pyrus sativa</i>	6,47	6,48	6,48	0,86	1,27	1,51
Williams/ <i>Cydonia oblonga</i>	4,56	4,57	4,56	0,75	1,11	1,32
Comtesse de Paris/ <i>Pyrus sativa</i>	5,85	5,88	5,87	0,56	0,83	0,99
Comtesse de Paris/ <i>Cydonia oblonga</i>	4,34	4,35	4,34	0,32	0,47	0,56
Stanley/ <i>Prunus sativa</i>	7,80	7,83	7,82	0,89	1,32	1,57
Stanley/ <i>Prunus cerasifera</i>	8,04	8,07	8,1	0,66	0,98	1,16
Pescarus/ <i>Prunus sativa</i>	8,10	8,10	8,15	0,91	1,35	1,60
Pescăruș/ <i>Prunus cerasifera</i>	8,30	8,33	8,34	0,96	1,42	1,69
Tuleu gras/ <i>Prunus sativa</i>	8,25	8,29	8,3	0,88	1,30	1,55
Tuleu gras/ <i>Prunus cerasifera</i>	8,36	8,60	8,54	0,25	0,37	0,44

Irrespective of specie and rootstock, treatment with ecological products did not influence significantly the number of shoots/tree, values of this parameter being close in both treated and untreated variants.

Coalescence of grafting partners is accompanied by changes in anatomic structure both level of the rootstock and scion due to reciprocal interaction, preponderance being observed at the scions level (Schmid, Heiner, 1999). Because of these reason stem diameter (measured above and below the grafing point) and the ratio between these indicators offer a complex image regarding vigour of grafted tree and coalescence degree.

Stem diameter was higher at pear both scion and rootstock level when grafting was made on *Pyrus sativa* than *Cydonia oblonga* (tab 4.). At plum trees bigger values of this parameter were recorded when grafting was made on *Prunus cerasifera*, which may be due to higher vigour of this rootstock comparing with *Prunus domestica*.

Table 4

**Stem diameter at some pear and plum cultivars with different grafting compatibility degrees**

Rootstock / scion	Rootstock diameter (2 cm below grafted area) (mm)					
	V1-untreat (control)	V2 – treat. with P1	V3 – treat. with P2	DL 5%	DL 1%	DL 0,1%
Curé/ <i>Pyrus sativa</i>	23,39	24,53	24,85	1,21	2,38	3,17
Curé/ <i>Cydonia oblonga</i>	21,75	22,67	23,87	1,85	3,66	4,88
Williams/ <i>Pyrus sativa</i>	23,58	25,20	25,23 <sup>l</sup>	0,90	1,78	2,38
Williams/ <i>Cydonia oblonga</i>	21,60	22,68	24,08 <sup>l</sup>	1,35	2,67	3,56
Comptesse de Paris/ <i>Pyrus</i>	21,63	22,89	23,51 <sup>l</sup>	1,62	3,21	4,28
Comptesse de Paris/ <i>Cydonia</i>	21,91	22,87	24,44 <sup>l</sup>	1,92	3,80	5,07
Stanley/ <i>Prunus sativa</i>	23,69	24,83	24,8	1,25	1,85	2,20
Stanley/ <i>Prunus cerasifera</i>	26,97	28,13	28,21	1,67	2,47	2,94
Pescaruș/ <i>Prunus sativa</i>	25,05	25,85	25,86	1,61	2,38	2,83
Pescaruș/ <i>Prunus cerasifera</i>	28,65	29,52	29,95	1,7	2,52	2,99
Tuleu gras/ <i>Prunus sativa</i>	23,74	24,88	24,56	1,58	2,34	2,78
Tuleu gras/ <i>Prunus cerasifera</i>	26,79	29,36	28,45	1,44	2,13	2,53
Scion diameter (2 cm above grafted area) (mm)						
Curé/ <i>Pyrus sativa</i>	19,85	20,17	20,75	1,83	3,56	4,75
Curé/ <i>Cydonia oblonga</i>	17,90	18,92	19,72 <sup>l</sup>	1,52	3,01	4,01
Williams/ <i>Pyrus sativa</i>	18,71	20,19 <sup>(xx)</sup>	21,03 <sup>l</sup>	0,94	1,86	2,48
Williams/ <i>Cydonia oblonga</i>	17,07	19,61 <sup>(xxx)</sup>	20,66 <sup>l</sup>	1,27	2,51	3,35
Comptesse de Paris/ <i>Pyrus</i>	18,17	19,12	20,05	1,24	2,46	3,27
Comptesse de Paris/ <i>Cydonia</i>	17,04	18,35 <sup>(xx)</sup>	20,09 <sup>l</sup>	1,95	3,86	5,15
Stanley/ <i>Prunus sativa</i>	20,70	20,87	21,56	1,44	2,13	2,53
Stanley/ <i>Prunus cerasifera</i>	19,07	21,64 <sup>(xxx)</sup>	21,81 <sup>l</sup>	1,86	2,75	3,27
Pescaruș/ <i>Prunus sativa</i>	19,56	21,31 <sup>(xx)</sup>	21,15 <sup>l</sup>	1,49	2,21	2,62
Pescaruș/ <i>Prunus cerasifera</i>	19,73	21,44 <sup>(xx)</sup>	22,18 <sup>l</sup>	0,91	1,35	1,60
Tuleu gras/ <i>Prunus sativa</i>	18,86	20,26 <sup>(xx)</sup>	21,10 <sup>l</sup>	1,33	1,97	2,34
Tuleu gras/ <i>Prunus cerasifera</i>	21,96	22,49	22,72	1,27	1,88	2,24

Scion/rootstock stem diameter ratio is used as an important parameter in grafting success evaluation. Values close by 1 of this parameter suggest a good coalescence of the two grafting partners and a further good development of the trees. A slight increasing tendency of the values of scion/rootstock stem diameter ratio it has been observed at the variants treated with ecological products (both Product 1 and Product 2) irrespective of graft compatibility degree (tab.5). At pear incompatible variants scion/rootstock stem diameter ratio values were close to those recorded at compatible combinations. Instead at plum trees, a net differentiation of this parameter values between compatible and incompatible combinations has been recorded, higher values being noted at compatible association scion rootstock Pescaruș/*Prunus sativa*, Tuleu gras/*Prunus sativa*, Stanley/*Prunus sativa* and Stanley/*Prunus cerasifera*..

Table 5

**Scion/rootstock stem diameter ratio at some pear and plum cultivars with different grafting compatibility degrees**

Rootstock / scion	V1-untreat (control)	V2 – treat. with P1	V3 – treat. with P2
Curé/ Pyrus sativa	0,85	0,82	0,84
Curé/ Cydonia oblonga	0,82	0,83	0,83
Williams/ Pyrus sativa	0,79	0,80	0,83
Williams/ Cydonia oblonga	0,78	0,79	0,80
Comtesse de Paris/ Pyrus sativa	0,84	0,84	0,85
Comtesse de Paris/ Cydonia oblonga	0,78	0,80	0,82
Stanley/Prunus sativa	0,87	0,84	0,87
Stanley/Prunus cerasifera	0,71	0,77	0,77
Pescaruş/Prunus sativa	0,78	0,82	0,82
Pescăruş/Prunus cerasifera	0,69	0,73	0,74
Tuleu gras/Prunus sativa	0,79	0,81	0,86
Tuleu gras/Prunus cerasifera	0,76	0,77	0,80

In Romania, ecological products are used in orchards in the last decades, but their utilization in grafting process is relatively new, and these results have to be verified by the further studies.

## CONCLUSIONS

1. Irrespective of specie and rootstock, an increasing of grafting success percentage has been observed at treated variants comparing with untreated (control), especially when **Product 2** was used.

2. At the end of the growing season treated with ecological products had a higher shoots length comparing with control, but a difference regarding featuring degree between treated and untreated variants was not observed.

3. Scion diameter recorded higher values when **Product 2** was applied comparing with control and those treated with product 1, which led to an increasing of scion/rootstock stem diameter ratio so we selected **Product 2** for further researches.

### *Acknowledgments*

This research was supported by a research project PN II Parteneriate 52-109/2008.

## REFERENCES

1. Schmid Heiner, 1999 - *Pomii fructiferi. Metode de altoire*. Editura M.A.S.T., Bucureşti.
2. Gudarowska Ewelina, Adam Szewczuk, 2004 - *The influence of agrotechnical methods used in the nursery on quality of planting material and precocity of bearing in young apple trees in the orchard*. Journal of Fruit and Ornamental Plant Research, vol. 12, pages 91-96.
3. Pilar Errea, Lilibeth Garay, Juan Antonio Marín, 2001 - *Early detection of graft incompatibility in apricot (Prunus armeniaca) using in vitro techniques*. Physiologia Plantarum Volume 112, Issue 1, pages 135–141.