Peach-nectarine : Comparison of the behavior of eleven rootstocks. First observations realized in France from an evaluation network.

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Abstract

Rootstocks choice represents an important part of the techno-economic success of the future orchard. The ideal rootstock need to satisfy to various conditions, independent of each other : adaptation to pedoclimatic and soil biology conditions, high level of vigor, quick enter in production, regularity of production in term of quality and quantity, compatibility with the cultivar, good aptitude to replantation. The available rootstocks respond partially to these objectives, however, the strong societal expectations in term of reduction of inputs (fertilizer and water) need to dispose of more vigorous rootstocks.

The objective of the trial is to identify, among the new tested rootstocks, those that have an equal or superior vigor than the references. The rootstocks with this particularity could permit i) a reduction of the inputs (fertilizer and water) in a context of an more environmental respectful agriculture, ii) a use in a replantation context (resistance to soil fungus…), iii) a wider adaptation to various type of soil.

The study is led in the frame of the 'cultivars and rootstocks assessment national chart'. This study is realized by a network that includes four sites localized in the main peach and nectarine French basin of production.

The trials are conducted with the cultivar CRISTAL ® Monries cov (white flesh nectarine) and were planted during the winter 2012-2013. Thirteen rootstocks, from various origins are assessed : Rootpac ® 90 Greenpac, Rootpac ® 70 Purplepac, Rootpac ® 40 Nanopac, Rootpac ® Replantpac, Garnem GN 15, PF 8, ZH 8, Krimsk 86 ® Kuban, P 2175, Myran ® Yumir and GF 43.

Keywords: *P.persica*, testing trials, rootstocks performance, network.

Introduction

Rootstock choice represents an important part of the techno-economic success of the future orchard. The ideal rootstock needs to satisfy various conditions, that are independent of each other : adapts easily to pedoclimatic and soil biology conditions ; high level of vigour, begins fruiting early ; regularity of production in terms of quality and quantity ; compatibility with the cultivar ; good aptitude to replantation

The available rootstocks respond partially to these objectives, however, the strong societal expectations in terms of reduction of inputs (fertilizer and water) means more vigorous rootstocks need to be found.

The objective of the trial is to identify, among the new tested rootstocks, those that have the same or superior vigour than the reference varieties. The rootstocks with this particularity could result in i)a reduction of the inputs (fertilizer and water) for a more environmentally friendly agriculture, ii) a use in a replantation context (resistance to soil fungus…) and iii) a wider adaptation to various types of soil.

Material and methods

- **Localisation of the trials**

The study is carried out within the framework of the 'cultivar and rootstock assessment national chart', by a network that includes three sites in the main French peach and nectarine areas of production. The assessment of the rootstocks is conducted in a network of three sites localized in different pedoclimatic conditions. The orchards are conducted on a integrated pest management (IPM) way.

- Ctifl Centre of Balandran. Mediterranean climate , Bellegarde (30) , France
- Serfel. Mediterranean climate, Saint Gilles (30), France
- Sefra. Etoile-sur-Rhône (26), France : trial panted on a producer parcel (Mr Aubenas ; Chateauneuf sur Isere (26), France)

	Ctifl Centre of Balandran	Sefra	Sud Expé Serfel
Climate	Mediterranean	Altered Mediterranean climate	Mediterranean
Soil	Silt-clay-sand 30 % stone	Silt-clay-sand 40 % stones	Silt-clay-sand 40 % stones
Trial specificity	Replantation directly after peach orchard. No soil disinfection.	Trial planted on a on-farm plot with a previous history of root rot	Replantation directly after peach orchard. No soil disinfection.
Date of plantation	January 2013	March 2013	February 2013
Distance of plantation	6 x 3 m	5.5 x 3.5 m	6 x 3 m
Density (trees / ha)	555	519	555
Trees shape	Double Y	Double Y	Double Y
Type of dispositive	Block	Blocks	Blocks
Number of tree per elementary plot	2	3	2
Number of repetitions	3	3	3

- **Vegetal material**

The trials are conducted with the cultivar CRISTAL ® Monries cov (white flesh nectarine) and were planted during the winter 2012-2013. The trials were planted with fruit-plants for all the rootstocks. The fruit-plants were furnished by the pépinière VEAUVY (Crest, 26 , France)

Rootstocks		Origin	Compatibility	Vigor	Chlorosis	Asphyxia
Rootpac ® 90 Greenpac (1)	(P. dulcis x P. persica) x (P. persica x P. Davidiana)	Spain	Peach-nectarine, almond and plum	Very high	Tolerant	Sensitive
Rootpac ® 70 Purplepac (1)	(P. dulcis x P. persica) x (P. persica x P. davidiana)	Spain	Peach-nectarine and almond	medium to high	Tolerant	Sensitive
Rootpac ® 40 Nanopac (1)	(P. dulcis x P. persica) x (P. dulcis x P. persica)	Spain	Peach-nectarine, apricot, almond and plum	medium	Moderately tolerant to tolerant	Sensitive
Rootpac ® Replantpac (1)	Free pollination of Myrobolan	Spain	Peach-nectarine, almond and apricot ?	medium	Tolerant	Tolerant
Garnem GN 15 (4)	P.persica x P.dulcis	Spain	Peach-nectarine and almond	Very high	Tolerant	Sensitive
Krimsk 86 ® Kuban (2)	P.persica x P.cerasifera	Russia	Peach-nectarine, apricot, almond and plum	high	Tolerant	Tolerant
Clone of Myrobolan N°1 (3)	P.Cerasifera	France	Peach-nectarine, apricot and plum	medium		
Myran ® Yumir (5)	P.belsiana x P.persica	France	peach-nectarine, almond and some apricot varieties	high to very high (> Damas)	sensitive	Tolerant
GF 43 (5)	P. domestica	France	Peach-nectarine , apricot and plum	high	Tolerant	Moderately sensitive to tolerant
GF 677 (5)	Amigdalus communis x prunus persicae	France	Peach-nectarine and almond	very high		very sensitive
CADAMAN ® Avimag (6)	P.persica x P.davidiana	France	peach-nectarine and almond	high	Tolerant	

- **Observations and measures**

Observations are realized on different points :

Mortality.

Tree vigour. The tree vigour is compared by measuring the trunk circumference, once a year .

Phenology. Various observations are made in order to define if some rootstocks can potentially delay or advance harvest. The observation concerns bud burst date; flowering date, including the beginning of flowering (10 % open flowers), F2 step (50 % open flowers), end of flowering (10 % petals fallen) and the intensity of the flowering (on a scale from 0 to 5).

Agronomic results. For each experimental plot, the production volume is measured. This measurement is completed by determining fruit size according to fruit size category and by measureing the pack out. These measurements allow the annual and pluriannual productivity per rootstock to be calculated.

Physico chimical analysis. The sugar rate and the acidity are analyzed for each fruit size category for each harvest. These results give an indication of the fruit quality.

Post-harvest behavior. The observation of post-harvest behaviour is carried out by Ctifl Centre of Balandran. The test consists in comparing the development of post harvest diseases (essentially brown rot).

Results and discussions

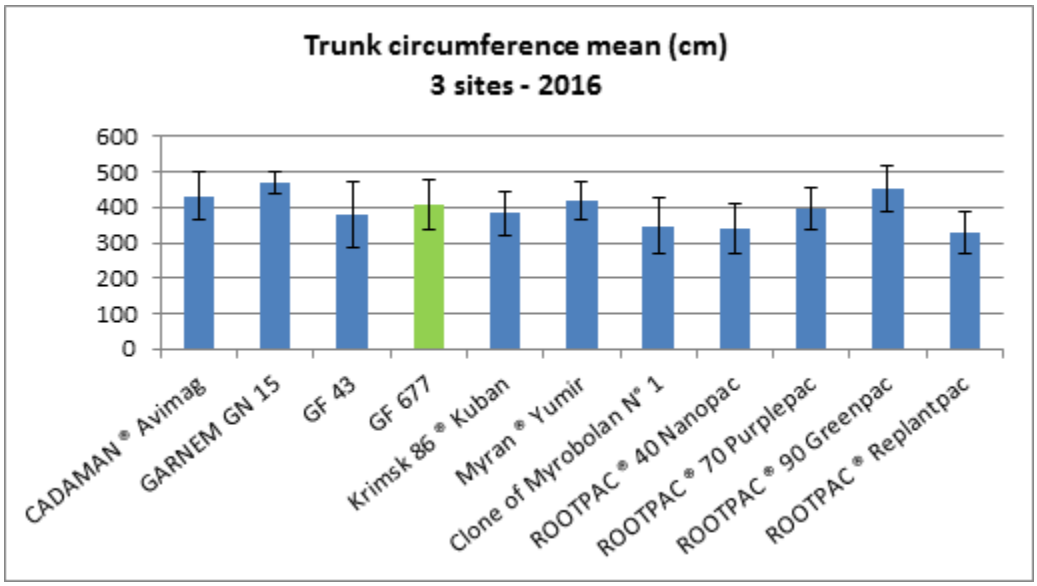
The results that are presented below do the synthesis of the first years of assessment. The orchards were, in 2016, entering in their second year of production. These first conclusions must be confirmed by the observation done during the future seasons.

- **Mortality**

	Ctifl	Serfel	Sefra
CADAMAN ® Avimag	0	0	0
GARNEM GN 15	0	0	22 %
GF 43	0	0	0
GF 677	0	0	0
Krimsk 86 ® Kuban	0	0	0
Myran ® Yumir	0	0	0
Clone of Myrobolan N°1	0	0	0
ROOTPAC ® 40 Nanopac	0	0	11 %
ROOTPAC ® 70 Purplepac	0	0	0
ROOTPAC ® 90 Greenpac	17 %	0	22 %
ROOTPAC ® Replantpac	0	0	0

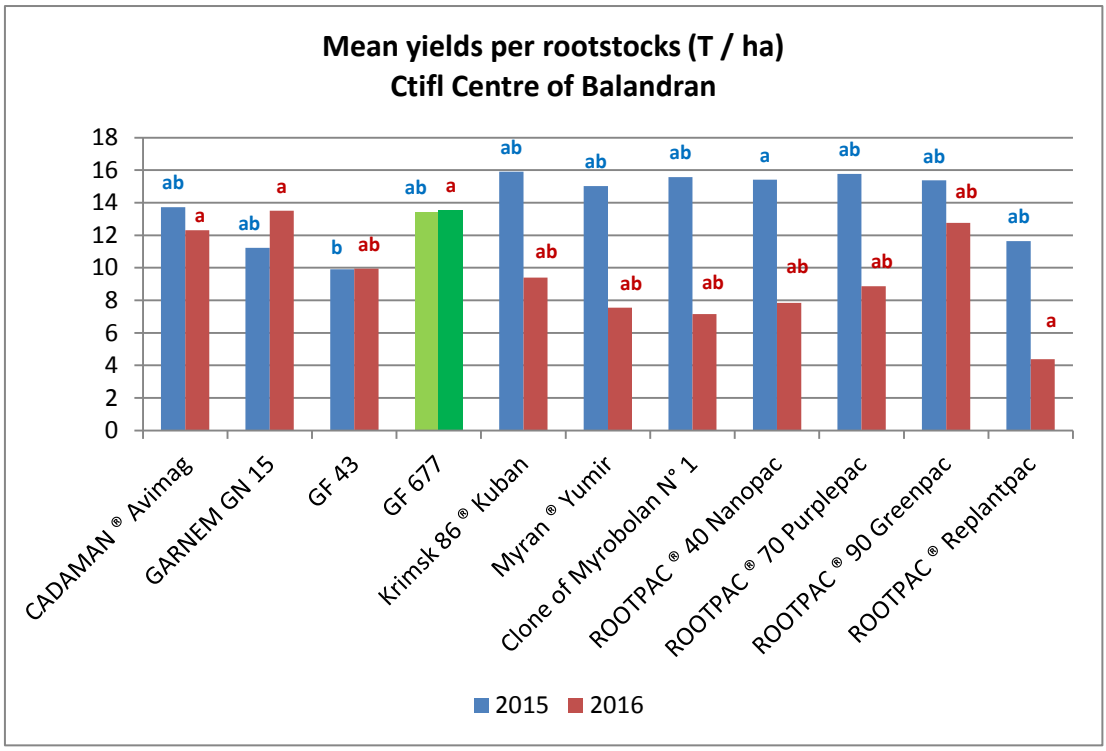
Some cases of mortality have been observed on three rootstocks : ROOTPAC ® 40 Nanopac, GARNEM GN 15 and ROOTPAC ® 90 Greenpac. The mortality is due to bacterial canker of stone fruits (*Xanthomonas* a. *pv. pruni)* for GARNEM GN 15 and ROOTPAC ® 90 Greenpac and root rot (*Armillariella sp*.) for ROOTPAC ® 40 Nanopac).

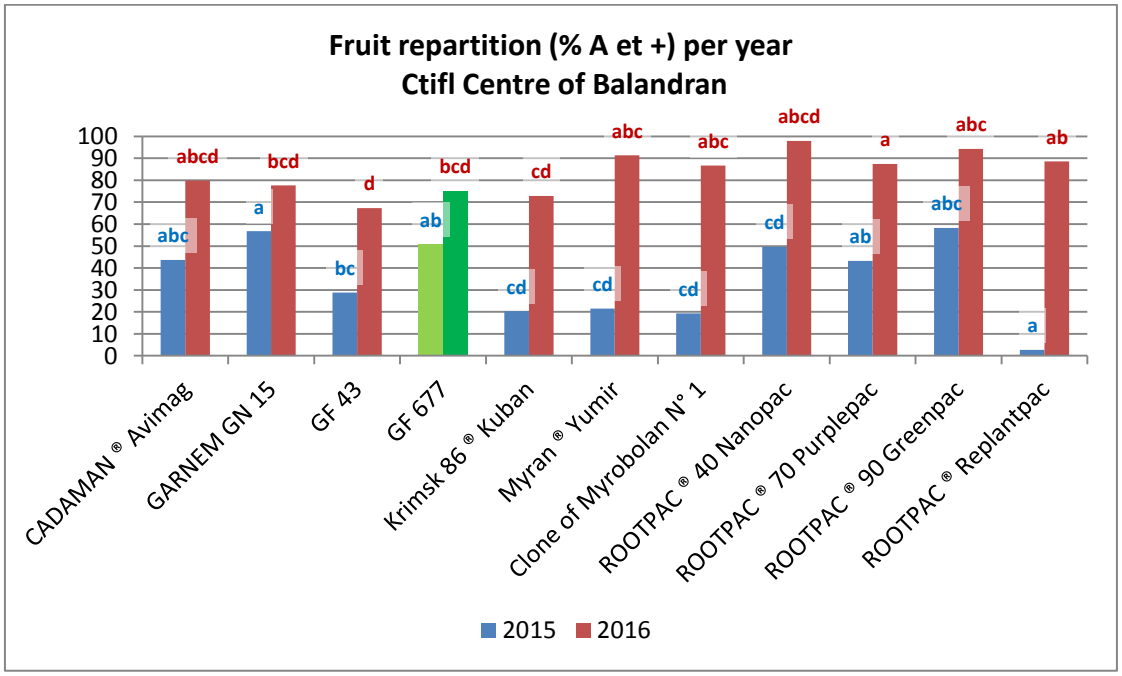
- **Vigour**



The measurment of the trunk circumference allows the viguor induced by the different rootstocks to be estimated. After 4 years, the more vigourous rootstocks are GARNEM GN 15, ROOTPAC ® 90 Greenpac and CADAMAN ® Avimag . The less vigourous ones are Clone of Myrobolan N°1 , ROOTPAC ® 40 Nanopac and ROOTPAC ® Replantpac. However, the statistic analysis (Anova, alpha = 5 %) didn't higlight any difference between the rootstocks.

- **Agronomic results**

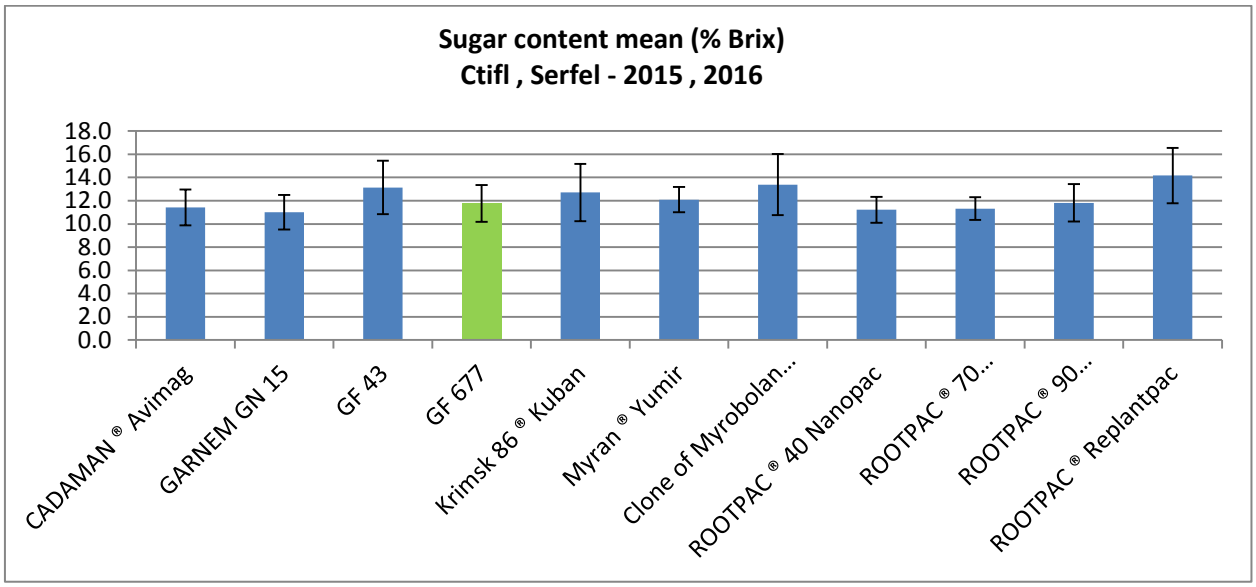




These results are issued from Ctifl orchards only. The relatively low level of production in the 2 first years can be explained by the young age of the orchards and by the « low » abundance of flower observed in 2016 (which is due to lack of cold during the winter). These paricular conditions didn't allow the trees to exploit their full potential. The two graphs show some tendancies in terms of productivity and fruit size potential. In 2016, the higher yields were observed for GF 677, GARNEM GN 15 and ROOTPAC ® 90

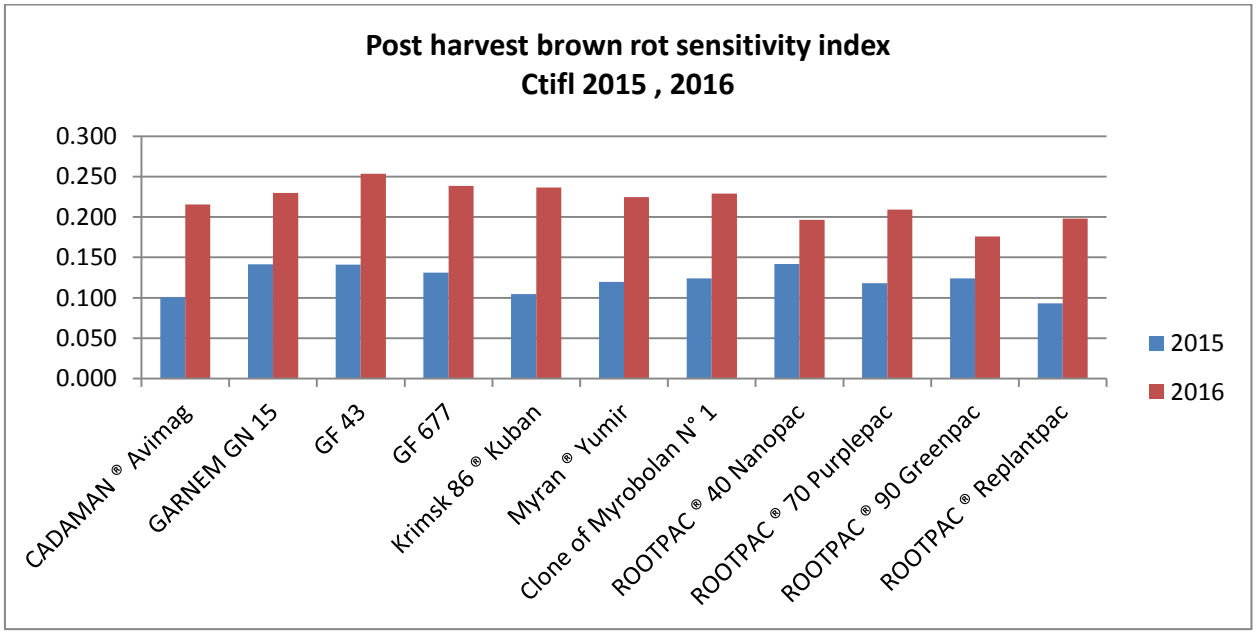
Greenpac..The higher rates of « % A and more » are observed for ROOTPAC ® 40 Nanopac, ROOTPAC ® 90 Greenpac and Myran ® Yumir.

- **Fruit quality**



A difference of sugar content has been observed. The higher sugar contents are observed on ROOTPAC ® Replantpac, PF 8 and Clone of Myrobolan N°1 . This difference in sugar content is probably linked to the lower yield.

- **Post-harvest evolution**



The observations were realized in Ctifl. A difference of behavior is clearly observed between the two years of observation. This difference can be explained by the climatic conditions which were more favorable to moniliose development in 2016. However, the graph shows some differences between

rootstocks. It seems that GF 43, P 2175, Krimsk 86 ® Kuban and GARNEM GN 15 induced a higher level of susceptibility to post-harvest diseases. Indeed, due to the large number of factors involved in the development of brown rot (vigour) this test must be repeated to confirm or not these first observations.

Conclusions

This study is part of a long-term approach set up by Ctifl and the regional experimental stations. Its objective is to evaluate plant material in order to provide the growers with adapted rootstocks or cultivars. The experimental orchards were 4 years old in 2016, corresponding to their 2nd year of production. Due to the « youth » of the trees, it‘s difficult to conclude on the potential interest of the tested rootstocks. However, these first observations provided some interesting knowledge : i) The first cases of mortality were observed on two sites : Ctifl and Sefra ; ii) the more vigourous rootstocks are also the more productive : GARNEM GN 15 , ROOTPAC ® 90 Greenpac , CADAMAN ® Avimag and GF 677 and iii) the Prunus type rootstocks seem less adapted to the soil of the trials

This network study will be continued for a longer period in order to obtain enough years of observations. The future observation campaign should increase knowledge on the behavior of the rootstocks in terms of adaptibilty to pedoclimatic conditions, adaptibility to replantation, agronomic performance and regularity of production, influence on the fruit quality…