

# **EVALUATION OF ‘CHANDLER’ WALNUT ON ITS OWN ROOTS AND GRAFTED TO VARIOUS ROOTSTOCKS – 2005**

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## **ABSTRACT**

Reports that “own rooted” ‘Chandler’ walnuts out performed grafted trees stimulated the creation of this replicated trial. The performance of own rooted ‘Chandler’ trees, ‘Chandler’ grafted to own rooted ‘Chandler’, and ‘Chandler’ grafted to three paradox selections and to a vigorous English selection is investigated in this trial. Rootstock trees were planted in March 1999 at the California State University Farm in Chico. Scions were grafted using wood collected from mature ‘Chandler’ trees in the spring of 2000. Initial survival, yield and trunk cross sectional area (TCSA) data collection began in 2001. Catkin abundance, bloom timing and leafing date, husk split dates, tree yield, and trunk circumference data was collected in 2005 and is reported here.

## **OBJECTIVES**

The objectives of this trial are to investigate the following questions:

- a) Does a graft union have a limiting effect on tree growth and productivity?
- b) Is ‘Chandler’ a superior English rootstock?
- c) Do trees on clonal paradox show less variation than those on paradox seedling rootstocks?
- d) Are own rooted ‘Chandler’ trees superior to ‘Chandler’ on paradox?

## **PROCEDURES**

The following six treatments are being evaluated:

1. ‘Chandler’ own rooted via tissue culture (not grafted).
2. ‘Chandler’ grafted on own rooted ‘Chandler’ rootstock.
3. ‘Chandler’ grafted on English ‘Waterloo’ rootstock.
4. ‘Chandler’ grafted on common paradox rootstock.
5. ‘Chandler’ grafted on ‘Trinta’ paradox rootstock.
6. ‘Chandler’ grafted on ‘PX1’ paradox rootstock.

Small (3/8” diameter) rootstocks for these six treatments were planted on March 19, 1999 in a randomized block design with six replicates made up of two trees per replicate. Top working (grafting) took place in the spring of 2000 with wood collected from mature ‘Chandler’ trees. Initial tree survival data was collected in 2000. In 2005, observations on catkin abundance, bloom timing, leafing date and female flower abundance and number were made. Measurements were made of tree growth expressed as trunk cross sectional area (TCSA), and yield data was collected. Yield efficiency was calculated and is also presented.

## RESULTS

*Initial tree survival in 2000 on the various roots is as follows:*

'Chandler' not grafted = 100 %	Common paradox = 58 %
'Chandler' grafted = 100 %	'Trinta' paradox = 75 %
English 'Waterloo' = 92 %	'PX1' paradox = 100 %

In 2003 one additional tree on 'Trinta' paradox died reducing the survival to 67%.

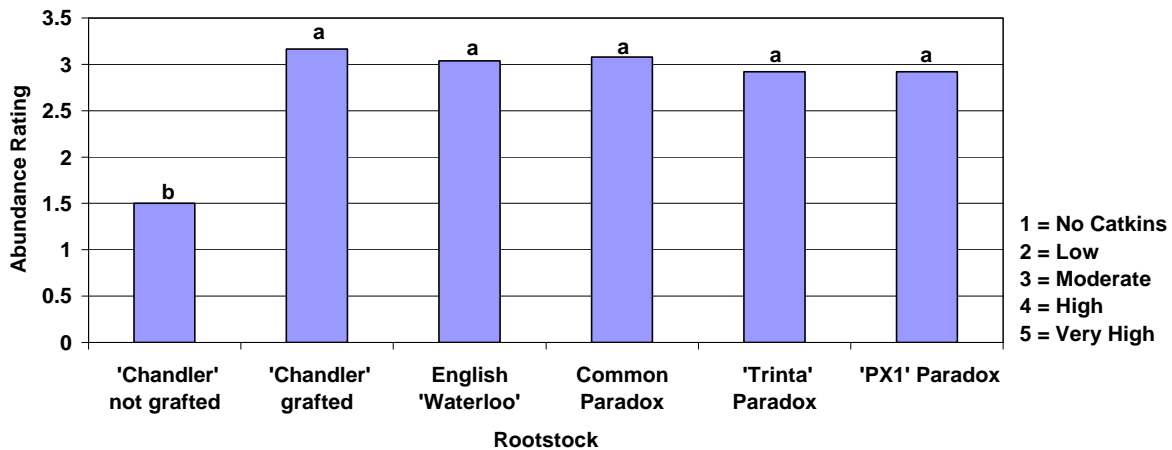
*Presence of crown gall:*

As of a 2004 observation, one tree on common paradox and one tree on 'PX1' paradox were showing a visible crown gall.

*Catkin abundance:*

Our subjective rating system is: 1 = no catkins; 2 = low number of catkins; 3 = moderate number of catkins; 4 = high catkin abundance; and 5 = very high catkin abundance. Observations in 2005 indicate that own rooted 'Chandler' trees have an average catkin abundance rating of 1.5 while all other grafted treatments averaged between 2.9 and 3.2. Catkin abundance on own rooted 'Chandler' trees was significantly less than that on all other treatments (Figure 1).

**Figure 1. Catkin Abundance**



Using Fisher's LSD procedure, different letters indicate significant differences between rootstocks at  $P < 0.05$

*Bloom timing and leafing date:*

Pollen shed began earliest on 'Chandler' grafted and on common paradox rootstocks and started latest on 'Trinta' and 'PX1' paradox (Table 1). Pollen shedding peaked and concluded at the same time in all treatments. Female bloom began earliest on English 'Waterloo' and on 'Trinta' paradox but started and finished latest on own rooted 'Chandler' trees that were not grafted. Leafing date was also latest in this treatment (Table 1). No differences were observed between stocks in the abundance of female flowers or in the number of female flowers per inflorescence (data not shown).

**Table 1. 'Chandler' male and female bloom timing and leafing date vs. rootstock.**

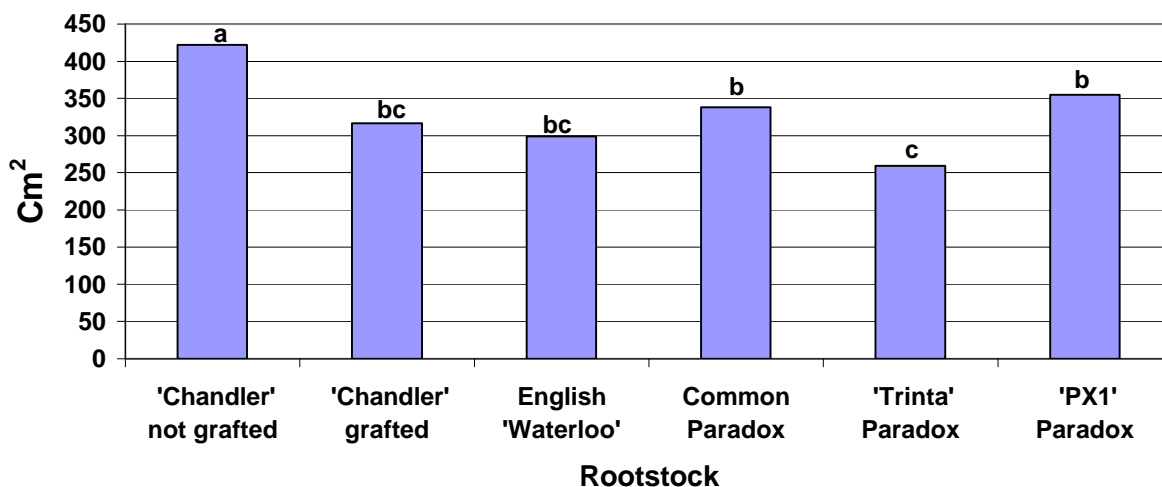
<u>Rootstock</u>	<u>Pollen Shed</u> <u>1st - Peak - Last</u>	<u>Female Bloom</u> <u>1st - Peak - Last</u>	<u>Leafing</u> <u>Date</u>
'Chandler' not grafted	3/31 - 4/15 - 4/19	4/19 - 4/22 - 4/29	4/2
'Chandler' grafted	3/28 - 4/15 - 4/19	4/15 - 4/19 - 4/22	3/28
English 'Waterloo'	3/31 - 4/15 - 4/19	4/11 - 4/19 - 4/22	3/28
Common Paradox	3/28 - 4/15 - 4/19	4/15 - 4/19 - 4/22	3/28
'Trinta' Paradox	4/2 - 4/15 - 4/19	4/11 - 4/15 - 4/20	3/28
'PX1' Paradox	4/2 - 4/15 - 4/19	4/15 - 4/19 - 4/23	3/28

Rating of 1st replicate only.

*Tree growth - Trunk cross sectional area (TCSA):*

Trunk circumference measurements are made on all trees approximately 36 inches above the ground. Own rooted 'Chandler' not grafted has a significantly larger TCSA than all other treatments. Trees on 'Trinta' paradox rootstock are significantly smaller than all other treatments (Figure 2). Trees on the remaining rootstock treatments are intermediate in size.

**Figure 2. Mean Trunk Cross Sectional Area (cm<sup>2</sup>)**



Using Fisher's LSD procedure, different letters indicate significant differences between rootstocks at P < 0.05

*Harvest timing:*

The time of harvest maturity based on an estimate of the date of 90% husk split also varies somewhat relative to rootstock treatment. The crop on 'Trinta', 'PX1', and common paradox rootstocks displayed the earliest maturity compared to other treatments. 'Chandler' on its own roots for both grafted and not grafted trees was projected to be approximately 10 days later in maturity than trees on paradox. The English 'Waterloo' rootstock was intermediate in maturity (Table 2).

**Table 2. Percent husk split on October 4, 2005 and projected harvest date (90% husk split).**

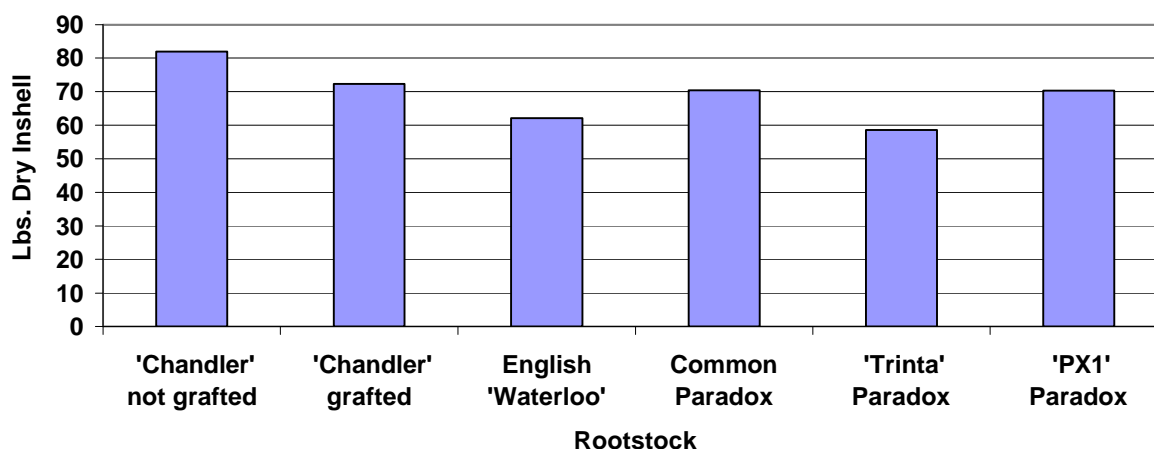
<u>Rootstock</u>	<u>% husk split on 10/4/05</u>	<u>Harvest date projected from 10/4/05 (to 90% husk split)</u>
'Chandler' not grafted	59%	October 16th
'Chandler' grafted	66%	October 14th
English 'Waterloo'	74%	October 11th
Common Paradox	88%	October 5th
'Trinta' Paradox	90%	October 4th
'PX1' Paradox	92%	October 3rd

Rating of Replicate 1 only. Actual harvest date was October 19, 2005.

*Yield:*

The 2005 season was the sixth growing season for scions in this trial. Although TCSA is still significantly different between treatments, trees in all treatments are beginning to fill their space in the orchard. As a consequence of more similar canopy size, average yield per tree was the same this year for all treatments. Differences seen between them are not significant at the 5% level (Figure 3).

**Figure 3. Mean Yield per Tree**

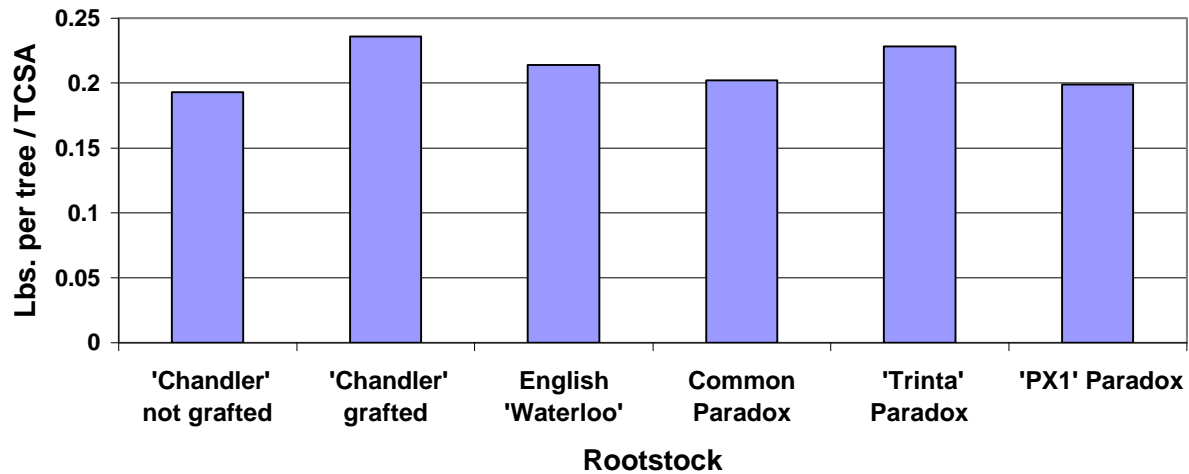


Using Fisher's LSD procedure, 2005 yield is not significantly different between rootstocks at  $P < 0.05$

*Yield Efficiency:*

Yield efficiency is tree yield divided by TCSA. This measure is designed to identify productivity differences that may not be related to tree size. Despite significant differences in TCSA presented earlier, yield efficiencies for 2005 are the same for all treatments. There were no significant differences between treatments (Figure 4).

**Figure 4. Yield Efficiency**



Using Fisher's LSD procedure, 2005 yield efficiency is not significantly different between rootstocks at  $P < 0.05$

## DISCUSSION

The tissue cultured own rooted 'Chandler' not grafted trees are now seven years old and although the 'Chandler' scion wood was collected from mature trees we suspect that the effects of age difference between these two sources of wood may have been overcome by this time.

Data so far suggests that the presence of a graft union has:

- 1) Increased catkin abundance ('Chandler' not grafted trees have significantly fewer catkins).
- 2) Reduced tree size ('Chandler' not grafted trees are significantly larger).
- 3) No effect on tree yield (all treatments had the same 2005 yield).
- 4) No effect on yield efficiency once the canopy of the trees has substantially filled their space in the orchard (all treatments had the same yield efficiency in 2005).

In all parameters measured there is no evidence that the English 'Chandler' rootstock is superior to the English 'Waterloo' rootstock used in this trial. 'PX1' paradox appears to be similar to the common paradox rootstock in nearly all respects. Common and 'Trinta' paradox rootstocks had greater initial mortality compared to the 'PX1' paradox. Both common and 'PX1' paradox rootstocks produced larger tree size (TCSA) than the 'Trinta' paradox rootstock.

There has been no tree mortality in 'Chandler' on its own roots either in grafted or not grafted trees or in trees on 'PX1' paradox rootstock. A visible crown gall was noted in 2004 on one tree on both the common and 'PX1' paradox rootstocks and this should be re-evaluated as trees age.

A possible advantage for own rooted 'Chandler' trees may be having fewer catkins and larger trees at a young age. Another advantage might be its usefulness in areas with high incidence of blackline virus since without a graft union it would be tolerant of the disease. There are no yield differences in these seventh leaf trees. Lower initial tree mortality might be a consideration but a larger trial with many more trees would be necessary to re-confirm these limited results.