

EVALUATION OF ROOTSTOCKS FOR PISTACHIO PRODUCTION

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SUMMARY

In 1989, Dr. Louise Ferguson wisely initiated five rootstock trials distributed throughout the state. They were located in western Kern County, the UC Westside Field Station (western Fresno County), the Kearney Agricultural Center (eastern Fresno County), eastern Madera County, and Shasta County (near Anderson). Each trial included *P. atlantica*, *P. integerrima*, (Pioneer Gold I), *P. integerrima* x *P. atlantica* (Pioneer Gold II), and *P. atlantica* x *P. integerrima* (UCB-1).

These trials provided milestone information about cold (Shasta County), verticillium (Westside Field Station) and salinity tolerance (western Kern County). The Kern County (prior to its use as a salinity experiment), Madera, and Kearney Agricultural Center (KAC) trials served to establish production differences among the four rootstocks. Cumulative yields from the first five bearing years showed UCB-1 significantly more productive than PG II or PG I, the latter two being very similar in yield. *P. atlantica* was significantly less productive than the other three rootstocks. Yield data collected 20 years later in 2009 continued to support the superior yield performance of UCB-1 over the other rootstocks at this location.

Additionally, the KAC trial revealed significant differences in seedling rootstock performance within a given species or hybrid, which spurred great interest in clonal development procedures and monitoring commercial fields for "superior seedlings". The authors identified one such UCB-1 seedling, and a long term, replicated trial was established by the lead author to compare its performance as a vegetatively propagated clone to standard seedling UCB-1 and *P. integerrima* seedlings.

The first yield data was collected from the new trial in 2008. Thus far, after three years, no significant yield differences have been observed between the three rootstocks. There have also been no differences in nut quality relative to split nuts, edible closed nuts or blank nuts.

PROCEDURES

A. The original trial

The portion of the rootstock trial planted in 1989 consists of 400 trees (cv. Kerman) which were divided into 100, four-tree plots, containing one of each rootstock. Ten of these four-tree plots were then grouped into a single 40-tree irrigation set to facilitate irrigation and nutrition studies. Male trees (cv. Peters) were also replicated on each rootstock and placed every third tree within the row and every third row.

Management and pruning have been directed and executed by the lead author. The orchard was circled tied in 2006 to minimize the need for large pruning cuts. The orchard has always been hand pruned by a crew trained by Chris Wylie, Ranch Manager of AgriWorld. The 2009 season represented the fourth year in which the 1989 block was free of any experiments with possible yield impact. The extremely heavy crop also provided an excellent opportunity to contrast rootstock performance of 20 year-old Kerman trees to that recorded during their first five bearing years.

At harvest, these trees were mechanically shaken. The nuts from each tree were then collected onto tarps, and a field weight was recorded. A random sample was collected from each tree and composited by rootstock into a twenty pound sample for commercial grading by Paramount Farms. Five composite samples resulted for each of the four rootstocks, and each represented 20 trees within a given irrigation set. The grade sheets were then used as the basis for calculating total dry yield and nut quality for each rootstock.

B. The new clonal trial

In the summer of 2002, hardwood cuttings were harvested from the rootstock mother tree of KAC101 and transported to the UC Davis Plant Science Department for vegetative propagation. On April 9, 2003, twenty of these trees were planted in a randomized complete block experimental design, along with an equal number of *P. integerrima* seedlings (obtained from Pioneer Nursery, Delano, CA), and seedling UCB-1 sourced from the Foundation Plant Materials Service, Davis, CA. The resulting four data rows were surrounded by UCB-1 buffer rows. On August 15, 2003, the trees were budded to the Kerman cultivar by the lead author and the buds were pushed 10 days later by notching and heading back the rootstock 50%. Missed trees were re-budded in late August and not pushed to avoid possible cold injury from early fall frosts. Four clonal KAC101 trees died during the second growing season due to weakness of the initial planting material. The trees are irrigated by Fanjets emitting 10 gph.

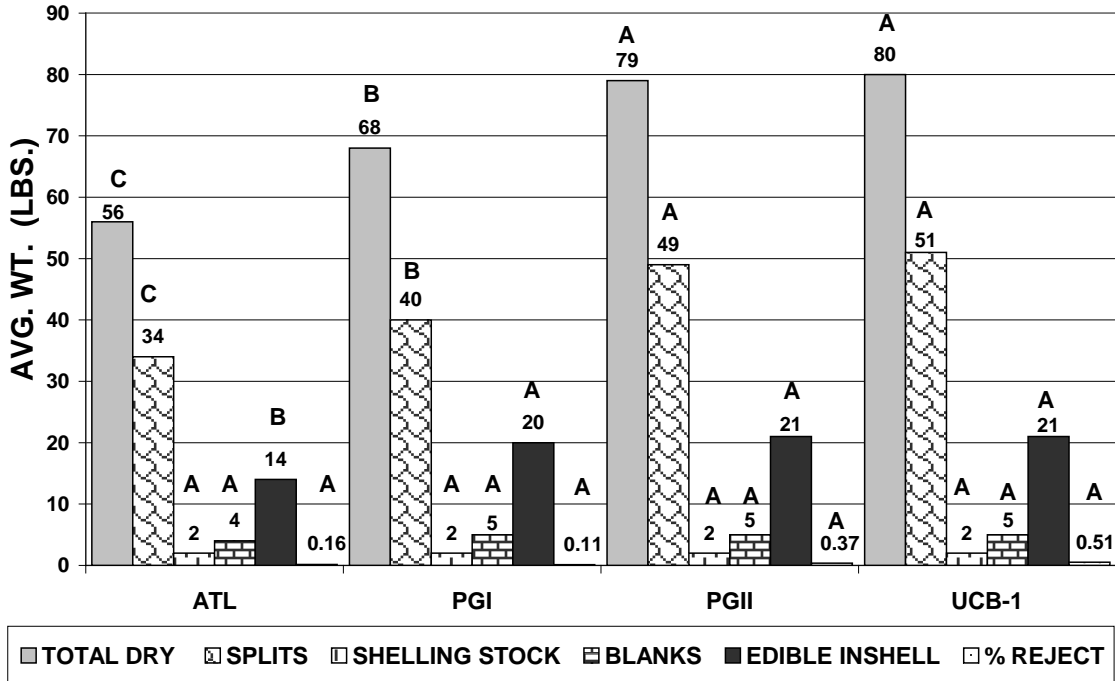
Standard training and pruning practices were followed over the next five seasons, resulting in an orchard representative of a commercial sixth-leaf planting. Yield recording began in 2008, the sixth year. The same harvest procedures used for the mature trees have been employed for the new trial, with the exception that each data tree was individually sampled (about two pounds) and hand evaluated. This allowed each tree to serve as a single tree replication in the statistical analysis. A single composite 20 pound sample was also taken for each rootstock and submitted to Paramount Farms for grading. This provided a commercial reference for the individual samples graded by hand.

RESULTS AND DISCUSSION

Figure 1 shows the 2009 yield data from 90 individual trees per rootstock in the 1989 planting. It shows the total dry weight was significantly greater for UCB-1 and

PGII compared to PGI and *P. atlantica*. *P. atlantica* produced the least. The relative production of split nuts between the rootstocks was the same as the total dry weight. UCB-1 and PGII produced an average of 10 pounds more split nuts than PGI, and 15 pounds more split nuts than *P. atlantica*. UCB-1, PGII, and PGI all yielded the same amount of edible closed inshell nuts. Yield data was not collected again in 2010, due to its extremely light crop. Only six bins were collected from the 2.76 acres. This did not justify the expense associated with individual tree harvest.

Figure 1. Comparison of 2009 pistachio rootstock performance at the Kearney Agricultural Center, Parlier. Yields represent an average of 90 trees per rootstock. Orchard age is 20 years.



A third year of data was collected September 27, 2010, from the new clonal rootstock trial. Figure 2 shows the relative performance of eight-year-old Kerman trees (budded August, 2003) on KAC101, UCB-1, and *P. integerrima* rootstocks. Although there were no statistical differences between the rootstocks in total dry weight or nut quality, KAC101 averaged 2.4 pounds more dry weight, and 1.85 pounds more split nuts per tree than PG-1. Edible closed and blank nuts were very similar between all three rootstocks. Analysis of yield per trunk cross sectional area revealed almost identical values, and that suggests any yield improvement associated with the rootstock is most likely a function of greater tree size than fruiting efficiency.

Figure 2. Comparison of Kerman yield performance on clonal KAC101, seedling UCB-1, and *P. integerrima* (PGI). Averages based on 16 single trees, eight years old. Kearney Ag Center, Parlier, CA.

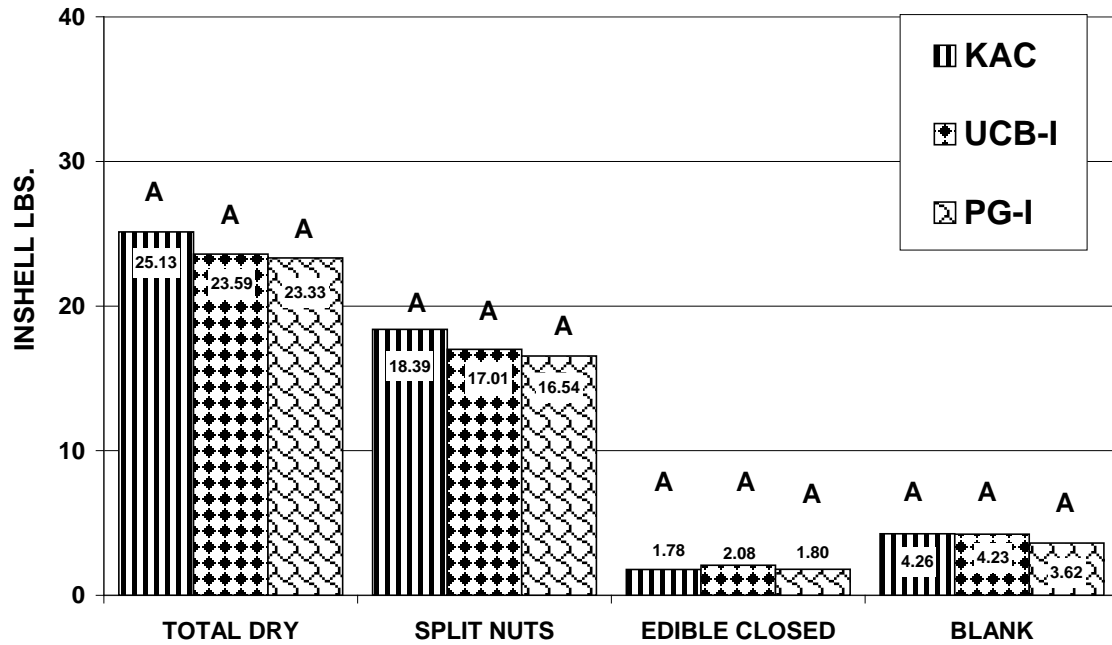
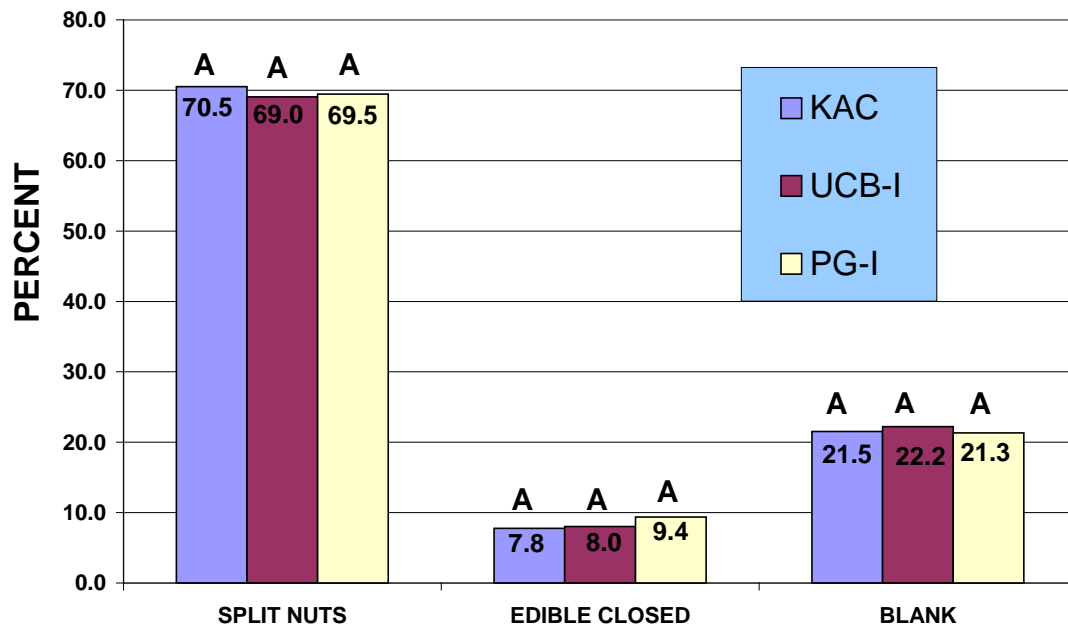


Figure 3 shows that there were no differences between the rootstocks relative to the percentages of split, edible closed, or blank nuts.

Figure 3. Effect of clonal KAC101, seedling UCBI, and *P. Integerrima* (PGI) rootstocks on Kerman pistachio nut quality of eight year-old trees. Averages represent 16 single tree replications harvested September 27, 2010. Kearney Agricultural Center, Parlier, CA.



CONCLUSIONS AND PRACTICAL APPLICATION

After twenty years, UCB-1 remained the highest yielding rootstock in this particular trial. Unreported data collected at this location suggests the increase is associated with greater tree size, and not increased fruiting density. Thus, the comparison made within this experiment may not remain true indefinitely, since nurseries can now refine the quality and uniformity of their rootstock parent material using clonal procedures.

The third year of yield collection on the new clonal trial suggests that KAC101, a UCB-1 selected from the 1989 trial and vegetatively propagated by hardwood cuttings, is performing similarly to randomly selected UCB-1 seedlings and *P. integerrima* (PG-I). We will continue with this yield comparison to determine if this particular selection has any production superiority over our established rootstocks. Yield records have not yet suggested there is justification for screening its verticillium, salinity, and cold tolerance.

ACKNOWLEDGMENTS

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