

Rootstocks: Do they impact flavour?

Eliza Greenman, U.S Orchardist

Earlier this year, as I was doing some research on the effects of grafting apple varieties to *Malus angustifolia* (Southern crab apple), I kept running across interesting accounts of noticeable changes to the apple varieties when grafted to crab apples. One of these changes is in flavour, which is what I'm writing about today.

The Iowa Homestead gives the experiments of J.L Budd, in grafting the cultivated apple on the wild crab, which, as our readers know, is an entirely different species from the common apple, and the fruit very sour and astringent. He states that "fifteen years ago he grafted the Bethlehemite apple on this crab stock, with which it united well, and bore good crops of very fair fruit. But of late years, while the apples have the appearance of the Bethlehemite, they partake largely of the astringent taste of the wild crab, and are unfit for eating."

This is the original snippet that sparked my interest. Why? Because this grower back in the 1800s is telling me that when he took the Bethlehemite apple, a dessert/culinary apple, and grafted it to a crab apple rootstock, he got something different from the original variety. The grafted Bethlehemite apple had developed some astringency. Astringency is the key word here.

OMG, did this guy turn a dessert apple into a cider apple by grafting it onto a crab rootstock?

This thought has rumbled around in my head for the better part of this year and whenever I had a moment to sit at the computer and not read my emails, I researched this topic a bit more. First, I went back in history (via Google Books) to find more testimonials of these findings. Here are a few:

1867: Horace Piper said in the Report of the United States Patent Office (Ag.) 1867, p.315: "The common apple when grafted upon trees bearing very austere fruit is injured by the crude and bitter sap of the tree on which it has been grafted. On the contrary, it is improved by being grafted on a stock superior to its own."

1873: A writer in the New York Tribune says: "In an old orchard we have a favorite apple called Pomme Royale. It ripens in October, is inferior in size, slightly acid, green, tender and juicy, and of exquisite flavour, relished by everybody. Forty years ago, perhaps, scions were cut from it and inserted in three fully grown seedling trees. The natural fruit of the first was a small, juicy russet, excessively sour. That of the second was a larger apple, partially red, not quite as sour as the first, and bitter to the taste. The third tree produced a sweet apple, of pale green color, dry and corky. When the grafts came to bear, fruit from the first compared favourably with that of the tree from which the scions were taken. That from the second tree was not as good, and would sometimes be slightly tinged with red; yet it was tolerable. The third tree produced larger and fairer fruit than either of the others, but it was hard, tough and dry as compared with the true kind, and never gave satisfaction. Each of the three were unmistakably Pomme Royale, but they differed widely in quality, which we could account for only on the theory that the stock does affect the fruit."

Another:

In 1889, the editor of the American Agriculturist said: "We have long held the opinion that the differences often seen in samples of well-known varieties of apple, and which frequently puzzle the expert pomologist, may be accounted for by the differences of stock used in grafting. This is an excellent topic for investigation at any of our experiment stations."

I could go on, but there are many, many testimonials in favour of rootstock having a flavourful impact on the grafted variety. There were some naysayers, who basically just said "this can't be so" and changed the subject. But all in all, my historical research has been in favour of a rootstock's ability to change flavour in apple varieties.

Eager to pursue this topic, I started looking up scientific papers on the subject and started with this, research by Cornell University on nutrient uptake by different rootstocks. The thoughts and questions of the horticulturalists back in the 1800s seem to still align with the questions of today, as seen in this conclusion:

As the availability and knowledge of diverse rootstocks increases, it will increase the potential to impact fruit productivity, quality and ultimately profitability of our apple orchards. The choice of the best rootstock for the site, scion and orchard system is going to become more important than ever. Nutrient uptake and transport characteristics will be added to the current requirements of disease resistance (fire blight, replant), cold hardiness, dwarfing and productivity that the Geneva breeding program has delivered to the industry. The ability to match the nutritional requirement of a scion cultivar to a specially tuned rootstock will enhance orchard management in the future by allowing healthier trees and more efficient use of fertilizers. This study, first of its kind, lays the foundation for this scenario and hopefully will provide better choices to our apple growers in terms of rootstock technologies.

"The ability to match the nutritional requirements of a scion cultivar to a specially tuned rootstock..." could, in my opinion, create a cider apple out of a dessert fruit.

Positive, I kept up the research and found considerable evidence in citrus fruit that rootstocks can change the flavour of the fruit.

A study which looked at an apple rootstock's impact on triterpene (cancer and immune disease prevention chemical compounds) found this:

"The largest differences in triterpene content were found between rootstocks. The results showed that both at harvest time, and after cold storage except the first harvest time samples, the apples from rootstock MM106 had significantly higher triterpene content compared with those from M9; ... Selecting suitable rootstock might increase the triterpene content in apple peel in practice production."

And a study on different rootstock's impact on peaches showed that the variety 'Suncrest' on Julior (rootstock) and GF677 (rootstock), followed by Ishtara (rootstock), produced fruit with the greatest antioxidant activities and total phenolic contents. The 'Suncrest' on Citation (rootstock) and, especially, Barrier1 (rootstock) had reduced nutritional values of the fruit.

What does all this mean?

Right now, everyone I know who is planting a cider orchard is planting on known rootstocks like the MM series or the Geneva series. With these rootstocks, we know what size of tree we'll get and we generally know when it will start cropping apples. This is valuable information because we want order and sense in our orchards. We also know the disease tolerances of each rootstock, which have been known to convey some resistance to the apple scion, and that's all well and good. There are many knowns of these rootstocks because they've been extensively studied...for dessert fruit. But what about cider fruit? How many rootstocks have been thrown out in university trials for imparting astringency to an apple? Probably a lot. But what if this is what we're after?

If someone came to my farm peddling their wares and told me that they could take my dessert apple and turn it into a cider apple with one of their amazing magical rootstocks, I would buy it. I'm sure it would be a hit. This is why we have started in on the private research of grafting apple varieties to different rootstocks for the purpose of flavour/nutrient evaluation (as well as growth influences).

Currently, my partner and I have *M. angustifolia* (Southern crab), *M. baccata* (Siberian crab), own-root, M7 and M111 trees grafted in our nursery to the same variety. These will soon get planted out at the farm in an area set up for evaluation. This, I believe, is another untouched frontier whose findings could be incredible for the future of growing super fruits, having value-added rootstocks, and growing with lower inputs.

So far, the science and the observations are there. There's much more to learn, but why not start in on the fun?

Eliza Greenman is an orchardist, fruit explorer, blogger, public speaker, farmer activist, and sometimes consultant. I've been obsessed with learning about growing fruit trees since 2007. After learning the management practices that go into producing flawless fruit, I've started to question the ethics currently involved in producing the status quo.

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