Growth and development of container grown crops in coir based soils©

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INTRODUCTION

As commercial propagators all of us are engaged in the business of selling plants. Some of us grow seeded plugs, while others produce cutting-grown liners to sell to other growers and some of us specialize in difficult-to-propagate plant material by means such as tissue culture. The methods we employ are as varied as are the multitude of plants we seek to reproduce. One thing we all have in common, though, is the need for a medium that meets our own specific needs. Usually, our propagation, potting and canning soils are made up of various organic materials that are combined at different ratios to achieve the desired physical properties for a successful outcome. Components such as sphagnum peat moss, fir mulch, perlite, vermiculite, compost, pumice, rice hulls, loam soil, sand, etc. are some products that come to mind. Over the past few years, a new product has been emerging that has caught the attention of many growers. This product is often times referred to as "coco peat," "coir pith," or simply called "coir."

WHAT IS COIR?

Coir is a byproduct of the coconut industry. The coconut palm, *Cocos nucifera,* bears what we commonly refer to as a coconut. This coconut is covered by a husk that, once removed, is further processed into other products. The long fibers contained in the husk are used to make coco mats, ropes, stuffing for upholstery, etc. However, between these fibers is a corky material that is left behind and is known as coir or coco peat and is what we use in the horticultural industry.

Coir has some very beneficial qualities that make it an excellent component for use in soilless media.

- High water-holding capacity
- Excellent air porosity
- Decomposes slowly
- Rewets easily after getting dry
- Less costly than sphagnum peat moss
- Renewable, sustainable

Coir also has some challenges that need to be addressed before it can be used as an amendment for soilless media.

First, coir contains high amounts of sodium, potassium, and chlorides that need to be buffered to prevent it from having a negative effect on plant growth. This "buffering" is generally achieved using a calcium nitrate solution either before or after incorporation into the mix. Secondly, coir is generally shipped to growers as compressed blocks, usually 5 kg, which need to be hydrated to expand the coir and make it ready for use. Most often, it is during this wetting and expansion process that buffering takes place. This process takes time and space to achieve. There is some specialized equipment on the market that can process the coir blocks which can be easily incorporated into a continuous soil mixing line. The equipment is expensive and choice is limited.

CHALLENGES

Our current soil mix

For the past 4 years at Duarte Nursery, we have been growing our crops in a standard

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peat and rice hull (4:1, v/v)-based soilless medium. Prior to that time, our mix was peat and perlite (7:3, v/v) and the change from perlite to rice hulls came after many trials showed that our crops grew just a well, if not better in some cases, when less costly rice hulls were used instead of perlite. Our crops, including grafted grapevines, rootstocks used for the production of almonds, walnuts, pistachio and other stone fruit trees all performed up to expectations in the peat and rice hull mix. However, there were some other cultural problems we were experiencing with such a light and airy mix.

1) It was difficult to get the proper compaction of medium in our pots without some physical interaction during the pot-filling process.
2) Significant settling of the medium in the pots after planting required labor to refill the pots. We thought this to be a necessary step to allow more volume of soil for greater root development.
3) It was difficult to manage medium moisture in the bottom of the pot which was causing some root rot issue in our *Citrus* crops.

Coir, could it alleviate our problems?

1. Citrus.

In 2014, we began to run extensive trials on the crops we were growing. First, we needed to address the root rot issues in our citrus crops. We had already been given some suggestions of how much coir to add to our current mix by a citrus grower from Spain who had experience with coir. We began adding coir at 30% and 50% (v/v) to our standard peat and rice hull (4:1, v/v) mix and measuring plant growth. At different times during the plant's growth after transplanting, we measured plant height, stem caliper, and foliage and root dry weights. We also made observational notes on root health, overall plant growth and development. Additionally we were interested in how the mixes physically held up in the containers. The end result showed that a coir, peat, and rice hull (5:4:1, by vol.) mix provided the best results.

2. Bench grafted grapevines.

Budbreak vs. no budbreak.

After our initial success with the addition of coir to our potting mix for citrus, we began to look at other crops we were growing in the standard mix of peat moss and rice hulls. We grow large numbers (8 million in 2015) of bench grafted grapevines of *Vitis vinifera* on various rootstocks of *Vitis* spp. for the wine industry in California and the Pacific Northwest. Again we had some distinct challenges that we were interested in seeing if coir could help to improve our production.

Much of our propagation material for the production of grapevine transplants is sourced from vines that we farm and sell the grapes to wineries in California. I am of the opinion that the farming techniques for growing quality grapes for making wine is not always the best for producing quality propagation material! Because of this and the fact that we produce many scion/rootstock combinations throughout the production season, we inherently are challenged with a phenomenon that we term budbreak vs. no budbreak! Briefly, what that means is that the scion portion of the grafted vines begins to break out of dormancy during the callusing process, while others do not. The importance of this "budbreak" is used to determine the probable success of that particular grafted lot and whether or not we will meet the projected need for that order or if it is necessary to graft more of those vines.

So, we were curious to see if coir would have any effect on the "budbreak/no budbreak" vines after being transplanted into a coir based medium. We know what works for citrus, but wanted to see what effect, if any; varying amounts of coir might have on grafted vines. Soil trials were designed with varying amounts of coir ranging from as little as 30% to as high as 80% in combination with peat and rice hulls and in some trials even 100% coir was investigated.

At planting, bundles containing 100 grafted vines were sorted into lots of those that broke bud in callusing and those that had yet to break bud and were potted into the various soil mixes. Data on plant height, stem caliper, root and foliage dry weights, and bud break counts were taken and recorded at various times during the production cycle.

Scion and rootstock combinations.

Because of the vast number of rootstock and scion combinations that are used by our customers, we wanted to look at some of those combinations that had been ordered to see how they performed in soil mixes containing various amounts of coir. For this particular trial, specific clones of *V. vinifera* and the rootstocks used were as follows:

- Pinot Noir 23/1103P (*V. berlandieri* × *V. rupestris*)
- Pinot Gris 04/Freedom (1613 (Solonis × Othello) × Dogridge
- Pinot Gris 04/Salt Creek (*V. candnicans* × *V. rupestris*)
- Chardonnay 76/101-14 MG (*V. riparia* × *V. rupestris*)
- Pinot Noir 2A/3309C (*V. riparia* × *V. rupestris*)

The media for this trial had two sizes of coir, one described as being ¼-in. size, the other as ¾-in. size. Amounts of coir were combined with our standard mix at rates of 70% or 80% (v/v) in addition to 100% coir and our standard mix. Average root dry weights were recorded on 8/20/14 at the end of the trial.

A third trial of a single scion/rootstock combination involving PG04/Salt Creek and potted into our standard mix containing the two different sized 1/4-in. and 3/4-in. coir at rates of 30, 50 and 70% coir (v/v) in addition to 100% coir and our standard mix was also observed. In this single combination, average height, caliper, foliar and root dry weights, and saleable plants were recorded.

Trends.

In most of the trials we conducted with grafted grapevines, coir had a positive impact on growth and development. One exception was in the budbreak vs. no budbreak trial, the vines that had already broken bud in callusing, did much better in our standard soil mix versus the vines potted into the 100% coir. In contrast, however, in the very same trial, the "no budbreak" vines after being potted into 100% coir actually had a higher percentage of buds to break out of dormancy and grow better than the "no budbreak" vines potted into our standard peat and rice hull (4:1, v/v) standard soil mix. This may have been due to the fact that we "buffered" the coir in the pots with a calcium nitrate solution drench immediately after planting and a second drench 7 days after the initial drench, whereas our standard mix (UTC) did not receive a calcium nitrate treatment.

In trials in which we looked at various scion/rootstock combinations of grafted vines, the results varied greatly as to the individual scion/rootstock combination and the amount of coir in the mix. The results were not all that surprising since each individual rootstock in the trial, had their own distinct characteristics and thus one might have expected them to react differently to the amounts of coir.

In the single scion/rootstock trial of PG04/Salt Creek, if a decision had to made strictly on the results of the number of saleable plants, then the ¾-in. 100% coir produced the most saleable plants, with the 50% and 100% ¼-in. close behind.

SO, WHERE DO WE GO FROM HERE?

Currently, because of the other crops we grow besides grapevines, we have transplanted substantial numbers of our other crops in the same coir, peat, and rice hull (5:4:1, by vol.) mix in which our citrus is grown. We will continue to observe the growth of our rootstocks used in the production of almonds, walnuts, and pistachios in this mix as compared to the standard peat and rice hull (4:1, v/v) mix and most likely continue to examine the growth of our crops in 100% coir!

We know coir is in our future as a major component of our soil mix based on its cost and what we've observed so far in trials. As to how much to use; only trials and time will tell!

ACKNOWLEDGEMENT

I want to thank the Horticultural Research Staff at Duarte Nursery for all their time in setting up trials and collecting data that was used in preparation of this manuscript.