Apple blossom Density Mapping Using a UAV (aka Drone)

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Precision Apple Cropload MANagement (PACMAN) -- in whatever form it takes -- is "the topic of our time." Unmanned Aerial Vehicles -- UAV's, more commonly known as drones -- likely have a role. In fact, at least one company, Outfield already provides a low cost, turn-key (more or less) solution using drones to map apple blossom and crop density. To that end I acquired a sub-$1,000 «consumer» drone in the spring of 2023 and worked with U.K. based Outfield to get a feel for what this technology could provide?

After getting my FAA Part 107 Remote Pilot Certificate allowing me to legally fly «my» drone -- a DJI Air 2S -- while on the job at UMass, the helpful folks at Outfield (Oli and Andrew) provided me with a cloud based «dashboard» wherein I initially mapped my apple orchard blocks of interest -- five at the UMass Orchard in Belchertown, MA and three at Tougas Family Farm in Northboro, MA. The blocks totaled 3.5 hectares (8.6 acres). Outfield returned to me "flight plan" files that were imported into Litchi. Once the orchard blocks were in full bloom in early May, 2023, and I was ready to fly following all the standard flight safety planning practices, using the Litchi app the drone took off, flew the zig-zag-across the row flight plan while taking (many) high resolution pictures of the trees from about 10 meters (30 feet) above the canopy (Fig. 1). All done automatically, including landing in the exact spot the drone took off. No crashes or wayward drone (yet)! Now, it sounds easy, and it was, but not without some nail biting and making sure everything was in order prior to flying. After flying the block, the images are uploaded into the Outfield dashboard and were processed withing 24 hours resulting in a colored blossom density "heat" map (Figs. 2 and 3).

Figure 1. Litchi zig-zag block flight plan with picture locations.

Figure 2. Honeycrisp block blossom density map in Outfield dashboard

OK, so what? Is it an "actionable, holy grail" component of PACMAN? Well, I did do a bit of visual ground truthing, but found it kind of difficult to figure out exactly where I was in the block in relation to the "heat' map. (I have put in a feature request to Outfield to make the overlay more "transparent" so the individual rows can be seen.) It seems to me, and I think Outfield is headed in this direction, is the map needs to be synced with a variable rate sprayer so that, for example, bloom thinning sprays could be adjusted accordingly to where bloom density is higher (or lesser)?

Once the apples reach golf-ball size Outfield tells me I can repeat the flyovers and they will give me a yield estimate for the block (and fruit sizes on the horizon). I have not seen that yet. Drone use in agriculture is evolutionary, I suspect some aspect of this tool to better manage crop load -- or do pest scouting? -- is in my and your future. Stay tuned...

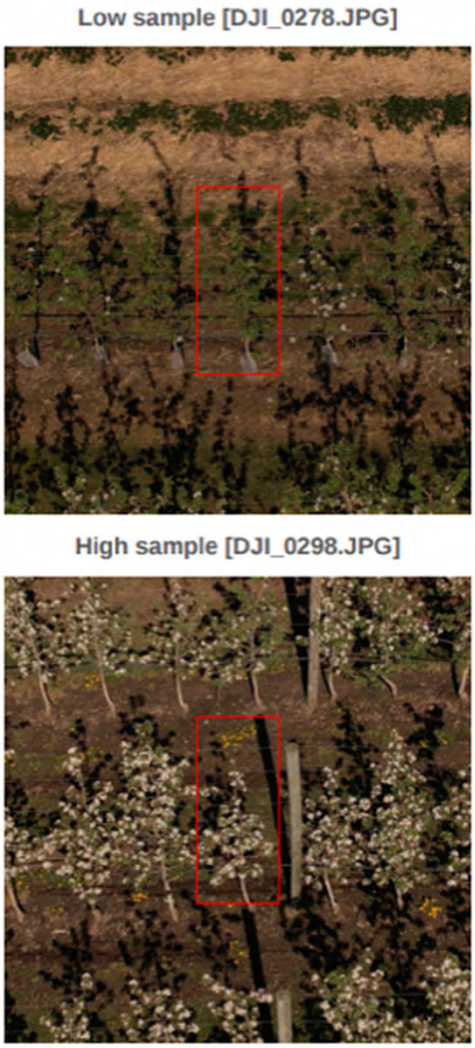

Figure 3. Low-high Honeycrisp blossom density example.