

Mechanization in the Coffee Orchard

A two year case history in Laos

Coffee is the second largest traded commodity after oil. Estimated 25 million families depend on coffee cultivation and are located between Tropic of Cancer and Capricorn. Maybe 11 million hectares are devoted to coffee cultivation.

Labor was always a major factor being solved with slave labor in the past. Today many areas offer coffee employment, however, much still resembles slave labor conditions.

Even today, coffee is still a predominant hand crop. Mechanization is new to coffee cultivation. Many coffee farms are located in difficult terrain. Mechanization is difficult or impossible in some of these mountainous areas.

Worldwide the trend is to replace expensive hand labor with machinery, no matter what crop involved. There is a trend for coffee cultivation to move from steep mountain areas, into more flat areas, where mechanization is possible.

The most expensive coffee task is harvesting. Hawaii, Australia, parts of Brazil and some other areas are working with harvesting machines to reduce labor costs and survive in the coffee business.

In Kona Hawaii where labor is expensive (\$ 8-14 /hr.), harvesting is done by hand because of challenging terrain. This accounts for the relative expensive green coffee of \$ 12 to \$18 per pound. Kona is fortunate to have buyers for their expensive green coffee, largely based on quality.

Mechanization and machine selection are area specific and depend on topography and soil conditions.



Mechanical coffee picking in Queensland Australia. Picking results 35% Over-Ripe, 55% Ripe, 10% Under-Ripe



For machines to function the ground has to be smooth and rocks have to be removed.

Requirements for coffee mechanization:

1. Terrain needs to be reasonably flat. A self-driven harvester can handle a 22% incline.
2. Rock removal is necessary, as machines do not mix with rocks very well. This applies to harvesting as well as orchard maintenance.
3. Field layout needs to conform to machine spacing, turn around areas and harvest machine space requirements. Layout needs to accommodate drainage and erosion control planning.
4. Supporting roads need appropriate dimensions.
5. Machines save labor but need qualified maintenance..
6. If irrigation is required, drip irrigation would have advantages over overhead irrigation.
7. Windbreak or shade trees need planting to coexistence with machinery.
8. Shorter, more compact coffee varieties are more suitable for mechanical harvesting.

Field Preparation / Rock Removal



Modified steel plates pulled by tractors can handle large and small rocks. Very large rocks need two tractors. Front blades on tractors are a great tool.

Rocks up to 1.5 feet can be handled with a Rock Rake. Surface rocks are winrowed from two sides and picked up by the Rock Picker. "Beats hand picking any day".



Dozer with rock rake for pushing rocks and leveling of high spots.





The rock picker can pick rocks up to 1.5 feet (maybe 2 feet) in diameter. The rocks can only be picked up on the surface and need a harrow (for the smaller rocks) to bring them to the surface.



Large rocks need a backhoe or other digger for removal. Ripping with the dozer can bring most rocks to the surface.

Field Preparation / Marking and Deep Ripping



Hydraulic marking arms on a 6 foot wheel base "Row Crop Tractor" makes field marking easy.



Ripping to 1 meter depth helps with tap-root growth. Good root development is essential for sustainability. Ripping also fractures the top layers, helping with drainage. The open furrow helps with getting calcium and phosphorus into the deeper layers, as they are difficult to move in the soil horizon.



Tree logs can be used as land levels, provided they are heavy and on angles.