Four steps to cost-effective **Wood Fuel Production** from Orchand Termination

Modern fruit orchards are industrial crops, based on intensive management and early replacement of the exhausted plants. When production declines, the plantation is terminated and a new orchard is established using fresh planting material. This operation generates a large amount of wood biomass, estimated at 25-50 oven-dry tons (odt) per ha, depending on orchard type, age and development. Rootstocks represent about 20% of the total mass, which is generally low quality and creates a disposal problem for most farmers. What is more, fruit production is often concentrated in regional districts, making residue management a strategic issue. Due to the low quality and the large amount, residue cannot be recycled through residential use at a local level: in contrast, it can be fed to an industrial plant, especially if mixed with better quality feedstock.

The opportunity offered by the large and concentrated availability of orchard residues was one of the reasons that convinced Mombracco Energy Ltd (www.mombraccoenergy.it) to specifically target this resource. The company was established in 2010 with the goal of building a 1 MWe biomass-fed power station based on the ORC technology manufactured in Italy by Turboden (www.turboden.com). Commissioned in Envie (Northwestern Italy) at the end of 2011, this plant can easily process orchard termination residue, but the issue arises about devising a cost-effective solution to move the residue to the plant. That requires four specific actions: cutting the above-ground tree portion; chipping it and taking the chips to the plant; digging up the rootstocks; cleaning the rootstocks, grinding them and taking the resulting ground product (hog fuel) to the plant.

A number of makeshift technical solutions have been tried over time and still many farmers resort to stopgap measures. Not so with Mombracco Energy Ltd, which was born from the partnership of a local farmer and a renowned machine manufacturer – Pezzolato Inc. Famous for its chippers and grinders, Pezzolato immediately set out to design and manufacture dedicated equipment for orchard residue processing, and used Mombracco Energy as the ideal test bench. Within a short time, a complete range of equipment was ready and started effective operation, which is still going on at present, with much satisfaction by all parties involved.

KEY WORDS
Orchard residue
Bioenergy

COUNTRY/REGION
Italy/Piemonte

AUTHORS
Raffaele Spinelli
(CNR- IBE)
Team ITABIA

BRANCHES

BOOSTING RURAL BIOECONOMY NETWORKS FOLLOWING MULTI-ACTOR APPROACHES

ADDITIONAL INFORMATION

The 4 actions proceed as follows:

1) For cutting the above-ground tree portion a new low-cost purpose-built feller is used: a simple hydraulic shear is installed on the front hitch of a farm tractor, offeset to the right, which allows the tractor to drive along the row cutting the trees and to direct the tree fall, building windrows of orderly aligned trees. The operation is very fast and proceeds at a rate of about 12 odt per hour.

2) Chipping and transporting the above-ground tree portion: a new dedicated terrain chipper (derived from a conventional drum chipper model that carries full-length knives, in order to minimize the impact of feedstock contamination) is installed on a trailer with a high-lifting container bin. The system is completed by tractor-trailer units, tasked with hauling chips to a roadside landing or directly to the plant. Therefore, the complete operation consists of the tractor-powered terrain chipper, the miniexcavator that feeds it and two tractors with their respective trailers, plus the four operators. Overall cost is estimated at 300 € per hour and productivity at 6 odt per hour.

3) For digging up the rootstock (one of the most difficult tasks associated with orchard termination and field recultivation) a continuous single-pass rootstock extractor is used, which is designed for cutting and pulling up orchard rootstocks in one single motion. The new machine consists of a single sturdy frame supporting two functional units: cutter and shaker. Productivity is over four times that of the excavator this system replaces and is estimated at 3 odt per hour.

4) Because rootstocks are contaminated with soil and stones, they must be processed with a machine using blunt tools like a grinder, a shredder or a crusher. Even better, rootstocks can be left in the field for several months, allowing further cleaning through the exposure to weather agents. Extended storage also contributes to a strong reduction of moisture content, which can easily drop below 30%.

ABOUT BRANCHES

BRANCHES is a H2020 "Coordinaton Support Action" project, that brings together 12 partners from 5 different countries. The overall objective of **BRANCHES** is to foster knowledge transfer and innovation in rural areas (agricolture and forestry), enhancing the viability and competitiveness of biomass supply chains and promoting innovative technologies, rural bioeconomy solutions and sustainable agricultural and forest management.

COORDINATOR: Johanna Routa - (Luke) johanna.routa@luke.fi
DISSEMINATION: itabia@mclink.it

www.branchesproject.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101000375

THE PARTNERSHIP

Luke Luonnonvarakeskus
National Research Council of Italy Institute of BioEconomy Department of Biology, Agriculture and Food Science
VTT
University of Warmia and Mazury in Olsztyn
DBFZ
circe Research Centre for Energy Resources and Consumption
ITABIA Italian Biomass Association
MTK
aveBiom Spanish Biomass Association
UFZ
W-M ODR
BioEconomy Cluster