Development and optimisation of a machine for automatic picking of hops

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Objectives:

In the framework of a research project, funded by the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) in cooperation with the Federal Agency for Agriculture and Food (BLE) under the program to encourage innovation, manual mount of hop vines shall be replaced by the procedure that vine stacks of 6-7 m long hop vines dropped by the transport vehicles are loaded dosed into the new picking machine which pre-cuts and pre-picks the stacks in about 1 m long pieces before reaching the main picking unit. The aims are:

- Elimination of manual mount of the hop vines
- Increase of the picking rate up to 1000 vines per hour, thus saving up to 4 workers
- Improved safety according to the EC machinery directive 2006/42/EC
- Minimizing losses and maintaining at least current picking quality

Results:

Based on a digital prototype created in 3D model construction, the functions of new modules were tested virtually and a kinematic analysis was carried out. In this way, potential construction faults were minimized before assembly and the time of development was significantly reduced. Based on the optimized digital prototype, a delivery ramp supplying the vines stack, pre-cut system and pre-pick unit were built and tested in practical use in 2012. In 2013, the main picking unit was built together with a conventional subsequent picking and cleaning system with various pre-cutting belts. The operation can be described as follows:

The vine stacks deposited by the transport vehicle are supplied via an inclined ramp with a scraper floor into a pre-cutting unit which cuts approximately 1 m long pieces by bottom-up cutting blades. A pre-picking belt which is arranged adjacent to the cutting device and moves upwards with the cutting tool, picks a portion of cones during the cutting operation and conveys the vine portions separated on a conveyor belt. In this section the vine pieces are supplied to a main picking unit consisting of three consecutive belt pickers. On the way, a separation of the already picked hop cones and leaves of the vine pieces is performed by a sorting belt. The subsequent picking and cleaning process is more or less the same as in conventional picking machines.

Results: Pre-cutting and picking of the hop cones from the cut vines work fine. Improvements can be made, however, in the continual and steady feed of the main picking unit as well as the maintenance of a good picking quality.

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Cooperation:
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