

Development and optimisation of a machine for automatic picking of hops

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Introduction:

Although Germany produces more than a third of the world's hop, the technical progress, particularly in picking machine has barely developed since their introduction 50 years ago. Still the hop vines are hooked into the picking machine by hand. These strenuous (7 days a week, 12 hours per day), ergonomically stressful (work related) and accident-prone work (hand injury) is mainly carried out by foreign seasonal workers. Due to the improved employment opportunities in countries of origin and increasing labor costs, it is increasingly difficult to attract suitable persons for these activities. Therefore, the considerations are to automate the manual mount of hop vines into the picking machine. Then the entire hop harvest from tearing off the vines on the field up to pressing the dried hop into the bales would be automatable.

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 the picking rate to 1000 vines per hour at savings of up to 4 workers
- Improved safety according due to the EC machinery directive 2006/42/EC
- Minimizing losses and maintaining quality at least on the current state



Results:



Based on a digital prototype created in 3D model construction, the functions of new modules were tested virtually and kinematic analysis was carried out. In this way, potential construction faults were minimized before the assembling and the time of development has been significantly reduced. Based on the optimized digital prototype a delivery ramp supplying the vines stack, the pre-cut system and the pre-pick unit were built and tested in practical use in 2012. 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 yet to be constructed main and side picking unit. On this way, a separation of the already picked hop cones and leaves of the vine pieces is performed by a sorting belt. The first results of pre-cutting and pre-picking were promising. In first tests the precision of picking were analyzed and compared to conventional hop picking machine results.

Fundation in the framework of the program to encourage innovation:

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Projectpartner:

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Cooperation:

Fuß Fahrzeug- und Maschinenbau GmbH & Co. KG, Schkölen