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Techniques for the Separation of Wire Pieces During the Hop Harvest

During the hop harvest, the whole vines are transported to the picking machines on the farms. Together with the enclosed up-line wire, the remaining vines are chopped after the separation of the umbels and brought back to the fields as organic fertilizer. During transport, material gets lost frequently, and short pieces of wire lying on public roads, which are also termed hop spikes, cause damage to the tyres of road vehicles. In the 2004 season, three different systems for the separation of these pieces of wire from the chopped material were tested and evaluated.

The largest coherent hop cultivation area in Germany is situated in the Hallertau region. In the year 2003, 1,416 farms cultivated approximately 14,000 ha of hops [3]. Despite the enormous growth of their farms, the farmers have been struggling with the consequences of diminishing consumption and sinking producer prices for quite some time [2]. In addition, hop cultivation has been criticized for the so-called „hop spikes" in recent years. Hop spikes are 1-3 cm short pieces of wire which are waste products of the hop harvest. When the hop umbels are picked in stationary plants, the remaining vines with the enclosed up-line wire (climbing aid) are comminuted (chopped) and spread in the hop-yards as organic fertilizer. During transport, smaller quantities of this chopped material get lost, and the short pieces of wire contained in it lie on the roads. These pieces of wire can pierce vehicle tyres and thus either directly lead to a blowout or slow pressure loss. The ADAC (German Motor Vehicle Club) has taken up this problem and considers these conditions „a clear contravention of the Road Traffic Regulations" demanding „immediate remedy" [1]. Efforts to clean the roads in regular intervals using special magnetic collectors during the hop harvest may ease the situation to a certain point. However, they ultimately cannot solve the problem satisfactorily. For the future, efficient solutions which are suitable for practice and easy to realize are urgently necessary.

The separation of the wire from the chopped material directly at the picking machine is a sustainable solution to this problem. The iron (approximately 400 kg/ha = 5,600 tonnes/year in the Hallertau region) could thus be recycled as raw material. For this purpose, two Bavarian manufacturers offer systems featuring magnetic separators (drum- or belt separators). In addition, a prototype for the sedimentation of hop spikes has been developed and tested at the Institute of Agricultural Engineering, Building Research, and Environmental Technology.

Material and Method

In the 2004 season, three different separating systems were used on farms and tested extensively. The systems tested were the two magnetic separators (*Fig. 1 and 2*) and the sedimentation unit (*Fig. 3*). For this purpose, a method for the determination of efficiency was defined and tested, which allows the results to be compared. During the tests, the wire separation performance of the units was measured while picking 100 vines (running time ~ 30 minutes), whose average wire length had been determined. The wire selected from these 100 vines was collected and

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Keywords
Hop harvest, pieces of wire, wire separation

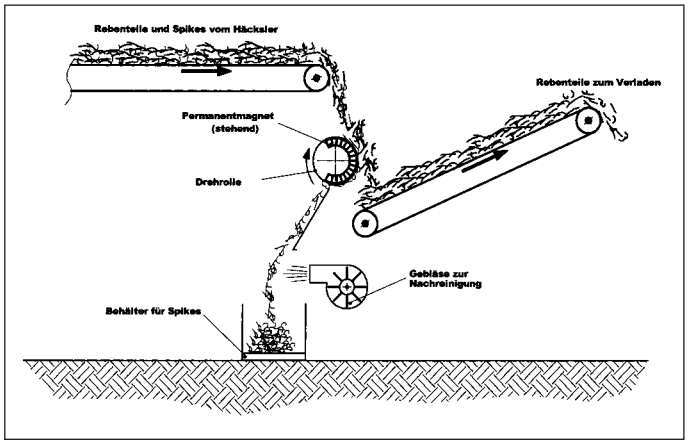

Fig.1: Structure of the magnetic drum separator (company Soller)

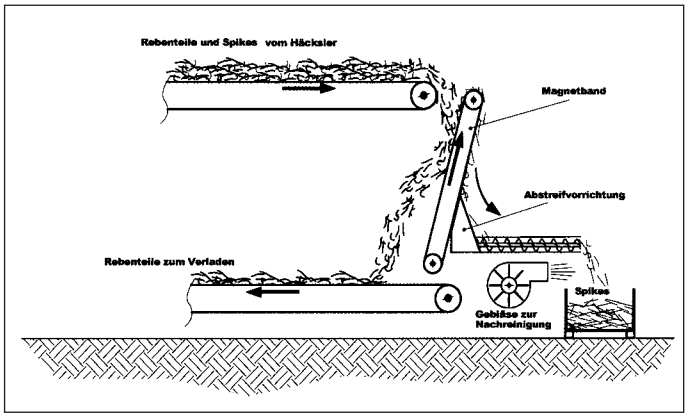

Fig. 2: Structure of the magnetic belt separator (company Wolf)

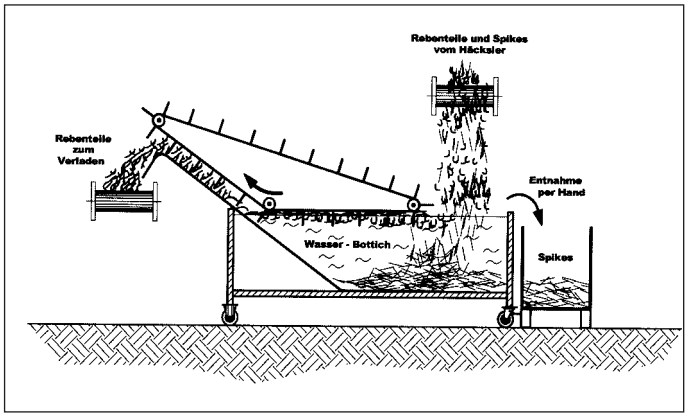

Fig. 3: Structure of the sedimentation unit (system Weihenstephan)

separated from impurities. The ratio of the wire selected by the unit and the quantity of wire fed into it were used to calculate efficiency and separating power. All measurements were repeated three times and carried out at two different times (hop varieties).

Results

Efficiency of Separation

The measured efficiency of separation values are shown and summarized in *Fig. 4*. The majority of the measurement results indicate an efficiency of separation of approximately 90%. No clear differences can be detected between the individual types of units. One measurement of the two magnetic separators each shows an efficiency of separation of only about 70%. The reason for this result is a malfunction of the picking unit. Due to short-time clogging or uneven material flow, separation deteriorates because uneven feeding leads to unsatisfactory operation of the separating units. This also provides an explanation for the slightly better results achieved by the magnetic drum separator, which was integrated into a picking unit where the material flow was more uniform than in the two other systems.

Operation

With regard to operation and the course of functions, the magnetic separators are superior to sedimentation. Apart from a certain time needed for checks and maintenance, both units work continuously and automatically. In addition to water supply, sedimentation requires regular cleaning and refilling of the sedimentation basin. Beside this additional work, problems caused by wet spikes and those soiled by green material may arise because clean iron is necessary for old metal recycling.

Conclusions

In the current prototype stage, sedimentation cannot be recommended due to complicated operation even though the efficiency of separation is good. The two magnetic separators work reliably, provide high efficiency of separation, and can be retrofitted in most picking machines at a reasonable expense.

Literature

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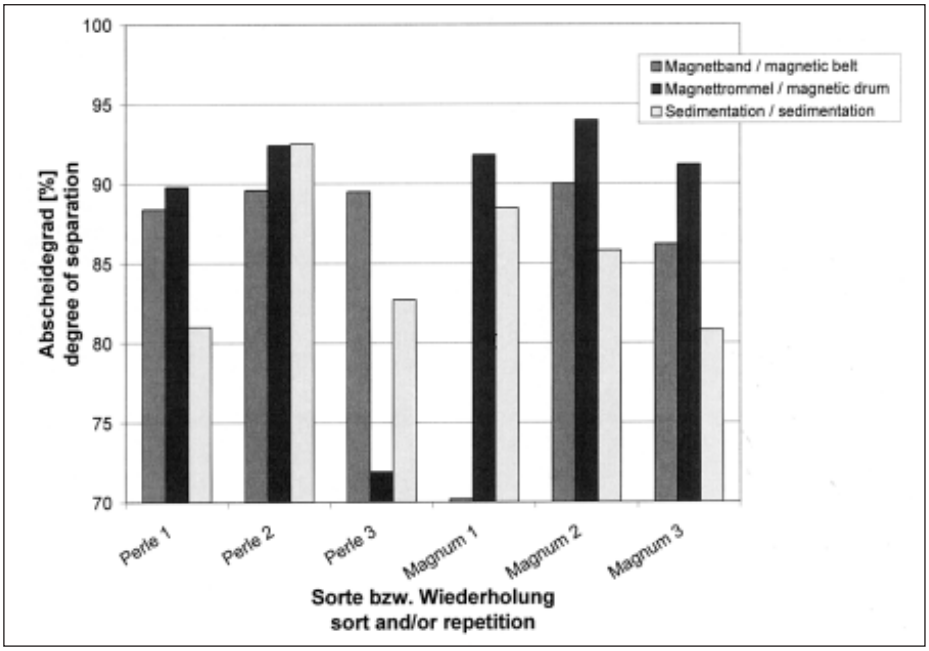

Fig. 4: Efficiency of separation of the examined systems in the individual measurements