CASE STUDIES

SEMI-AUTOMATIC HARVESTING OF WHITE ASPARAGUS

1. Organisations involved

Leibniz-Institute of Agricultural Engineering

Max-Eyth-Allee 100

14469 Potsdam, Germany

2. Description of the case

2.1. Introduction

White asparagus are cultivated in 20-30 cm high ridges of sandy soil. Harvesting them is very labour intensive and the costs are about 25% of all costs involved in asparagus cultivation. The harvest period of white asparagus is rather short: 8-10 weeks in April, May and June. When using plastic greenhouses, the harvest can start as early as the beginning of March. Regardless of location, each field of asparagus can only be used for 8-10 weeks. The growth of the asparagus spears is very dependent on temperature. At cold temperatures, in the beginning of the season, the daily yield of outside fields is about 50 kg/ha. High temperatures, however, can increase the daily yield up to 600 kg/ha.

To make the harvest more efficient, the asparagus ridges are covered with a black and white film to influence the growth of the spears. At low temperatures the black side is turned upwards to absorb the sunshine and warmth. At high temperatures the white side is turned upwards to reflect the sunshine. Thus, the fluctuations in growth of the spears are less than without the film. The harvest can be restricted to once a day or even once every two days, with more ripe spears per covered meter. However, putting aside the film before cutting the spears and recovering the ridges afterwards poses high physical demands on the workers and takes up extra time. The length of the film is about 5500 m per hectare (100x100m) of asparagus field.

Left: cutting asparagus spears and taking them out of the sandy ridge. Note the extreme trunk flexion. Right: pulling back the black/white film to cover the ridges after cutting the spears.

2.2. Aims

To reduce the physical workload of manually handling the film and reduce the time spent on that activity, both individual growers and commercial companies developed harvesting systems. The individual growers built rather simple systems, with the main goal of lifting the film and transporting the harvested spears. The commercial companies built more elaborate systems with multiple goals: lift the film, set the harvesting speed, transport the harvested spears and protect the workers from rain and sunshine. Some systems even have seats to enable the workers to sit down while harvesting.

A simple harvesting system built by an individual grower. It is hand-moved, lifts the film from the ridge for several meters and contains a box to transport the harvested spears.

A commercial electrical-driven 1-row harvesting system with seat. The system lifts the film, transports the harvested spears, gives cover against sun and rain and takes care of the ridge.

A commercial motor-driven 5-row harvesting system. The system lifts the film, transports the harvested spears and gives cover against sun and rain. It has no seats for the workers.

2.3. What was done, and how?

To reduce the physical workload of manually handling the film and reduce the time spent on that activity, both individual growers and commercial companies developed harvesting systems. The costs of the home-made devices are unknown. The costs of commercial systems vary between 1.250 euros for a simple hand-pulled 1-row system to 20.000 euros for an elaborate electrical-driven 3-row system. There is no information available about the development process and challenges faced.

2.4. What was achieved?

- The physical workload of pulling away the film from the ridge and pulling it back after cutting is eliminated.
- The energetic workload of walking along the ridges to remove and put back the film is eliminated.
- The physical workload of carrying the baskets and the energetic workload of walking long distances to empty them is eliminated. However, the lifting of full baskets from the harvesting aid to a central gathering wagon remains.
- The static working posture is more favourable when the harvesting system is equipped with seats.
- The workers are protected against sun and rain when the harvesting system is equipped with a weather shelter.
- It takes less time to harvest the spears.

The amount of time saved when using harvesting systems depends on many factors: the density of spears, the cutting technique, the number of rows from which the film is lifted at the same time and the length of the film that is lifted from the ridge. Compared to hand harvest with a basket, most time is saved when applying a multiple-row system on a field with a high density of spears. With a yield of 300 kg spears/ha and a blind cutting technique the work is done 24% faster. The amount of time saved with a lower yield of 100 kg/ha is still 21%. Put in hours, the time saved on film handling and emptying the full basket is 2-3.5 hours per hectare. An extra 2 hours per hectare can be saved on

frequent emptying of filled baskets in the case of long ridges and very high yields (500-600 kg/ha). A number of prerequisites have to be met, though, to reach this amount of time saving. The length of film lifted should be long enough to enable continuous cutting, the workers have to be able to cut the spears blind and they must work at the same cutting speed in each row of the multiple-row system. Furthermore, it should be possible to adjust the forward speed of the harvesting aid to the density of the spears to prevent waiting time.

Compared to hand harvesting with a basket, time can be saved too with a 1-row system that lifts the film along many meters. Depending on the yield, the work is done 9% (at 200 kg/ha) to 19% (at 300 kg/ha) faster. A 1-row system that lifts the film along a short distance only has to stop often to allow the workers to cut the spears. This discontinuous movement leads to a lower working speed compared to hand harvesting. Thus, at low yields (100 kg/ha) hand harvesting with a basket is 21% faster than harvesting with a discontinuously moving 1-row system. Only at high yields (300 kg/ha) working with the 1-row system saves time (9%).

Some harvesting systems are equipped with seats. This reduces the distance between the trunk and the ridge, making the static posture more favourable than in standing. Also, sitting requires less energy than standing and walking.

Other advantages of semi-automatic harvesting systems are the existence of a weather shelter and the possibility to talk to others when working with a multiple-row system.

On this multiple-row harvesting system the worker can sit down while cutting the asparagus spears.

2.5. Success factors

A semi-automatic harvesting system will be successful when it maximally reduces the physical and energetic workload and saves as much harvesting time as possible. The first goal is achieved with a harvesting system that not only lifts and transports the film and transports the harvested spears, but is also equipped with seats. These enable the workers to sit down while cutting the spears. The second goal is achieved when several success factors are met. One should use a multiple-row harvesting system on a field with a high density of spears. The length of film lifted should be long enough to enable continuous cutting, the workers have to be able to cut the spears blind and they must work at the same cutting speed in each row of the multiple-row system. Furthermore, it should be possible to adjust the forward speed of the harvesting aid to the density of the spears to prevent waiting time.

2.6. Further information

Dr. Martina Jakob

Leibniz-Institute of Agricultural Engineering

Max-Eyth-Allee 100

14469 Potsdam, Germany

Tel: +49 331 5699 624

E-mail: mjakob@atb-potsdam.de.

2.7. Transferability

The mechanical harvesting systems presented here provide a good solution to the physical and energetic workload problems associated with manual handling of the film that covers the ridges in which asparagus spears grow. These systems are so specific, though, that they can not be applied to other crops. For no other plant grows in ridges of the same height and in-between distance as asparagus. The principle of automatic film handling, however, might be used in other crops that are covered with film to influence the growth.

3. References, resources:

- http://www.asperges-verhoeven.nl
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