

Hans Kirchmeier, Gerhard Rödel and Markus Demmel, Freising

# Development and construction of a planter for horse radish cultivation

*Horse radish is a regionally limited, very labour-intensive crop, which requires a lot of manual labour. For the agricultural machinery industry, it is virtually impossible to develop and offer special machinery for this relatively small and very specialized market. For this reason, a new planter based on the base frame of a potato planter was developed and built at the Institute of Agricultural Engineering, Construction-, and Environmental Engineering in Freising-Weihenstephan. This planter was used successfully during a complete planting season and was able to fulfill the high requirements with regard to work quality and worktime reduction in an excellent manner.*

Dipl.-Ing. (FH) Hans Kirchmeier works in the Department of Process Engineering in Plant Cultivation of the Institute of Agricultural Engineering, Construction-, and Environmental Engineering of the Bavarian State Institute for Agriculture, Vöttinger Strasse 36, D-85354 Freising-Weihenstephan; e-mail: [hans.kirchmeier@LFL.bayern.de](mailto:hans.kirchmeier@LFL.bayern.de).  
Dipl.-Ing. (FH) Gerhard Rödel works in the Department of Mechatronics at the same institute.  
Dr. Markus Demmel is coordinator of the Department of Process Engineering in Plant Production.

## Keywords

Horse radish, planter, special crop

In some regions, horse radish plays an important role as a source of income for agriculture. In Franconia, for example, approximately 180 farms cultivate this special crop on about 140 ha [1]. Horse radish is a very labour-intensive, though lucrative crop from which many farms derive their main income. The degree of mechanization in horse radish cultivation is generally very low. Thus, this crop is still planted manually using the simplest tools on approximately one quarter of the area today. A special horse radish harvester developed by the Institute of Agricultural Engineering, Construction-, and Environmental Engineering allowed the harvest to be improved and facilitated significantly [2].

The planting of horse radish, for which no suitable machine has been available so far, is very labour-intensive. In addition, planting, which is very demanding with regard to the optimal insertion of seedlings, forms the basis for successful cultivation. In the case of horse radish, root cuttings are planted instead of young plants. These cuttings, which are 30 to 40 cm long and approximately 1 cm thick, are placed in the soil in an inclined position and develop into the "pole" of the new horse radish plant (Fig. 1). Those plants are harvested from autumn until spring together with the root cuttings (some of which become the planting material for the coming year). Correct insertion (angle and depth) during planting is decisive for growth and, hence, yield. In addition, it is also the prerequisite for the reduction of harvest losses to a minimum and an easy harvest. Therefore, it is particularly important to improve and optimize planting significantly.

## Stage-wise development - Improvement of the existing machine (2004/2005 season)

For several years, some farmers have already tried to cope with the demanding insertion of the root cuttings with the aid of specially built or converted planters. In principle, these planters are so-called "star wheel machines". They feature a rolling wheel which uses mounted (star wheel) teeth to punch holes into the soil into which the root

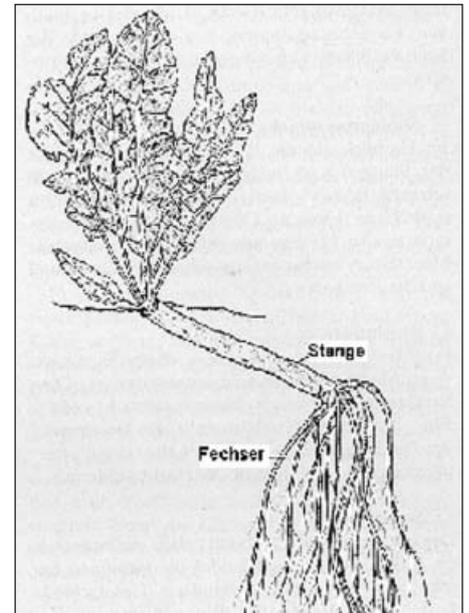


Fig.1: Body and habitus of horse radish

cuttings are planted. This unit is followed by ridders or coulters, which shut the holes.

Such a planter (Fig. 2, left part) was used specifically in the year 2003 together with a group of horse radish cultivators and analyzed in detail. These tests showed that the penetration depth of the star wheels into the prepared seedbed varies depending on the soil conditions. For this reason, precise planting depth could not be kept. The subsequent covering of the planting hole with soil by the following baffle plate was also insufficient, i.e. uneven. Little by little, the machine was redesigned and continuously tested in practice.

The conversion of the machine for use in optimally pre-shaped ridges (using a ridge tiller or a ridge shaper from potato cultivation) provided decisive improvement (Fig. 2, right part). For this purpose, a ridge shaper was integrated into the front part of the machine, which mainly serves to guide the machine, but can also perform little corrections of the ridge shape. Thus, the planter is guided along the raised ridges, and the adjustable planting wheel always enables the star wheels to penetrate into the soil centrally and at the desired depth. The star wheels were also improved stepwise with regard to their shape and the choice of materials. For the shutting of the planting holes, different solu-



Fig. 2: Vegetable planter modified for horse radish – development stages

tion concepts were also discussed and tested. A planter equipped with a second ridge shaper in the rear part of the machine proved very efficient. When the planting wheel penetrates into the soil, the ridge walls are slightly pushed apart. Then, the ridge is caught by the rear ridge shapers and compressed into its original form when the machine moves on. Thus, the position of the root cuttings is maintained, and the reliable, precise covering of the seedlings is guaranteed.

This redesigned machine, which was improved in many other details, was used and tested in the 2004 season. For the 2005 season, it was redesigned and optimized again based on the insights gained.

### The new development of the planting machine "Kren-planter" (2006 season)

It was the goal of this project to use the experiences gained during the described improvement of an existing planter for the construction of an optimized new machine, which should be based on a series machine if possible in order to keep the costs of production and development to a minimum (Fig. 3). The search for a suitable basic implement led to the choice of a 2-row bunker-hopper potato planter (Grimme type GL 32 B). Thanks to its stable, extendable frame and its chassis, this machine seemed well suited for this purpose. In a first step, the frame in front of the chassis was extended after the different possibilities had been weighed in order to be able to integrate the front ridge shaper- and planting wheel units. Due to the positive experiences, the teeth of the planting wheels were made out of fiberglass-reinforced plastic, and their form as well as their size were redesigned once again. In contrast to the first machine, the new machine has its own chassis. Therefore, the machine can be operated in a floating position while planting. In combination with the hydraulically adjustable chassis, planting depth can always be set precisely. The inclination of the rear ridge shaper can be adjusted hydraulically in order to be able to

close the planting holes reliably at any time. In addition to the merely functional units, the operating personnel was considered who must manually insert the root cuttings into the pre-punched holes. The arrangement of the seats immediately on top of the rear ridge shapers allows the personnel to assume a sitting position as close as possible to the insertion point of the cuttings, which is relatively pleasant given the circumstances. Both the seats and the seedling hoppers can be adapted and adjusted to the needs of differently tall persons.

### Result

The consistent improvement of an existing planter in several steps, which led to the development of an entirely new machine, allowed a fully functional prototype to be created within just two years. This machine integrates optimally into the ridge cultivation system, which has meanwhile been introduced and is being practiced, and features the following characteristics:

1. Efficient, practical overall technique (seedbed preparation, ridging, planting and harvest with the aid of mutually adapted machines)

2. A planter which fulfills all requirements, can be adjusted and adapted optimally, and is ergonomically favourable
3. Machine based on the frame and the units of a potato planter produced in series
4. Extension and conversion of the series machine without significant alterations (only two welding spots). All required modifications and supplements are bolted or clipped on (modular principle).

### Conclusions / Outlook

With the development, the construction, and the testing of the first unit of a new planting machine based on a potato planter, an additional element in the mechanization concept for horse radish cultivation became available. Like in many special crops, far more mechanization and, hence, development are needed for horse radish cultivation from planting and harvesting to storage and processing. Therefore, more activities will be required in this field.

### Literature

- [1] Amt für Landwirtschaft und Forsten Fürth: Mitteilungen und Aufzeichnungen des ehemaligen Mitarbeiters Josef Graf
- [2] Sauter, G.J., H. Kirchmeier, R. Geischeder und G. Rödel: Roden von Meerrettich. LANDTECHNIK 57 (2002), H. 4, S. 204 -205



Fig. 3: Horse radish planter „Kren – Planter“ (system Weihenstephan)