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Trends in potato technology

Below, some important trends in potato cultivation are presented, which are going to be reflected by the machinery- and implement programme shown at the Agritechnica 2005. This preview only provides pre-information and cannot replace a trade fair visit. Completeness is not aimed for.

Potato production is subject to heavy price fluctuations due to the still relatively free play of the market forces, which are reflected by long-term economic gains or losses of potato-cultivating farms. In recent years, good harvests and a continuous reduction of potato consumption have increased the pressure on producer profits Europe-wide. The agricultural machinery industry, which wants to contribute to the realization of the goals, i.e. product safety, product quality, and profitability in potato cultivation, by providing innovative solutions, is also affected by this development.

Cultivation and maintenance

Given these conditions, the tendency towards the combination of work steps has increased significantly in particular in potato cultivation. After plant bed preparation and planting had been combined in a first step (in particular through front-end mounting of soil cultivation implements), simultaneous terminal ridging has been added today. This early ridging with the aid of different ridging tools requires great vitality of the seed potatoes and sufficiently dry soil in order to keep the risk of emergence damage as low as possible. The combination of planting and ridging in one work step allows worktimes to be almost halved and the process costs to be reduced.

As a result of this change of techniques, more frequent transition to trailed planters can be observed. Since these planters have their own chassis, hopper size can increase significantly so that their share of non-productive times can be reduced further with the aid of efficient filling techniques, such as conveyor belts or wide blades on tractors or wheeled loaders. However, the tracking of the trailed planters is less good. This problem is intended to be addressed by means of slope discs and hydraulic control systems on the wheels and the drawbar. Thanks to the arrangement of the soil cultivation implement between the planter and the tractor, the track width of the latter may differ from row width. In order to avoid soil compaction and clod formation, the tractor should be equipped with soil-protecting tyres, and the working depth of the soil cultivation tools should be sufficient.

For ridging on light to medium soils, ridgers which loosen the soil and convey it to the ridge area are generally used both on the maintenance equipment and behind the planters. In single-stage terminal ridging, these tools are followed by a shaping board or cage rollers at a second tool level, which form the ridge and reconsolidate the soil. The cage rollers require considerably less tractive force and provide a rougher ridge surface, which reduces mud accumulation in the soil. In order to avoid water erosion in the furrows, simple loosening tines behind the shaping boards are offered. In addition, rolling dibblers or controlled carriers, which generate grooves or form small lateral ridges in adjustable intervals and thus regularly interrupt undesired water runoff, can be mounted behind the maintenance equipment or the rotary cultivators.

Harvest

In the mechanization of potato cultivation, the harvest is the largest cost block, which can be changed only to a limited extent because harvesting exerts a long-term influence on the entire quality of the potatoes. Whereas susceptibility to damage increases with falling tuber temperatures, for example, daily and seasonal harvester output grows significantly. Optimized plant bed preparation or bed separation provide conditions of use under which the quantity of dirt is small and which favour higher harvesting speeds. Often, however, active dirt separators become the unit which limits the output of bunker-hopper harvesters. Therefore, more and more machines are used which only feature simple dirt separating systems. Here, the modular design of the new harvester generations provides clear advantages. Given more and more different conditions of use, however, the manufacturers should realize this design in an even more consistent and variable manner.

Another possibility of increasing the output is enlarging hopper capacity in order to be able to harvest longer fields and to reduce the number of transfer processes. Today, large one-row bunker-hopper harvesters hold up to 6 t of potatoes, which corresponds to a maximum digging distance of 1,600 m given an average yield of 50 t/ha. In trailed two-row bunker-hopper harvesters, however, hopper capacity is limited to 3 to 4 t per row,

Fig. 1: In potato cultivation, plant bed preparation, planting, and ridging can be combined.

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Keywords

Trends in development, potato cultivation technology, planting, harvesters, storage and processing

Fig. 2: Due to larger hopper capacities, one-row harvesters can increase their capacity even more.

and even self-propelled four-row harvesters do not exceed 4 t per row. Due to the larger hopper, the one-row machines can increase their capacity significantly. Under good conditions, their campaign capacity even significantly exceeds 50 ha in practice today.

When a filling system was developed which enables pallet boxes to be filled directly on the harvester, a mainly quality-oriented approach was pursued. By combining the grading line of the harvester with a special box filling system, the number of falling steps and, hence, the danger of damage was able to be reduced significantly. In addition, the potatoes are loaded into the boxes without dirt and bulk cone formation, which results in improved storage life of the harvested potatoes.

For the haulage of the potatoes collected by a harvester, large all-purpose transport trailers are available on most farms, whose tuber-protecting filling requires a far-lowering elevator and padded vehicles. In addition, the tyres of these trailers are generally designed for road transport instead of providing maximum soil protection. For quality- and cost reasons, the use of special reloading wagons for the field transport of potatoes has not been able to establish itself so far. Therefore, new approaches in logistics should be developed and tested here. Harvester development is still focusing on dirt separators equipped with laterally or longitudinally arranged rollers as well as the performance- and quality-oriented optimization of the transfer elevator. One manufacturer also offers a two-row harvester with a lateral ridge pick-up again, which allows more powerful tractors with soil-protecting tyres to be used.

Self-propelled potato harvesters are still a very limited market segment, where, however, the range of available machines is growing due to new models and new suppliers, in particular in the range of four-row bunker-hopper harvesters. The higher purchasing costs of the self-propelled machines can only be compensated for under favourable conditions, such as long campaign duration, large field structures, and adapted logistics. However, they become more preferable on heavy soils and for the harvest of late-ripening processing potatoes, which requires highly reliable machines even under difficult conditions.

Storage and processing

In many cases, storage equipment on farms is still sufficiently dimensioned for increased harvesting capacities or the transition from one to two-row harvesting. Only in old buildings can rather frequent changes in the loose storage chain lead to labour management bottlenecks. Despite a higher risk of damage and storage, pre-grading of the harvested potatoes during storage is still meeting with growing interest for marketing reasons. In addition to universal flat-sieve pregraders, machines with corrugated rollers or revolving chain webs are used, which are in particular suitable for special conditions of use.

While forced ventilation and underfloor channels are still predominant in bulk storage, different ventilation systems are used for the storage of pallet boxes. In addition to the classic forced ventilation of the pallet boxes by means of a ventilation wall, a forced suction system for open boxes is offered. For the room ventilation of box stores, various solutions including fanless lift ventilation can be found, which, however, may reach their functional limits in particular during the drying phase of the potatoes.

For efficient quality conservation in the store, mechanized cooling is gaining more and more in importance. In seed potato production, for example, even a financial bonus for mechanized cooling is granted in some cases. Most processors for ventilation systems are also designed for the control of mechanized cooling systems so that installation in existing store houses does not cause any problems. In addition to pre-assembled cooling towers ready for operation, which only require a waste heat opening in the building, often cooling systems with a spatially separated evaporator- and compressor arrangement are used which can be individually dimensioned for each store.

For the processing of food potatoes, electronic grading- and picking systems are establishing themselves only relatively slowly in practice due to the still rather poor price-benefit ratio. As a result of the steady improvement of the machines and the marketing of food potatoes based on tuber weight as one criterion stipulated by revised grade regulations, the demand is expected to increase significantly in the years to come. In the sector of weighing- and packing machines, the filling and later handling of even smaller packing units in addition to further capacity increase and gentle potato treatment are important.

In the entire processing chain, attention is focusing on operational hygiene due to integration into quality management systems. Under this aspect, good accessibility of the machines for cleaning, the use of paints safe for all foods, or the use of suitable oils in the hydraulic systems of the machines are new criteria to be considered. In addition, sanitation is also important for protection against the propagation of pathogens in seed potato production. Therefore, several manufacturers already offer machines for the cleaning and disinfection of pallet boxes.

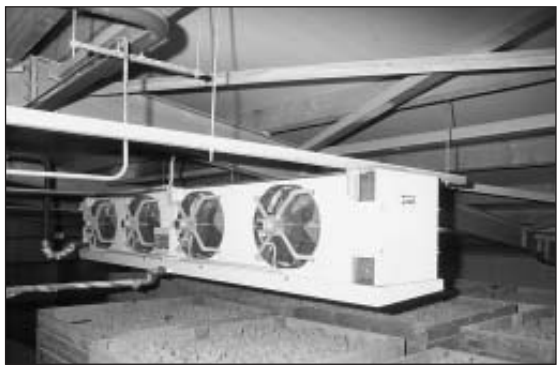

Fig. 3: For quality reasons, mechanized cooling is increasingly gaining in importance for potato storage.