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Trends in potato technology

Fig. 1: The GL 34T from Grimme allows tillage, potato planting, and ridging to be carried out in one pass (photo: Dr. Metzner)

Below, important trends in potato cultivation are presented, which will be reflected by the machine and implement programme shown at the Agritechnica 2007. This preview cannot replace a trade fair visit. It only provides pre-information and does not claim to be complete.

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Keywords

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

The very good potato prices of the last marketing season, which were a result of the small harvest, fit the optimistic atmosphere in the agricultural sector. Due to the large transport volume and the high transport risks, however, the potato market is largely a European market, which is influenced only indirectly by the increased demand for agricultural products on the world market. Due to these conditions, potato cultivation is facing growing competitive pressure on the farms, which is going to result in more structural change.

Storage and processing

The over-average temperatures during the entire storage season 2006/07 significantly stimulated the demand for cooling systems for potato storage. Combination with existing ventilation systems for outdoor air operation allows the necessary cooling capacities and operating costs to be kept within limits. Moreover, new concepts for the insulation of stores are needed because potatoes must not only be protected against frost, but also against outdoor heat. Especially for long-term storage and in stores cooled by machines, this urgently requires the realization of higher insulation values for the building shell. In addition, large storage rooms must increasingly be divided into several separate sections again. The use of grain cooling systems in potato storage for additional cost reduction, however, is not practicable because grain coolers work with a significantly higher saturation deficit, which leads to excessive water losses in potatoes.

Electronic control systems for ventilation systems are becoming more and more complex not just as a result of the integration of cooling systems, but also due to new controlled variables, such as the CO_2 content. Mainly in combination with new agents and application techniques for sprouting inhibition or the integration of weather prognoses, additional tasks are emerging which may contribute to the optimization of storage conditions for potatoes if common processors are used for control. The data transmission systems which are ready for practical use today enable these units to be operated in real time even from the farm PC or the mobile telephone. Moreover, the data can be stored and compiled easily for documentation in the different quality programmes.

Due to their universal applicability, flat-sieve sorters are still primarily used for the size-based sorting of potatoes. In addition to better modification of the machine-specific sieve movements, the opto-electronic determination of the composition of the potato flow as a reference value for the adjustment of the sorting machine is being worked on. In large processing operations, automatic opto-electronic sorting and picking machines are beginning to establish themselves after several development and testing phases. Machines from fruit cultivation, which were adapted to the requirements of potato processing by means of appropriate program modifications, are also used for this purpose. The large potential of these machines lies in the free combinability of the individual selection parameters so that even the most different product requirements, such as size, weight, or the outer quality of the tubers can be met immediately.

Since consumers tend to buy smaller quantities frequently, the package sizes of potatoes continue to decrease. Therefore, the automatic weighing and closing machines

known from large packing operations are now also used more and more often on large farms which have their own processing line. Due to the modular design of the weighing units and easy combinability with different closing techniques, the machines can be specifically adapted to the individual conditions. However, the possibility of high weighing frequencies also causes the risk of the tubers being exposed to heavier mechanical loads on their way into the bag. Here, parallel conveyor belts or special padding in the delivery and closing area provide possibilities of reducing the risk of damage.

Fig. 3: In the new Varitron 270 from Grimme, great importance was attached to gentle delivery of the harvested potatoes (company photo)

Cultivation and care

For potato planting, a wide range of two to eight-row machines is available, which also reflects the different demands and structures of worldwide potato cultivation. While the demand for simple two-row designs is stronger in Southern Europe, two-row planters for use in separate beds (e.g. in the UK) are often equipped with sensor-controlled depth guidance, liquid dressing, driven intensive shakers, and monitoring cameras. In addition, it must be possible to adjust the machines to various row widths in a range between 0.6 and 1 m, at least in certain areas.

In the past years, the trend towards a combination of work steps has increased significantly also in potato planting. Especially plant bed preparation or ridging and increasingly also row fertilizing are combined with planting. When mounted planters are used, the soil cultivation implement is generally attached to the front hydraulics of the tractor so that the largest possible quantity of seed tubers can be carried. Since drawn planters have their own chassis, they offer various possibilities of combination. However, soil pressure, which grows with total weight, may not be ignored. For the direct formation of the terminal ridge during planting, ridgers which are generally combined with following shaping boards or cage rollers are available. For quick reaction to changing soil water contents and seed potato quality, easy mounting and removal of these ridgers is important.

Cultivation implements are also offered as two to eight-row models so that their working width matches the width of the planters. On heavier soils, the rotating tines or hooks of row tillers provide sufficient loose soil for ridge formation, whereas differently sized cultivator tines can supplement the work of the ridgers or ridging discs in drawn implements. Here, one can also choose between cage rollers and differently formed shaping boards for actual ridge formation. In the case of exclusively mechanical cultivation, the cultivation implements can be equipped with special ridgers and additional hoeing shares or discs for weed control. Especially during cultivation, the use of automatic steering systems controlled by opto-electronic sensors or GPS suggests itself. If machinery use is appropriately harmonized, a GPS data base collected during planting allows the quality of work including harvesting to be significantly improved.

Harvesting

During the potato harvest, area capacity and potato quality are basic evaluation criteria for successful work. The one-row harvesters with a wider sieve canal and a hopper capacity of up to 6 t of potatoes offered on the market provide an additional increase in capacity potential, which can be used profitably in particular by growing farms and facilitates later transition to two-row machines. Optimized assemblies in all areas, which combine an unimpeded tuber flow with efficient separation of soil, haulm, and admixtures, provide other advantages. In addition to improved or new tools, the use of sensors and electronic control and monitoring units contributes to the better work efficiency of the harvesters. The possibilities of cost minimization by means of an extension of the annual area of use, however, are limited because constantly growing quality requirements must be fulfilled in all processing directions today and optimal harvesting conditions cannot be expected every autumn.

The price level of two-row bunker-hopper harvesters frequently leads to discussions about a changeover to harvesting with a cost-effective unmanned harvester. The use of an unmanned harvester requires locations where the quantity of admixtures is generally small and a rather short distance between the farm and the field. Soil separation before potato planting enables the area of application of unmanned harvesters to be extended significantly and allows uniform mechanization to be realized in particular on farms with changing locational conditions. However, the cost advantages during the actual harvest require larger expenses for transport and storage as field-farm distances increase. These expenses can neutralize or even invert the economic preferability of the overloading technique.

The advantages of potato windrowing, such as better storability or clearer skin colour, are only used by approximately 10% of the potato-cultivating farms in Germany. Accordingly, the offer and the technical development of machines for the divided harvesting technique are limited. The increasing use of the windrower for the harvesting and deposition of two or four rows between two ridges, however, could result in growing interest in these machines in the future. This enriched harvesting technique allows area capacity to be increased in a cost-effective manner because a conventional two-row harvester can harvest a significantly larger quantity of potatoes.

Fig. 2: The new one-row harvesters WM 4500 and WM 6000 from WM Kartoffeltechnik are characterized by optimized capacity and several innovations (company photo)