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Technological Trends in Organic Fertilizing

The demands with regard to the quality of solid- and liquid manure application have increased substantially. The conditions are determined by environmentally relevant criteria. The focus is on better exploitation of the fertilizing value and the reduction of environmental pollution. Aspects of labour- and farm management are gaining in importance. The development of application equipment for organic fertilizer is characterized by demands regarding efficiency, soil protection, and even nutrient distribution because organic fertilizer spreading is being more and more taken over by contractors, machinery rings, and machinery-sharing cooperatives. Larger investments in this special equipment, which provides larger volumes, improved chassis, weighing and documentation of the work processes, as well as sophisticated spreading systems, must be considered the main reason for this development.

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In addition to poultry fattening, calf rearing, and pig husbandry, a growing percentage of animals in cattle fattening and dairy cattle husbandry is kept on straw. Mainly as a result of programmes for the promotion of species-compatible animal husbandry and solid manure programmes, an increasing demand for vehicles is being observed. The quality of distribution depends on the rotting degree, straw length, and dry matter content.

Increasing Regional Importance of Solid Manure Techniques

An application date adapted to the needs of the crops requires sufficient storage capacities. Even though manure is not usually processed before application, processing is very advantageous for even nutrient distribution and -availability.

The spreaders of the new generation are characterized by larger volumes for better efficiency. With progressing structural change, farm-field distances are growing.

In addition, an optimal application date adapted to the needs of the crops helps to improve nutrient exploitation and to reach the crops' growth optimum.

Due to the larger loading volume, the chassis of these wagons must fulfill greater demands. Large-volume low-pressure tyres are state of the art. In order to keep soil pressure within acceptable limits, more and more vehicles are equipped with force-steered twin- or even triplet axles. In combination with central tyre inflation systems, the ideal air pressure during road rides allows rolling resistance and, hence, wear and energy consumption to be reduced. In addition, drag and soil pressure on the field can be kept within a tolerable range.

Metering during solid manure application still causes difficulties. Driving speed-regulated scraper floor control and push-off slides cannot conceal the heterogeneous rotting degree of the solid manure. Even nutrient distribution is required and must therefore be striven for. Redistribution of the dung is likely to be indispensable for even rotting and helps to improve nutrient dynamics sustainably. In any case, this approach is more cost-effective than investment in expensive additional equipment. New developments for even quantity distribution are based on the torque of the metering rollers. However, this requires a homogeneous application product.

Broadcast distributors with distributing plates are standard today. They comminute and distribute solid manure better than most distributors which only feature horizontal or vertical rollers. In addition, they also reach larger working widths. Spreading vanes whose length and angle can be set and the alteration of the feed-on point on the distributing plates through adjustment of the rear baffle plate allow the quality of distribution of heterogeneous material to be improved.

Weighing equipment makes sense even if the initial material is homogeneous and nutrient concentration is high. Thanks to a given set quantity per hectare combined with optimal working width, even manure- and nutrient distribution can be expected. Under the aspect of process technology, a very high price is paid for environmentally compatible and crop-adapted nutrient supply through liquid manure.

Liquid Manure Techniques: Focus on Environmentally Relevant Aspects

In liquid manure techniques, the focus is also on environmentally relevant aspects. There is a tendency towards quantity- and nutrient reduction. New feeding techniques, nutrient-adapted feeding, and special drinkers which help to avoid unnecessary water losses can be considered trend-setting from this point of view. This in particular helps those farms whose fertilizer balances show continuous excess quantities as defined by the Fertilizing Decree. In addition, the transport of liquid manure to arable farming regions with little livestock farming is very expensive.

When applying liquid manure, nutrient- and crop-adapted fertilizing is also a matter of course. The necessary storage capacities have meanwhile been created. The percentage of high-level tanks is growing. Tightened odour regulations require container covering. In addition, they help to reduce ammonia emissions during the storage period. The goal is emission reduction by at least 80%. Natural swimming covers, chopped

Fig. 1: Biogas plants of all sizes enjoy currently a boom (photo GE Jenbacher)

straw covers, granulated bulk material, as well as tent- and fixed roofs are all possible solutions.

The containers are usually filled via the edge up to the swimming cover. With the aid of a submerged cutting pump, liquid manure rich in fibre is conveyed from the dung pit to the final storage container. Otherwise, electrically driven positive displacement pumps are used.

Homogeneous liquid manure is the prerequisite for even distribution. Among the wide variety of stirring techniques, propeller agitators are increasingly establishing themselves due to their higher efficiency. Hydraulic techniques (based on pumps and agitator nozzles) are only used in a few smaller containers.

Electrically driven submerged motor agitators having a driving power of more than 10 kW and tractor-driven bar mixers are still in demand. If designed as tower mixers, they allow containers more than 4 m in height to be efficiently homogenized. These mixers are particularly suitable for cooperative use.

With regard to the design- and agitating concept of round containers, clear experiences and evaluations are available. It seems that construction-physical and fluid-technological findings regarding under-stall storage have not yet become common knowledge. This is the only explanation for the wide range of slot mixers available. The auxiliary use of these small machines for stirring becomes necessary due to malfunctions in some areas of the storage system caused by construction errors or insufficiently dissolved sinking layers or swimming covers. For stirring in single-duct channels, they must be considered standard.

Discussions about the later treatment of liquid manure have abated. Neither additives nor separation with the aid of various concepts, vaporization, filtering, or reverse osmosis have gained any significant importance in practice. Interest in biogas plants, however, has grown substantially. The higher electric power supply price and the possibility of cofermentation as well as the use of organic waste from industrial production for a cost refund had a positive effect on the profitability of these plants. The supply of equipment for the processing and metering of cofermentation products is growing. The offered solutions have generally been designed on the basis of feed mixing systems for stationary use.

For liquid manure application, the single-stage technique, where the same tanker is used for transport and application, is still the rule. Only in a few regions did the use of specially designed vehicles for road transport and application meet with wide acceptance. This variant is popular among machinery-sharing cooperatives, contractors, and machinery rings. In order to increase efficiency, ever larger tankers having greater filling capacities are used for the single-stage technique. In order to keep rolling resistance during road rides and soil pressure within acceptable limits, some of these tankers feature weight transfer onto the tractor, up to four steered axles, lift axles, large low-pressure tyres, and a central tyre inflation system.

For the efficient filling of these giants, which are meanwhile also suitable for motorway rides, dock arms and suction tubes are available. In combination with a hydraulically driven centrifugal pump at the suction tube, the latter have a higher filling capacity. Filling aids are generally very popular in particular for sucking from deep-lying channels and containers.

The distribution- and metering accuracy of the different distributors has been constantly improved by means of electronic display- and control systems. Here, technology has reached a level of quality comparable with mineral fertilizer spreaders. According to the Fertilizing Decree, broadcast distributors may only be used under certain weather conditions or on the field if the manure is incorporated afterwards. Therefore, the trend continues to favour the use of trailing hoses for slurry spreading on the field. Thanks to improved metering- and distributing systems, working widths of more than 20 metres are no problem. Integrated control systems facilitate operation and monitoring. For slurry application on grassland, systems which deposit the liquid manure on the soil, though in the sward, have become more popular. The desired results of these trailing shoe implements are lower emissions and less plant soiling, which results in better growth qualities. Slotted implements are no longer discussed today. They no longer play a role in our regions: no better emission effect, greater power requirements and, hence, higher energy consumption, sward damage, higher application expenses, and restricted efficiency are the most important arguments.

Future Prospects

The development towards improved solid and liquid manure techniques is unbroken. Due to the heterogeneous composition and structure of solid manure, better metering is the greatest challenge. Technical requirements and benefits should be well balanced because one-time redistribution of the manure is likely to be cheaper in most cases. This particularly applies because the application of solid manure per kilogram of nutrients is more expensive than the spreading of liquid manure.

At present, there is no urgent need for significant improvement in liquid manure techniques. As tank sizes increase, there is a growing demand for greater filling capacity. Therefore, interesting detail improvements can be expected here.

Foto Dr. Metzner

This also applies to trailing hose distributors, which can also be used on grassland after minor modifications.