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Development trends in equipment for solid and liquid manure

Not more than a few years ago neither liquid manure tankers nor dung spreaders offered controlled application of organic manure according to crop and environmental requirements. This has changed, especially for slurry tankers where present technology offers standards of dosing and spreading precision that can hardly be bettered. The improved technology has become more expensive, however. Work pressures have increased too. Both developments mean organic manure application is increasingly handled by labour arrangements outwith the farm.

Expensive technology and high labour peaks mean that organic manure is increasingly applied by contractor, machinery ring or machinery group thereby increasing demand for higher capacity machinery. Newest developments aim for increasing capacity through larger-scale machinery while also attempting to keep ground pressure, draught requirement and costs reasonable. Processing of manure and documentation are also being encouraged.

Fertiliser value knowledge important

One of the greatest problems with liquid or solid manures is that their fertiliser value is not known so that the exact dosing of plant nutrients indispensable for proper crop nutrition is impossible. In the past analysing nutritive values was a laboratory job with high cost and work input. This could change in the foreseeable future . Firstly, development of more practical and speedier analytical systems to determine the three main nutrients through near infra red spectroscopy for on-location results are being intensively worked on. Secondly, a perhaps more interesting development features new sensors to precisely determine liquid manure application rates and estimation of nutritional content through considering the feed and intake of the livestock involved and its metabolic deposition plus gaseous (N) losses. This possibility needs no sampling of manure, nutritional values are already known and complete documentation of the nutrition cycle is therefore possible. However, the nutritional value thus calculated refers to a single charge and is only then precise when manure is properly mixed before bringing-out.

Processing organic manure

Little is new in organic manure mixing machinery. As before, solid manure is seldom mixed although such a procedure is important. At the most, the manure heap may be turned over with a loader. Mixing liquid manure before application is by now standard with pumps used for mixing in smaller tanks as well as applied in moving the liquid. Slurry in larger containers can be mixed with the very much more efficient propeller systems. With slurry pumps efficiency can be increased through a series of detail improvements and there are now so many versions on offer that the most different requirements can be met. The same applies to propeller mixers which have also proved themselves in biogas plants, where slow-working paddle systems are also being applied.

Of the many possibilities for processing solid or liquid manure neither the adding of preparations nor the mechanical, biological or thermal handling have been able to establish themselves in practice. However, promising new possibilities continually appear although many fail through too high costs,

Fig. 1: Solid manure should be mixed before field application (Factors photo)

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Keywords
Organic manure, preparation, application

poor practicability or increased labour requirement. Energy production through feeding biogas plants with solid and liquid manure can, on the other hand, be very efficient. The boom in this branch continues unabated with the tendency towards larger, community-serving, plants.

Spreading machinery becomes larger

For both solid manure spreader and liquid manure or slurry tanker, the increase in larger biogas plants and the sometimes mercurial growth in size of livestock units has encourage a trend towards very large application vehicles. The limit here is set by road and traffic regulations. In Germany (StVZO) maximum weight of tractor and loaded trailer/implement is 40 tonnes. This means a slurry tanker, which can have triple axles, can have a maximum load of around 21 m^3 liquid manure. With the tractor weighing around 9 t and tanker weighing 10 t any more slurry would lead to overweight. In the meantime not only many contractors but also slurry tanker manufacturers have recognised this and the development of large slurry tankers with lower tare weight is now in full progress.

Another tendency concerns slurry tanker size, with large three-axle vehicles being again superseded by more twin-axle ones with load capacities of around 16 m^3. Where transport involved is around 5 km these tankers offer more economical application operations. The discussion on road traffic regulation limits on slurry tanker size has led to once again more thought being given to separate transport and application systems with slurry delivery to the field mostly by truck and subsequent pumping into a spreader tanker (which can be self-propelled) or a fieldside container. This procedure means more input through additional loading and unloading but offers the advantage that transport and application operations are carried out by specialised machinery with resultant lower costs.

A problem in this respect is the matching of transport and application capacities. To avoid waiting times the number of transporters has to be altered according to distance travelled. This is not too easy to organise and the difficulties increase when distance travelled changes several times daily as operations move from one small field to another. Where, however, large spreading areas are involved with longer distances to be covered the separate vehicle approach is certainly worth consideration. Fieldside containers as intermediary storage points help avoid spreader waiting times but cost and labour is increased. This procedure has found impressive growth especially in areas with large farm structure such as eastern Germany. It enables application performance which can easily lie at around 70 m^3/h.

Fig. 2: Large farms increasingly favour separate transport and application approaches (Factory photo)

Exact dosage and uniform application

Exact dosage of required per hectare rates is possible with slurry tankers nowadays. With flow measuring equipment the slurry amount is continually monitored and controlled by pushblade or bypass so that the predetermined amount is actually applied. So far, similar accuracy has not been reached with solid manure spreaders. Weighing systems to determine the loaded amount, pushblades for equalising differing load heights and regulated floor scraper action are, however, developments that already offer definite improvements in application accuracy. The large working width spreading capability with solid manure spreaders offers the advantage of manuring large areas at a single pass although there remains the problem of substantial windblow susceptibility and associated loss of spreading accuracy, especially with a relatively light manure. The increased shredding/separation action of solid manure spreaders is a substantial advantage from a soil nutrition availability aspect.

Most important techniques in spreading liquid manure are the reciprocating jet, impact plate, umbilical hose system, slurry shoe spreader and slurry injector systems. All these approaches have seen working widths increased. Additionally, work is continuing towards uniting the advantages of the umbilical and slurry shoe spreading system which would mean, just like the swinging jet and impact plate systems, a single spreader being able to work on both bare land and growing crops.

Whatever the spreader type, liquid and solid manure can be applied without risk to environmental balances as long as the right weather conditions are chosen and/or simultaneous incorporation of spread material takes place.

Outlook

Following the substantial progress of spreading machinery developments in recent years, important now for both solid and liquid systems is, for instance, that development of methods for rapid analysis of nutrient concentration in organic manures be expedited.

The higher development requirement is for solid manure - and technology for better mixing here would be welcomed. Additionally, the susceptibility to windblow during spreading with otherwise acceptable working widths must be reduced. Otherwise it must be accepted that, in the organic manuring sector, the era of spectacular new developments is coming slowly to en end. Developments in future will be more concerned with the details.