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Slurry lagoons

Specifications and experiences

In order to gain knowledge in general on number, dimensions and utilisation of slurry lagoons a questionnaire was distributed amongst 150 farmers in August 2000. Results indicated that the average lagoon capacity was an impressive 1877 m³. Despite the relatively high land area involved, the economical construction of lagoons as well as their simple operation led to a high degree of satisfaction amongst farmers. In that limited emissions of ammonia from lagoons also appear to be confirmed (see page 30) a further distribution of this form of slurry storage can be expected, despite the requirement for official planning permission.

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This project was jointly financed from the Baden-Württemberg Ministry of Nutrition and Rural Areas and also supported by the firms CenoTec GmbH, Graven and Paulmichl, Leutkirch, (company of Wolff-System Gülleerdbecken) [1].

Keywords

Lagoon, survey, assessment

Literature

[1] *Krause, M. und E. Hartung*: Umweltwirkung von Güllelagunen. Endbericht zum Forschungsprojekt, Aktenzeichen: 22-8237.42, Hohenheim, 2000

From 150 distributed questionnaires 76 were returned containing answers on 84 lagoons. This represented a response of just over 50%, a good reaction.

The location

for creating a lagoon has its logic. Thus, 30% were situated on the edge of villages, nearly 50% in steadings set apart from neighbouring buildings and 17% out in the fields. Through the relatively large ground area required including the earth wall and because of the open constructional design no permission for siting within the village is generally given. On the other hand, often a lagoon is the only construction permitted outwith the village because – especially when it is greened-over – it fits in with the landscape better than a slurry silo.

The size

of the lagoon was determined through area, depth and additionally the volume. Nearly two-thirds of the lagoons were square and only around a third rectangular. From 75 responses average surface area (max. emitting surface) of the lagoons was 745 m² (230 to 6400 m², *table 1*). The ground area was an average 410 m² (90 to 2915 m², *table 1*), thus relatively large areas of land were used for the lagoons. With the same volume a comparable round silo requires 470 m² ground area (Ø 24.4 m, depth 4 m).

Around 55% of the lagoons were from 3.0 to 3.3 m deep (*table 1*). Depths of more than 3 m were the exception with only 19% of 4 m or more. Compared to this, most concrete containers have a depth of ~ 4 m.

If the volumes given by the farmers under questions regarding size of their lagoons were compared with the theoretic gross volume from the other given measurements then there are some large discrepancies. These would seem to be caused in the main by the fact that, in practice, the container is not filled to the upper edge but instead is always left with a safety margin of around 0.5 m (= net volume).

The average gross volume was 1877 m³ with a minimum of 175 m³ and a max. 15000 m³ (*table 1*). Nearly 25% of the volumes

were under 1000 m³, around 46% between 1000 and 2000 m³, 25% between 2000 and 4000 m³, and only 6% of lagoons topped 4000 m³ volume (*table 2*).

The use

of the lagoons involved over 70% being filled with pure cattle slurry. The proportion used for storing pig slurry was only 24%. A specialty noted concerned using a lagoon for liquid manure from ducks.

Given as the average dry matter content of slurry so stored was 7.5% (1.2 to 12.6%). This reflects an overall average for the substance. Over 60% of the farmers were unable to give information on dry matter of slurry.

Table 1: Size of lagoons

Size	Number	Average	min.	max.
max. surface area in m²	75	745	230	6400
Ground area in m²	72	410	90	2915
Depth in m²	78	3,3	1,5	5,3
Gross volume in m³	84	1877	175	15000

Table 2: Gross volume of lagoons

Gross volume in m³	Number	Proportion in %
100 - 999	20	23,8
1000- 1999	39	46,4
2000 - 3999	20	23,8
> 4000	5	6,0

Removing and storing

The removal of slurry was by tanker for 74% of the lagoons and only 21% of farmers used a pump for this.

For just under 30% of the farmers their lagoons were completely full for a period of up to four weeks in the year. Another proportion of almost 30% gave the periods their lagoons were absolutely full as from five to twelve weeks. For more than 20% this state lasted for longer than three months, i.e. another storage facility had to be available.

An empty lagoon over a period of max. four weeks in the year was admitted by 33% of the farmers, up to twelve weeks for a further 20%. Amazingly, nearly 20% of respondents had their lagoons empty for more than three months. This can probably be explained through stock being grazed, „expansion" in capacity being created, and by many farmers using already existing slurry containers so that the lagoons increasingly were being used as additional or reserve containers.

Table 3: Reasons for building a lagoon (multiple naming possible)

Reason	Number	Share in %
Price advantage for lagoon compared with concrete container	75	98.7
Existing slurry storage to small	45	59.2
Existing slurry storage to old	4	5.3
Lagoon fits better into landscape	42	55.3
Higher straw content problematic when pumping in concrete container	7	9.2
Other reasons	16	21.1
Number of response	189	
Responses per farm (76)	2.5	

This was confirmed in that around 55% of farms used, in addition to the lagoon at least one, as a rule already existing, storage facility for liquid manure. Some 43% of such containers were above ground silos, 38% were silos below ground surface and 19% part-underground. Just under 17% of the containers already in existence had a drivable floor. The capacity of such containers represented on average just under 400 m^3 (40 to 1250 m^3) and thus were substantially smaller than the lagoons.

Reasons for a lagoon

Why did farmers decide to build a lagoon and how satisfied were they with this decision?

On average, two to three reasons were given per questionnaire for building a lagoon. The reason cited most was the cost advantage compared with a conventional concrete silo (98.7%, *table 3*). For very nearly 60% the existing liquid manure container was too small and required extension. A further 5% of farmers claimed that their container was too old, i.e. required repairs. That a lagoon fitted in with the landscape better than, for instance, a concrete container was a reason given by 55%. Around 9% of the farmers found the high straw content in their liquid manure a problem during pumping in the concrete container, a problem not present with lagoons.

Over 20% gave still other advantages for the lagoon solution: emptying was easier, leakage through a not properly closed sluice (labour problems) could not occur because lagoons had no sluice gates; no danger of sudden collapse of walls; the technology involved in stirring was simpler and easier to execute; the slurry flowed per gravity from housing to lagoon; easier to repair; planning permission for only one lagoon (Schleswig-Holstein); a quarry with blasting nearby had led to cracks in concrete.

Satisfaction

In total almost 80% of the farmers were very satisfied, and a further 15% satisfied, with their lagoons, representing a very good acceptance level. Any reservations here were grounded on the high proportion of rainwater which has to be considered in subsequent slurry transport and, especially, in the construction of the lagoon. For example: the „average" lagoon of 1877 m^3 capacity had a surface area of 745 m^2. In comparison, a 4 m deep concrete silo had 470 m^2 surface area. Thus the surface area of the lagoon is around 1.5 times that of the silo. At 700 mm annual precipitation this means 193 m^3 more rainwater and with 1000 mm, 275 m^3. Two farmers claimed that this could be regarded as positive, however, in that, as known, this dilution aids the vegetation tolerance to slurry, especially in pasture. Mixing in a lagoon with its corners was seen as more difficult that in the past with round containers by three farmers.

Summary

In total it can be concluded that almost 95% of farmers were satisfied with their lagoons. Most were built because of an increase in stocking, sometimes as the only storage facility, sometimes to enlarge storage capacity. That most were built on the village edges or outwith housing areas was because there was mostly no possibility of production expansion and the associated extra slurry within the village.