# Environmentally compatible slurry spreading in mountain areas

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## Abstract

Ammonia emissions can be reduced by using trailing hose systems to spread slurry. This system represents a step towards environmentally sound slurry spreading. However, farmers in mountain areas are very reluctant to implement it, as they question its operational reliability.
Over 100 users of trailing hose spreaders took part in a survey conducted to collect current experiences on farms. A test bench was also set up, allowing the measurement of spreading accuracy on the level and on hillsides with gradients of up to 30 %.
The written survey was split into the following subject areas: purchase decision, applications and practical experience relating to application limitations, slope gradient, more efficient fertilizer use and odour emission.
The spreader was operated on the test bench at various gradients and flow rates. Using cattle slurry, most spreaders even showed good distribution on hillsides, with an average deviation of less than 15 % from the average flow rate per hose.

Keywords: trailing hose, slurry, mountain area, spreading accuracy, test bench, survey

## Introduction

The mountain areas of Switzerland are characterized by a high proportion of grassland. The forage produced there is utilized by ruminants, mainly in strawless or low-straw housing systems, thus producing slurry. A system that spreads slurry evenly at ground level, even on hillsides, is needed so that the plant nutrients in the slurry can be returned to the grassland in an environmentally compatible manner.
Uniform spreading helps the grass sward to take up the nutrients contained in the slurry. In addition, good spreading allows well-adapted stock management of forage areas and prevents local over-fertilization or under-supply. The spreading of slurry at ground level with trailing hoses also reduces ammonia- (Frick and Menzi, 1997) and odour emissions. In lowland areas, the benefits for plant production and the environment have led to the increasing use of trailing hose spreaders. However, in mountain areas, the adoption of this system has been slow, as there are doubts about the operational reliability of trailing hose spreaders on steep hillsides.
The purpose of the study was firstly to collect experience on the trailing hose spreaders used to date, and secondly to measure the hillside spreading accuracy of the spreaders currently available in Switzerland.

## Materials and methods

Questionnaires were sent to over 150 farms currently using trailing hose spreaders. The questionnaire was split into the following subject areas: technical data, purchase criteria, applications, problems which occurred in use and satisfaction with the system.
A special test bench was constructed to investigate the spreading accuracy of spreaders. The test bench was built in accordance with standard prEN 13406 (Anonymous, 1998). This provides for stationary spreader operation and collection of the slurry flowing from individual spreader hoses. After a measuring period of approx. 30 seconds, the flow from each

individual hoses was scaled and the average deviation from the overall mean was calculated. A unique feature of the FAT test bench is that a slewing mechanism on the spreader suspension can simulate any desired gradient. Experiments were conducted with six types of spreader available on the Swiss agricultural machinery market (Table 1) with working widths of 7.8 – 9 m, using different flow rates (450 and 750 l/minutes), gradients (0, 15 and 30 %) and supply methods (pressure tank, spiral pump). All the treatments were carried out three times with diluted cattle slurry, whose DM content varied between 3.8 and 4.3 %.

## Results and discussion

Over 100 responses were used to analyse current experiences on farms. It was shown that the most important criterion for the purchase of a trailing hose spreader was a more efficient N utilization of farmyard manure. 97 % of respondents gave this as their reason for investing in this system. The reduction of odour emissions was also important for 95 % of respondents. 81 % of the investment was made without government subsidies, a much higher proportion than in other countries.

Contrary to the expectations that led to the purchase of this system, only 76 % were able to confirm better N utilization of farmyard manure in practice. However, 95 % found that odour was reduced during slurry spreading. 93 % of all respondents approved this method of slurry spreading and would invest in this system again.

As regards spreading accuracy, it was shown that the spreaders reacted differently to flow rates and slope gradients. preading accuracy tended to improve as flow rate increased and to deteriorate as the gradient iSncreased. Spreading accuracy on the level fluctuated between 2 and 10 % (average deviation). An average deviation of between 4 and 24.3 % was measured at a 30 % gradient and a flow rate of 750 l/min (Figure 1). Between the spreaders tested, differences were also found in the maximal negative and positive deviation of individual hose from the average flow rate (Table 2).

## Conclusion

Trailing hose spreaders are already being successfully used by farmers on hillside grassland. The reduction of odour emission is perceived as a major benefit. Not all the respondents considered that their expectations of a more efficient use of the nitrogen contained in the slurry had been confirmed in practice.

Measurement on a test bench showed that the spreaders varied in their ability to spread accurately on hillsides. Most spreaders tested complied with the maximum 15 % average deviation value specified by standard prEN 13406.

## References

Anonymous (1998) European Standard prEN 13406. European Committee for Standardization, Central Secretariat, rue de Stassart 36, B-1050 Brussels.

Frick R. and H. Menzi (1997) Hofdüngeranwendung: Wie Ammoniakverluste vermindern?. FAT Report No. 496, Swiss Federal Research Station for Agricultural Economics and Engineering, Tänikon, Switzerland.

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Table 1: Tested trailing hose spreader

| Manufacturer / Selling agency: | Address: | Type: |
|---|---|---|
| Brunner Landmaschinen | CH 9536 Schwarzenbach | RAB 8.40 m |
| Fankhauser Maschinenfabrik | CH 6102 Malters | Perfekt 9 m |
| Landtechnik Zollikofen | CH Zollikofen | Garant 9 m |
| Hadorn's Gülletechnik | CH 4935 Leimiswil | Spider Compact 9 m |
| Hochdorfer Gülletechnik | CH 6403 Küssnacht | Excenter-Cut 9 m |
| Schweizer AG | CH 9536 Schwarzenbach | Terracare 7.8 m |

Tabel 2: Average deviation and maximal positive and negative deviation (%) from the mean flow rate per hose (total flow rate: 750 l/minutes)

| | | Type of trailing hose | | Excenter-Cut 9 m | Garant 9 m | Perfekt 9 m | RAB 8.4 m | Spider Compact 9 m |
|---|---|---|---|---|---|---|---|---|
| gradient | 0% | Average deviation | (%) | 2.2 | 2.9 | 10.0 | 1.8 | 6.2 |
| | | Maximal -/+ deviation | (%) | -3.7 / 4.3 | -13.3 / 5.2 | -21.2 / 30.9 | -4.2 / 3.6 | -11.3 / 18.3 |
| | 15% | Average deviation | (%) | 1.8 | 11.5 | 9.4 | 1.7 | 8.7 |
| | | Maximal -/+ deviation | (%) | -3.7 / 4.3 | -35.9 / 15.0 | -18.5 / 35.7 | -4.3 / 4.3 | -14.5 / 22.8 |
| | 30% | Average deviation | (%) | 7.1 | 24.3 | 9.2 | 3.9 | 5.5 |
| | | Maximal -/+ deviation | (%) | -41.1 / 59.1 | -59.0 / 33.6 | -25.9 / 28.9 | -14.0%/ 8.2 | -12.2 / 15.8 |

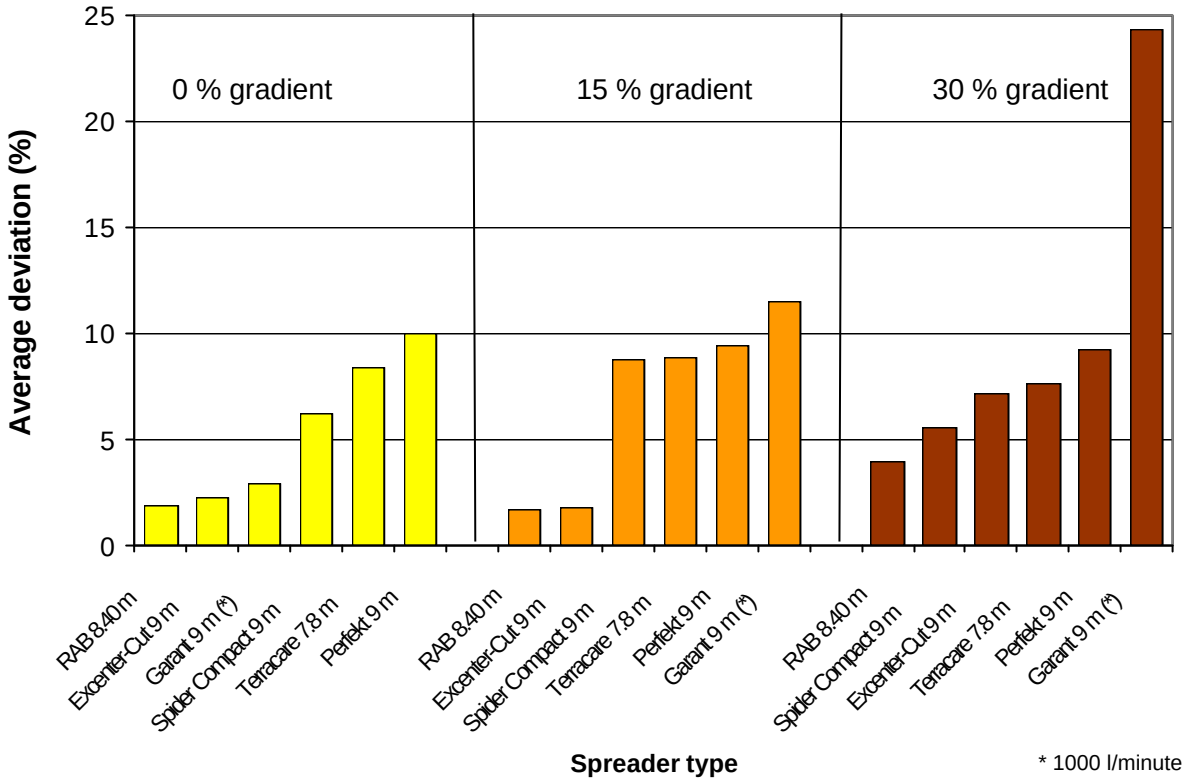


Figure 1: The influence of gradient on the average deviation at a total flow rate of 750 l/minutes