

Practice PF n° 6

FERTILISER SPREAD PATTERN MEASUREMENT AND SPREADER ADJUSTMENT USING COLLECTION TRAYS

Introduction

Category: Good Practice (GP)

Practice identity card

#Fertilizer spread pattern, Spreader adjustment

#PF, Food, Feed, Fibre, Oil, Industrial, GP, Belgium



Short description

- ➔ Optimizing fertilizer inputs in agricultural production systems is seen as an important strategy to reduce their large environmental impact while supplying the world's increasing need for food, fibre and fuel. Centrifugal fertilizer spreaders are by far the most used mineral fertilizer spreaders due to their large working width, small size, low price and their simple and robust design. Although simple in working principle, the spreading process is difficult to control because it depends on various parameters such as the physical properties of the fertilizer particles, wind conditions, spreader settings, etc. Therefore, deviations between the desired and the actual spread pattern can occur in practice, leading to local under- and over-applications and losses out of the field.
- ➔ To assess the spreader performance at farm level and adjust the machine, if necessary, the spread pattern must be determined. The uniformity of the spread pattern is assessed by measuring the single

transverse spread pattern by placing a row of collection trays equipped with anti-reflection grids in the field perpendicular to the driving direction. After collection, material from each tray is weighed and converted into an application rate. Because of their working principle, broadcast fertilizer spreaders generate gauss or trapezoid shaped spread patterns. As a result, the applied dose is higher centrally behind the spreader and decreases towards the sides of the spreading width. Because of this, overlap is necessary between subsequent swaths to achieve a homogeneous distribution.

- Spread uniformity across the swath width is calculated (and expressed as coefficient of variation (CV)) and the optimal swath width (and corresponding application rate) can be determined based on the measured single spread pattern. According to the European standard EN13739 (2003) (1), the CV should not exceed 15%. If an undesirable spread pattern is measured, the next step is to adjust the spreader setup to obtain a more uniform spreading. This can be done, for example, changing the position of the vanes on the disks, height above the ground, position of the orifice, etc. These measurements are mostly performed for mineral fertilizer centrifugal spreaders but are also applicable for pendulum and manure spreaders. Besides the problem of under- and over-application, broadcast fertilizer spreaders have a high risk of spreading beyond the field border because of their large working width and typical spread pattern. To avoid these losses to the environment, different border spreading technologies (e.g. deflector plate, disc-integrated border spreading...) are now available. Using the collection tray method, the performance of these technologies can be tested and optimized further contributing to optimal fertilizer use.
- (1) EN 13739:2003 Agricultural machinery - Solid fertilizer broadcasters and full width distributors - Environmental protection

Implementation process

Which practice is considered as the standard in this region? In most cases no check of the spread pattern is performed. Adjustment of the spreader is done following the instructions of the machine manufacturer or a default setting is used.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Poor distribution of the fertilizer leads to yield losses, visible spreading lanes and quality difference within the field. Fertilizer losses out of the field mean economic losses for the farmer, losses to the environment and are bad for the reputation of the farmer.

How long did it take to implement the practice and which are the measures needed to monitor: ILVO's fertilizer spreader calibration service was established as the result of a 4-year research project and is operational for several years. Due to the large spreading widths, performing spread pattern tests is a very laborious, time-consuming process. Adjusting the spreader needs some operational knowledge combined with trial and error which makes spread pattern measurements quite expensive. In addition, measurements are weather dependent and require a lot of space. Finally, there is no mandatory spreader testing in Europe which is different from sprayers. For these reasons, and despite the clear advantages, the level of implementation by farmers is relatively low. The level of implementation could increase by setting up a (voluntary or mandatory) spreader testing campaign and/or to foresee some subsidies for farmers testing their spreader. Today, there is no direct monitoring. Indirect monitoring is done among others by measuring nitrogen content in soil and surface water.

Logistics

- **Logistic aspects to consider:** Availability and transportation of the collection trays. Performing the measurement requires manpower and some operational knowledge. Measurements are weather dependent and require a lot of space where fertiliser application is allowed. The collection tray method can be applied to all models of fertilizer spreaders
- **Other specific tools involved/included:** no
- **Additional requirements for application:** Not for the actual application but the measurements are weather dependent (no rainfall) and require a lot of space. The tests should be carried out on an even, horizontal and hard surface. The air velocity should be less than 2 m/s during the tests. The air humidity should be less than 65 % and the temperature 10 °C to 25 °C.
- **Skill/education level required:** rather low

Agronomical traits

- **Can the practice be applied to a multitude of cultivation techniques?** Solid fertilizer or manure, broadcast spreaders, border spreading in different cultivations
- **Targeted crop categories:** food, feed, fibre, oil, ornamental, industrial
- **Influence on soil quality:** A more uniform level of fertilization at the correct dose rate resulting in less over- and under- applications.
- **Suitable soil types:** silty, chalky, loamy, clay, sandy, peaty
- **Expected effect on crop yield:** increase
- **Expected effect on crop yield variation:** decrease
- **Expected effect on crop quality:** increase
- **Expected effect on crop quality variation:** decrease
- **Which costs may increase due to the practice?** unskilled labour, Storage
- **Which costs may decrease due to the practice?** fertilizers
- **Expected long-term/indirect economic benefits of the practice:** More accurate spreading along the field borders (because of the better adjustment of the equipment) will limit the need of large fertiliser-free borders along watercourses and improve surface water quality.
- **Expected effect on the leaching of nutrients:** nitrogen: decrease
- Phosphate: decrease
- Potassium: decrease
- **Specific materials applied through the practice:** animal manure, compost

Administrative context

- **Does the practice qualify for subsidies?** no
- **Status of the legal framework that regulates the practice:** there is hardly any
- **Are there any policy barriers complicating the practice's application?** No
- **Does the practice involve the use of hazardous substances?** no (only fertilizers)
- **Is the practice supported by Eco-schemes?** No
- **Are there any gaseous emissions to be considered upon application of the practice?** No
- **Greenhouse gas (GHG) reduction potential of the practice:** little or none
- **Expected effects from the practice on the time occupation of the farmer?** moderate increase
- **May the practice contribute to a better public image of agriculture?** The better adjustment of the spreader will reduce the amount of fertilizer that potentially is spread over the border of the

-
- field (e.g. on roads, ditches, ...). This leads to less pollution of roads, ditches... and a better public
- image.
- **May the practice improve the farmer's self-image?** A uniform crop without spreading lanes is for sure something the farmers like to see.
- **Other relevant information:** This GP is a pre-season adjustment that can be performed for all solid fertilizer types on the farm. So time occupation is of less importance for the farmer.

Contact

Name of the FIN (Fertilization Innovation Network) partner submitting the information: ILVO
Contact information of the FIN partner: donald.dekeyser@ilvo.vlaanderen.be
Eu member state: Belgium

Find out more

Source of information Flemish AgrifoodTEF (<https://www.agrifoodtefvlaanderen.be/en/>)

Additional info/links:

<https://www.agrifoodtefvlaanderen.be/en/sectors/geautomatiseerde-testopstelling-voor-kunstmeststrooiers>