Precise, accurate and even spreading

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Fertiliser is a hugely important and expensive input. The role of the fertiliser spreader in applying fertiliser evenly, is often underestimated. The challenges on tillage farms are huge with wider bout widths demanding technically good spreaders and precise setting, to ensure even spreading. Correct machine choice, good quality fertiliser and proper setting of the machine are all critical.

As fertiliser is an expensive input that impacts on yield, quality, profitability and the environment, there is a substantial research effort continually trying to determine the optimum level of crop nutrition for specific crop and soil situations. However this improved level of precision in fertiliser recommendation is of little use if the fertiliser is applied unevenly or the incorrect rate is applied. Uneven spreading is often seen as striping in a crop, however crop yield and quality are frequently impacted at levels of unevenness that are not obvious as a crop colour difference. In an 8 year life of a fertiliser spreader working on a 100ha tillage farm, poor spreading could cause a crop loss of €40,000! To avoid these losses, four critical factors must be considered:

- Correct choice of machine for the fertiliser being used at the chosen bout width
- Use of fertiliser with good physical quality characteristics
- Correct setting of the machine for fertiliser and bout width using setting resources based on comprehensive tests
- Correct setting and use of the machine on the field headland and narrow bout widths

Wide bouts and windy conditions

Todays' spreaders have a huge challenge with most tillage farmers using 24m bout widths and some up to 36m. Broadcast spreaders rely on forming an overlapped pattern (Fig 1) to give an even spread. Some 24m spreaders need to spread fertiliser almost 48m, with fertiliser just visible in the next tramline, to give the correct overall spread pattern. While spreaders, and their setting for bout widths, are developed in perfect conditions in indoor test halls, field conditions with wind and undulating ground can cause a huge deterioration in spreading evenness. The impact of wind on wide bouts should never be underestimated.

Machine design.

Today there is a huge emphasis on spreader control technology and this has increased with TAMS grants available for position-based control systems and weighing systems. However while this technology can help even spreading in certain situations, the most important aspect of a spreader is the basic design of the spreading elements and how it impacts on the spread pattern. Features such as paint quality, hopper design, robust construction etc are all important but the ability to spread evenly must be the first factor to be considered.

Full spread test reports

Machine design has a huge impact on how evenly the fertiliser is spread. The only way to assess a particular model is to have a spread test report where evenness of application is measured. While the major fertiliser spreader manufacturers have their own test-hall facilities capable of giving very accurate test results, they only put the best results in their brochure. Results from independent test halls are of far more value, but these tests are increasingly rare. ***You should look for an independent test result and always favour a manufacturer who provides one.***

The evenness of spread is frequently summarised by a single figure; the coefficient of variation (CV) – the lower the CV% the better the spread pattern. A CV value of less than 15% would be acceptable in the field, but figures of 5% to 10% should be demanded from a test hall, where perfect conditions prevail.

But the CV does not tell the full story. The shape of the basic spread pattern determines how likely good spreading will be achieved in the field. A triangular shape like that in Fig.1 tells us that the spread will be a little less sensitive to wind or fertiliser variation than the more shouldered pattern of Fig. 2. The spreader producing a pattern like Fig 2 would need to be very carefully set to suit the fertiliser characteristics and spreading conditions. Better spreaders should have both a low CV and a good basic spread pattern.

Fertiliser quality

The physical characteristics of the fertiliser will affect how evenly it spreads and the spreader settings required; and should be considered when purchasing. The key factors are:

- ***Size of the granules***: Generally larger particles will throw further. Where most particles are in the 2-4mm range it's easier to achieve a good spread, but larger diameters (3- 4.5mm) may make it easier to achieve wider spread widths. The component parts of blends should have similar size distributions.
- ***Shape of the granule***: Rounded particles will roll off the disc more predictably
- ***Density of the fertiliser***: Low density fertiliser such as urea is more difficult to throw.
- ***Strength of granule***: Strong particles will resist break-up on the disc.

Spreading Urea

Urea will be more widely used across all farm types in the future. Its lower density (80%) presents a greater spreading challenge and it usually will not spread as wide as denser material. Urea with larger particle sizes is easier spread. Even with a good size distribution it is vital that the correct spreader setting is used and that the bout width limitations of the spreader with urea are observed. Wind will affect urea more than denser products so spread in calm conditions if possible. Blends of urea and conventional density fertiliser need to be considered very carefully. Proper size matching of particles

(larger urea with smaller dense fertiliser particles) can help even spreading, but the onus is on the fertiliser supplier to show that this can be achieved.

Machine setting for evenness

The bout width being used and the physical quality of the fertiliser will determine the setting/adjustment required. Spreader manufacturers have a database of settings for different fertilisers and the setting process increasingly requires the operator to match the fertiliser to be used to one in the database, by measuring size distribution, strength, density and shape. Using a smart phone app, website, or detailed brochure, the appropriate setting for the bout width being used is determined. The components that are adjustable vary between manufacturer and model but include one or more of the following:

- Disc type, disc speed; vane type and position on disc.
- Position of fertiliser drop point onto disc.
- Disc height over crop/soil, or spreader / disc angle.

Rate setting / calibration

Getting the correct rate of fertiliser out (kg/ha or bags/acre) is also important and while manufacturers setting guides are a starting point, some level of field calibration is usually needed. Some makers have very useful setting aids such as calibrated flow bags which can be accurate, while others make full calibration through the spreader easy. On-board weighing systems can make calibration very easy. Whatever system is used, it's important to establish the correct rate setting before field-scale errors are made.

Headland spreading

Headlands present particular problems for broadcast spreaders. Recent Oak Park research indicates that fertiliser distribution in the headland areas of fields on tillage farms is quite uneven compared to the in-field area, contributing to yield loss. There are two challenges: 1) spreading to the boundary and 2) merging the in-field runs with the headland runs.

To spread evenly to the field margin, the pattern to the headland side has to be completely different from the normal in-field pattern, to apply the desired rate up to the boundary without spreading past that boundary. Different manufacturers use different techniques to achieve this altered spread pattern such as: deflectors dropped into the fertiliser flow; altered disc speed and fertiliser drop point etc. Many allow the pattern to be altered if yield optimisation is prioritised over fertiliser loss across the boundary. Operators need to ensure that the headland settings are correct.

Merging the in-field runs with the perpendicular headland runs requires operation of the shutter opening and closing at a precise distance from the headland. This can be very difficult to achieve with modern spreaders which throw fertiliser considerable distances. Accurate GPS systems can automatically control the on/off point making this more precise than can typically be achieved manually, thus avoiding fertiliser waste and crop lodging at the headland. These need to be set carefully.

Finally.

Spreading fertiliser evenly over wide bout widths is a challenge. To achieve this:

- Choose a spreader that has a good basic pattern and can achieve the bout width with a low CV value.
- Value fertiliser that has good physical quality which will spread evenly at wide bout widths.
- Use the manufacturer's resources to identify the correct settings for the fertiliser and bout width being used.
- Ensure the headland spreading mechanism is properly set up.
- Consider technologies such as GPS headland switching and dynamic weighing to ease the task of headland operation and calibration.

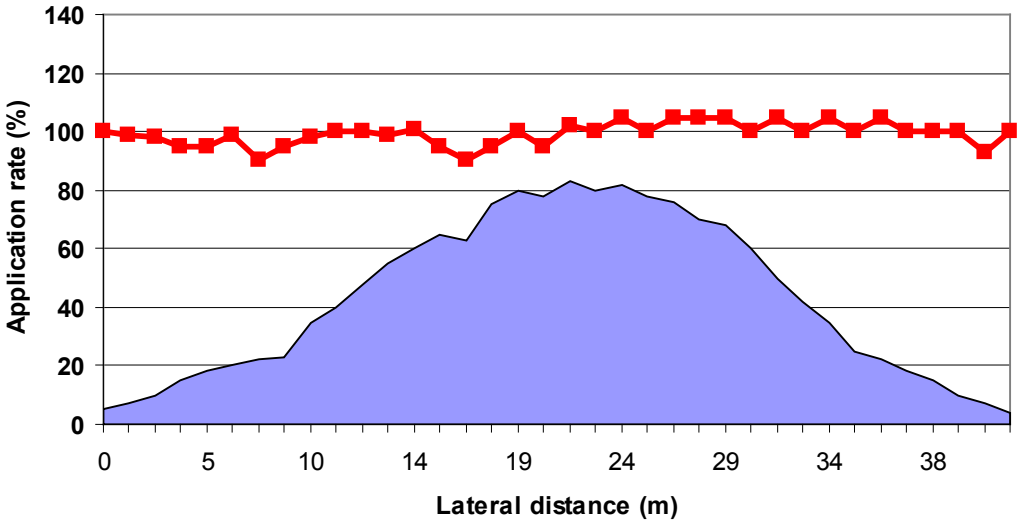

Fig.1: Basic (shaded area) and overlapped (line) spread pattern at 18m: Good pattern.

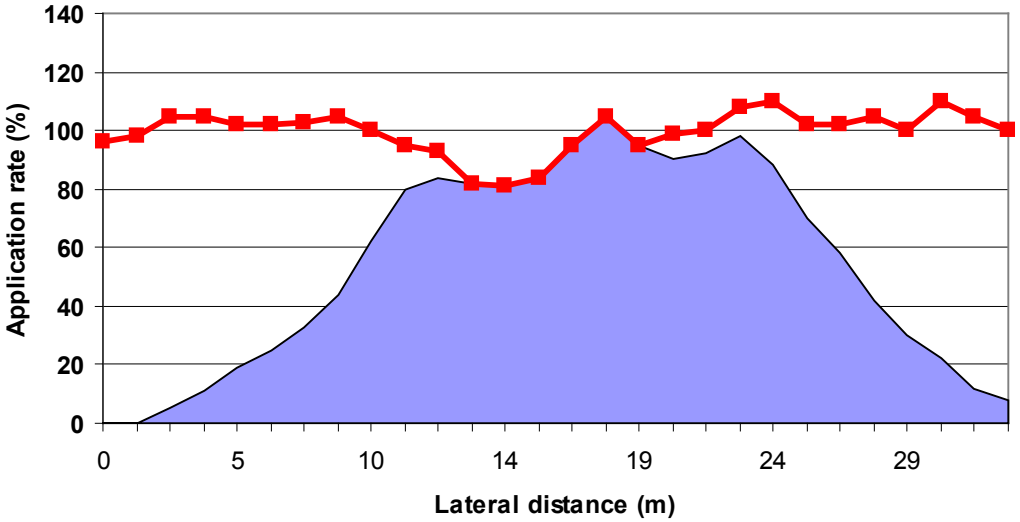

Fig.2: Basic (shaded area) and overlapped (line) spread pattern at 18m: Shouldered pattern