kverneland group

FERTILISER SPREADING

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The Future of Farming

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"Every granule in the correct place"

1.
INTRODUCTION

Efficient management of your crop protection to secure a profitable harvest is a decisive factor. You have to be dedicated towards every days food production, by taking care of the crop in a precise and sustainable way.

Spreading is all about precision and getting the best yield from your crop. Optimal spreading of fertiliser means using exact amounts of nutrition and avoiding overlap. The job has to be done with the highest possible efficiency. You want to cut back waste, reduce input costs and minimise the impact on the environment.

Weather and field conditions are changing continuously, so skills, experience and smart farming systems are decisive factors in your daily business.

Our spreading solutions help you to work in an easier and more profitable way. At the end of the day spreading is all about accuracy. Our innovative solutions support a better harvest and increased crop yield, because every crop deserves the best care.

Every crop deserves the best care

2. THE BASICS OF FERTILISER SPREADING: BALLISTICS

To be able to get good spreading results with high precision, you need to have a better understanding of the influence of the fertiliser granule on the flow inside the spreader and its behavior during the projection in the air.

Different fertilisers have a mix of different granular sizes, which is influencing the spreading pattern and the maximum possible spreading width.

A fertiliser spreader has to fulfill two basic requirements:

2.1. OUTPUT RATE

The spreader has to ensure that the right amount of fertiliser is applied in the field. This is the required output rate in kg/ha. The dosing opening setting must reach the target setting of the instant flow rate in kg/min. The output rate is calculated according the following formula:

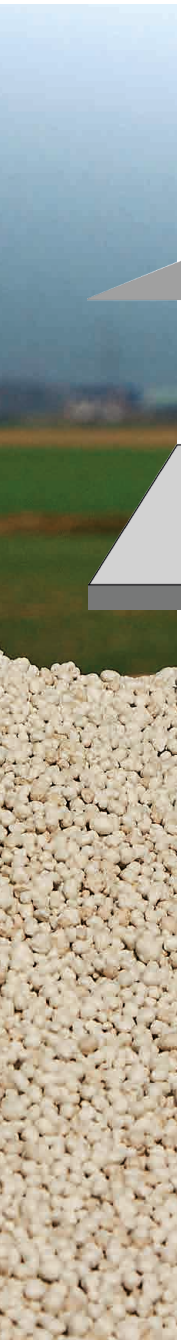
$$\textit{Output rate (kg)/min)} = \frac{\textit{Working width (m) x Speed (km/h) x Application rate (kg/ha)}}{600}$$

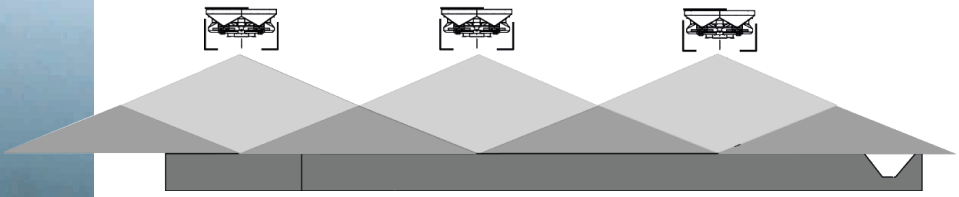
The flow rate will depend very much on the fertiliser properties and will change with increasing or decreasing the humidity. The theoretical setting can be found in the spreading charts manual, via the mobile phone App or on the spreading charts website, but it is recommended to check and re-adjust the values by a calibration test. A calibration test can only be replaced by using a weighing spreader, since it is continuously calibrating and correcting the flow rate during work.

2.2. SPREADING PATTERN

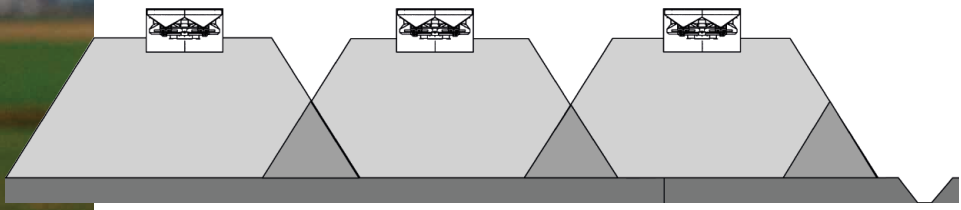
The spreader has to ensure that the fertiliser granules are evenly distributed across the field. For this purpose, a certain spreading pattern is tested by the Spreader Competence Centre. There can be triangular or trapezium shaped patterns or also patterns in between those two shapes.

It is crucial that you are respecting the recommended settings. It is very difficult and risky to draw your own conclusions to improve settings and to try to correct patterns. Good working knowledge of fertiliser properties and tools like tray tests are a minimum requirement. The main reason for this difficulty is that the correct application is achieved over two passes which have to complete each other to get finally even fertiliser distribution in the field.





Triangular shaped spreading pattern: complete overlap between passes



Trapezium shaped spreading pattern: partly overlap between passes

The fertiliser pattern or distribution on the ground is measured by calculating the coefficient of variation, ("CV"). This value is measured in % and determines the relation of the standard deviation compared to the average values.

In the table below is described what a good or bad CV means.

CV < 10%	Very good result
CV between 10% and 15%	Good result
CV > 15%	Bad result

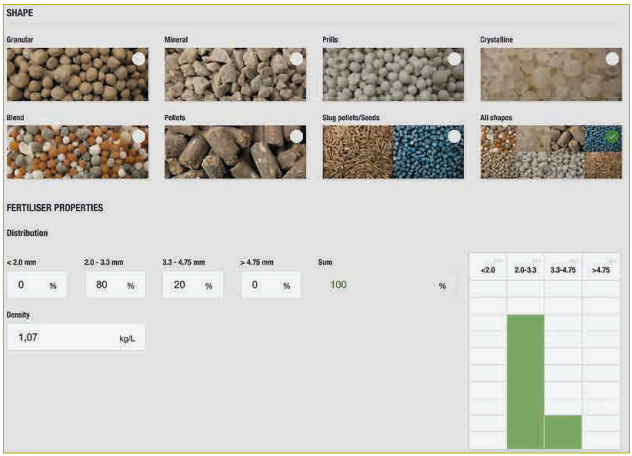
All settings which can be found in our platforms, like spreading tables, the App or website make sure that the setting reaches at most a CV of 10% in the Spreader Competence Centre under ideal circumstances.
In this way, we are sure that under real circumstances, in the field with uneven ground and some wind, the spreading pattern will stay correctly.

3. COMPETENCE CENTRE FOR ACCURATE SETTINGS

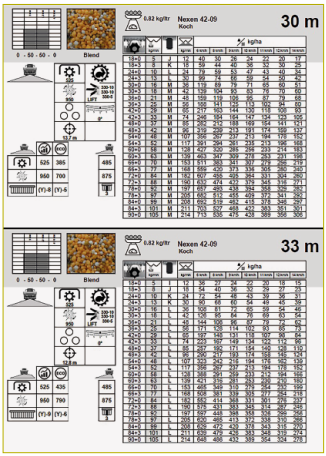
The Spreader Competence Centre located in the Crop Care factory in the Netherlands is providing high quality spreader settings. A spreader can only perform correctly when the right settings are used.
The Spreader Competence Centre is constantly testing new fertilisers and publishing the data via the different platforms. Newest technology with 3D testing with rotating spreaders and test trays with weigh cells, are able to measure differences of 0,1 gram.
Our test engineers are using this tool to establish the optimal setting for each spreader, each fertiliser type and each working width for different dosing settings.

These results are available all over the world via our spreading charts, Apps, website and also via the integrated AutosetApp on the IsoMatch Tellus terminals in the tractor cabin. Make sure to synchronise the AutosetApp before each season with the official spreading charts website. You can use a wireless connection if the terminal is equipped with a Wi-Fi dongle, or use a simple USB stick. In this way you are sure to have the most up to date settings available.

AutosetApp



Spreading charts website/App for smartphones



Manual spreading charts

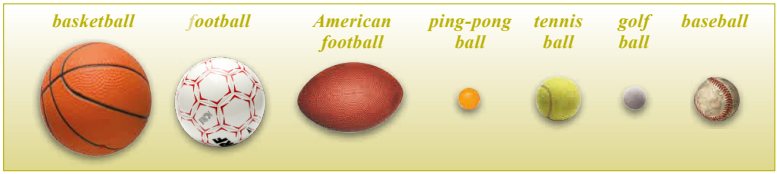
Spreader Competence Centre

4.
INFLUENCE OF FERTILISER PROPERTIES

Every fertiliser has its own physical properties, which will influence different factors. In the overview below are several examples shown of a ping-pong ball, golf ball, tennis ball, baseball, football, basketball and an American football. This examples can be compared with different types of fertiliser.

- **Influence of the weight:** For example; the ping-pong ball cannot fly on such a big distance than a golf ball. Both of them are similar in size, but the weight is different and therefore the golf ball will reach a bigger distance.

- **Influence of the shape:** Round shaped forms have less friction and better aerodynamics than others. Therefore it is easier to reach bigger distances with a football or basketball than with an American football, despite similar sizes and weight.



Examples of physical properties

4.1.
INFLUENCE OF THE GRANULAR SIZE DISTRIBUTION
(DIFFERENT SIZE OF FERTILISER)

- Granules with a diameter less than 2 mm are considered as very small = dust.
- Granules with a diameter bigger than 4,75 mm are considered as very big = grit.
- The ideal fertiliser has 80% of the granules in the two middle compartments (2 mm and 3,3 mm) of the granule size box. For wider working widths, like 36 metres, the granular size in the 3,3 mm and 4,75 mm compartments should dominate.

Too much dust will make the tractor and spreader dirty and pollute the air. Fertiliser dust is a loss! Too much grit or granules that are too big might damage sensitive crops like spinach, leeks or sugar beet for example. You can use the granular size box even when buying fertiliser to be able to determine the quality of the fertiliser.

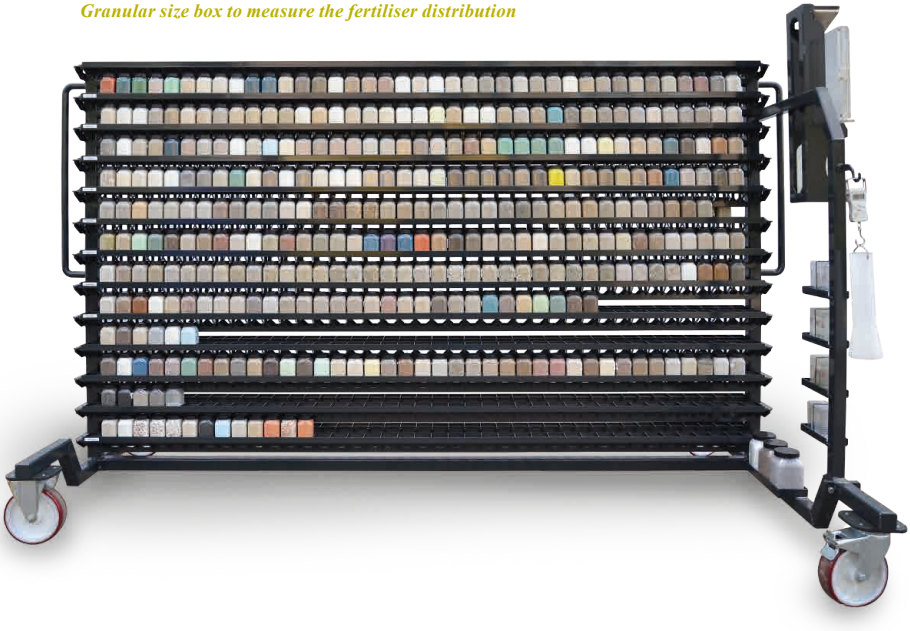
All of our fertiliser spreaders are delivered with a granular size box as standard equipment. The granule size box is the most important tool, which always has to be used when the spreader is being adjusted before spreading.

The granular size box is the main tool to adjust the spreader to ensure the even distribution of the granules on the soil by respecting the required working width!

Fertiliser is available in different types and with different nutrient contents.
Fertilisers are produced in different factories all over the world.
That means that fertiliser with the same name and the same nutrients can have very different physical properties, for example the granular sizes. But the essential parameters to adjust the spreader correctly are the physical properties and not the name or nutrient content.

Taking the fertiliser name as a reference to adjust your spreader could mislead you and can cause a very bad spreading result!

Granular size box to measure the fertiliser distribution

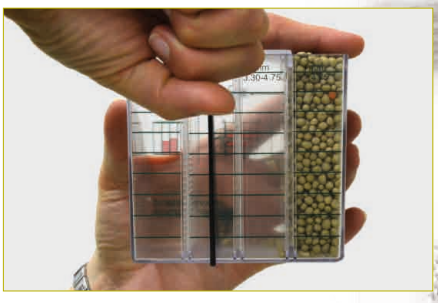


A mix of different fertilisers, the so called blends mostly have no commercial known name. The fertiliser granular size box is the solution, but keep in mind that a good blend needs granules with similar specific weights and similar sizes. Otherwise, it is impossible to reach a correct spreading result with a blend!

How to use the granular size box correctly?

Step 1: Open the cover of the box above the last compartment with the biggest grid inside and fill it up to the top by pulling it through the fertiliser.

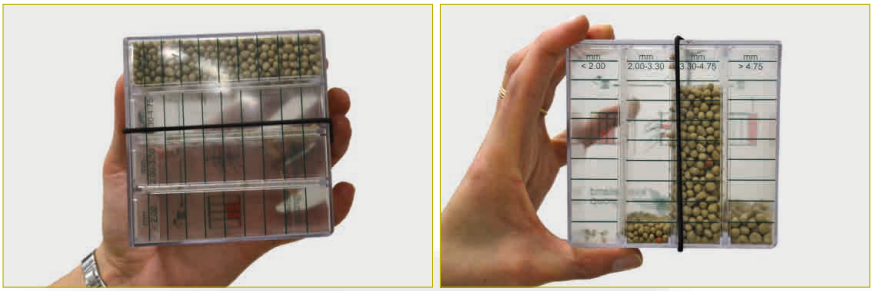
Step 2: Close the cover and shake the box in such a way that the fertiliser will separate and go through the grids until no further separation is possible.
It is important to shake long enough to get the final correct result! By adding up the result of the different compartments, you should always end up with 100%.



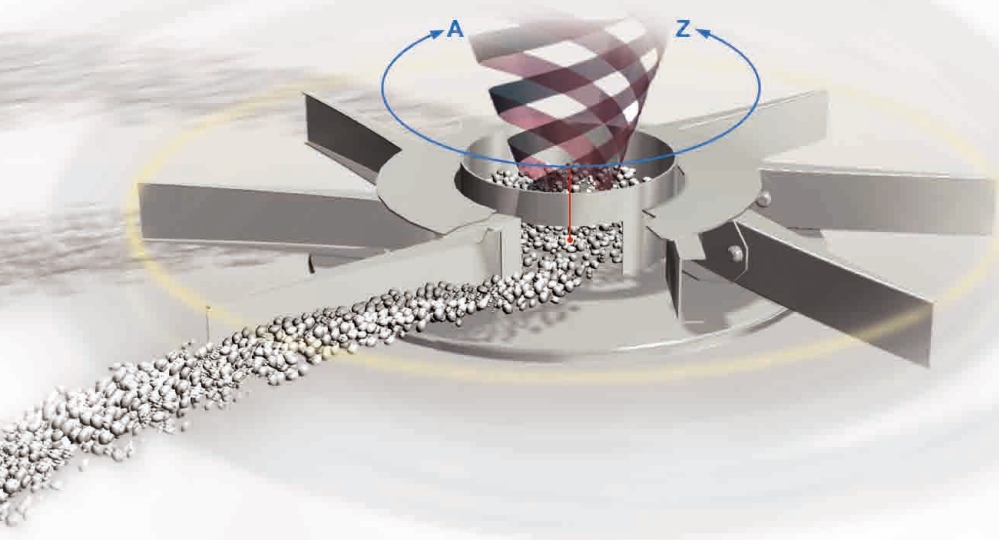
Step 1

Repeat the operation several times (at least 3 times) and take the fertiliser from different locations in the big bag, hopper or silo, to get an average fractionation. Loose fertiliser can separate into different granular sizes more easily than in bags. In this case, do not take samples from the surface, but try to find a representative place more inside the fertiliser.

The result of the granular analysis is mainly determining the “Letter” setting of the spreader, which is used to optimise the spreading pattern in the field, in relation to the required working width. The letter setting is deciding at which point the fertiliser is entering the vanes; so the projection will be more to the outer side for a bigger width or more to the centre.



Step 2



Fertiliser release point 'letter setting'

4.2. INFLUENCE OF FERTILISER DENSITY OR SPECIFIC WEIGHT (KG/L)

The best situation is when the weight per liter is 1 kg, but there are many different fertilisers on the market. Some are very light which makes them very sensitive to wind influence and maximal spreading width.
On the other hand, with very heavy fertilisers there is a risk of crop damage.

How to use the 1 litre measuring set:

Step 1: Use the tare function of the weighing scale, before filling the cylinder.
Step 2: Fill up the cylinder until the top.
Step 3: Compact the fertiliser by tipping it lightly on the ground.
Step 4: Refill to the top and measure the weight.
Step 5: Because the measuring cylinder contains exactly 1 litre the value indicated on the scale corresponds directly to the fertiliser density expressed in kg/l.

Step 2

Step 1

Step 3

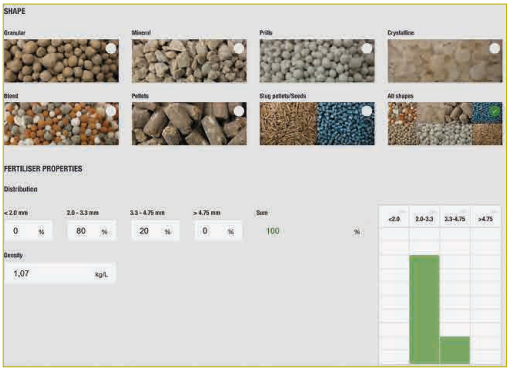
Step 4

Step 5

4.3.
INFLUENCE OF FERTILISER SHAPE AND SURFACE

- Each and every granule is behaving differently on the vane, depending on its shape and surface.
- Sharp edged shapes have a longer travelling time on the vanes.
- Round shaped grains roll over the vanes and have less friction.
- Coatings can reduce friction, but some coatings are sticky and will influence the spread pattern by creating a layer on the vanes, slowing down the acceleration of the granules.

Example of vanes after using a coating



Fertiliser identification on the website and App

By selecting the shape during the process of adjustment, the search for a setting is directed in a certain direction.
For example by choosing “Prills”, all other types of fertiliser will be eliminated from the search.

Also by entering a density (kg/l), the search will be narrowed down to very similar density fertiliser types only.

Too many restrictions may mean that you will not find a setting for your search. In this case, do not fill in the density for example and try again. If this does not help you can show the whole database with all fertiliser types for the required working width by un-ticking all fields and select “All shapes” only. Then you can search the closest match yourself by scrolling through all fertilisers.

Another reason when the search gives no result, is that your fertiliser is simply not compatible with the required working width. By searching with a smaller working width you might find a setting.

4.4. INFLUENCE OF GRAIN STRENGTH

- A week granule is more sensitive for damages: dust.
- Coating can improve the strength and reduce friction.
- Working width = give energy to the granule.
- Every change of direction = additional impact and resistance.
- Additional resistance = also additional wearing.
- Rough surface = additional resistance.

The grain strength question can be answered simply: The harder, the better. When fertiliser is too soft there is a risk that it is being damaged by the agitator or vanes. This can result in problems with the flow inside the spreading system. Broken granules are also not reaching the required width and create bad spread patterns in the field.

5. FREQUENTLY ASKED QUESTIONS - FAQ

5.1. How important is the density or specific weight for the setting compared to the granule size and shape?

The answer is that both are important. Nevertheless there are only significant influences between “normal” densities of most of the granular fertiliser (1 kg/l), “light” fertiliser which are often Ureas (0.72 kg/l) and heavy fertiliser like Magnesium or PK wtih 1.55 kg/l. There will be not a big difference between 0.98 and 1.06 kg/l densities for example.

5.2. How important is the shape of the fertiliser for the settings?

There are big differences in the flow rate and also in the working width between the different shapes. The flow rate is lower for angular fertiliser or organic fertiliser, because the friction between the granules is quite high. Also the friction on vanes of angular granules is greater and they are less aerodynamic. This effect can be partly compensated by bigger specific weights.

5.3. If I have to select the closest fertiliser in the database amongst all data, what is more important: the fertiliser granular distribution, the shape or the specific weight?

First criteria is comparing similar fertiliser types. Compare granular fertiliser always with other granular fertiliser and not with prilled or mineral (angular) fertilisers. Second criteria is to compare within the fertiliser “family” the most similar granular distribution (the picture of the granule size box should look as similar as possible). Third criteria is then the specific weight which should not be too different. Very light fertiliser should not be compared with heavy ones.

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