

MANAGING NUTRIENTS EFFICIENTLY IN WATER PROTECTION AREAS

HOW CAN MAIZE GROWERS STAY PRODUCTIVE DESPITE REDUCING FERTILISER RATES?

Farmers who farm land in water protection areas must reduce their nitrogen inputs by 20% and therefore have to plan their fertilising schemes carefully. The question is whether maize can cope with lower N inputs or whether there are other ways of supplying the plants with the nutrient? The following article presents various approaches.

In the past, maize has been considered a 'slurry disposal crop' and hence a cause of nutrient ingress into the groundwater. Today, we can consider this a thing of the past, because today's maize varieties are more nutrient-efficient and can also be recommended for planting in water protection areas under the new German fertiliser application ordinance DüV. This is attributed to a number of factors:

- Modern maize varieties make more efficient use of nutrients thanks to appropriate breeding efforts
- In many years of experimenting, we have learned at which stage in the vegetation cycle the crop needs a specific nutrient – nitrogen (N), phosphorus (P), potassium (K), etc. – and this allows us to apply the fertiliser in a more targeted manner
- Advanced slurry application technology facilitates more targeted applications

- Strip tillage helps to make more efficient use of N and P

The use of cover crops is essential for growing maize successfully and in line with the latest fertiliser application rules, because they help conserve the nutrients in the soil or supply additional nutrients. In water protection areas it is in fact obligatory to sow a cover crop before growing a summer crop. This said, not all cover crops are ideal companions for maize; in fact, species-rich



TAB. 1: PLANNING NUTRIENT DEMANDS FOR
SILAGE MAIZE IN A WATER PROTECTION AREA

Targeted yields	45,000 t/ha
N requirement	200 kg N/ha
- N _{min}	30
- N remaining in the soil from the previous year	15
= N requirement	155
-20% reduction in water protection area	31
= Remaining fertiliser requirement	124
→ + N mobilised by TerraLife®	approx. 60 kg/ha
= Available N	approx. 184 kg N/ha

Source: Edited according to Chamber of Agriculture in Lower Saxony 2021

mixes have proved particularly successful for maize.

Species-rich cover crops fix nitrogen

The species-rich TerraLife® mixes that contain legumes can compensate for a skipped initial application and mobilise nitrogen. This is of benefit for the following crop and makes up for any deficiencies in the supply of nutrients (see Table 1). When crediting the N_{min} value

and the organic fertiliser and by deducting 20% nitrogen for water protection area-treatment, the remaining N requirement is 124 kg. This can be compensated to a certain degree by a well-developed TerraLife® mix. The mix is defined as a ‘non-legume’ mix, because it can supply the maize with approx. 20–60 kg N/ha.

When is the nitrogen from the cover crop made available?

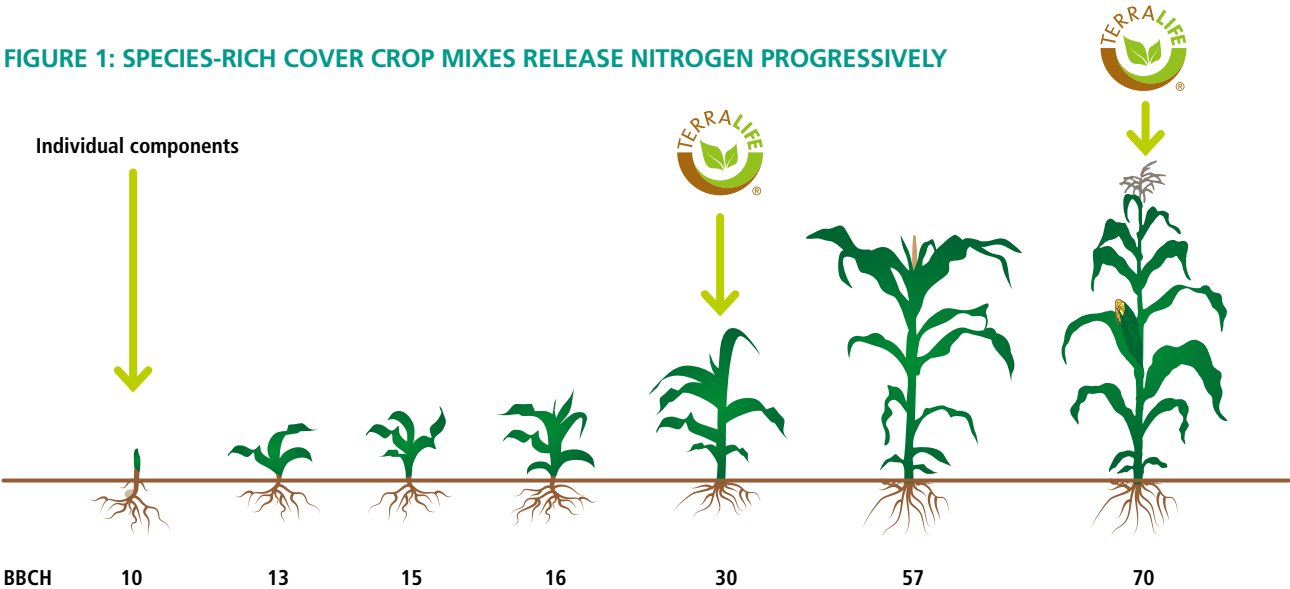
Another important aspect is the timing at which the cover crop releases the nitrogen and when this becomes available to the maize. Single-species cover crops (mustard, oil radish) store considerably fewer nutrients and release them very selectively. Depend-

ing on the C/N ratio, this timing may not be good for the main crop. By comparison, mixes that consist of many different species have a different effect, because each species in the mix releases N at a different time (see Fig. 1). This means that the nutrient is supplied much more consistently to the subsequent crop which in this case is maize.

New ways of farming: Maize mixes can mobilise phosphorus

Maize mixes that contain large-seeded legume species suggest a particular advantage because these release fixed phosphorus. Studies have shown that organic acids are formed during N-fixation. Among other things, organic acids make phosphorus

FIGURE 1: SPECIES-RICH COVER CROP MIXES RELEASE NITROGEN PROGRESSIVELY





Its deep roots and many fine roots make sorghum very drought-tolerant.



The exudates from maize root are a clear benefit of this crop.

available to plants. More precisely, legumes are able to form so-called proteoid roots which release exudates that reduce the pH level in the soil solution, thereby increasing P levels in the soil.

In mixed crops of maize and broad beans, the pH was found to have a positive effect on the P uptake and root length of maize (Zhang et al., 2015).

Mixes of maize and runner beans reduce the N requirement by approx. 30kg N/ha (P and K being applied as usual rates). Thanks to new breeds of runner bean varieties, a maize-bean mix now yields the same quantity of the main crop as an all-maize crop. In this mix, the maize benefits from the N-fixing power of the nodule bacteria. Research by the Nürtingen-Geislingen University of Applied Sciences showed that even more nodule bacteria are produced the less N is available (S. Hubert, mais 2/2021, 48. Jg.). This makes the system particularly suitable for nitrate-polluted areas.

Preventing nutrient overhangs by growing sorghum

Nutrient overhangs can be avoided by adding further crops to the rotation. One such crop is sorghum. Using this as a main or secondary crop provides new opportunities as it offers particular benefits regarding the new fertiliser restrictions, because thanks to its system of very deep and very fine roots it efficient-

ly takes up nutrients and also water. These characteristics make sorghum very drought tolerant and suitable for dry sites with light soils. Sorghum can also be grown in a mix together with maize. This can serve to secure yields and extend the harvest window while increasing the biodiversity.

Conclusion

Maize used to be considered a 'slurry disposal crop'. Today's new varieties however have the ability to use nutrients efficiently and hence are suitable for growing in water protection areas at productive yield levels. Species-rich cover crop mixes like TerraLife®



Runner beans climb the maize stalks.

not only encourage the mobilisation of N but also release N progressively and consistently throughout the vegetation stage of the maize, hence providing an optimal supply of the nutrient. Another option are maize mixes that contain large-seeded legume species such as field or runner beans as these reduce the N requirement on the one hand and improve P solubility in the soil on the other. Also, extended rotations that include sorghum can prevent nutrient overhangs and contribute to biodiversity also in mixed maize crops.

Carmen Fiedler
Lippstadt

Fon +49 2941 296 236



Luisa Lilienkamp
Lippstadt

Fon +49 2941 296 262

