



**Innovation for
your growth**

DynaSeed

Innovative seed technology

Dr. Ulf Feuerstein · Asendorf



Researchers in Asendorf near Bremen have spent the past few years working hard on the development of seed technology. Their aim was to better exploit the potential of high-quality seed. Now in 2017, DSV Deutsche Saatveredelung AG offers a new range of additives under the new DynaSeed brand – a formulation that provides a dynamic boost to plant development processes and thus ensures greater environmental stability. For farmers, this means greater reliability and in the case of alfalfa, higher yields.

DynaSeed LegumeMaxx for high, reliable yields

We have spent many years conducting numerous trials to find the best seed treatment for alfalfa. Enormous differences between va-

rieties are evident just by looking at the trial plots from ground level. But when you look at images captured by drones (Fig. 1), the differences are even more striking. And it's not just the images themselves that are impressive. The

photographs help the researchers to determine the yields for each specific plot even before harvest. The photograph shows various varieties trialled during the product development of DynaSeed LegumeMaxx, with yield variations ranging from 0.2 kg/ha and 1.2 t/ha. So what's the secret behind DynaSeed LegumeMaxx? This specific seed treatment affects three key areas. Germination speed, early growth and vitality. By positively affecting these areas, we can increase nitrogen fixation and generate higher yields.

Natural symbiosis of legumes

When legumes are sown in the field, they form a symbiotic relationship with soil bacteria (rhi-

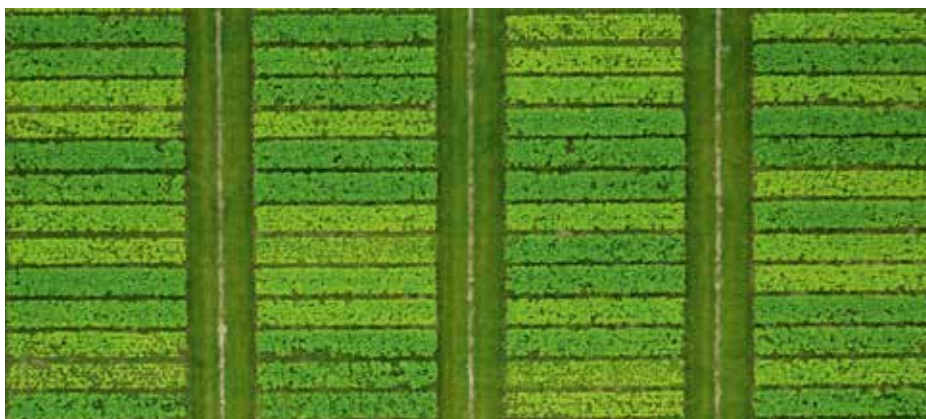


Fig. 1: Plots of alfalfa (Planet variety) reflecting different seed treatments, photographed from a height of 100m.

zobia) fairly rapidly, which allows them to fix nitrogen. Neither the rhizobia nor the legumes can fix atmospheric nitrogen independently.

After germination, the legumes secrete root exudates which attract the bacteria to the rhizosphere. This process is highly specific. Each species group depends on specific rhizobia for successful symbiosis. For instance, clover rhizobia do not work with alfalfa, and vice versa. This is why we make a distinction between LegumeMaxx T (for trifolium species, e.g. red clover) and LegumeMaxx M (for medicago species such as alfalfa). Lupins, soya beans and fabaeae-species (peas, beans and lentils) each form a symbiotic relationship with different species of rhizobia.

Rhizobia enter the plant via the root hairs and colonise the fine roots. Eventually they form growths on the roots known as nodules in a process called nodulation. This first phase of colonisation is an infection that causes stress to the plant.

It takes several weeks for the symbiotic relationship to become fully established. The plants then supply the bacteria with carbohydrates and in return receive nitrogen in a form they can use. Once the symbiotic relationship is fully established, the plant draws on this source of nitrogen and gains significant advantages, especially if other sources of nitrogen are scarce.

After a few months, a balance between rhizobia reproduction and death occurs. At this stage, nitrogen is released in the legume's rhizosphere. Non-nitrogen-fixing plants in mixes with clover and alfalfa ultimately benefit from this source of nitrogen.

DynaSeed LegumeMaxx influences symbiosis

We know that rhizobia are widespread in central European soils and that legumes will be colonised naturally soon or later. Therefore our research focused primarily on encouraging rapid and successful symbiosis between legumes and rhizobia.

At trial sites in Ven Zelderheide in the Netherlands and Asendorf in Germany, we tested combinations of DynaSeed LegumeMaxx seed treatments compared with untreated alfalfa seed and recorded yield increases between 13 % and 87 %, depending on the site. These fluctuations show that the fewer soil-borne rhizobia present, the greater the effect of the seed treatment.

Although it is not practical to verify the number of soil-borne bacteria at a given site, a standardised seed treatment is in any event advantageous. The rhizobia are embedded in a coating made from rock dust, biological binders and algae extracts.

As well as calcium, the carefully selected rock dust contains small amounts of potassium, magnesium and iron. This combination, together with an algae extract containing the right phytohormones, has a positive effect on legume germination and rhizobia division. Tests show that the rock dust coating helps to retain moisture around the seed and improves both germination and the reactivity of the freeze-dried bacteria.

Seeds treated with LegumeMaxx germinate faster and more consistently. The rhizobia attracted by the root exudates, together with

Importance of nitrogen fixation



Nitrogen fixation is systematically exploited in agriculture. Legumes fix approx. 39 million tonnes of nitrogen a year worldwide. The WHO estimates the global demand for synthetic nitrogen in 2017 at 113,310,397 tonnes. Legumes thus make a substantial contribution to agricultural nitrogen supplies. Some research groups are working on transferring nitrogen fixation to arable crops which do not currently fix nitrogen, although this is still a long way from becoming reality.

Nowadays we already use a range of crops for nitrogen fixation. Among the native species of nitrogen fixers, the Bavarian State Institute for Agriculture places alfalfa way ahead of the field, with an average of 342 kg/N/year, followed by red clover with 306 kg/N/year. According to other sources, white clover is responsible for fixing approximately 250 kg/N/year.

those already present in the coating, penetrate and colonise the root hairs more rapidly. A successful symbiotic relationship is quickly established in just a few weeks.

Test results show significant advantages

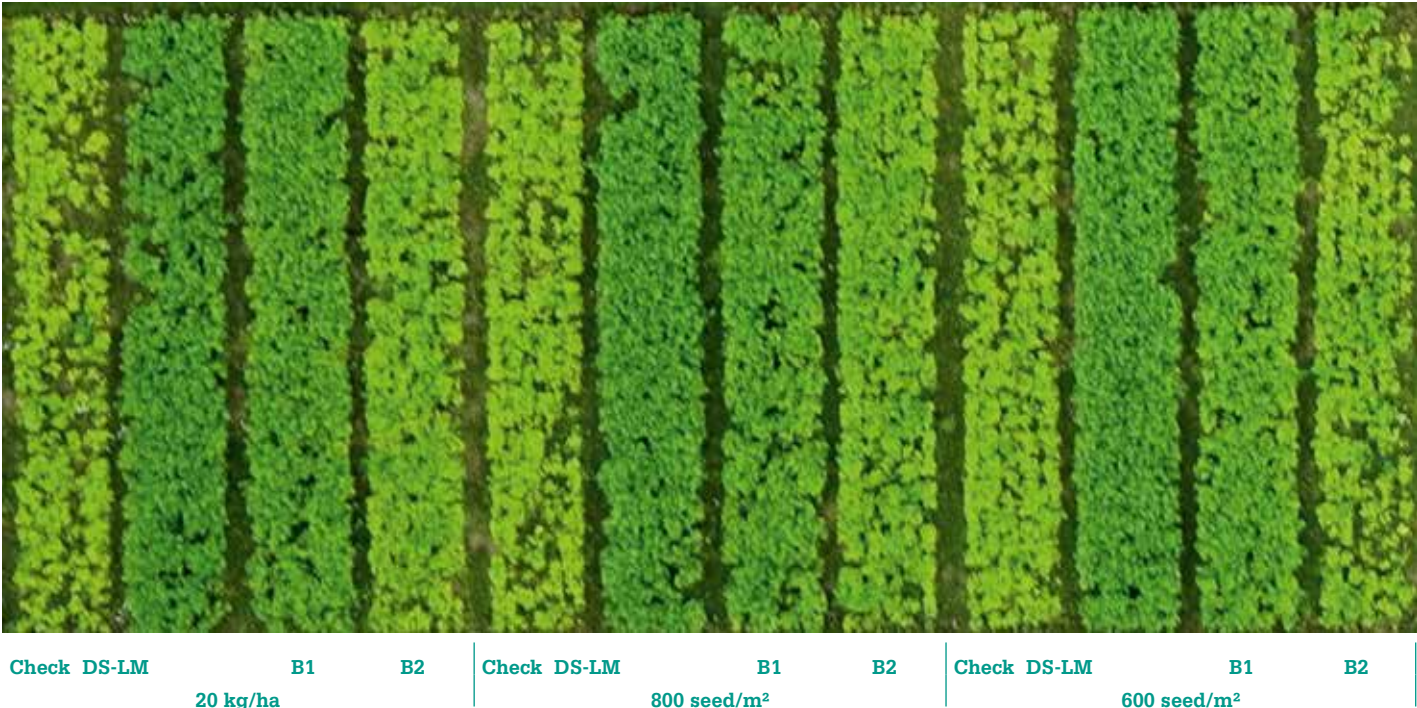
In addition to boosting nitrogen fixation, another advantage of the DynaSeed coating is that the rhizobia remain directly on the seed and dust generation in the seed is lower than with other methods. Furthermore, the coating increases the speed of germination. After 72 hours, the radicles (germ roots) of the untreated control seed measured 16.7mm compared with 24.1mm for the LegumeMaxx radicles. Strong radicles release more root exudates and attract rhizobia more rapidly to the root hairs to initiate the process of symbiosis. In the Asendorf

Tab. 1: Performance of LegumeMaxx M at different sowing rates

Variant	Seed rate	t/ha	Dry matter yields (year 1) (%)*		
			Average from 2 trial sites	HS = Site 1 (Hof Steimke)	VZH = Site 2 (VZH)
Untreated lucerne	20 kg/ha	3,6	100	100	100
LegumeMaxx M	20 kg/ha	4,9	137	137	137
LegumeMaxx M	800 seed/m ²	5,5	133	142	124
LegumeMaxx M	600 seed/m ²	5,5	153	142	164

*The relative results refer to untreated lucerne crops sown at identical rates

Fig. 2: Trial results of alfalfa LegumeMaxx, treatment variants and untreated seed



soil, the treated seeds were found to develop significantly stronger nodulation compared to the untreated seeds, as evident from the number of nodules on the roots.

Significant differences were also observed between the different sowing rates (Fig. 2). The untreated variants (Check) are significantly paler than the LegumeMaxx variants (DS-LM).

In all cases, the seed treated with LegumeMaxx M clearly outperformed untreated variants sown at the same rate. The untreated alfalfa yielded 3.6 t/ha dry matter on average across both sites, while treatment increased the yield to 4.9 t/ha, which equates to an average increase at both sites of 37 % (Tab. 1).

With a sowing rate of 800 seeds/m², the LegumeMaxx produced an additional yield of 33 % across both sites. At a sowing rate of 600 seeds/m², LegumeMaxx produced a particularly striking yield increase of 53%.

The results of the sowing rate trial suggest that growers can expect a consistent yield increase of 30 % to 50 % with

LegumeMaxx compared with the untreated alfalfa, regardless of kg/ha or seed/m² rates.

Seed treated with DynaSeed LegumeMaxx behaves not differently to untreated seed in terms of the sowing time. When sown at the usual time for the area, the seed benefits from the coating in that this ensures it is consistently supplied with moisture. As a result, seeds are less susceptible to stress situations, leading to more consistent germination.

Summary

Over recent years, the Deutsche Saatveredelung AG has been systematically developing the innovative DynaSeed seed technology. Using a scientific approach, we have developed products which have a visible impact on plant development and ensure successful cropping and higher yields for farmers.

LegumeMaxx is such a product, which is available in two versions: M for alfalfa and T for clover.

Seed treated with LegumeMaxx shows faster, more consistent field emergence than untreated

seed. Stronger radicle growth enables rapid colonisation with rhizobia and fast early growth. In terms of sowing time, sowing rate and storage, LegumeMaxx can be treated in the same way as untreated seed. Extensive field trials on two test sites have shown that LegumeMaxx has significant and clearly visible yield benefits compared with untreated seed.



Dr. Ulf Feuerstein
Fon +49 4253 9311 11