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FYTOGREEN-FOAM IN LAYING OUT SPORTS FIELDS

- Research results and experience -

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INTRODUCTION

Increasing the water absorption capacity of rootzone layers of the soil has always been a desirable goal, especially in situations in which the natural precipitation, in respect of distribution and amount, is insufficient for the vegetation desired.

I would like to present the results of the research and experience concerning FYTOGREEN FOAM RG 22. I will include in this the results of the Sports Turf Research Institute of Bingley

and of our own research.

I will do this based on the following questions:

- What is FYTOGREEN FOAM?
- What does FYTOGREEN FOAM achieve?
- How does FYTOGREEN FOAM work?
- What is the potential of FYTOGREEN FOAM?
- What economic advantages can be gained by the use of FYTOGREEN FOAM?

What is FYTOGREEN FOAM?

FYTOGREEN FOAM is an organic-synthetic amino resin hard foam manufactured on the basis of urea, certain melanins and methanol. It is biodegradable. With the help of certain production processes, characteristics which are advantageous for creating water-retaining void volumes are expected to occur. In particular, the continuity and accessibility of the pores is expected to be high, because of the new kind of cell structure (see fig. 1).

FYTOGREEN FOAM according to German law, is considered a soil accessory material or a fertiliser, respectively.
As a soil accessory material (the present situation) it is intended mainly to improve the physical properties of soils and substrates in laying out sports fields. This refers especially to its capacity to retain water and the nutrients dissolved in it. It can be used as a carrying layer for the grass surface not only of football pitches, greens, fairways and tees of golf courses but also for tennis courts, horse-riding tracks, rugby pitches, etc.

What does FYTOGREEN FOAM achieve?

FYTOGREEN FOAM increases the water retaining capacity and the absorption of the nutrients dissolved in water (e.g. nitrate) in certain types of soil and in certain rootzone mixes for lawns. With the simultaneous availability of air-filled pores - in the ideal situation a ratio of 60 vol.%/40 vol.% (water/air) - additional advantageous conditions are created for the root growth of the grass of the lawn.

As the maximum water retaining capacity of the pure FYTOGREEN FOAM, values of up to 2,600 weight% have been established. This means that 1 litre of foam in the form of flakes could store about 570 g of water (57 vol.-%). In the form of foam blocks, the water retaining capacity is less. A wetting agent, added to the water, achieves higher values (table 1).
The water retaining capacity of rootzone mixes with FYTOGREEN FOAM is varying, as might be expected. Tests with mixtures of Pleinfeld sand, a relatively coarse sand, have shown a considerable increase in the water retaining capacity (see figures 2 and 3, and table 2). It was, for instance, possible to increase the storing capacity at 40 cm water column from 8.2 weight% to 11.5 weight% by adding 20 vol.% of FYTOGREEN FOAM. This means an increase of 40 %. If the FYTOGREEN flakes are, in addition, mechanically treated, an even greater increase is achieved: 13.5 weight% (64 %). Also the laboratory tests of STRI in Bingley (S. BAKER, UK) prove the increase in the water retaining capacity when adding FYTOGREEN FOAM (Capillary Porosity). With three different basic substrates, it was, for instance, possible to significantly increase the portion of water saturated pores at a soil moisture tension of 40 cm wc (= 40 mbar resp. 4 kPa). The increase in this case was more than 100 % (pure sand), and even in the case of a sand-peat mixture up to 30 % (see also fig. 6).

Furthermore, when mixed with substrates, the elasticity of the foam results in an increased elasticity of the substrate mixtures for lawn carrying layers. In very hard mixtures, this is advantageous from a medical point of view (less strain on the joints of the sports people).

The addition of FYTOGREEN FOAM reduces the hydraulic conductivity of carrying layers. In our own laboratory tests this effect was shown to vary (see fig. 5). With an addition of 10 vol.% FYTOGREEN FOAM the hydraulic conductivity was raised, whereas at 20 and 30 vol.% it was shown to be less. This decrease is, however, no problem if we take it into account when mixing. The results from Bingley show a clear negative effect on the hydraulic conductivity. It was, however, still within the limits of acceptability (see fig.1).

How does FYTOGREEN FOAM work?

The capacity of the substrate of lawn rootzone mixtures to store water e.g. on football pitches, golf teeing grounds and greens, is raised by increasing the portion of certain pores. Medium and narrow coarse pores are decisive for the water retaining capacity. These are pores with a diameter of 0.2 to 50 μm. Because of the capillary breaks which are prevalent in the profile structure of sports grounds, voids of up to 100 μm are important for the short-term storage of water.
For this reason, and because the international research methods assume a test water surface tension of 40 cm water column, the water storage capacity has been established in the laboratory at a suction tension of 40 mbar (4 kPa).
The results show, that by using FYTOGREEN FOAM RG 22 in amounts of 7.5 to 30 vol.% the water storage capacity can be raised significantly to a considerable degree (see fig. 6).

There are, however, substrate mixtures where the use of FYTOGREEN FOAM does not have the same positive effect (see fig. 4). In one type of fine sand a positive effect was achieved by adding 10 vol.%, while higher additions did not result in an improvement of the water retaining capacity.

Apart from water-filled voids the use of FYTOGREEN FOAM at the same time provides the soil or the lawn carrying mixture with air-filled pores. In spite of this, the share of air-filled pores decreases overall since the water-filled voids are dominant (see fig. 3).

It has been proved that also the elasticity of the lawn carrying layers in sports fields can be increased by the use of FYTOGREEN FOAM. Elasticity means a certain resilience, so that the carrying layer is less hard and has an improved absorption of energy. This effect is achieved because the foam demonstrates a certain restorative capacity after being weighted so that it works elastically. Laboratory tests have proved this characteristic (see table 3).

What economic advantages can be gained by the use of FYTOGREEN FOAM?

With a high water-storing capacity, more rainwater or sprinkler water is retained in the carrying layer and, from there, supplied to the grass. The figures/volumes in absolute terms, as well as the financial savings achieved depend on many factors and cannot be quantified in general terms. However, the relative savings potential can be shown with the help of a theoretical example. If a layer of sheer sand is compared to a layer which has been improved by 20 vol.% of FYTOGREEN FOAM it is seen that the number of sprinkling actions can, theoretically, be reduced by more than 40 % (see calculation 1).

The fact that FYTOGREEN FOAM consists of about 30% nitrogen demonstrates another savings potential. If a degradation time of 10 years is assumed for the foam, as well as a normal input volume of about 20 l flakes every m5, this implies that - as a calculation - 6 g/N ≅ m5 nitrogen is supplied per year. The annual nitrogen input for an intensively used football grass pitch, therefore, can be reduced by 25%, with a respective reduction of the costs.

What potential does FYTOGREEN FOAM have?

From an ecological point of view, FYTOGREEN FOAM potentially substitutes peat, a non-renewable material, at least to some extent. If it is developed further it might be possible, moreover, to substitute peat completely. When considering this, the fact that the basic substances of FYTOGREEN FOAM could, in future, be produced from renewable raw materials is especially important.

Fig. 1: Pore structure of FYTOGREEN FOAM RG 22 (enlarged)

Tab. 1: Water retaining capacity of pure FYTOGREEN FOAM (floating on water)

	Water content in weight%	
	Test 1	**Test 2**
Flakes		
After 1 hr.	2578	-[1)]
After 6 hrs.	-	2467
After 24 hrs.	2633	2617
	Without wetting agent	With wetting agent
Foamed blocks		
After 1 hr.	297	349
After 24 hrs.	314	450

1) not determined

Tab. 2: Water storing capacity of the vegetative mixtures with Pleinfeld sand

Mixture	Lab capacity (LC 100) in weight %	
	at 40 cm wc	at 15 cm wc
11 (100 PS)	8.2	10.7
12 (80+20 peat)	11.1	19.0
13 (80+20 FG)	11.5	-[1)]
13 (80+20 FG)*)	13.5	15.4
14 (80 PS+20 FG)**)	10.6	11.8
14 (80 PS+20 FG)***)	13.1	17.0

1) not determined
*) mechanically treated
**) FYTOGREEN FOAM with wetting agent
***) FYTOGREEN FOAM with wetting agent and mechanically treated
PS = Pleinfeld sand mixture
FG = FYTOGREEN FOAM
wc = water column

Tab. 2a: Water storing capacity and hydraulic conductivity of the rootzone mixes with fine sand

Mixture	Lab capacity (LC 100) in weight%	Hydraulic conductivity in mm/min	
	At 40 cm wc	DIN	GB
1 (100 FS)	15.9	2.81	1.20
3 (90 FS+10 FG)	17.4	2.00	1.29
4 (80 FS+20 FG)	14.5	2.29	1.93
5 (70 FS+30 FG)	16.0	1.99	1.72

FS = Fine sand mixture
FG = FYTOGREEN FOAM
DIN = Measured according to DIN 18035 T4
GB = Measured according to English method
wc = water column (soil moisture tension)

Tab. 3: Elasticity of test sample after compaction

Mixture	Height difference on compaction and after 60 min. (Load 72kp/cm5, 10 min)	
	in mm	in %
1 (100 FS)	0.05	0.5
2 (90 FS+10 FG)	0.11	1.3
3 (80 FS+20 FG)	0.15	1.7
4 (70 FS+30 FG)	0.23	2.8
5 (80FS+10T+10FG)	0,21	2.5
6 (Lavaterr)	0.17	1.7

FS = Fine sand mixture
T = White peat
FG = FYTOGREEN FOAM

Calculation 1: Calculation example of water savings - comparison of a layer of 10 cm sheer sand with a mixture of sand and FYTOGREEN FOAM (80 : 20)

Material: Medium-coarse-Sand, Quartz

Assumption:
- 30°C temperature, closed turf
- ca. 7 l/m5 ≅ daily water requirement
- d_B = 1,50 g/cm;
- dry period of 1 month

Water storage of medium-coarse sand without foam = 12 l/m5
Water storage of medium-coarse sand with 20 vol.% foam = 20 l/m5

Number of theoretically necessary
Watering actions: without foam = 17
With foam = 10