EFFECT OF INCLUSION OF BIORAISER POWDER IN GROWING MEDIA ON GRASS GROWTH AND WATER RETENTION OF THE GROWING MEDIA

Final report of appropriate research section of the 'Green cover' –project
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Summary
Influence of BIORAISER Powder on seedling emergence of grass, green ground coverage (plant density), growth and drought tolerance was studied in MTT Plant production research by tray tests conducted in greenhouse and net house. BIORAISER Powder accelerated initial growth and seedling emergence. This test arrangement did not reveal any positive influence on drought tolerance of grass. Inclusion of BIORAISER Powder to peat-based growing medium decreased amount of water infiltrating through 10 cm substrate in normal rainfall conditions. Application of BIORAISER Powder accelerated seedling emergence and tillering at the initial growth stage. In growing media watering test (without plants) BIORAISER Powder mixed with peat decreased surface runoff when watering 15 degrees sloped surface-dry peat medium.

Background
Research offer and contract specified four different tests, all of which were performed. In this report the tests are subdivided into two groups based on used growing medium: I) BIORAISER Powder added to commercial off-the-shelf lawn substrate (Envorin erikoismulta = Envor's special soil) ja II) BIORAISER Powder added to Black peat-based growing medium of Vapo.

Material and methods
The tests were executed at MTT Plant production research facility at Jokioinen. The growing media were mixed by concrete-mixer at Plant production research facility. Plastic boxes (trays) having dimensions 30 cm x 40 cm and height 11 cm were filled with 10 cm layer of growing media. Boxes bottoms were punched with 2 holes of ⌀ 5 mm. Tests were started in early spring in greenhouse and continued in summer in net house having glass roof. Peat substrate tests were performed in net house i.e. in normal rainfall conditions, surface runoff was tested with watering pot as well as in rain simulator.

Fig. 1. Tests were started in the traditional greenhouse wherefrom they were moved outdoors into roofed net house at the beginning of summer. In the foreground You can see trays where BIORAISER Powder was mixed into surface in 0-2 cm layer. Perennial ryegrass is well emerging whereas Kentucky bluegrass is just starting to emerge..

I Inclusion of BIORAISER Powder into lawn's growing media

I Test 1 Lawn establishment ensuring effect with different growing media and plant species having different seedling emergence rate

Two species have been used in this experiment: Perennial ryegrass having fast germination rate and powerful growth and Kentucky bluegrass which is establishing slowly. BIORAISER Powder was applied to two different growing media. One of the substrates was off-the-shelf Envorin Erikoismulta (= Envor's special soil). More quick-drying substrate was prepared by adding sand to Envorin Erikoismulta in amount of 30 per cents of the total volume of the prepared growing media. On both growing media BIORAISER Powder was mixed into 5 cm surface layer so that it had double content of the powder compared to calculated total depth of the growing medium. (Normally recommended depth of lawn substrate is 20 cm.). Seedboxes were compacted with standard pressure. Boxes were weighted after setting the growing media and several times during the test time. Dates of germination and green ground coverage were recorded and cut yield was measured. No supplementary fertilizing was used. At the beginning of testing watering of all growing media was performed with small amount of water. Later watering was adapted to actual growth of plant species.

Test arrangement was based on split-plot design, where plant species were in main square, growing media in subsquare and inclusion of BIORAISER Powder in sub/subsquare. As plant species were quite different they have been processed separately in this report. So we are dealing with subsquare test where substrate is in the main square and added amount of BIORAISER Powder in the subsquare.

Plant species:

A1	Rapidly establishing Perennial ryegrass A2 Slowly establishing Kentucky bluegrass

Growing media:

HM	Envorin erikoismulta (normal off-the shelf lawn soil)
KM	Envorin erikoismulta modified to dry faster by adding 1/3 part of sand. (BIORAISER Powder was added to special soil & sand mixture).

Amount of BIORAISER Powder:

C1	No BIORAISER Powder (reference)
C2	BIORAISER Powder 5 volume-% (10% at the top 5 cm of the growing media)
C3	BIORAISER Powder 10 volume-%. (20% - " -)
C4	BIORAISER Powder 20 volume-%. (40% - " -)

Test squares: 4 x 2 x 2 x 4 repeats = 64 pcs. Test arrangement: sub/subsquare test. Statistical processing of the results by species in 2-factor test. Box dimension 30 x 40 cm, depth 11 cm. Depth of growing medium 10 cm. Observations: germination and tillering rate, green ground coverage 2 times a month, cut yield based on growth, weighting of cut yield (dry matter yield) and determination of nitrogen content for sample combined by boxes.Test growing took place in greenhouse in April-May and outdoors in net house in June-July. Main findings, see figures 2-8.

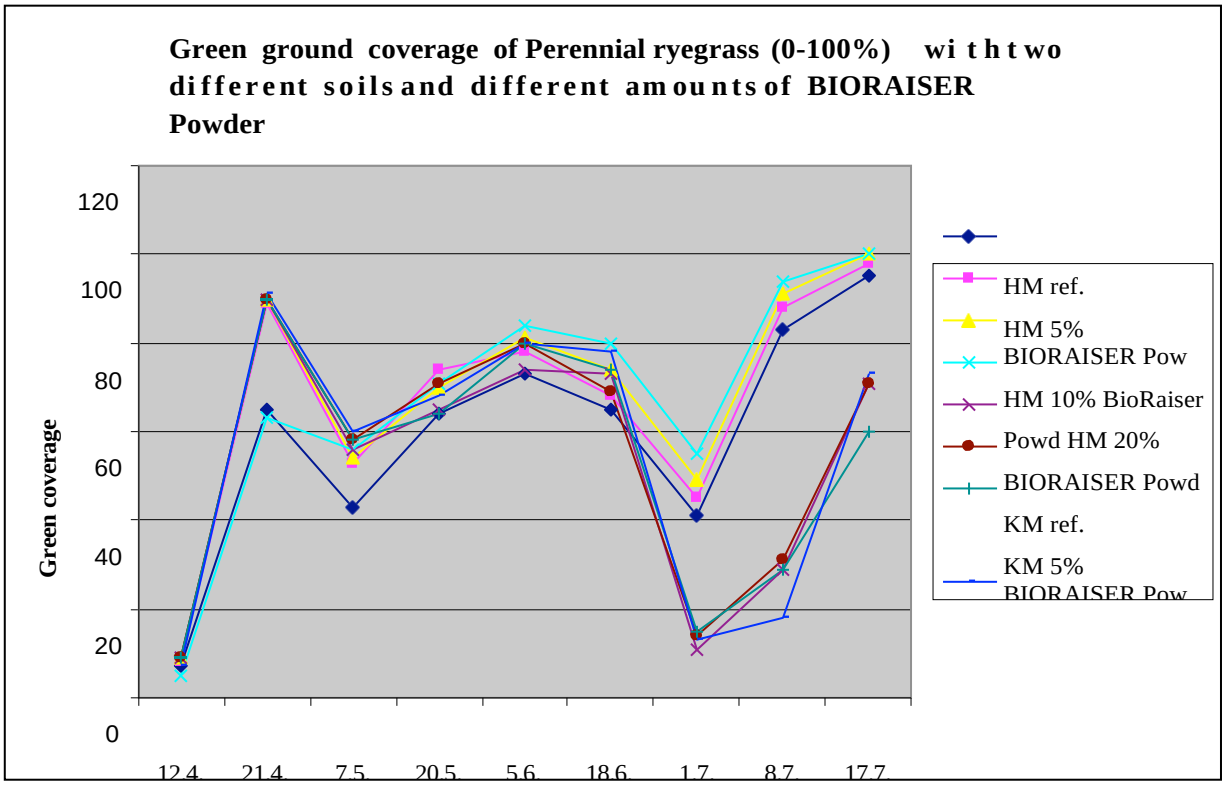


Fig. 2. Green ground coverage of Perennial ryegrass (0-100%) with different BIORAISER Powder inclusions and different growing media.

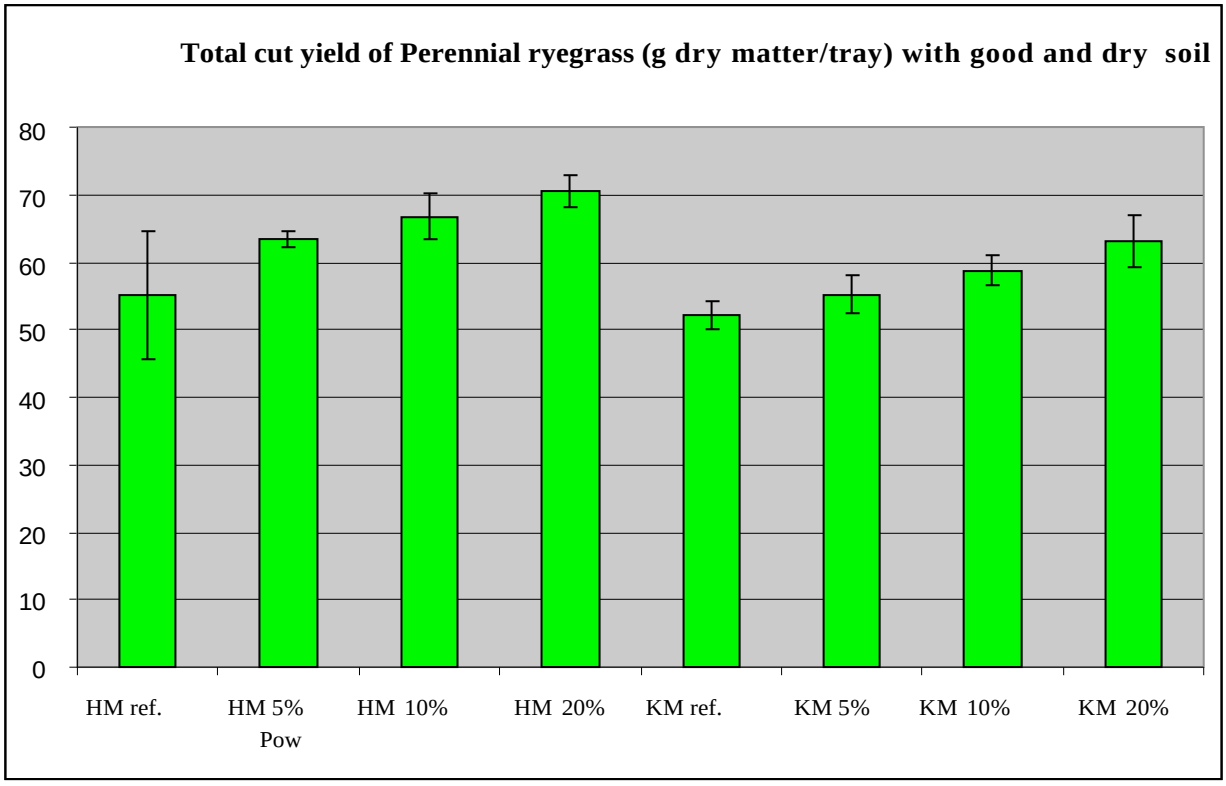


Fig. 3. Total cut yield of Perennial ryegrass (g dry matter/tray) during test cycle with different BIORAISER Powder inclusions and different growing media. BIORAISER Powder improved growth of grass with both growing media.

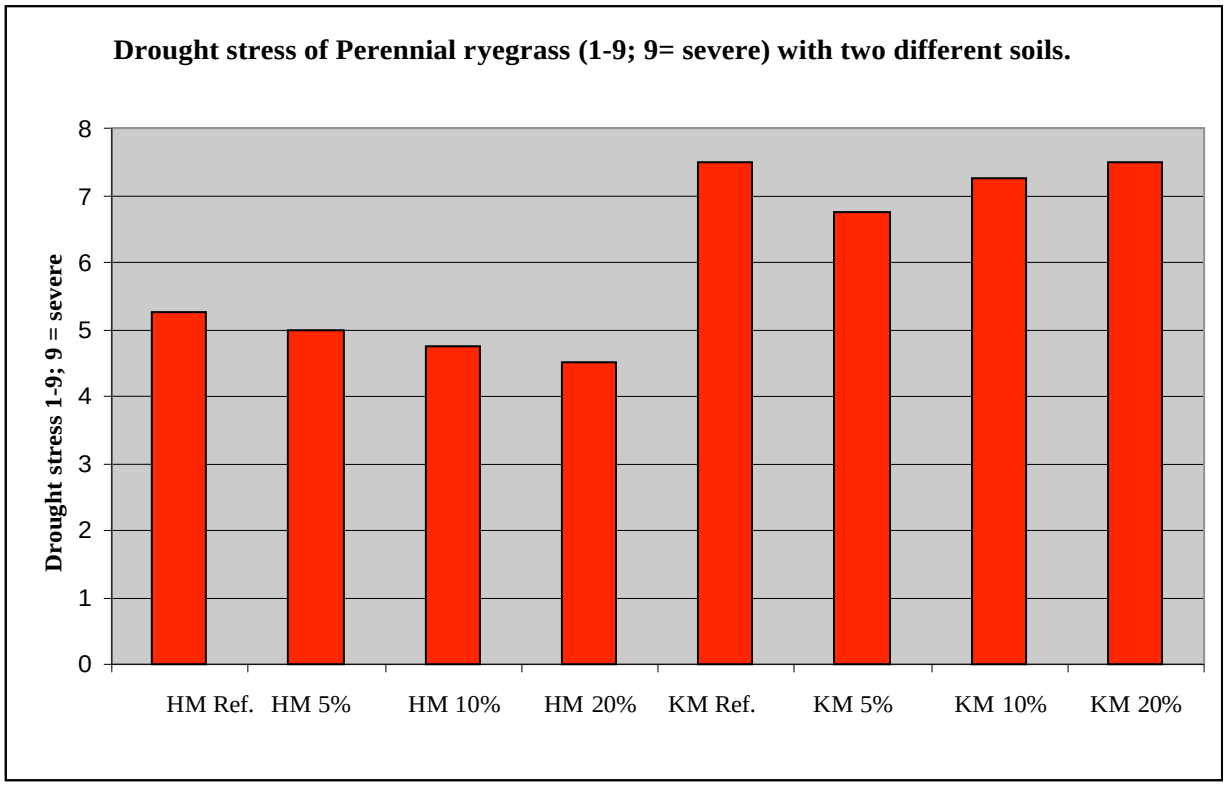


Fig. 4. Visual estimation of drought stress of Perennial ryegrass (1-9; 9 = severe stress) in drought tolerance test with different amounts of BIORAISER Powder and with different gr. media.

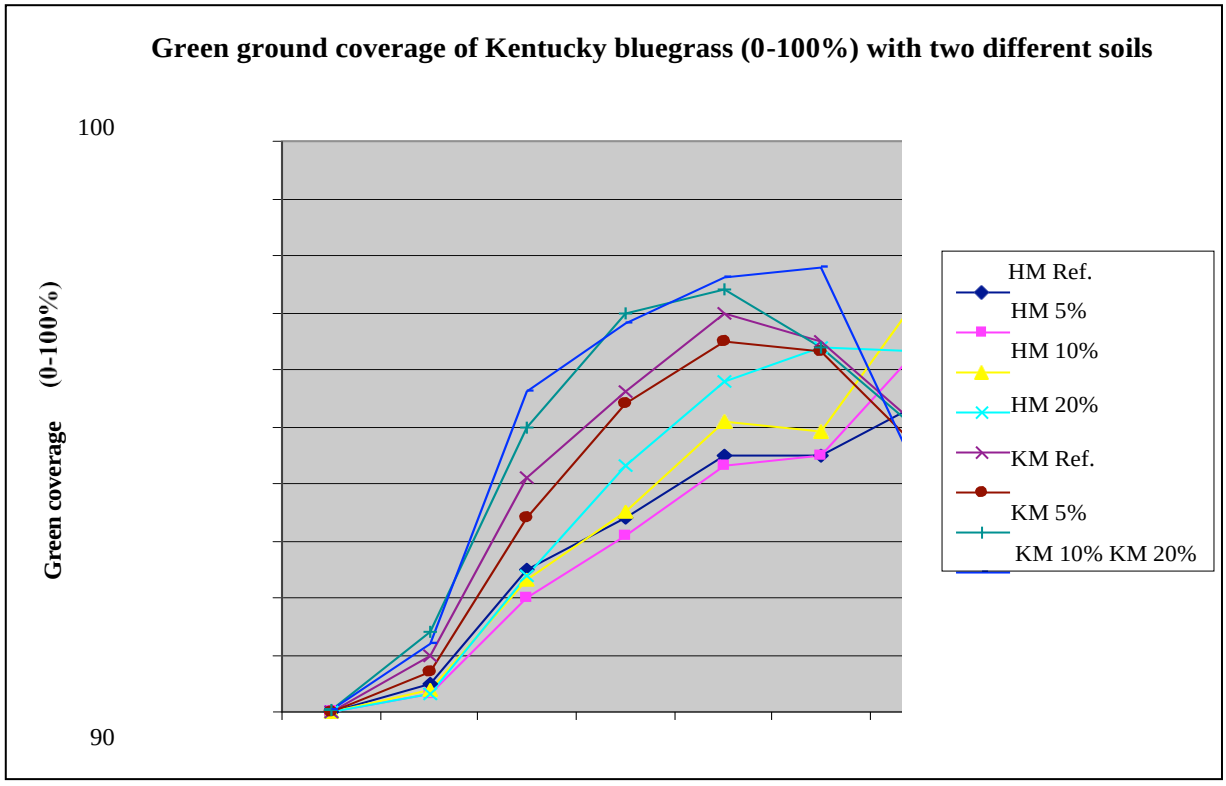


Fig. 5. Green ground coverage of Kentucky bluegrass (0-100%) with different BIORAISER Powder inclusions and different growing media. All plants did not recover from drought tolerance test with dry growing medium.

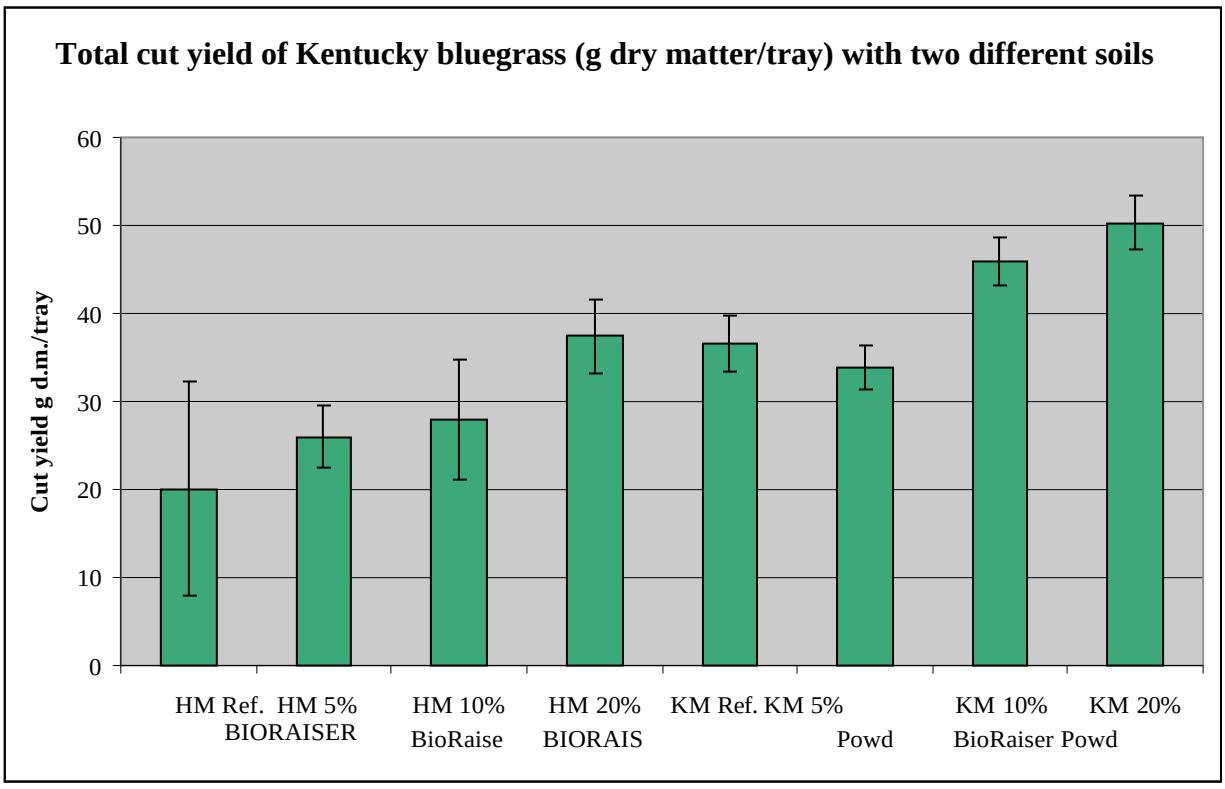


Fig. 6. Total cut yield of Kentucky bluegrass (g dry matter/tray) during test cycle with different amounts of included BIORAISER Powder and different growing media. BIORAISER Powder improved growth of grass with both growing media.

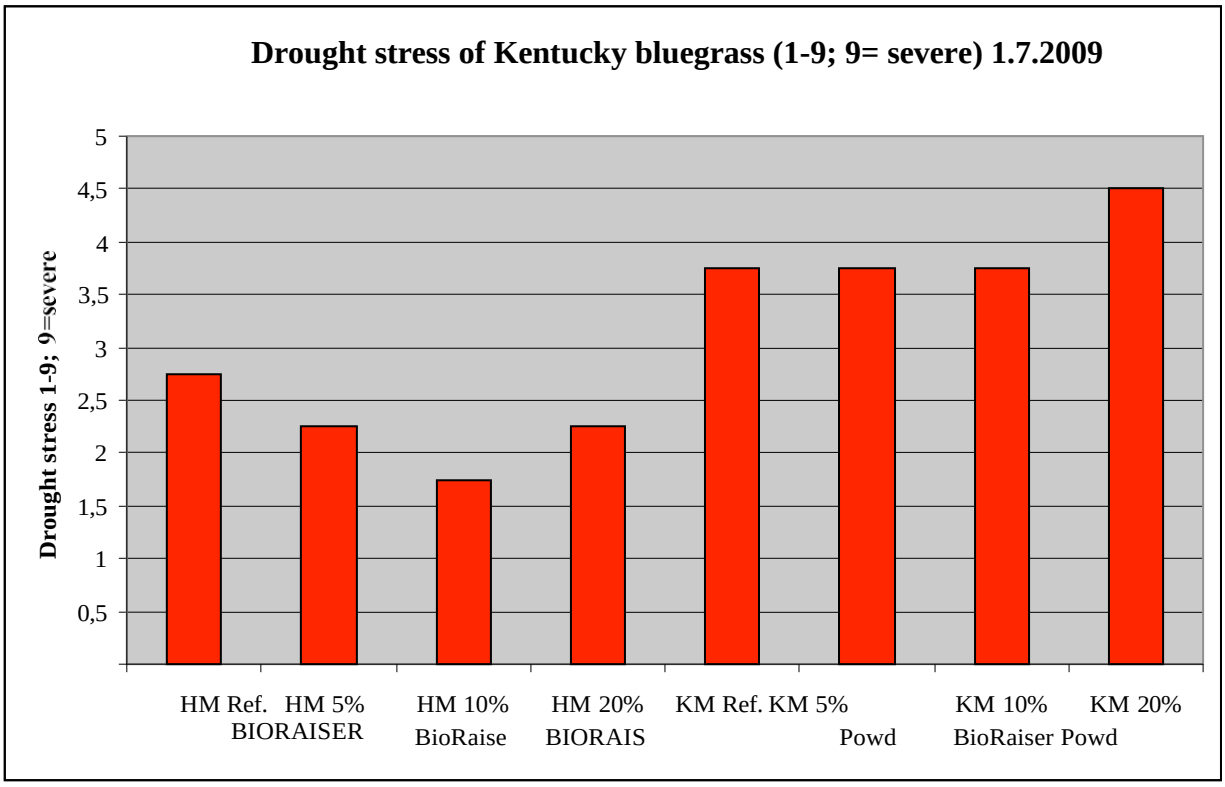


Fig. 7. Visual estimation of drought stress of Kentucky bluegrass (1-9; 9 = severe stress) in drought tolerance test with different amounts of BIORAISER Powder and with different growing media after the first week of drought testing.

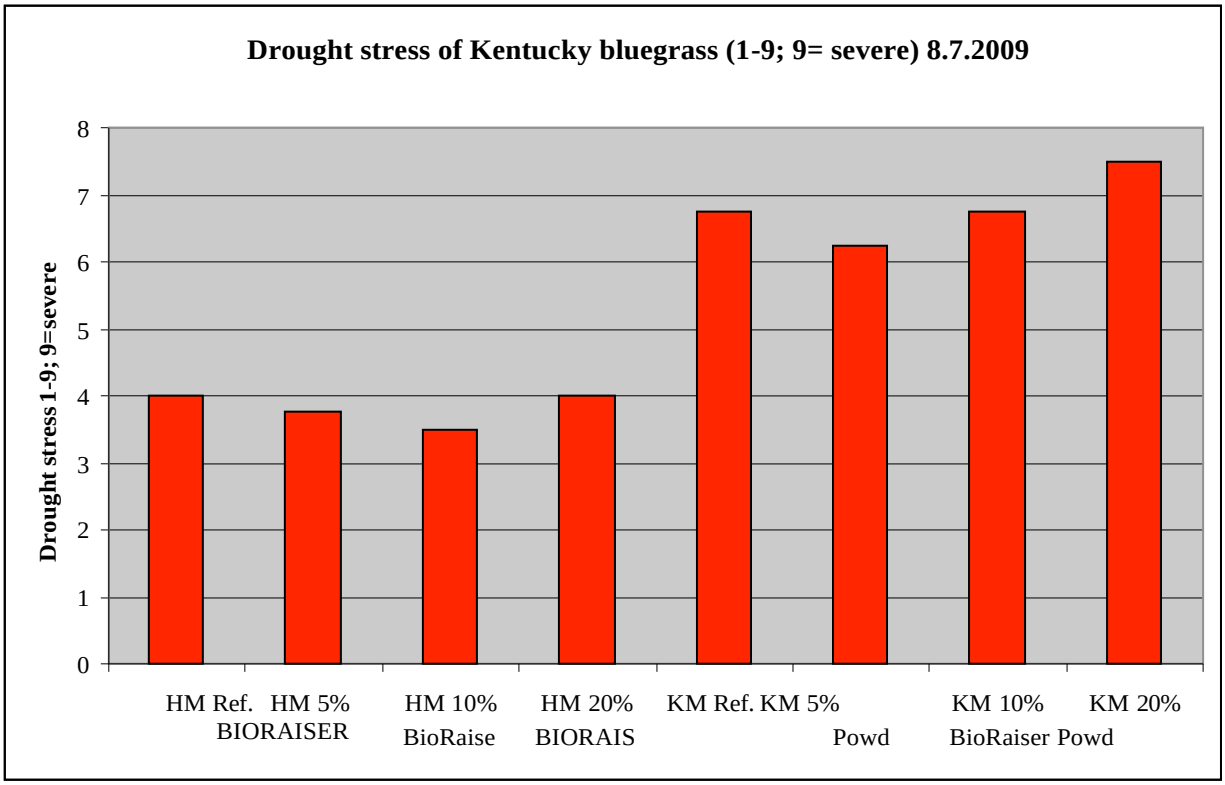


Fig. 8. Visual estimation of drought stress of Kentucky bluegrass (1-9; 9 = severe stress) in drought-resistance test with different amounts of BIORAISER Powder and with different substrates after the second week of drought testing.

I Test 2) Influence of BIORAISER Powder inclusion into growing media on drought tolerance at lawn establishment stage

The task of the test was to achieve reasonably uniform seedling emergence of grass and to induce period of drought while seedling emergence is still in progress. The idea was to find out influence of BIORAISER Powder on drought tolerance of established lawn as well as on recovery after restarting of watering. Amount of water in growing media was monitored by weighing plant trays and by using gypsum (resistance) blocks in the trays. The test was conducted in a greenhouse in April-May and in the net house in June-July. Off-the-shelf 'Envorin erikoismulta' in the top 5-cm layer of which BIORAISER Powder has been included.

Amount of BIORAISER Powder in growing media:

A1	Normal Envor erikoismulta and no drought stress. Ref. sample to drought stress. A2 No BIORAISER Powder. (reference)
A3	5 - volume % BIORAISER Powder (10 % in top 5 cm layer of growing media)
A4	10 - volume % BIORAISER Powder (20% - " -)
A5	20 – volume % BIORAISER Powder (40% - " -)
A6	10 – volume % BIORAISER Powder on the top 0-2 cm layer (10 % of total growing media)

The test was performed with four repetitions i.e. with 24 trays. The test was established in greenhouse on 23.4.2009 and drought resistance test was done outdoors in net house. Moisture content of trays was monitored by weighting and measuring conductivity of resistance blocks (of gypsum). S e e p h o t o s 1 and 9 – 15 for testing and results.

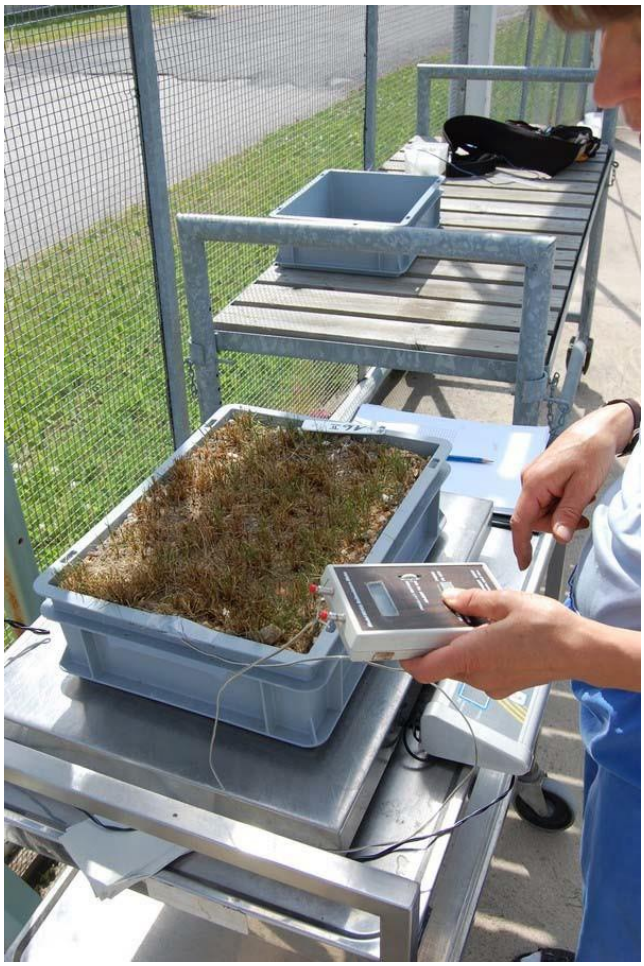


Fig. 9. Drought stress severity at lawn establishment stage was monitoredby measurement of electrical conductivity of resistance blocks located intoboxesaswellasbyweightingoftheboxes..

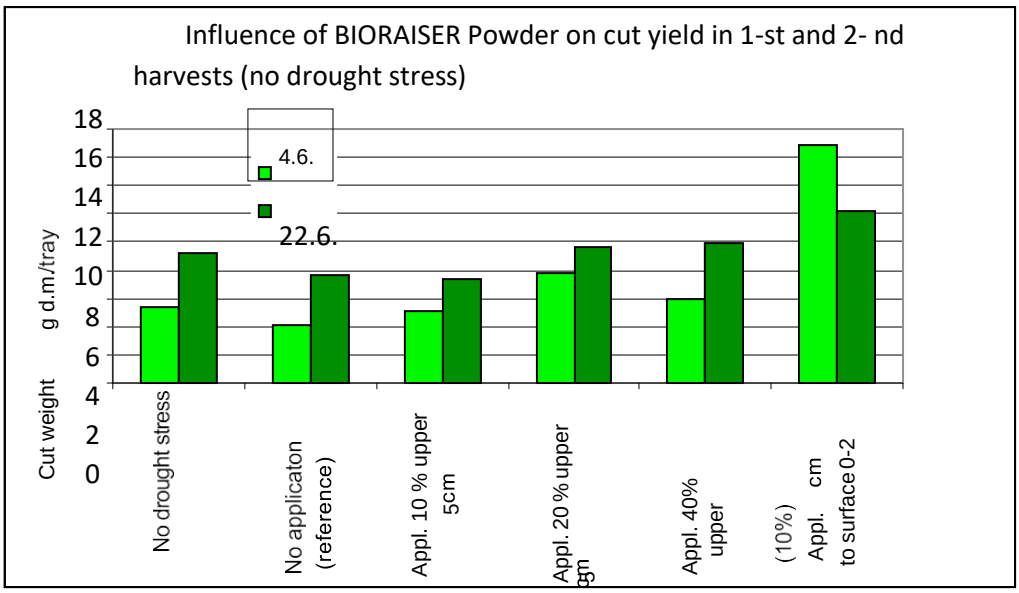


Fig. 10. Particularly spreading of BIORAISER Power on the surface increased plants cut yield at two first harvests (before starting drought stress testing).

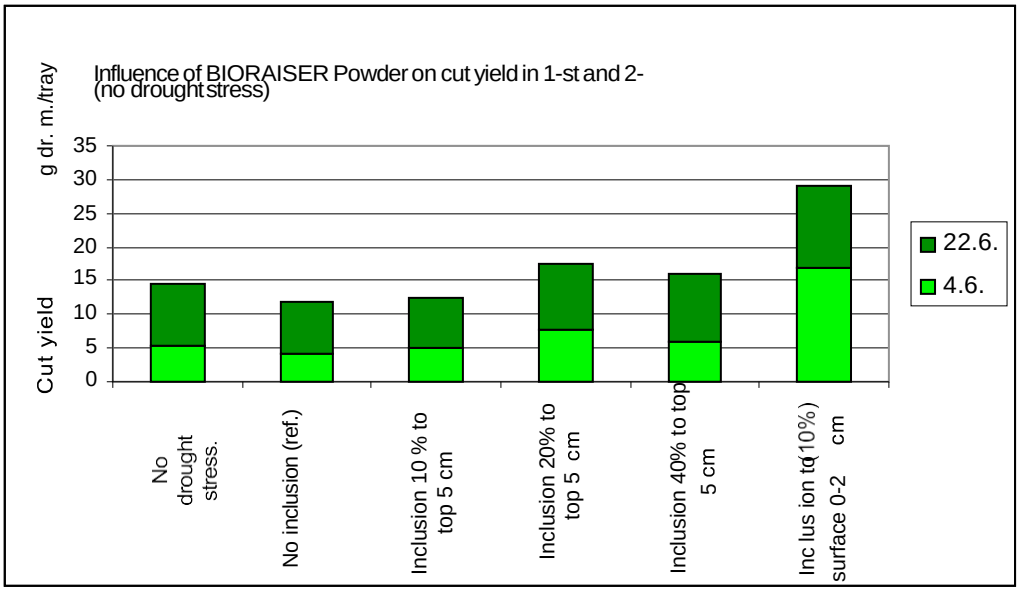


Fig. 11 . Surface-spreaded BIORAISER Powder increased first cut yield significally. When BIORAISER Powder was spreaded over the surface, yield of two first cuts was twice as big as yield of the reference sample.

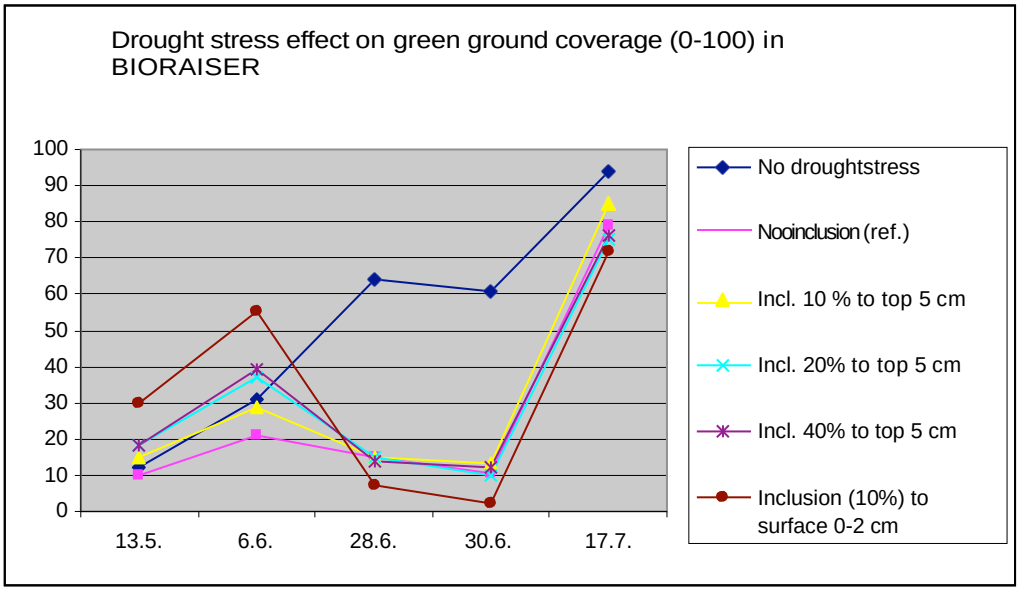


Fig. 12. Influence of BIORAISER Powder inclusion on green ground cover during initial growth, drought stress test and after the stress test. BIORAISER Powder improved green coverage at seedling emergence stage. The best improvement was achieved with BIORAISER Powder spread over the surface. BIORAISER Powder did not increase drought tolerance in drought stress conducted after small irrigation.

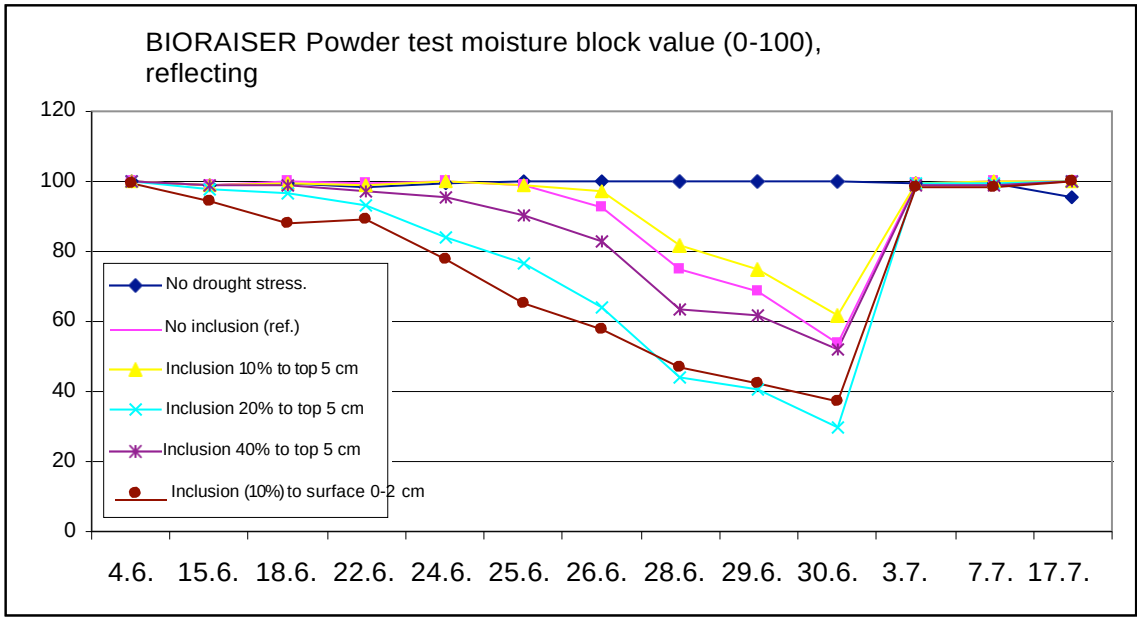


Fig. 13 . Water available for plants during drought stress was measured by gypsym blocks buried 5 cm into growing medium. BIORAISER Powder seemed to have resulted to slightly faster decrease of water which may have been resulted from stronger plant stands in the appropriate trays.

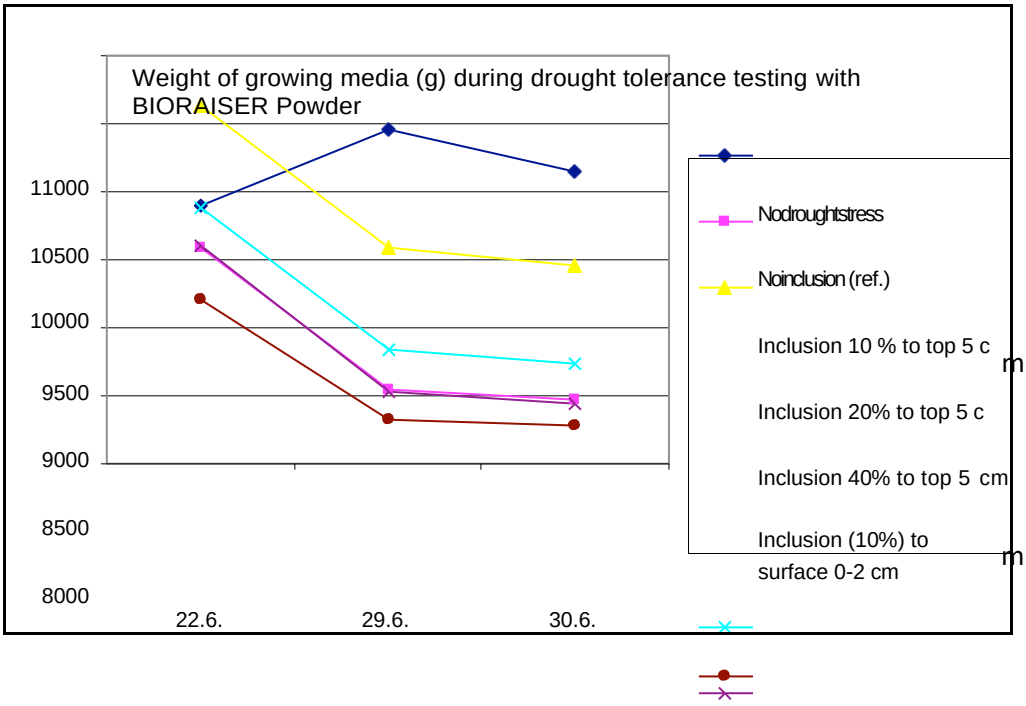


Fig. 14. Change in weight of growing media during the drought stress testing. It looks that BIORAISER Powder did not reduce evaporation as it is very similar to reference sample results.

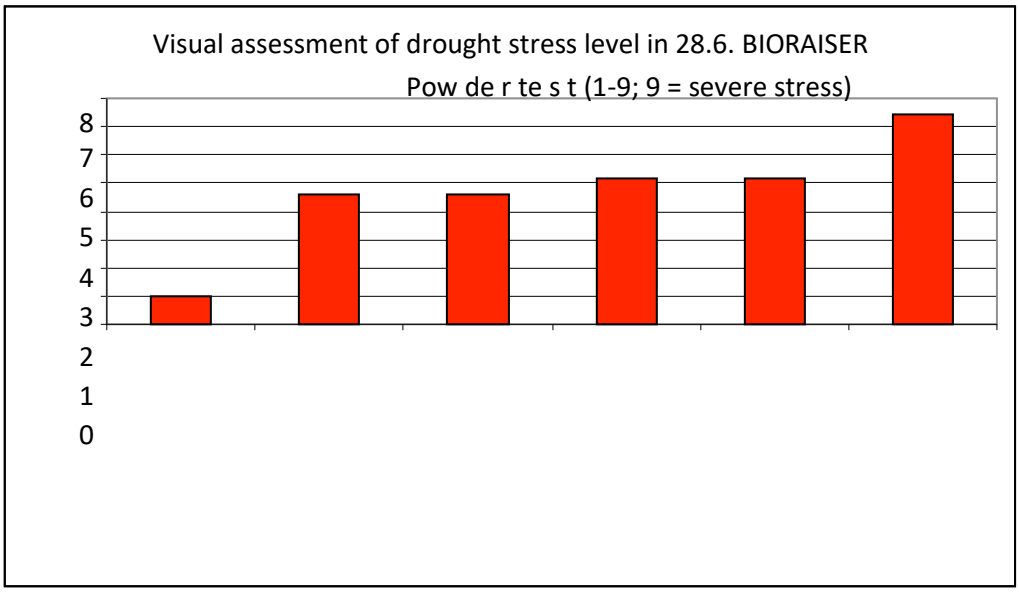


Fig. 15 BIORAISER Powder inclusion into the growing media did not decrease drought stress after some days drought period. BIORAISER Powder supplied to the soil surface layer increased stress. Irrigation was relatively low before commencement of stress treatment. Grass growing in trays with BIORAISER Powder had stronger stands and had therefore a "risk" to get drought stress situation with the same water reserves.

II Testing with peat-based growing media

II Test 1 Effect of BIORAISER Powder on peat growing media water infiltration and water retention and surface runoff in irrigation simulation experiment

Tested growing media:

1. Commercial black garden peat of Vapo without BIORAISER Powder
2. Inclusion of 20 volume-% BIORAISER Powder into layer of black garden peat of Vapo

In tests with 'black garden peat of Vapo' 20 per cent of BIORAISER Powder was mixed within the whole growing media layer. Leaching was measured as surface runoff and infiltration through tray as well as tray weight change i.e. amount of water absorbed by growing media. Testing was performed with growing media without plants. There were three repetitions of the test.
After preparation of mixtures initial weights of the boxes was determined and boxes surface was let to dry. Surface runoff was measured by inclination of boxes to 15 degrees angle. Tray was placed under lower edge of each box to collect all the water running through the handle opening. Watering pot was used to pour 1000 milliliters of water on top edge of the test box. Water running off the lower edge of the box was measured for every box. Box weight difference defining water retention amount was measured during the testing. Results of surface run-off tests are presented in Fig.16.

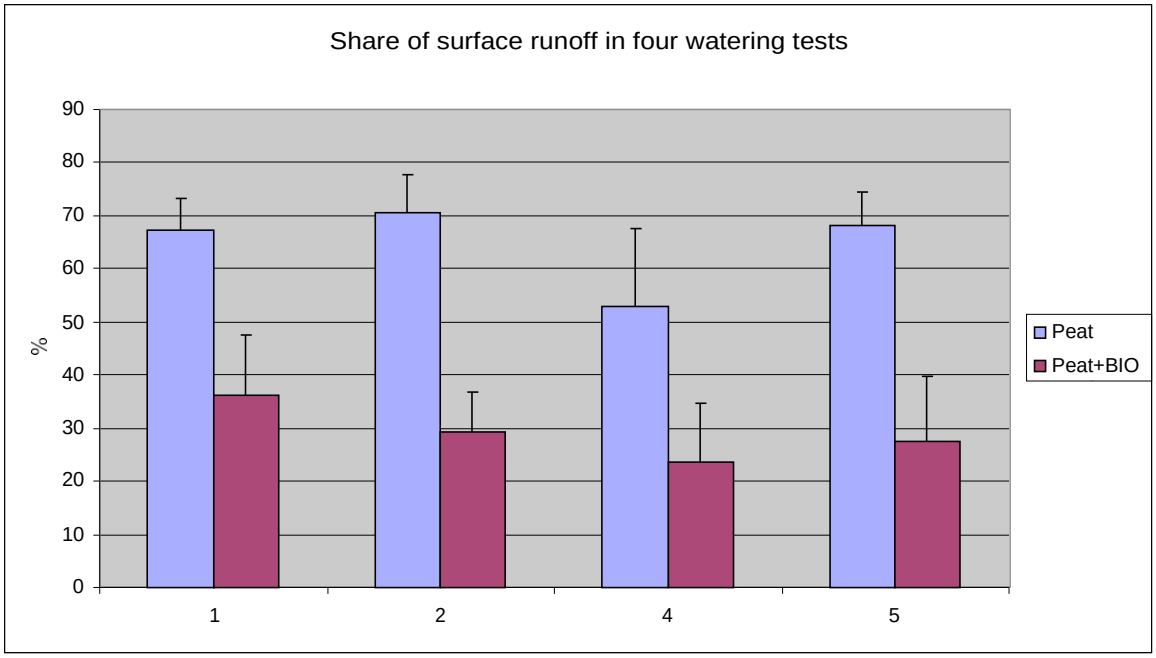
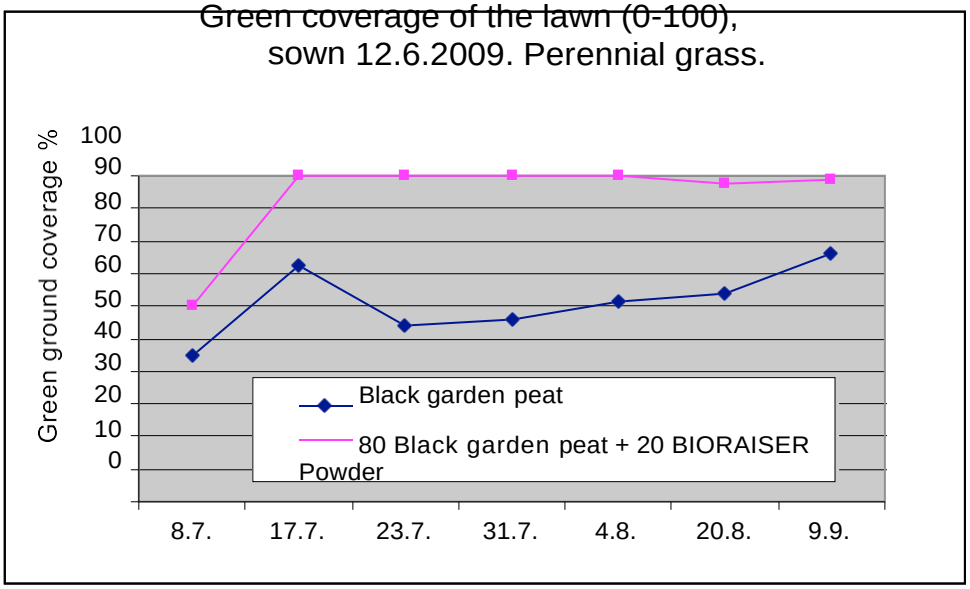


Fig. 16. Share of surface run off water of total amount of irrigation water when the surface-dry growing media was irrigated by pouring water. Three repetitions.

II Test 2 Effect of BIORAISER Powder on lawn germination and water infiltration / retention by peat growing media.

Tested growing media:

1. Commercial black garden peat of Vapo without BIORAISER Powder
2. Inclusion of 20 volume-% BIORAISER Powder into layer of black garden peat of Vapo



Perennial ryegrass was sown as tested lawn grass. Watering conditions: natural rainfall, however test trays were irrigated once due to dry weather cycle. Green coverage and growth of lawn was observed during seedling emergence. Tests were completed in net house. . Main findings are presented in figures 17 – 19.

Fig. 17. Green ground coverage of grass . The growing media were watered before sowing and once during the test. Otherwise natural rainfall

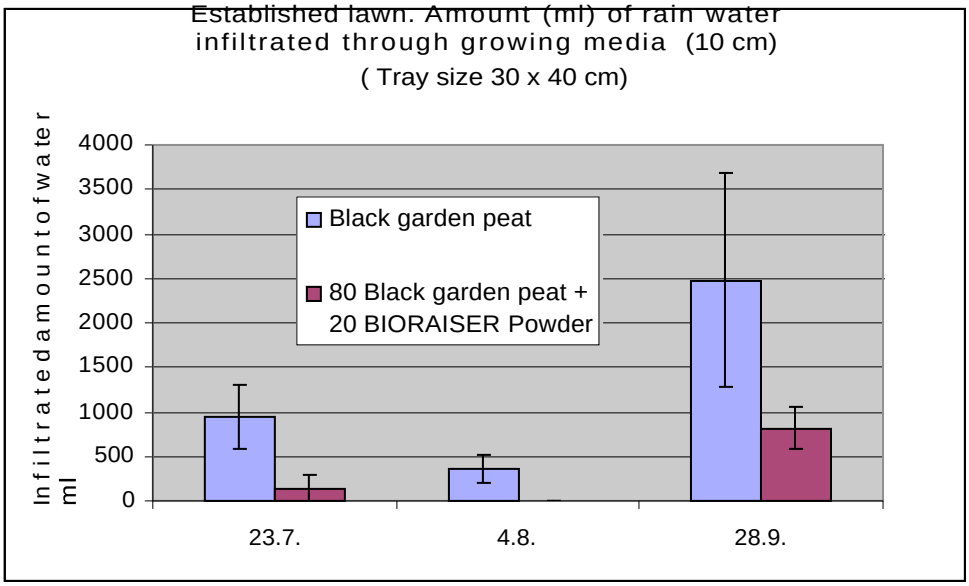


Fig. 18. Amount of rain water infiltrated through growing media on different dates.

Fig. 19 . Inclusion of 20 volume-% of BIORAISER Powder to black peat growing media speeded up tillering and growth after sowing. There was no difference in germination rate. Trays with BIORAISER Powder inclusion are the 2nd and 4th from the left of the top row and 1st and 3rd on the lower row.

The same test arrangement was repeated with growing media containing 10 g of garden quicklime per 1 l of peat. First of all quick-limed peat batch was prepared to be used in reference growing media as a well as in BIORAISER Powder growing media. The test was sown in net house with four similar samples. Perennial ryegrass was used as test plant. Watering was arranged by natural rainfall. Thus growing plants were subject to "unnecessarily" heavy watering. Seedling emergence of grass in this rather late sown experiment was faster with growing medium containing BIORAISER Powder (Fig. 20). Lawn growth was minor, however it was stronger with growing medium containing BIORAISER Powder. Inclusion of BIORAISER Powder at the first stage strongly decreased amount of water infiltrated through growing media (Fig. 21). As heavy rainfall continued in the fall infiltration through BIORAISER Powder media increased as well, but at the average it was still a shade less than with peat-based growing media.

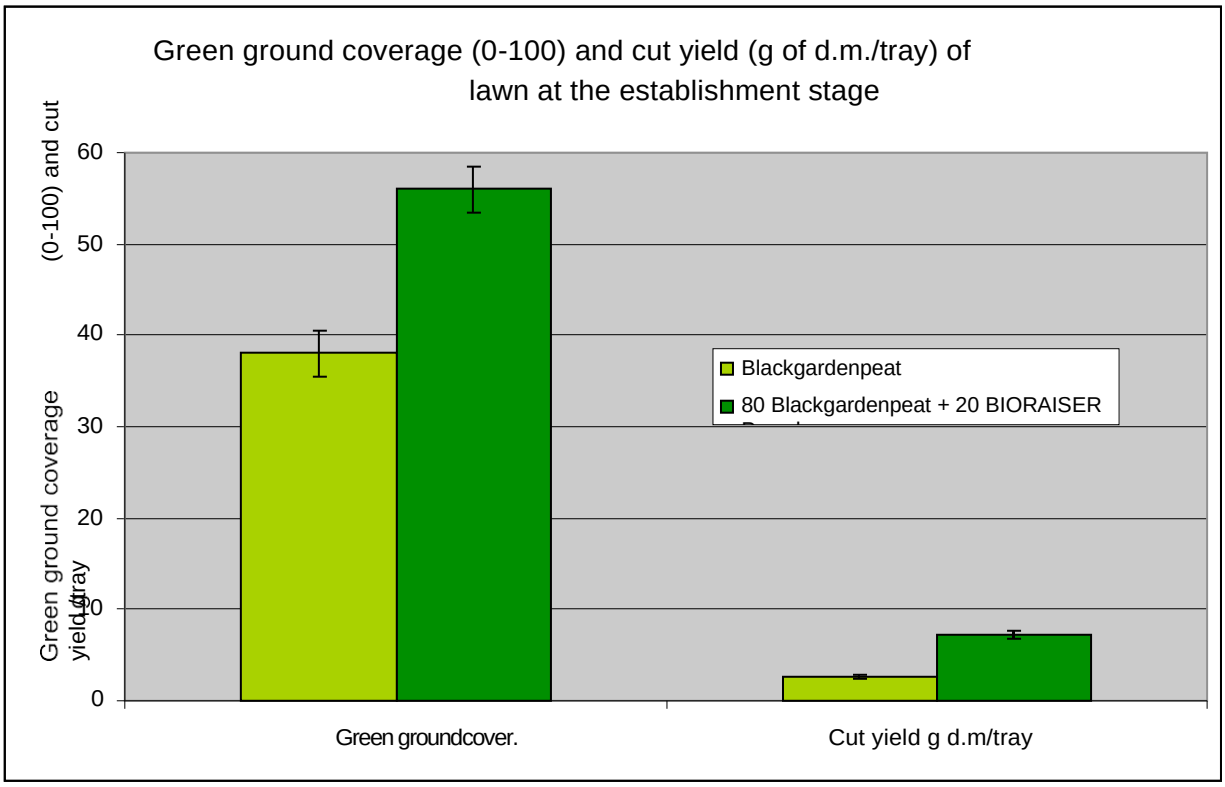


Fig. 20. Green ground cover on 9.9.(0-100%) and cut yield on 7.10 (g of dry matter/tray) of stands sown 20.8.. Application of BIORAISER Powder speeded up seedling emergence and increased first cut yield.

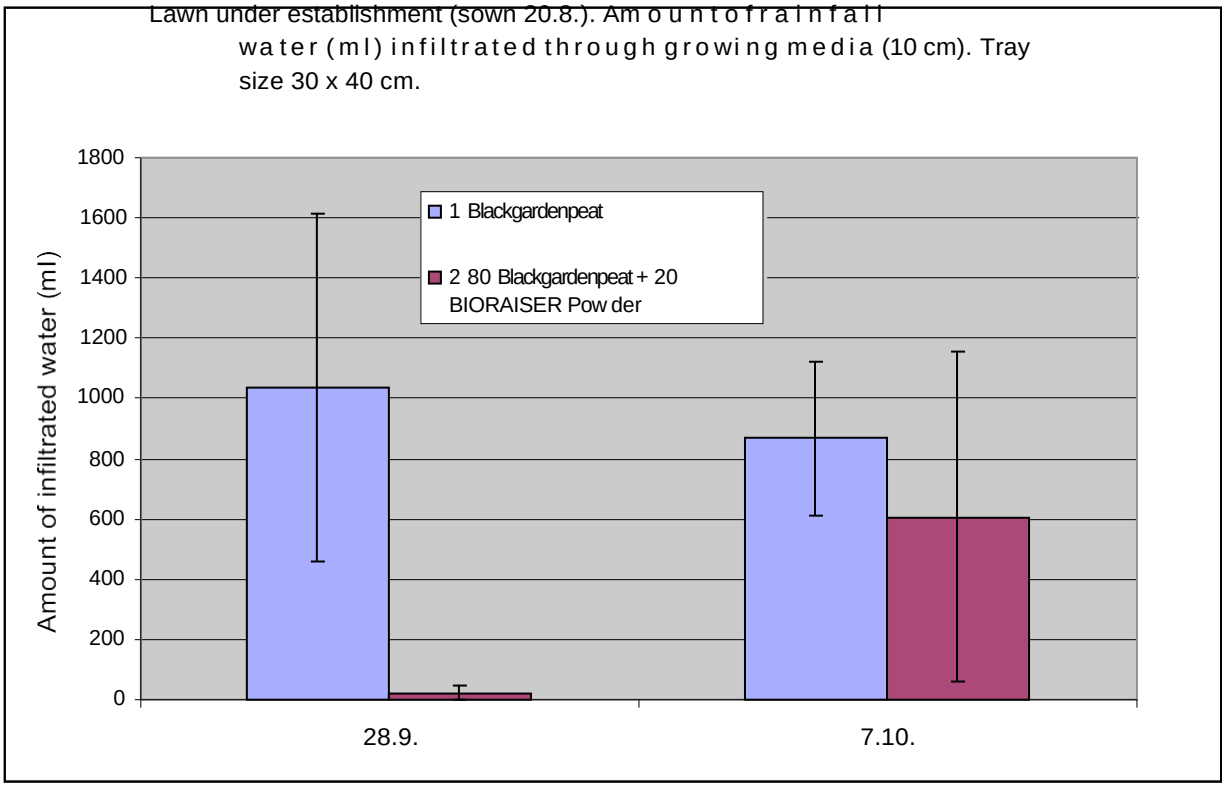


Fig. 21. Amount of rainfall water infiltrated through the 10 cm thick growing media in test sown 20.8..

Test review

In trays containing BIORAISER Powder plant stand and growth was stronger. Stronger plants probably evaporated more water than weaker ones. With the same watering amount stronger growth was leading to more severe drought stress. Most probably in normal growth environment root would grow stronger and deeper being able to take more water from bigger soil volume. In this experiment the same soil volume and raining was arranged to all test batches. At growth test raining was not 'exceeding needs' so that the water stayed within the growing media and infiltration through 10 cm layer of growing media was minor. Initial task was to measure effect of BIORAISER Powder on drought tolerance. Heavy watering at some establishment stage would possibly be more natural situation to be followed by drought cycle. Possibly in such case positive effect on water retention and drought tolerance management would be revealed because results of peat-based tests indicate good water retention properties of BIORAISER Powder. In unfertilized growing media BIORAISER Powder speeded up seedling emergence. BIORAISER Powder was possibly releasing nitrogen, which could influence on faster growing and tillering.

Conclusions

BIORAISER Powder speeded up lawn establishment in this trial in which no fertilizer was added to the growing media. Inclusion of BIORAISER Powder into peat- based growing media resulted to better water absorption from dried peat surface in heavy watering conditions. Surface runoff was clearly stronger from dried peat surface compared to peat & BIORAISER Powder mixture case. In natural rainfall conditions inclusion of BIORAISER Powder into the peat-based growing media decreased amount of water infiltrated through the growing media.

Publication of the Research results

Detailed public research report will be published in the MTT Raportti series.

Jokioinen, Oiva Niemeläinen

NOTE: MTT is currently LUKE (www.luke.fi)