Researching the impact of Ocean Glas & Humic Acid in preventing the effects of salinity stress on turfgrass

Abstract

A comprehensive trial was carried in a Turfgrass Research & Trial facility to investigate the effectiveness of a combination of *Ascophyllum nodosum* liquid extract (ANE) (Ocean Glas) and Humic acid liquid (H). The Research & Trial focused on analyzing various application rates of both products at various application rates (2oz per 1000sq.ft, 4oz per 1000 sq.ft & 8oz per 1000sq.ft) evaluating turfgrass tolerance to salinity stress.

The most notable results include:

1. A combination of OceanGlas & Humic Acid allowed Perennial Ryegrass (golf fairway and stadium variety) to maintain a good appearance and vigour at a salinity level of 14dS/m.
2. A combination of OceanGlas and Humic Acid at all application rates prevented Pythium root rot in Fescue.
3. Improvement in shoot and fresh root weight were seen in Fescue treated polts at application rates of 20L/ha and 40L/ha.

This study indicates that a combination of *Ascophyllum nodosum* extract and Humic acid effectively alleviates the harmful effects of salinity stress on Turfgrass. Further research is required to elucidate the mechanisms by which Ascophyllum nodosum and Humic acids increase Turfgrass tolerance to salinity stress.

Introduction

Salinity stress is one of the critical challenges concerning turfgrass management. Over half the irrigation water used to irrigate Turfgrass worldwide is affected by salinity. Global warming is causing reduced surface water and placing pressure on groundwater usage, leading to a high content of salts and contaminants in irrigation water. Increased use of effluent and low-quality water for turfgrass irrigation is causing an accumulation of salts in growing profiles (sand/soil), creating a substandard growing environment for many turfgrass species. Intruding waves in coastal areas can result in salt spray, which is often stressful for turfgrass.

There have been numerous publications to date that indicate the usefulness of *Ascophyllum nodosum* extract and humic acid in improving plant tolerance to biotic and abiotic stress.

Methods

The trial was performed under greenhouse conditions, planting cultivars in plastic pots filled with a mixture of soil and sand (7:3 by volume) as a growing substrate.

Three different turfgrass species were analysed in detail throughout the trial Ryegrass, Fescue, and Bentgrass. They were grown under natural growing conditions in a greenhouse environment. The average soil temperature throughout the experiment was 12 - 16 degrees Celsius, the average moisture of growing media was between 25% - 30%.

Ryegrass, Fescue, and Bentgrass were sown in 64 individual 17cm x 17cm plots, including 16 plots of Golf Fairway Ryegrass, 16 plots of Stadium Ryegrass, 16 plots of Fescue, 16 plots of Pure Distinction Bentgrass at rates of 50g/m2, 50g/m2, 35g/m2, and 9g/m2, respectively.

The Turfgrass was treated every 7 days over 21 days. Treatments included 10L/ha of *Ascophyllum nodosum* extract (ANE) & 10L/ha of Humic Acid (HA). 20L/ha of ANE & 20L/ha of HA. 40L/ha of ANE and 40L/ha of HA and the control, whereby only water was added. These treatments were all done in quadruplicates on each turfgrass species.

The *Ascophyllum nodosum* extract (ANE) product used in this trial was Ocean Glas, and the Humic acid product used in this trial was Humic Acid.

Salt stress was applied to the Turfgrass using seawater on day 21 of the trial. It involved adding diluted increments (3dS/m, 6dS/m, 9dS/m, 12dS/m) until the soil salinity reached 14 dS/m at 9 weeks after the beginning of the stress treatment.

Soil Salinity readings were achieved by calculating the electrical conductivity (EC) of the saturation extract (ECe) in the root zone at 25 °C.

Visual assessments were made during weeks 1 through 9 of the salt stress treatments. Photos were taken of each trial plot weekly to note any signs of stress. Each individual turfgrass plot was scored from 1 to 9 and was scored as follows:

1: Normal growth, no symptoms of stress.
2: Nearly average growth, some patches of grass yellowing.
3: Growth severely affected, only some blades elongating.
7: Complete cessation of growth, most blades of grass dried and brown, some blades dying.
9: Almost all grass dead or dying

After 9 weeks of salt stress, shoot and fresh root weight were taken from 3 different cores on each treatment replicates for perennial Ryegrass, Fescue, and Bentgrass. The average shoot and root weight were calculated for the control, 10L/ha ANE & HA, 20L/ha ANE & HA, and 40L/ha ANE & HA.

Results

Perennial Ryegrass Treated with a Combination of Ocean Glas and Ocean Humiful displayed Improved Tolerance to Salt Stress

Considerable improvements in tolerance to salt stress were seen in the *Ascophyllum nodosum* extract and humic acid treated perennial Ryegrass plots.

The visual health of the untreated perennial Ryegrass declined considerably by week 9 and progressed to a score of 9 (All turf cover dead or dying).

Perennial Ryegrass at 2oz per 1000sq/f showed reduced decline under salinity stress and was particularly useful up to a salinity of 9 dS/m and began to decline faster after this; however, it was still very effective in alleviating adverse effects of salinity when compared with control.

Ryegrass treated at 4oz per 1000 sq/f of each product also showed improved tolerance to salt stress and averaged at a score of 5.5 by week 9 at 14 dS/m. The perennial Ryegrass treated at 40L/ha displayed increased tolerance and remained at a score of 3 (nearly normal growth, some grass yellowing) up to week 9 at an ECe rating of 14 dS/m.

Images were taken throughout the trial to assess how the ANE and HA treatment affected the overall appearance of the Turfgrass under the salinity stress. There was a considerable difference in the appearance of the Perennial Ryegrass plots

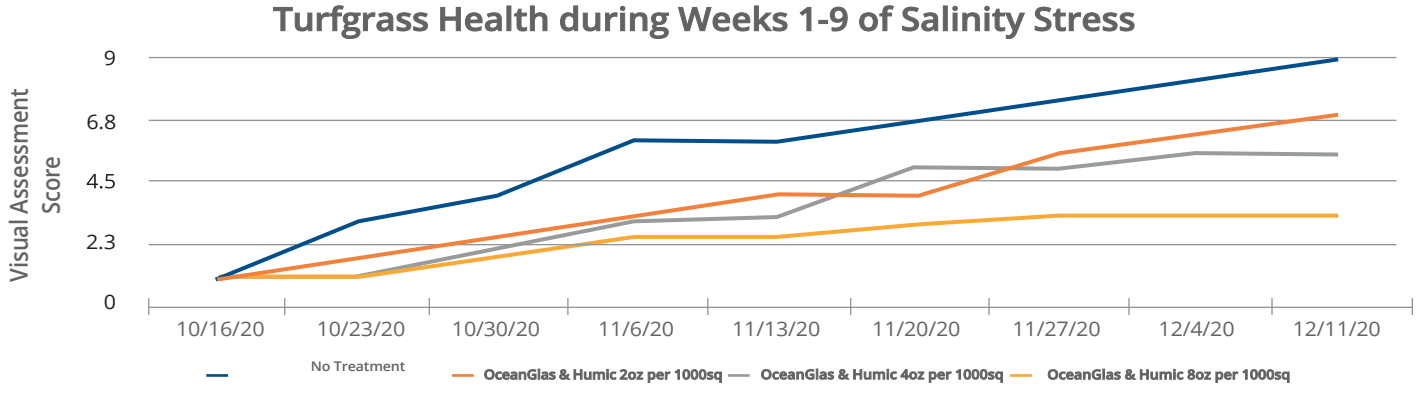


Fig 1(a) Graph Illustrating Turfgrass Health Score at Weeks 1 – 9: The graph shows progression in decline over 9 weeks of salt stress. Turfgrass that received no treatment scored 9 by week 9, turfgrass treated at 10L/ha received a score of 7 by week 9, 20L/ha treated ryegrass scored 5.5 by week 9 and 40L/ha treated ryegrass scored 3 by week 9. A lower score indicates less salt stress symptoms.

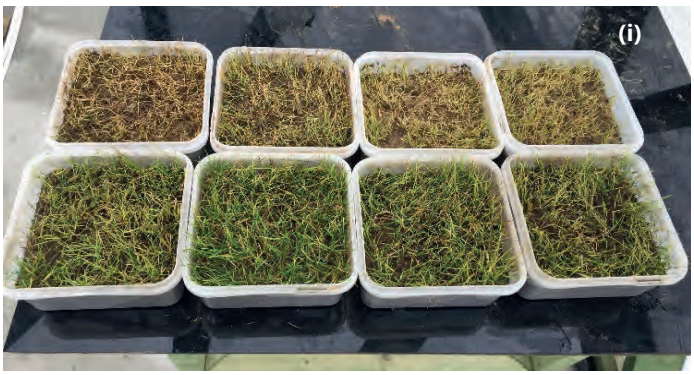


Fig 2(a) Image showing Perennial ryegrass plots after 9 weeks of salt stress (14 dS/m): The ryegrass treated at 8oz (ii) of ANE and HA showed improved appearance under salt stress when compared with the control (i).

that were treated with ANE and HA compared to no treatment and, in particular, in the ANE and HA at 8oz. (Fig 2(a)).

Fescue Treated with a Combination of

Ocean Glas and Humic Acid Resulted in Prevention of Root Disease

When assessing the root health of the Fescue after 9 weeks of applying salt stress, the development of Pythium root rot was seen on all the untreated fescue plots (Fig 3 (iv)).

This suggests that a combination of Ocean Glas

No cases of Pythium root rot were seen in the fescue plots treated with 2oz (Fig 3a (iii)), 4oz Fig 3a (ii)), or 8oz (Fig 3a (i)) Ocean Glas and Humic Acid.

and Humic Acid helps prevent the occurrence of disease in Fescue.

However, further studies are required to elucidate this fully and to investigate how these products assist Turfgrass intolerance to disease stress.

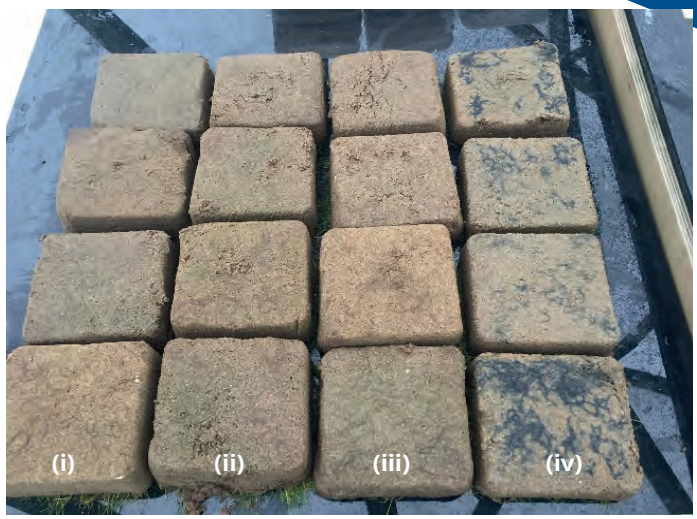


Fig 3(a) Image showing Fescue roots at the end of the trial: (L-R) column (i) = 8oz, column (ii) = 4oz, column (iii) = 2oz, column (iv) = Control

Ocean Glas and Humic Acid Treated Fescue Showed Higher Shoot and Root Fresh Weight after Salt Stress

Upon weighing 20 of each of the treated Fescue plants (control, 20z, 4oz, 8oz)

The average shoot weight of 20 Fescue plants treated with Ocean Glas and Humic Acid at 2oz was 1 gram.

The highest average shoot weight was seen in Fescue treated with Ocean Glas and Humic Acid at a rate of 4oz. For 20 treated fescue shoots, the average weight was 1.5 grams.

Of the 20 selected Fescue shoots treated with 8oz of Ocean Glas and Humic Acid, the average weight was 1.39 grams.

After weighing 20 of the untreated fescue plants, the average shoot weight was 0.99 grams.

The average root weight from 20 fescue plants treated with 2oz of OceanGlas and humic was 5 grams.

The average root weight of Fescue treated at 4oz was 7.6 grams.

The highest average root weight was seen in Fescue treated at 8oz of Ocean Glas and Humic Acid, which averaged at 7.76 grams. The lowest average root weight (4.17 grams) was seen in the untreated (control) Fescue.

Conclusion

The effectiveness of Ocean Glas (*Ascophyllum Nodosum* Extract) and (Humic acid) in combination was tested on Perennial Ryegrass (Lolium perenne) and Fescue (Festuca) and has displayed promising results.

A mixture of Ocean Glas and Ocean Humiful significantly improved the overall visual appearance of Perennial Ryegrass in extremely high levels of salt in the soil (11200 ppm), maintaining a dark green, vigorous turfgrass (Fig4(a)(ii)) when compared with the control, which quickly declined under stress. (Fig 2 (a)(i)). This is of huge value to the amenity industry, where aesthetic appeal is of vast importance.

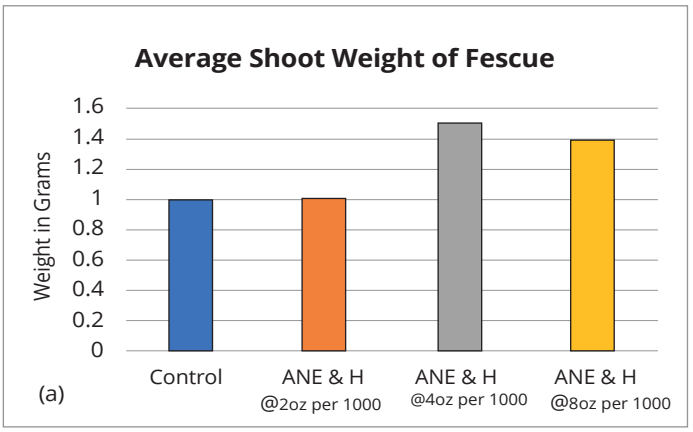
It is evident from the data shown on the above graph (Fig 4) that the use of Ocean Glas and Ocean Humiful in combination at all rates (2oz, 4oz, 8oz, but most notably using 4oz and 8oz has led to improved shoot and fresh root weight in Fescue, indicating that the treatment is effective in assisting Fescue's productivity under high levels of salt stress.

It is clear from the above data that Ocean Glas and Ocean Humiful are highly effective in mitigating salinity stress in Perennial Ryegrass and Fescue and the prevention of associated disease and adverse growth effects.

The mechanisms behind how the products help the Turfgrass to become more tolerant are not fully clear in this study. However, some very exciting findings have been generated, and the results found here to pave the way for more comprehensive trials to be carried out in this area in the future.

Ocean Glas = ANE

Humic Acid - H



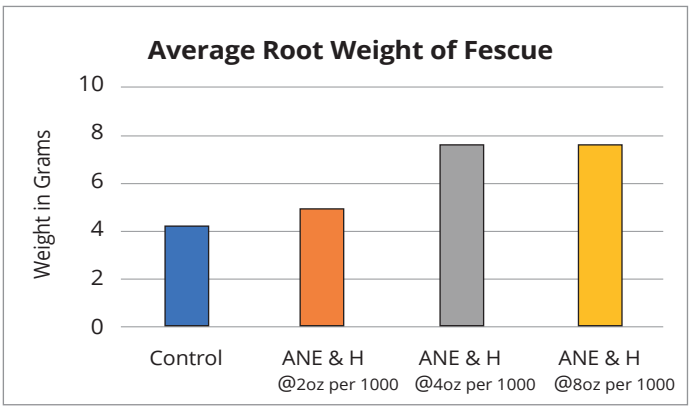


Figure 4: Graphs showing the average shoot fresh weight (a) and root fresh weight (b) of Fescue after 9 weeks of salt stress at 11200 ppm: The average for each treatment was taken from 40 core pulls of the Fescue pots, the roots and shoots of the Fescue plants were separated and weighed individually. (a): Considerable differences were seen in the shoot weight of fescue treated at 20L/ha and 40L/ha, when compared with the control. (b): All treated Fescue (10L/ha, 20L/ha, 40L/ha) displayed higher root weight than the control post 9 weeks salt stress.

Seed Reference

Greens Fescue Mix

Varieties	Weight
Barcrown Slender Creeping	20%
Bargreen II Chewings Fescue	10%
Barlineus Chewings Fescue	20%
Barpearl Slender Creeping Ryegrass	10%
Bodega Chewings Fescue	10%
Musica Chewings Fescue	10%
Viktorka Slender Creeping Ryegrass	20%

Sports Stadium

Varieties	Weight
Baradona Perennial Ryegrass	10%
Barcristalla Perennial Ryegrass	20%
EuroCordus Perennial Ryegrass	25%
Europitch Perennial Ryegrass	45%

Ryegrass Fairway Mix

Varieties	Weight
Barlibro Perennial Ryegrass	15%
Barolympic Perennial Ryegrass	30%
Barsignum Perennial Ryegrass	15%
Evening Shade Perennial Ryegrass	18%
Vantage Perennial Ryegrass	22%

Pure Distinction Bentgrass

Varieties	Weight
Tee 2 Green Bentgrass	100%