

Customised Finecut Rhodes Grass Growth Promotion

Summary

Beneficial soil rhizosphere microbes and biofertilisers, such as the SoiLife product, provide biodiverse microbiomes that can significantly assist plants in growth promotion. This trial on Coated Finecut Rhodes Grass has determined the most effective soil-microbe combinations that are both, compatible to the farm soil and the variety used. Five different microbial treatments were tested in combination with the SoiLife product and compared to mock treatments. Each treatment consisted of 30 biological replicates (30 pots) with ~13 plants per replicate (2,357 plants in total). For each treatment and replicate, plant growth was measured as the length of the leaves, the number of leaves per plant and the weight of cut leaves with three rounds of regrowth.

All microbial treatments led to significant ($p < 0.05$) growth promotion benefits compared to the control plants. Plant heights and fresh weights of cut grass were consistently higher for treated plants across different measurements and time points. The yield advantage of treated plants compared to the control plants reduced gradually over time, suggesting that repeat treatments may benefit plants over time.

When comparing average daily regrowth of cut grass measured over a time period of 31 days, SL-67 treatments lead to the best yield increases (87.4%) compared to the control plants. This was followed by SL-10 and SL-8 treatments with 81.2% and 78.6% increases, respectively. Therefore, the overall recommendation for Coated Finecut Rhodes Grass to be grown in the Bennett farm soil is to use **SL-67** as the preferred biofertiliser.

Background and Rationale

Soil rhizobacteria can provide significant benefits to plants by promoting growth and defending against pathogens. This is achieved by fixing nitrogen from the air, solubilising phosphorous that plants cannot normally access, producing siderophores for iron supply, producing plant growth hormones (e.g. auxin), priming plants for systemic induced resistance and producing a range of antimicrobial compounds that assist plants to defend themselves against pathogens.

However, not all soil bacteria are compatible to the farm soil and plant variety used, and it is important to select the most effective plant growth promoting rhizobacteria (PGPR) that can act synergistically with the microbiomes supplied by biofertilisers, such as the SoiLife product, and that are compatible to each farmer's individual farming conditions.

Approach and Methodology

In this trial, Soilife, in collaboration with the Sustainable Solutions Hub, have used a customised approach to determine the most effective microbe combinations that are effective in the soil of the Bennett Farm, by using a pot trial with soil and the plant variety supplied from the Bennett Farm. A total of Rhodes Grass plants were tested in pot trials using specific farm soil with five different soil rhizosphere bacteria in combination with the Soilife product. These included SL-6D, SL-8, SL-10, SL-46 and SL-67 that have previously shown good plant promotion results with wheat and several vegetable crops. A total of 30 biological replicates were used by using 30 small pots for each product combination to gain sufficient statistical significance. Each pot contained 13 plants on average and 2,357 plants were used in total.

Rhodes Grass seeds were germinated on 23 August 2023 in 30-cell trays (~13 seeds per cell) using the specific farm soil. Seeds were added with a small measuring cup (lid of an Eppendorff tube) that were then gently pushed manually into the wet soil. At 10 days after sowing (2 September 2023), plants were treated with various Soilife-Microbe combinations using approx. 9 mL of biofertiliser per pot. A repeat treatment was performed 12 days later (14 September 2023) with a reduced dosage (33% less rhizosphere bacteria) using the Soilife feeder product.

To generate Soilife-Microbe biofertiliser combinations, pure bacterial cultures were first streaked on YEP agar medium on Petrie dishes before using single colonies to inoculate 4 mL YEP liquid precultures that were grown on an orbital shaker at room temperature for 48 hours. These were then used as inoculum for 50 mL cultures that were grown for another 48 hours. Fresh cultures (15 mL each) were added to 250 mL freshly prepared 1:10 diluted Soilife product to generate each Soilife-Microbe combination. Soilife Feeder product (250 mL per treatment) was supplemented with 10 mL freshly grown cultures.

To account for uneven germination across different pots, a baseline measurement was performed on the 10-day old seedlings on 2 September just before biofertiliser applications. For each pot, the number of plants, the number of plants with two leaves and the number of plants that reached the pot edge were determined. Plant growth was first measured at 14 days after treatments on 16 September 2023 by measuring the lengths of the three tallest plants for each pot (height of plants over soil). Nine days later, grass was cut at the pot edge and fresh biomass was weighed. This was followed by three regrowth measurements on 5 October, 16 October and 24 October 2023 using the same technique.

Average values and standard errors were calculated for each dataset for each measurement type and treatment, and graphs were produced displaying average values with standard errors to account for statistical significance.

Results

Plant heights

At 14 days after microbial treatments, plant heights were significantly ($p < 0.05$) increased for all microbial treatments tested when compared to mock-treated control plants (Figure 1). Plant growth increases (determined by the length of the three tallest plants per pot; 90 plants per treatment) with microbial treatments compared to the control plants ranged from 31.8% for SL-10 to 36.9% for SL-6D treatments. A similar result was obtained when just comparing the top 50 plants per treatment.

When accounting for differences in germination using the baseline measurement (number of plants that reached the pot edge) for normalisation, all treatments, except SL-6D, still led to significant growth increases, with SL-67, SL-8 and SL-10 showing the best results.

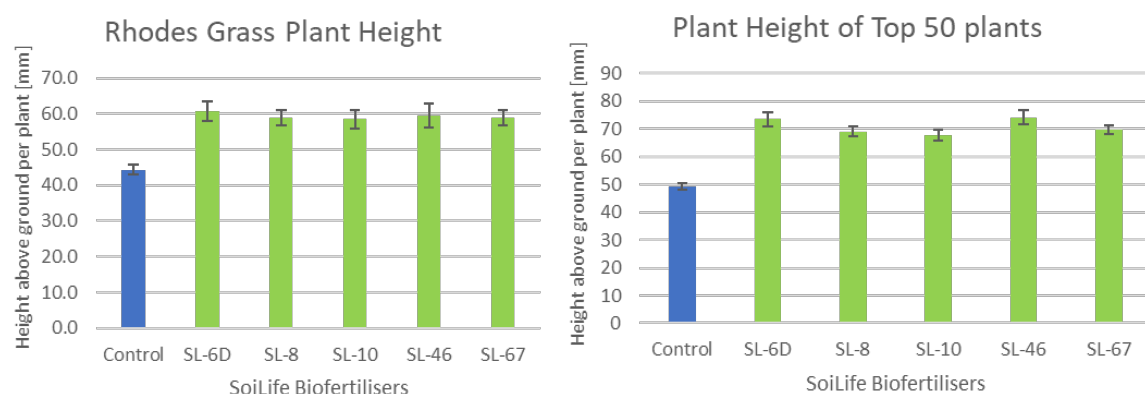


Figure 1. Rhodes Grass growth promotion after 14 days of microbial treatments

Fresh weight measurements

Fresh weights of cut grass was then measured at 23 days after microbial treatments. As shown in Figure 2 (top left panel), all microbial treatments lead to significant ($p < 0.05$) fresh weight increases compared to the control plants, with SL-67, SL-46 and SL-10 being most effective.

Regrowth was then measured at 34, 44 and 52 days after treatments to investigate how long the effectiveness of the treatments can last (Figure 2). All microbial treatments still showed significant growth promotion effects compared to the control plants, even at 52 days after the initial treatment. However, the yield advantage compared to the control reduced gradually over time, suggesting that repeat treatments may benefit plants over time.

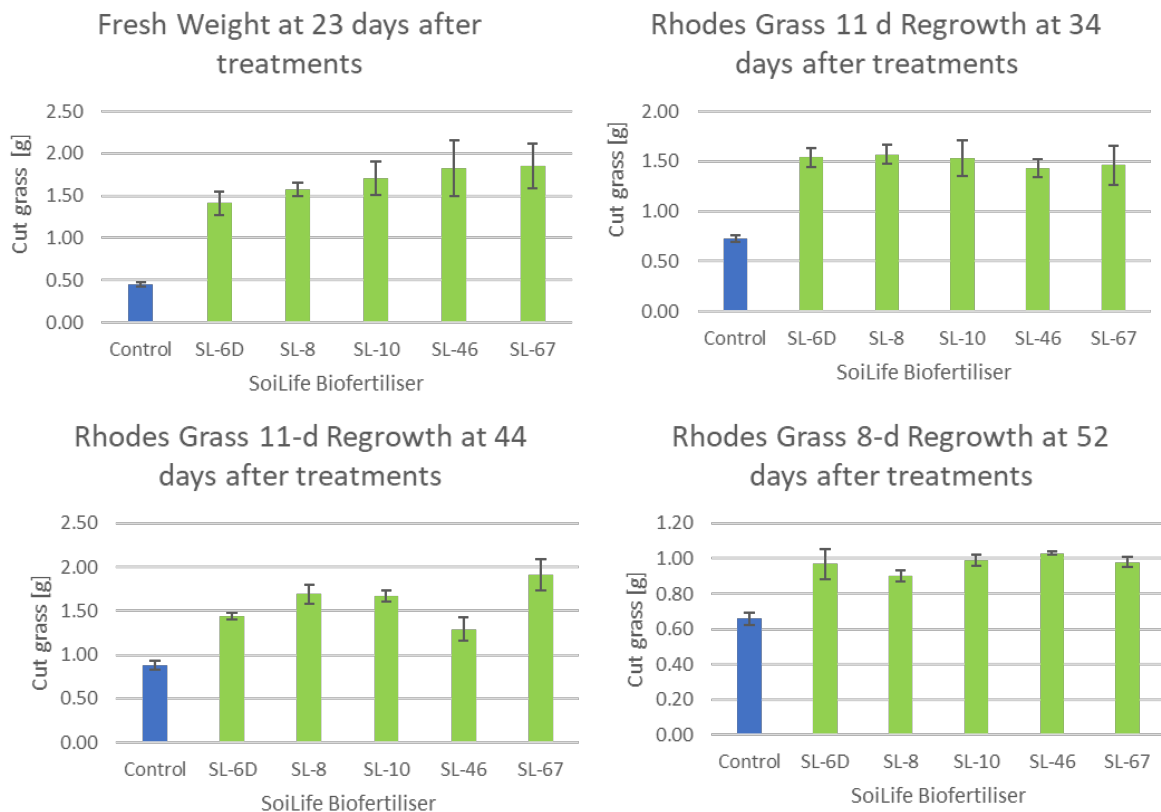


Figure 2. Rhodes Grass growth promotion after 23, 34, 44 and 52 days of microbial treatments

Regrowth of cut grass and yield comparisons over time

To determine which biofertilizer is most effective and consistent to promote plant growth of Rhodes Grass, average daily growth rates were determined over a longer time period (Figure 3).

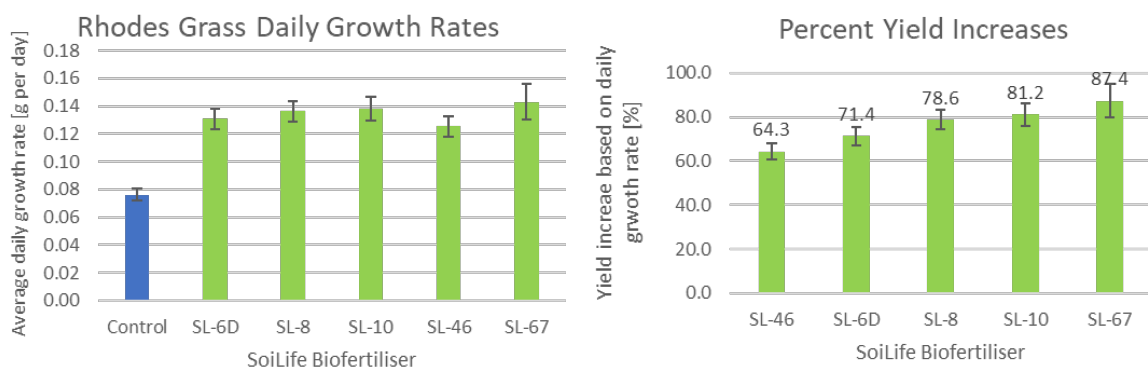


Figure 3. Daily growth rates and yield increases of Rhodes Grass after SoilLife Biofertiliser applications

When comparing average daily regrowth of cut grass measured over a time period of 31 days, **SL-67** treatments lead to the best yield increases (87.4%) compared to the control plants. This was followed by SL-10 and SL-8 treatments with 81.2% and 78.6% increases, respectively.

Therefore, our overall recommendation for Rhodes Grass to be grown in the Bennett farm soil is to use **SL-67** as the preferred biofertiliser. It appears that the soil at Bennett farm is highly suitable for microbial treatments. Should field trials be carried out, we also recommend to include SL-10 and SL-8 for comparison.

SL-67 is recommended for plant growth promotion of Rhodes Grass at Bennett Farm.