**Agronomic evaluation of RhizoMyx Eco Gr formulations for enhancing paddy growth and yield**

**ABSTRACT**

This study aims to evaluate the agronomic efficacy of different formulations of RhizoMyx Eco Gr, a granular microbial bioformulation, on growth, yield attributes, and soil biological activity in paddy (*Oryza sativa* L., var. VDG1) under field conditions. The experiment used a Randomized Block Design with eight treatments (T1–T8), each representing different formulations, replicated four times with uniform agronomic practices. Key parameters measured included plant height, tiller density, panicle length, grains per panicle, 1000-grain weight, grain and straw yields, and harvest index. RhizoMyx Eco Gr-2 (T2) showed the most significant improvement, achieving the highest plant height (35.95 cm), tiller density (591.50 m²), grains per panicle (257.25), grain yield (7270 kg/ha), and straw yield (11710 kg/ha), with a stable harvest index of 0.62. The control (T1) recorded the lowest values. No lodging or phytotoxic effects were observed, and grain moisture was within the optimal range. Additionally, the bioformulations enhanced soil biological activity, particularly dehydrogenase activity, indicating improved microbial health. These findings confirm RhizoMyx Eco Gr as a promising plant growth-promoting bio input that enhances nutrient uptake and yield in rice.

*Keywords: Paddy, Rhizomyx Eco Gr Formulations, Plant growth parameters, Yield.*

**1. INTRODUCTION**

Rice is India's most important crop as it is the major source of sustenance for a substantial section of the country's population and preserves the lives of millions of people living in rural regions (Mohidem et al., 2022). Due to the continual expansion in the population, there is an increasing need for rice. It is of the highest significance to boost productivity, particularly when the amount of land that is accessible for rice cultivation is diminishing (Mallareddyetal., 2023). Rice is the second most extensively cultivated cereal crop after wheat and serves as the primary dietary staple food for over half of the global population. Over 530 million metric tons of milled rice were produced all over the world during the most recent harvesting year. over history, countries located in Asia have continually held the highest portion of the global rice production shares over this time period. According to the most current official numbers, China was the greatest producer of milled rice in the world, with a production output consisting of more than 145 million metric tons, followed by India and Bangladesh ended in second and third, respectively (<https://www.statista.com>). Rice, being a climate-sensitive crop, faces significant sustainability challenges under conventional farming systems, especially in the context of global climate change. Current rice agriculture is hindered by declining yields, water scarcity, excessive use of agrochemicals leading to natural resource degradation, biodiversity loss, and heightened greenhouse gas emissions, alongside increasing losses from extreme weather events (John and Ray, 2023). Despite advancements, the reliance on chemical inputs continues to pose economic and environmental concerns, thereby emphasizing the urgent need for eco-friendly alternatives to improve soil health and rice productivity. One promising strategy is the application of biofertilizers that harness the benefits of beneficial rhizospheric microbes such as arbuscular mycorrhizal fungi (AMF) and plant growth-promoting bacteria (PGPB), in conjunction with organic amendments and nitrogen-fixing green manures like *Azolla* and leguminous cover crops (Ahmadi et al., 2014). Arbuscular mycorrhizal (AM) symbiosis, formed by fungi of the phylum Glomeromycota, enhances plant access to nutrients especially phosphorus and nitrogen through an expansive mycelial network, while receiving photosynthates from the plant in return. The evolutionary persistence of this symbiosis over more than 600 million years underscores its fundamental ecological role in plant nutrition, soil structure modulation, and stress mitigation under various edaphic and climatic conditions (Piliarová et al., 2019). Biofertilizers like RhizoMyco and RhizoMyx are built on this principle. RhizoMyco, containing 18 species of endo- and ectomycorrhizal fungi and growth-promoting agents, is available in soluble and injectable forms to boost nutrient availability and root architecture. RhizoMyx, an endomycorrhizal inoculant, enhances root nodulation and nutrient absorption, contributing to improved plant vigour and resilience (Yashavantha Rao et al*.*, 2020).

RhizoMyx Gr Formulation is developed by M/s.Novozymes South Asia Pvt.Ltd., Bangalore to evaluate this formulation in Paddy field at different treatments. This formulation comprises beneficial microbial consortia that are instrumental in improving soil fertility, increasing nutrient availability, and stimulating plant growth. Distinct from traditional chemical fertilizers, Rhizomyx Eco GR seeks to harness the natural symbiotic relationships between microbes and plants, thereby fostering sustainable agricultural practices and reducing the environmental impact associated with conventional rice farming.

This study aims to evaluate the agronomic bioefficacy of Rhizomyx Eco GR formulations in paddy cultivation through a comprehensive field trial. The specific objectives of this study include determining the effect of Rhizomyx Eco Gr products on the biometric parameters of paddy and to evaluate the effect of Rhizomyx Eco Gr products on the growth and yield parameters of paddy.

**2. MATERIALS AND METHODS**

**2.1 Site description, experimental design, and treatment**

Field experiments were conducted at Sugarcane Research Station, Melalathur, Tamilnadu with Lower Left 12.921969 Latitude (°N) 78.875595 Longitude (°E), Upper Left 12.922641 Latitude (°N) 78.875551 Longitude (°E), Upper Right 12.922823 Latitude (°N) 78.875505 Longitude (°E), Lower Right 12.922969 Latitude (°N) 78.875460 Longitude (°E) with temperature of 35°C to 41°C, Relative humidity percentages hovered between 75% and 94%,

The experimental site soil was characterized as sandy clay in texture, exhibiting slightly alkaline pH of 7.2 and the organic matter, available nitrogen(N), available phosphorous(P), available potassium (K) of the paddy soil were 0.5%, 173 kg ha-1, 18 kg ha-1, 215 kg ha-1 respectively. The experiments were carried out in a Randomized Block Design (RBD) with a plot size of 5 x 5 meters (25 m2), and each treatment was replicated 4 times for randomization. The following treatments are as per the recommendations of M/s. Novozymes South Asia Pvt. Ltd. was adopted to study the effect of the products listed in Table 1.

**Table 1. Treatment details**

|  |  |  |
| --- | --- | --- |
|  | **Treatment details** | **Rate and unit** |
| T1 | RhizoMyx Eco Gr-1 | 4 kg/ac |
| T2 | RhizoMyx Eco Gr- 2 | 4 kg/ac |
| T3 | RhizoMyx Eco Gr- 3 | 4 kg/ac |
| T4 | RhizoMyx Eco Gr- 4 | 4 kg/ac |
| T5 | RhizoMyx Eco Gr- 5 | 4 kg/ac |
| T6 | RhizoMyx Eco Gr- 6 | 3 kg/ac |
| T7 | RhizoMyx Eco Gr- 7 | 4 kg/ac |
| T8 | RhizoMyx Eco Gr- 8 | 4 kg/ac |

The experimental field was ploughed twice, and the generalized recommendation recommended for the location, consisting of 150:50:50 kg N, P2O5, and K2O ha-1 in terms of urea (N), super phosphate (P), and Murate of potash (K) was applied. Nitrogen and Potassium were applied in three split doses *i.e.,* 50% as basal, 25% each at active tillering stage and panicle initiation stages, and 100% of phosphorus was applied as a basal dose.

Seeds of Paddy variety VDG 1 were kept for pre-germination, and seeds were soaked in water for 24 hours to encourage imbibition. After soaking, the seeds were drained and dark environment for another 12-24 hours for the emergence of radical, which indicates the pre-germination. Finally, the pre-germinated seeds were sown in the nursery with proper spacing and covered with dry soil.

**2.2** **Measurement of plant morphology and yield traits**

Biometric observations were recorded from five randomly selected plants per plot in each replication at three critical growth stages viz., Maximum tillering, panicle initiation and harvest. These observations were conducted to evaluate the bioefficacy of various RhizoMyx Eco Gr formulations (developed by Novozymes South Asia Pvt. Ltd.) on paddy (Variety VDG 1). Plant height was measured from the soil surface to the tip of the panicle between 45 to 50 days after transplanting (DAT), and the average height expressed in centimeters. The average number of tillers per plant and the number of productive tillers per clump were also manually counted during the same period (45–50 DAT). Lodging severity was visually assessed at maturity and recorded as the percentage of plants exhibiting lodging, using a 1 to 9-point scale. The scale was defined as follows: 1 = no lodging; 3 = 0–10% lodging; 5 = 11–25% lodging; 7 = 26–50% lodging; and 9 = more than 50% lodging. Furthermore, the number of well-filled grains in the primary panicle of each plant was recorded.

The main panicle was measured from the neck of the panicle to the tip, and the length was recorded at harvest in centimetres (cm). The weight of the thousand filled grains was randomly selected, and the weight of the grain was recorded and expressed in grams (g). The tagged crops from each treatment were harvested and threshed separately. The grains were sundried for three days (14% moisture level) and the straw for 10 days for complete drying. Grain yield and Straw Yield was recorded in grams. Plants with panicles were dried and weighed, and expressed in grams. The harvest index was worked out by using the following formula.

**Harvest index = (Grain yield) / (Straw yield) X100**

**3. RESULT AND DISCUSSION**

The results obtained from this study is to show the bioefficacy of RhizoMyx Eco Gr products of Novozymes South Asia Pvt. Ltd., in the growth and yield of paddy are discussed hereunder.

**3.1 Effect of RhizoMyx Eco Gr products on vigour and plant height of paddy (Var: VDG1)**

The study examined the effect of various treatments of RhizoMyx Eco Gr on the vigour of paddy plants of the VDG1 variety. The vigour scores ranged from 3.50 to 4.00. The highest vigour scores (4.00) were observed in Treatments 2 (RhizoMyx Eco Gr-2) and 6 (RhizoMyx Eco Gr-6), as well as in Treatment 4 (RhizoMyx Eco Gr-4). In contrast, the lowest vigour scores of 3.50 were recorded in Treatments 5 (RhizoMyx Eco Gr-5) and 8 (RhizoMyx Eco Gr-8). This indicates that certain treatments of RhizoMyx Eco Gr significantly enhance the vigour of paddy plants. (Table 2). In terms of plant height, a minimum height of 21.28 cm recorded for Treatment 1 and a maximum height of 35.95 cm for Treatment 2. The other treatments recorded heights as follows: Treatment 3 (23.75 cm), Treatment 4 (25.43 cm), Treatment 5 (29.95 cm), Treatment 6 (33.85 cm), Treatment 7 (28.60 cm), and Treatment 8 (32.48 cm). These findings highlight the significant impact that specific treatments of RhizoMyx Eco Gr can have on enhancing the height of paddy plants. (Table 2) These findings are consistent with previous research indicating that combining biofertilizers with chemical fertilizers improves rice growth parameters. Noraida and Hisyamuddin (2021) found that a 50:50 biofertilizer-to-NPK ratio significantly improved plant height. Furthermore, studies by Nataraja et al. (2021) and Baghel and Singh (2025) support the conclusion that integrating biofertilizers with recommended or reduced chemical fertilizer doses promotes sustainable nutrient management, resulting in taller plants, better nutrient uptake, and improved yield. Together, these insights reinforce the efficacy of RhizoMyx Eco Gr as a biofertilizer that not only boosts paddy growth but also contributes to more sustainable, efficient fertilizer use.

**Table 2. Effect of RhizoMyx Eco Gr on vigour and plant Height of Paddy (Var:VDG1)**

|  |  |  |
| --- | --- | --- |
| **TREATMENT** | **Vigour** | **Plant height (cm)****45-60 DAT** |
| **T1-RhizoMyx Eco Gr-1** | 3.75 | 21.28 |
| **T2-RhizoMyx Eco Gr- 2** | 4.00 | 35.95 |
| **T3-RhizoMyx Eco Gr- 3** | 3.75 | 23.75 |
| **T4-RhizoMyx Eco Gr- 4** | 4.00 | 25.43 |
| **T5-RhizoMyx Eco Gr- 5** | 3.50 | 29.95 |
| **T6-RhizoMyx Eco Gr- 6** | 4.00 | 33.85 |
| **T7-RhizoMyx Eco Gr- 7** | 3.75 | 28.60 |
| **T8-RhizoMyx Eco Gr- 8** | 3.50 | 32.48 |
| **SEM** | 0.22 | 2.46 |
| **CD (5%)** | 0.64 | 7.16 |
| **CD (1%)** | 0.88 | 9.74 |

**3.2 Effect of RhizoMyx Eco Gr products on tiller count of paddy (Var: VDG1)**

The results of the present investigation demonstrate that different formulations of RhizoMyx Eco Gr exert varying degrees of influence on the total and productive tiller count of paddy (Variety: VDG1). Among the treatments, RhizoMyx Eco Gr-2 (T2) consistently outperformed all others, recording the highest total tiller count (620.75 tillers/m²) and the highest productive tiller count (591.50 tillers/m²). This indicates a strong potential of RhizoMyx Eco Gr-2 in promoting vegetative growth and enhancing paddy productivity. This trend is closely followed by RhizoMyx Eco Gr-6 (T6), which achieved 604.50 total tillers/m² and 568.75 productive tillers/m², also marking it as a highly effective treatment. RhizoMyx Eco Gr-8 (T8) was the third most effective, with 529.75 total tillers/m² and 497.25 productive tillers/m². T5 and T7 showed moderate effects, while T4 and T3 were comparatively less effective. Notably, RhizoMyx Eco Gr-1 (T1) demonstrated the least effectiveness, recording the lowest values in both total (406.25 tillers/m²) and productive tillers (360.75 tillers/m²) (Table 3). These findings are consistent with previous research highlighting the synergistic benefits of biofertilizer applications. The current results reinforce these observations, particularly with RhizoMyx Eco Gr-2, which appears to be the most effective in stimulating tillering. Additionally, Agake et al (2022) highlighted that long-term application of biofertilizers enhances nitrogen uptake and leads to increases in tiller number and key yield components. The high tiller counts observed with RhizoMyx Eco Gr-2 and Gr-6 may thus be attributed to improved nitrogen availability and microbial activity in the rhizosphere, contributing to overall plant vigour.

**Table 3. Effect of RhizoMyx Eco Gr on Tiller Count of Paddy (Var: VDG1)**

|  |  |  |
| --- | --- | --- |
| **TREATMENT** | **Total tillers/m2** | **Productive tillers/m2** |
| **T1-RhizoMyx Eco Gr-1** | 406.25 | 360.75 |
| **T2-RhizoMyx Eco Gr- 2** | 620.75 | 591.50 |
| **T3-RhizoMyx Eco Gr- 3** | 445.25 | 399.75 |
| **T4-RhizoMyx Eco Gr- 4** | 451.75 | 409.50 |
| **T5-RhizoMyx Eco Gr- 5** | 494.00 | 458.25 |
| **T6-RhizoMyx Eco Gr- 6** | 604.50 | 568.75 |
| **T7-RhizoMyx Eco Gr- 7** | 497.25 | 461.50 |
| **T8-RhizoMyx Eco Gr- 8** | 529.75 | 497.25 |
| **SEM** | 11.39 | 11.28 |
| **CD (5%)** | 24.57 | 24.46 |
| **CD (1%)** | 26.98 | 26.41 |

**3.3 Effect of RhizoMyx Eco Gr products on average grains per panicle and panicle length of paddy (Var: VDG1)**

The evaluation of the impact of various RhizoMyx Eco Gr treatments on the yield quality of paddy (Var: VDG1) demonstrated notable differences in both average grains per panicle and panicle length. The treatment T2 - RhizoMyx Eco Gr-2 exhibited the highest average grains per panicle, with a count of 257.25 grains, followed by T6 - RhizoMyx Eco Gr-6 at 254.50 grains, and T5 - RhizoMyx Eco Gr-5, which produced 246.50 grains. Treatment T8 - RhizoMyx Eco Gr-8 yielded 246.75 grains, while T7 - RhizoMyx Eco Gr-7 had an average of 242.75 grains. The remaining treatments, T4 - RhizoMyx Eco Gr-4 and T3 - RhizoMyx Eco Gr-3, resulted in 233.00 and 227.00 grains, respectively, with T1 - RhizoMyx Eco Gr-1 showing the lowest yield at 215.25 grains per panicle. (Table 4) Regarding panicle length, treatment T2 - RhizoMyx Eco Gr-2 again led with a length measurement of 24.73 cm, followed by T6 - RhizoMyx Eco Gr-6 at 24.23 cm. Treatment T5 - RhizoMyx Eco Gr-5 achieved a panicle length of 23.13 cm, closely followed by T8 - RhizoMyx Eco Gr-8 at 23.83 cm. Other treatments included T4 - RhizoMyx Eco Gr-4 with a length of 22.03 cm, T7 - RhizoMyx Eco Gr-7 at 22.53 cm, and T3 - RhizoMyx Eco Gr-3 at 20.93 cm. T1 - RhizoMyx Eco Gr-1 recorded the shortest panicle length at 20.00 cm. These findings underscore the significant influence of RhizoMyx Eco Gr treatments on key yield characteristics of paddy, indicating the potential for optimizing agricultural practices to enhance productivity (Table 4). According to Islam et al. (2012), the application of *Azospirillum* biofertilizer led to a marked improvement in panicle length, alongside other growth parameters such as plant height and tiller number. This improvement is likely due to the enhanced nitrogen fixation and growth-promoting substances (like indole-3-acetic acid) produced by *Azospirillum*, which stimulate root development and nutrient uptake, leading to more vigorous panicle formation. Moreover, Patriyawaty and Agustina (2022) highlighted those optimal combinations of biofertilizer type, dosage, and plant spacing significantly influence panicle length. Their study underscores the importance of tailoring agronomic practices to specific biofertilizer formulations and field conditions to maximize yield benefits. This suggests that panicle length improvement is not solely dependent on the biofertilizer type but also on how it is integrated into the cultivation system. In addition, Naher *et al.* (2016) demonstrated that combining biofertilizers with reduced chemical fertilizers not only maintained but, in some cases, enhanced panicle length and overall yield performance. This supports a more sustainable approach to rice farming, reducing reliance on synthetic inputs while maintaining crop productivity. The results point to the efficiency of biofertilizers in compensating for reduced NPK input, likely through improved soil microbial activity and nutrient cycling.

**Table 4. Effect of RhizoMyx Eco Gr on Yield Quality of Paddy (Var: VDG1)**

|  |  |  |
| --- | --- | --- |
| **TREATMENT** | **PANICLE** | **GRAIN** |
| **Average grains/panicle** | **Panicle length (cm)** | **Seed test weight (g)** | **1000 grain weight (g)** |
| **T1-RhizoMyx Eco Gr-1** | 215.25 | 20.00 | 18.35 | 18.35 |
| **T2-RhizoMyx Eco Gr- 2** | 257.25 | 24.73 | 18.53 | 18.53 |
| **T3-RhizoMyx Eco Gr- 3** | 227.00 | 20.93 | 18.40 | 18.40 |
| **T4-RhizoMyx Eco Gr- 4** | 233.00 | 22.03 | 18.43 | 18.43 |
| **T5-RhizoMyx Eco Gr- 5** | 246.50 | 23.13 | 18.50 | 18.50 |
| **T6-RhizoMyx Eco Gr- 6** | 254.50 | 24.23 | 18.53 | 18.53 |
| **T7-RhizoMyx Eco Gr- 7** | 242.75 | 22.53 | 18.43 | 18.43 |
| **T8-RhizoMyx Eco Gr- 8** | 246.75 | 23.83 | 18.48 | 18.48 |
| **SEM** | 6.89 | 0.77 | 0.05 | 0.4 |
| **CD (5%)** | 20.07 | 1.10 | 0.14 | 1.16 |
| **CD (1%)** | 27.28 | 2.27 | 0.19 | 1.58 |

**3.4 Effect of RhizoMyx Eco Gr products on seed test weight and 1000 grain weight of paddy (Var: VDG1)**

The data presented in Table 4 demonstrate the influence of various treatments of RhizoMyx Eco Gr on the seed test weight of paddy (Var: VDG1). The treatments T2-RhizoMyx Eco Gr-2 and T6-RhizoMyx Eco Gr-6 exhibited the highest seed test weight, both measuring 18.53 grams. Treatment T5-RhizoMyx Eco Gr-5 followed closely with a seed test weight of 18.50 grams, and T8-RhizoMyx Eco Gr-8 recorded a weight of 18.48 grams. Subsequently, treatments T4-RhizoMyx Eco Gr-4 and T7-RhizoMyx Eco Gr-7 showed equivalent seed test weights of 18.43 grams. T3-RhizoMyx Eco Gr- 3 had a seed test weight of 18.40 grams, while T1-RhizoMyx Eco Gr-1 represented the lowest seed test weight at 18.35 grams. (Table 4) The variance in seed test weights among the different treatments signifies the potential impact of RhizoMyx Eco Gr on enhancing paddy yield quality, with statistical measures indicating significance in the observed differences. Seed treatments with biofertilizers, as shown by Saryoko and Kusumawati (2021), resulted in increased panicle numbers and seed yield, contributing to a higher 1000-grain weight. Similarly, Pathirana and Yapa (2020) and Turmuktini et al*.* (2012) reported that the combination of compost and biofertilizers produced the highest seed weights and overall yield improvements. Furthermore, Turmuktini et al. (2012) emphasized that such integration not only boosts fertilizer efficiency but also contributes to soil health restoration, reinforcing the role of biofertilizers in promoting sustainable and productive paddy systems. This suggests that specific formulations of RhizoMyx Eco Gr may optimize seed characteristics, contributing to better agricultural outcomes.

**3.5 Effect of RhizoMyx Eco Gr products on lodging and grain moisture percentage of paddy (Var: VDG1)**

The study investigated the impact of various treatments of RhizoMyx Eco Gr on lodging and moisture percentage in paddy (Variety: VDG1). The findings indicated a consistent lodging percentage of 0.00% across all treatments (T1 to T8), suggesting that none of the treatments contributed to lodging in the crop. The recorded grain moisture percentages were as follows: T1 (RhizoMyx Eco Gr-1) exhibited a moisture content of 17.23%, T2 (RhizoMyx Eco Gr-2) showed 19.60%, T3 (RhizoMyx Eco Gr-3) achieved 17.59%, T4 (RhizoMyx Eco Gr-4) evidenced 18.02%, T5 (RhizoMyx Eco Gr-5) reached 18.68%, T6 (RhizoMyx Eco Gr-6) recorded 19.37%, T7 (RhizoMyx Eco Gr-7) reflected 18.33%, and T8 (RhizoMyx Eco Gr-8) indicated 19.03%. (Table 5). *Bacillus pumilus* TUAT1, as reported by Agake et al. (2022), significantly improved growth, root development, and lodging resistance in forage rice, contributing to enhanced yield components. This aligns with findings by Patriyawaty and Agustina (2022), who observed that various forms and dosages of biofertilizers positively influenced growth characteristics and yield in lowland rice, underscoring the importance of optimizing biofertilizer management. Furthermore, Zhang et al. (2025) emphasized the relevance of mechanical properties such as stem bending strength in japonica hybrid rice as key indicators of lodging resistance, providing insights for both breeding and crop management strategies. Complementing these findings, Harahap et al. (2023) demonstrated that indigenous plant growth-promoting rhizobacteria (PGPR) isolates not only enhanced nitrogen use efficiency but also improved agronomic traits and lodging resistance in upland rice.

These results illustrate a spectrum of moisture levels, suggesting potential variability in treatment effectiveness. Notably, treatments T2 and T6 exhibited the highest moisture levels (19.60% and 19.37%, respectively), while T1 presented the lowest moisture level (17.23%). The statistical significance of moisture variances was observed among the treatments. Research demonstrates that the application of biofertilizers significantly impacts the moisture percentage on grain and straw of paddy rice, ultimately enhancing yield and productivity. This data contributes to understanding the influence of RhizoMyx Eco Gr treatments on paddy crop characteristics, underscoring its potential agronomic benefits.

**Table 5. Effect of RhizoMyx Eco Gr on lodging and moisture percentage of Paddy (Var: VDG1)**

|  |  |  |
| --- | --- | --- |
| **TREATMENT** | **Lodging (%)** | **Grain Moisture At time of recording plot yield (%)** |
| **T1-RhizoMyx Eco Gr-1** | 0.00 | 17.23 |
| **T2-RhizoMyx Eco Gr- 2** | 0.00 | 19.60 |
| **T3-RhizoMyx Eco Gr- 3** | 0.00 | 17.59 |
| **T4-RhizoMyx Eco Gr- 4** | 0.00 | 18.02 |
| **T5-RhizoMyx Eco Gr- 5** | 0.00 | 18.68 |
| **T6-RhizoMyx Eco Gr- 6** | 0.00 | 19.37 |
| **T7-RhizoMyx Eco Gr- 7** | 0.00 | 18.33 |
| **T8-RhizoMyx Eco Gr- 8** | 0.00 | 19.03 |
| **SEM** | - | 0.97 |
| **CD (5%)** | - | 1.37 |
| **CD (1%)** | - | 2.82 |

**3.6 Effect of RhizoMyx Eco Gr products on grain and straw plot yield as per moisture of paddy (Var: VDG1)**

The results for grain yield and straw (Plot yield as per moisture at time of recording observations (kg / plot)) from the RhizoMyx Eco Gr treatments reveal notable differences in performance. For grain yield, the treatment with the highest yield is T2 - RhizoMyx Eco Gr- 2, producing 18.74 kg per plot, followed closely by T6 - RhizoMyx Eco Gr- 6 with 18.50 kg. T5 - RhizoMyx Eco Gr- 5 came next with a yield of 17.78 kg, while T8 - RhizoMyx Eco Gr- 8 yielded 17.89 kg. T4 - RhizoMyx Eco Gr- 4 had a yield of 16.59 kg, followed by T3 - RhizoMyx Eco Gr- 3 at 16.22 kg, and T7 - RhizoMyx Eco Gr- 7 with 17.38 kg, while T1 - RhizoMyx Eco Gr- 1 recorded the lowest yield at 15.51 kg. (Table 6) In terms of straw yield, T2 also achieved the highest yield at 29.28 kg per plot, with T6 - RhizoMyx Eco Gr- 6 producing 28.85 kg. T5 - RhizoMyx Eco Gr- 5 yielded 27.50 kg, while T8 - RhizoMyx Eco Gr- 8 followed closely with 27.78 kg. T7 - RhizoMyx Eco Gr- 7 yielded 26.85 kg, and T4 - RhizoMyx Eco Gr- 4 produced 25.88 kg. T3 - RhizoMyx Eco Gr- 3 had a yield of 24.73 kg, and T1 - RhizoMyx Eco Gr- 1 recorded the lowest straw yield at 23.48 kg (Table 6). Studies by Turmuktiniet al. (2012) and Islam et al. (2012) demonstrate that combining *Azospirillum* and *Trichoderma* with straw composting not only improves grain yield but also enhances soil health and moisture retention, suggesting a synergistic effect on soil microbial activity and organic matter content. This aligns with the findings of Cong et al. (2011) and Islam et al. (2012), where biofertilizer application alongside optimized nitrogen levels led to increased grain and straw yields, attributed to improved nutrient uptake and water-holding capacity of the soil.

Banayo et al. (2012) further reinforce these observations, reporting yield increases of up to 24% through the combined use of biofertilizers and reduced chemical fertilizers, without inducing significant moisture stress. This underscores the efficiency of biofertilizers in sustaining crop productivity under lower input conditions. Supporting this, Cong et al. (2011) emphasize that the appropriate application rates of biofertilizers significantly enhance water use efficiency and maintain optimal moisture levels throughout the paddy growth cycle. Comparatively, these studies converge on the conclusion that biofertilizers not only boost nutrient uptake and yield components but also contribute meaningfully to moisture retention and water use efficiency. The improved soil structure, microbial diversity, and organic matter content resulting from biofertilizer and compost application enhance the soil's ability to retain moisture, thereby supporting crop growth even under moisture-limiting conditions. Thus, integrating biofertilizers with organic and reduced chemical inputs offers a sustainable approach to achieving high yields while preserving soil health and water resources in paddy cultivation. This data emphasizes the effectiveness of various RhizoMyx Eco Gr treatments in enhancing both grain and straw yield in paddy cultivation, with substantial statistical backing for the observed differences.

**3.7 Effect of RhizoMyx Eco Gr products on grain plot yield adjusted moisture of paddy (Var: VDG1)**

The experimental results evaluating the impact of different RhizoMyx Eco Gr treatments on the yield adjusted moisture of paddy (Var: VDG 1) revealed significant variations in grain yield across the treatments. The treatment T2 - RhizoMyx Eco Gr-1 exhibited the highest plot yield at 18.18 kg/plot, indicating superior efficacy in improving yield compared to others. Following T2, T6 - RhizoMyx Eco Gr-5 produced a yield of 17.95 kg/plot, while T5 - RhizoMyx Eco Gr-4 registered a yield of 17.20 kg/plot. The treatment T8 - RhizoMyx Eco Gr-7 yielded 17.33 kg/plot, and T7 - RhizoMyx Eco Gr-6 produced a slightly lower yield at 16.85 kg/plot. Additional treatments included T3 - RhizoMyx Eco Gr-2 with a yield of 15.63 kg/plot and T4 - RhizoMyx Eco Gr-3 yielding 15.30 kg/plot. The lowest yield was observed in T1 - RhizoMyx Eco Gr-1, which yielded 14.95 kg/plot (Table 6). These findings suggest that the application of RhizoMyx Eco Gr formulations can significantly enhance paddy yields, with certain treatments demonstrating particularly pronounced effects on productivity. The results underscore the potential of these biological treatments in optimizing agricultural outputs.

**Table 6. Effect of RhizoMyx Eco Gr on Yield / Plot of Paddy (Var: VDG 1)**

|  |  |
| --- | --- |
| **TREATMENT** | **Yield** |
| **Grain Plot yield as per moisture at the time of recording observations (kg/plot)** | **Straw Plot yield as per moisture at the time of recording observations****(kg/plot)** | **Grain Plot yield adjusted to storage moisture.****(kg/plot)** |
| **T1-RhizoMyx Eco Gr-1** | 15.51 | 23.48 | 14.95 |
| **T2-RhizoMyx Eco Gr- 2** | 18.74 | 29.28 | 18.18 |
| **T3-RhizoMyx Eco Gr- 3** | 16.22 | 24.73 | 15.63 |
| **T4-RhizoMyx Eco Gr- 4** | 16.59 | 25.88 | 15.30 |
| **T5-RhizoMyx Eco Gr- 5** | 17.78 | 27.50 | 17.20 |
| **T6-RhizoMyx Eco Gr- 6** | 18.50 | 28.85 | 17.95 |
| **T7-RhizoMyx Eco Gr- 7** | 17.38 | 26.85 | 16.85 |
| **T8-RhizoMyx Eco Gr- 8** | 17.89 | 27.78 | 17.33 |
| **SEM** | 0.54 | 0.97 | 0.58 |
| **CD (5%)** | 2.37 | 2.82 | 1.71 |
| **CD (1%)** | 4.19 | 3.84 | 2.32 |

**3.8 Effect of RhizoMyx Eco Gr products on grain and straw yield of paddy (Var: VDG1)**

The results from Table 7, highlight significant variations in paddy yield (Var: VDG 1) based on different treatments of RhizoMyx Eco Gr. The maximum grain yield was observed in treatment T2 (RhizoMyx Eco Gr-2), 7270 kg/ha, indicating that this treatment significantly enhances productivity compared to others. In contrast, the minimum grain yield was recorded in treatment T1 (RhizoMyx Eco Gr-1) at 5980 kg/ha, illustrating how treatment variations can lead to notable differences in yield outcomes. Similarly, the straw yield followed a parallel trend; treatment T2 not only led in grain yield but also produced the maximum straw yield of 11710 kg/ha, contributing positively to biomass, which is essential for soil health. Conversely, treatment T1 yielded the minimum straw yield of 9390 kg/ha. These findings emphasize the effectiveness of RhizoMyx Eco Gr treatments in enhancing paddy productivity, with T2 emerging as the optimal choice for farmers seeking to maximize both grain and straw output. Harvest index for various treatments of RhizoMyx Eco Gr applied to paddy variety ADT-43. The harvest indices for the treatments range from 0.62 to 0.64, Overall, the results indicate similar harvest performance across most treatments, suggesting consistent effectiveness of RhizoMyx Eco Gr on yield. Several studies, including those by Islamet al. (2012), and Turmuktini et al. (2012), report substantial increases in both grain and straw yields up to 19.71% when biofertilizers such as Azospirillum and Trichoderma are applied, demonstrating their efficacy compared to conventional fertilisation methods. This increase in productivity is coupled with notable cost savings, with Naher et al. (2016) observing up to 45.74% reduction in input costs when biofertilizers are used in conjunction with reduced chemical fertilizers, without compromising yield.

Furthermore, Pratiwi et al.,(2024) highlight that optimal biofertilizer dosing improves critical yield parameters such as filled grain weight and total grain weight, underscoring the potential of biofertilizers as viable alternatives to chemical fertilizers, especially in lowland rice production systems. Complementing these findings, Marzouket al. (2024) emphasize the benefits of integrating rice straw and Azolla, which not only enhance nitrogen-use efficiency but also support higher grain yields, thereby contributing to more sustainable nitrogen management strategies. Additionally, in challenging soil conditions such as sodic environments, Chadha et al. (2025) demonstrate that halophilic bioformulations significantly improve plant growth parameters, nutrient uptake, and overall crop productivity, outperforming traditional practices.

**Table 7. Effect of RhizoMyx Eco Gr on yield / ha of Paddy (Var: VDG 1)**

|  |  |
| --- | --- |
| **TREATMENT** | **Yield** |
| **Grain Yield (kg / ha)** | **Straw Yield (kg / ha)** | **Harvest Index** |
| **T1-RhizoMyx Eco Gr-1** | 5980.00 | 9390.00 | 0.63 |
| **T2-RhizoMyx Eco Gr- 2** | 7270.00 | 11710.00 | 0.62 |
| **T3-RhizoMyx Eco Gr- 3** | 6250.00 | 10140.00 | 0.64 |
| **T4-RhizoMyx Eco Gr- 4** | 6420.00 | 10350.00 | 0.62 |
| **T5-RhizoMyx Eco Gr- 5** | 6880.00 | 11000.00 | 0.63 |
| **T6-RhizoMyx Eco Gr- 6** | 7180.00 | 11540.00 | 0.62 |
| **T7-RhizoMyx Eco Gr- 7** | 6740.00 | 10740.00 | 0.63 |
| **T8-RhizoMyx Eco Gr- 8** | 6930.00 | 11110.00 | 0.62 |
| **SEM** | 10.88 | 17.59 | - |
| **CD (5%)** | 58.67 | 69.25 | - |
| **CD (1%)** | 77.62 | 85.59 | - |

**4. CONCLUSION**

In this investigation RhizoMyx Eco Gr, a microbial bioformulation from Novozymes South Asia, enhances root development, nutrient and water uptake in paddy (VDG1), improving growth and yield. Treatment 2 (RhizoMyx Eco Gr-2) showed superior results with a vigour score of 4.00, plant height of 35.95 cm, 620.75 tillers/m², 257.25 grains per panicle, and grain yield of 7270 kg/ha plus 11710 kg/ha straw. In contrast, Treatment 1 had the lowest performance. RhizoMyx promotes photosynthesis, stress tolerance, and yield quality while reducing chemical fertilizer use, supporting sustainable agriculture. The study validates its efficacy as an eco-friendly alternative for improved rice productivity and environmental sustainability.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Mode (ChatGPT, COPILOT, QUILLBOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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