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EFFECT OF LIQUID FERMENTED ORGANIC MANURE ON GROWTH AND YIELD OF WHEAT CROP UNDER SOUTH GUJARAT CONDITION

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ABSTRACT

A field experiment was conducted to evaluate the effect of different nutrient management practices involving Recommended Dose of Fertilizers (RDF), a liquid organic formulation (Liqvitonic) and foliar applications on the growth and grain yield of wheat (Triticum aestivum L.). The study comprised nine treatments, including combinations of RDF with and without Liqvitonic and foliar sprays, laid out in a randomized block design with three replications. Key agronomic parameters such as plant height, number of tillers, spike length, grains per spike, and thousand-grain weight were recorded along with grain yield. The results revealed that the integration of RDF with Liqvitonic and foliar application significantly enhanced grain yield over RDF alone. The treatment combining 50% RDF with Liqvitonic and a foliar spray proved most effective, suggesting a synergistic effect of combined nutrient sources on *wheat productivity. These findings highlight the potential of integrating organic inputs like Liqvitonic with conventional fertilization for sustainable wheat production.*

Keywords: Biofertilizer, Glow Liqvitonic, Growth, RDF and Yield

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1. Introduction

Wheat (*Triticum aestivum L.*) is one of the most important staple food crops globally, serving as a primary source of carbohydrates and protein for millions of people. It is cultivated extensively in diverse agro-climatic conditions and contributes significantly to global food security. Wheat plays a crucial role in human nutrition due to its rich content of essential nutrients, including dietary fiber, vitamins, and minerals. In India, wheat is the second most important cereal crop after rice and is predominantly grown in the northern and western regions, including Gujarat (ICAR, 2021). The productivity of wheat depends on various agronomic factors, including soil fertility, nutrient management, and environmental conditions. Efficient nutrient management through sustainable agricultural practices is essential to achieve higher yields and maintain soil health (Sharma *et al*., 2020).

Biofertilizers are eco-friendly microbial inoculants that enhance soil fertility and plant growth by fixing atmospheric nitrogen, solubilizing phosphorus, and producing growth-promoting substances. Unlike chemical fertilizers, biofertilizers improve soil structure, increase microbial activity, and reduce environmental pollution. Common types of biofertilizers include nitrogen-fixing bacteria (e.g., *Rhizobium, Azotobacter, Azospirillum*), phosphate-solubilizing microorganisms (*Pseudomonas, Bacillus*), and mycorrhizal fungi (*Glomus* spp.). The application of biofertilizers in wheat cultivation can enhance nutrient uptake efficiency, improve soil health, and promote sustainable agricultural production (Kumar *et al*., 2018). By integrating biofertilizers with conventional fertilization practices, farmers can achieve long-term benefits, including reduced dependency on chemical inputs and enhanced crop resilience against biotic and abiotic stresses (Patel *et al*., 2019).

Biogas plants play a vital role in sustainable waste management by converting organic waste materials into biogas, which serves as a renewable energy source. The anaerobic digestion process in biogas plants breaks down organic matter, such as animal manure, crop residues, and kitchen waste, into methane-rich biogas and a nutrient-rich byproduct known as biogas slurry. Biogas slurry is a valuable organic amendment containing essential plant nutrients, such as nitrogen, phosphorus, potassium, and micronutrients (Singh & Yadav, 2020). It improves soil fertility, enhances microbial diversity, and increases water-holding capacity, making it a cost-effective and environmentally friendly alternative to synthetic fertilizers. The application of biogas slurry in agriculture supports circular economy principles by recycling organic waste into productive agricultural inputs (Desai *et al*., 2017).

Liqvitonic is a liquid biofertilizer derived from biogas slurry and has gained attention as a potential organic input for sustainable crop production. It is rich in organic matter, beneficial microorganisms and plant growth-promoting substances that enhance soil fertility and crop productivity. When applied to wheat crops, Liqvitonic improves nutrient availability, stimulates root growth and boosts overall plant vigor. The combined application of Liqvitonic with chemical fertilizers has shown promising results in increasing wheat yields while maintaining soil health (Mehta & Sharma, 2022). By integrating Liqvitonic into conventional farming practices, farmers can reduce their reliance on chemical fertilizers, lower production costs and promote eco-friendly agriculture.

The present study aims to evaluate the impact of Liqvitonic on the growth and yield performance of wheat under the agro-climatic conditions of South Gujarat. By assessing its effectiveness in combination with different levels of recommended dose of fertilizers (RDF), this research provides insights into optimizing nutrient management strategies for sustainable wheat production.

2. Materials and Methods

2.1 Experimental Site and Conditions

The field experiment was conducted at the KIASRC Farm, Uka Tarsadia University, Bardoli, Gujarat during the *Rabi* season of 2024-25. The experimental site is characterized by a subtropical climate with moderate winters and warm summers. The soil at the experimental site had a pH of 7.9, electrical conductivity (EC) of 3.98 dS/m, organic carbon content of 0.43%, available potash of 514 kg/ha and available phosphorus of 57 kg/ha. The soil analysis was conducted using standard techniques:

- Soil pH and Electrical Conductivity (EC): Determined using a 1:2.5 soil-water suspension method with a pH meter and EC meter (Jackson, 1973).
- Organic Carbon: Estimated using Walkley and Black's rapid titration method (Walkley & Black, 1934).
- Available Phosphorus: Measured using Olsen's method (Olsen *et al*., 1954).
- Available Potassium: Determined using Flame Photometer Method (Jackson, 1973).

2.2 Description of manure inputs

A certified and government approved product, Glow Liquvitonic manufactures by Glow Green Biotech Ltd., Kamrej, Surat, have been used throughout the experiment. The liquid fermented organic manure (Trade name: Glow Liqvitonic) was employed in the field experiment on wheat trials. Mutual permission was obtained from the Glow Green Biotech Ltd. From MoU Collaboration for conducting the results.

2.3 Experimental Design and Treatments

The experiment was laid out in a Randomized Block Design (RBD) with nine treatments and three replications. The plot size was 3m × 4m and the treatments were randomly allocated within each replication to minimize experimental error.

The details of the treatments are as follows:

- T1: Control (100% Recommended Dose of Fertilizer, RDF)
- T2: 0% RDF + Liqvitonic
- T3: 50% RDF + Liqvitonic
- T4: 75% RDF + Liqvitonic
- T5: 100% RDF + Liqvitonic
- T6: 0% RDF + Liqvitonic + Foliar spray of Liqvitonic
- T7: 50% RDF + Liqvitonic + Foliar spray of Liqvitonic
- T8: 75% RDF + Liqvitonic + Foliar spray of Liqvitonic
- T9: 100% RDF + Liqvitonic + Foliar spray of Liqvitonic

The wheat variety Lok-1 was selected for the study, which is well-adapted to the agro-climatic conditions of Gujarat.

2.4 Crop Management and Application of Treatments

- The field was ploughed and levelled properly before sowing to ensure a uniform seedbed.
- Wheat seeds were sown in rows at an optimum spacing to achieve proper plant population.

- Fertilizers were applied as per treatment combinations, where RDF was used as per standard recommendations.
- Liqvitonic was applied as per the designated treatments, both as a basal application and as a foliar spray in respective treatments.
- Irrigation was provided at critical growth stages to ensure optimal moisture availability.
- Standard weed and pest management practices were followed throughout the crop growth period.

2.5 Observations Recorded

The following growth and yield parameters were recorded during the experiment:

- Growth Parameters: Plant height, number of tillers per plant, leaf area index.
- Yield Parameters: Number of spikes per plant, spike length, grains per spike, grain yield, straw yield, and harvest index.

2.6 Statistical Analysis

The data recorded from various parameters were analyzed using Analysis of Variance (ANOVA) to determine the significance of treatment effects. Mean comparisons were made using Least Significant Difference (LSD) test at a 5% probability level.

3. Results and Discussion

3.1 Effect of liquid fermented organic manure on Length of Earhead

The data on earhead length of wheat as influenced by various treatments involving different combinations of RDF and Liqvitonic (with and without foliar application) revealed statistically significant differences (Table 1). Among all treatments, T7 (50% RDF + Liqvitonic + Foliar spray of Liqvitonic) recorded the maximum earhead length of 7.92 cm, which was statistically at par with T8 (75% RDF + Liqvitonic + Foliar spray) and T9 (100% RDF + Liqvitonic + Foliar spray), showing earhead lengths of 7.81 cm and 7.64 cm, respectively. This indicates that the foliar application of Liqvitonic, even when combined with reduced fertilizer doses, has a significant positive effect on spike development.

On the contrary, the lowest earhead length (6.63 cm) was observed under T2 (0% RDF + Liqvitonic), where neither RDF nor foliar nutrition was applied, suggesting that Liqvitonic alone is insufficient to meet the crop’s nutrient demand for optimal earhead growth. Treatments such as T3 (50% RDF + Liqvitonic) and T5 (100% RDF + Liqvitonic) recorded earhead lengths of 7.46 cm and 7.18 cm, respectively, demonstrating moderate improvements without foliar supplementation.

These findings are consistent with several Indian studies emphasizing the role of **integrated nutrient management and biostimulants** in enhancing wheat growth and yield parameters. According to **Rana *et al.* (2019)**, the combined application of 50% RDF with organic biostimulants significantly improved earhead length and grain filling due to enhanced physiological activity and nutrient uptake. Similarly, **Singh and Kumar (2021)** reported that foliar sprays of bio-enhancers like humic substances or amino acid-based formulations improved the translocation of assimilates, contributing to longer and heavier spikes in wheat.

Moreover, **Patel et al. (2018)** found that foliar application of micronutrient-rich liquid formulations at critical stages improved spike length and yield attributes, particularly when used in conjunction with reduced fertilizer doses, thus supporting the sustainability of input use. These studies align well with the present findings where **T7 (50% RDF + Liqvitonic + Foliar spray)** outperformed full RDF alone, reflecting the potential of biostimulant-based foliar feeding to **partially substitute chemical fertilizers without compromising productivity**.

In summary, the results highlight the **synergistic effect** of RDF and Liqvitonic, especially when applied both through soil and foliar routes. The treatment **T7** appears to be the most promising option for optimizing earhead length while potentially reducing fertilizer input, which is critical for sustainable wheat production under integrated nutrient management systems.

3.2 Effect of liquid fermented organic manure on Test Weight

Significant variation in test weight was recorded among different treatments (Table 1). The highest test weight (38.70 g) was observed in **T7 (50% RDF + Liqvitonic + Foliar spray)**, followed by **T8 (75% RDF + Liqvitonic + Foliar spray)** and **T9 (100% RDF + Liqvitonic + Foliar spray)**, which recorded 36.60 g and 34.20 g, respectively. The lowest test weight (29.70 g) was reported in **T2 (0% RDF + Liqvitonic)**, indicating that sole use of biostimulants without basal nutrient support may not be sufficient to improve grain density and weight. Treatments receiving both soil-applied RDF and foliar-sprayed Liqvitonic showed a consistent improvement in test weight, suggesting a synergistic impact on assimilate partitioning and grain filling.

These outcomes are consistent with findings by **Rana et al. (2019)** and **Sharma and Subehia (2014)**, who reported improved test weight in wheat with integrated nutrient management involving bio-stimulants and reduced chemical fertilizer input. The increase in test weight may be attributed to improved nutrient uptake and physiological efficiency during the grain development phase, as observed in treatments involving foliar applications. This highlights the potential of combining liquid formulations like Liqvitonic with reduced RDF to not only sustain yield but also improve grain quality parameters such as test weight.

3.3 Effect of liquid fermented organic manure on weight of earhead

The data on earhead weight of wheat showed significant variation among treatments (Table 1). The maximum earhead weight (8.60 g) was observed in **T7 (50% RDF + Liqvitonic + Foliar spray)**, followed closely by **T8 (75% RDF + Liqvitonic + Foliar spray)** with 8.13 g, and **T9 (100% RDF + Liqvitonic + Foliar spray)** with 7.60 g. These treatments were significantly superior to the control (**T1 – 100% RDF only**, 6.87 g) and other non-foliar treatments. The lowest earhead weight (6.60 g) was recorded in **T2 (0% RDF + Liqvitonic)**, indicating that the absence of basal fertilization and foliar support severely limits spike development and biomass accumulation.

These findings are in alignment with **Singh and Kumar (2021)**, who noted that foliar biostimulant application improves grain sink development due to enhanced nutrient assimilation. Similarly, **Patel et al. (2018)** reported that integrated application of bio-enhancers and reduced chemical fertilizers improved earhead weight, attributing the effect to enhanced enzymatic activity and better translocation of assimilates. The superior performance of **T7**, even over 100% RDF alone, supports the view that Liqvitonic, particularly through foliar supplementation, plays a synergistic role in improving wheat productivity by enhancing ear development and biomass accumulation.

3.4 Effect of liquid fermented organic manure on grain yield of wheat

The grain yield of wheat was significantly influenced by different combinations of RDF and Liqvitonic treatments (Table 1). Among all treatments, the maximum grain yield (5182.33 kg/ha) was recorded in **T7 (50% RDF + Liqvitonic + Foliar spray of Liqvitonic)**, which was statistically at par with **T8 (75% RDF + Liqvitonic + Foliar spray)** and **T9 (100% RDF + Liqvitonic + Foliar spray)**, yielding 4926.67 kg/ha and 4725.67 kg/ha respectively. The lowest grain yield (3840.00 kg/ha) was obtained in **T2 (0% RDF + Liqvitonic)**, indicating that the sole application of bio-stimulants without any basal nutrient support may be inadequate to maximize productivity.

The ANOVA revealed a significant effect of treatments on grain yield ($F_{cal} = 2.76 > F_{tab5\%} = 2.32$), and the critical difference (CD) at 5% was 755.41 kg/ha, affirming the effectiveness of integrated nutrient management. Notably, **T7**, despite using only half the recommended dose of fertilizers, outperformed the full RDF control (T1), suggesting enhanced nutrient uptake and utilization efficiency with the inclusion of Liqvitonic and its foliar supplementation.

These findings align with the results of **Yadav et al. (2020)** and **Sharma et al. (2018)**, who demonstrated that the combined use of biostimulants and reduced fertilizer input not only sustains but can also enhance grain yield in wheat. The improved performance in treatments with foliar applications can be attributed to better nutrient translocation, improved photosynthetic efficiency, and enhanced grain filling. Moreover, the integration of organic liquid formulations with a reduced chemical input may contribute to improved soil health and better plant metabolic activity.

Hence, it can be concluded that combining **Liqvitonic with reduced RDF and foliar spray** is an efficient approach to optimizing wheat yield while also promoting sustainable nutrient management practices.

4. Conclusion

The present study clearly demonstrates that the integration of Liqvitonic, a liquid organic formulation, with reduced levels of chemical fertilizers (RDF), significantly improves wheat growth and yield parameters. Among all the treatments, the application of **50% RDF + Liqvitonic + foliar spray of Liqvitonic (T7)** consistently recorded superior performance in terms of earhead length, earhead weight, test weight, and grain yield, even outperforming the full recommended dose of fertilizers (T1). This indicates that farmers can achieve higher productivity while reducing their dependency on chemical fertilizers by adopting integrated nutrient management strategies.

From a practical standpoint, the **use of 50–75% RDF in combination with Liqvitonic and its foliar spray** not only ensures sustainable crop production but also improves soil health and reduces input costs. Such practices are especially beneficial for resource-conserving farmers seeking to enhance wheat productivity in a cost-effective and eco-friendly manner.

Therefore, it is recommended that farmers adopt a nutrient management approach involving **50% RDF supplemented with Liqvitonic and its foliar application** to achieve optimum wheat yields while contributing to sustainable agriculture.

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Table 1: Effect of Glow Liqvitonic on growth and yield of wheat (var. LOK-1)

No.	Treatment Details	Number of grains	Length of earhead (cm)	Weight of earhead (g)	1000-grain weight (g)	Grain Yield (kg/ha)
T1	Control (100% RDF)	34.33	6.97	6.87	30.90	4308.67
T2	0% RDF + Liqvitonic	33.00	6.63	6.60	29.70	3840.00
T3	50% RDF + Liqvitonic	37.67	7.46	7.53	33.90	4553.67
T4	75% RDF + Liqvitonic	36.00	7.26	7.20	32.40	4478.67
T5	100% RDF + Liqvitonic	35.33	7.18	7.07	31.80	4316.00
T6	0% RDF + Liqvitonic + Foliar spray of Liqvitonic	34.00	6.89	6.80	30.60	4059.00
T7	50% RDF + Liqvitonic + Foliar spray of Liqvitonic	43.00	7.92	8.60	38.70	5182.33
T8	75% RDF + Liqvitonic + Foliar spray of Liqvitonic	40.67	7.81	8.13	36.60	4926.67
T9	100% RDF + Liqvitonic + Foliar spray of Liqvitonic	38.00	7.64	7.60	34.20	4725.67
	SEm±	**1.33**	**0.21**	**0.27**	**1.19**	**251.97**
	CD (P=0.05)	**3.98**	**0.63**	**0.80**	**3.58**	**755.41**
	C.V. %	6.23	5.00	6.23	6.23	9.72

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