Journal of Agriculture and Food Sciences
Volume 22, Number 1, April 2024, pp 14 - 30.

INFLUENCE OF GROWTH STAGES AND SOIL TYPES ON PERFORMANCE OF RICE (*ORYZA SATIVA* L.) ACCESSIONS GROWN IN FLOODED PADDY SOIL

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ABSTRACT

Soil and its microorganisms have for long been known to contribute to the performance of plant with regards to nutrient availability and uptake, therefore knowledge of its properties and its role is very vital in crop productivity. The study focused on assessing the structure of microbial communities in the rhizosphere of rice plants in Ebonyi State, considering soil types, rice varieties, and plant growth stages. Soil samples were collected from paddy fields, sieved, and flooded with ionized water before planting four rice accessions from the Biotechnology Research Centre of EBSU. Physicochemical parameters of the soils were analyzed, showing slightly acidic pH levels, various fractions of sand, organic carbon, organic matter, and essential nutrients like calcium, phosphorus, and magnesium. Pore water analysis revealed the presence of organic and inorganic ions, with higher concentrations of certain ions in planted soils compared to unplanted ones. The microbial population differed significantly between planted and unplanted soils, with varying effects of different rice accessions on microbial load. The study also observed changes in microbial populations at different growth stages of rice plants, with the microbial load decreasing as plants grew. The findings suggest that selecting adapted rice cultivars can enhance yields, reduce fertilizer usage, and improve food security. This research provides valuable insights for rice farmers and breeders to optimize productivity

Keywords: Microbial communities, Organic matter, Pore water, Rice accession

https://dx.doi.org/10.4314/jafs.v22i1.2

INTRODUCTION

Soil, an essential and non-renewable natural asset present on the Earth's surface, plays a crucial role in sustaining human life, supporting biological productivity, enhancing diversity, and maintaining environmental quality (Oweremadu & Oti, 2005). A comprehensive understanding of the intricate and dynamic characteristics of soil is vital for fostering healthy plant growth and maximizing crop yields. Analyzing the elemental composition of soil provides valuable insights for evaluating and managing soil behavior and fertility, aiding in the selection of suitable soils for agricultural and non-agricultural uses. The fertility level of soil determines its suitability for different plant types and agricultural activities.

The interaction among soil, plants, and microorganisms significantly influences the formation of the plant rhizosphere. Certain soil bacteria are now recognized for their role in promoting plant growth by utilizing nutrients present in the rhizosphere, which is enriched with organic compounds released by active root growth. While beneficial microbes in the rhizosphere enhance plant growth, nutrient absorption, and soil health, some microbes can have detrimental effects, leading to root diseases (Babalola, 2010). Microorganisms present in the soil and on root surfaces play a beneficial role in plant growth, contributing to various environmental processes such as nutrient cycling, plant health management, soil quality maintenance, and toxin removal (Barea et al., 2005).

Rice, a monocotyledon plant belonging to the genus Oryza and the grass family Gramineae, has a long history of cultivation, with different varieties like Oryza sativa and Oryza glabberima originating from distinct regions. (Ma & Bennetzen, 2004). Rice production is widespread in Nigeria, particularly in Ebonyi State, known for its significant contribution to the country's rice output. Various factors support rice cultivation in Ebonyi State, but challenges such as pest and disease management, aging farming population, inadequate weed control, low technology adoption, and climate change pose threats to agricultural productivity (Ekpe et al., 2017).

With the global agricultural demand projected to increase substantially by 2050, sustainable agricultural practices are crucial for meeting future food needs. However, limited research has been conducted in Ebonyi State, particularly on selecting suitable soil types and rice cultivars to enhance yields, reduce fertilizer usage, and ensure food security (Manner et al., 2007).

The low rice output in Ebonyi State is attributed to resource constraints, emphasizing the need for improved agricultural technologies to boost productivity. Rice cultivation in Nigeria exhibits genetic diversity, with various varieties adapted to different ecological zones. The unique qualities of Abakaliki rice, grown in Ebonyi State, include tolerance to environmental stresses, nutritional benefits, and cooking characteristics that set it apart from other rice varieties in Nigeria and Africa. The economic significance of rice farming in Ebonyi State is evident, with a growing interest among the population, particularly in highland and swampy areas, where rice cultivation thrives.

MATERIALS AND METHOD

Study Site and description of study area

Ebonyi, situated in the Southeast region of Nigeria, lies approximately between 70301 and 70E, 50401 and 60451 N, with a population of 149,683 and covering an area of around 5,935 square kilometers. The state shares borders with Benue to the north, Enugu to the west, Imo and Abia to the south, and the crossing river to the east. The state capital, Abakaliki, experiences a tropical climate with an average relative humidity of 75%, rising to 80% during the rainy season. The predominant vegetation consists of tropical rainforests, with temperatures around 30°C.

Collection and processing of soil samples

Soil samples from rice fields in the cities of Ikwo, Abakaliki, and Afikpo were collected at a depth of 0-20 cm after at least three years of cultivation. These samples were processed at the Department of Crop Production and the Green House for Landscape Management at the Ebonyi State University. Basic soil characteristics such as pH, soil organic carbon, total nitrogen, available phosphorus, and total phosphorus were analyzed using standard methods (AOAC 1965).

Collection and planting of rice samples and incubation study

The study involved obtaining rice seeds of four different accessions (Faro 44, Faro 52, Faro 59, and Faro 61) from the Biotechnology Research Centre of Ebonyi State University, Abakaliki (EBSU), in Nigeria. The seeds were germinated, transplanted into pots with different soil samples from three locations, and arranged in a randomized block design. Fertilizers such as uranium, phosphorus, potassium, and magnesium were used, with specific application ratios before and after planting. The pots were flooded with ionized water, drained daily, and incubated in a green house for 4 weeks. Soil samples were collected from the rhizosphere and bulk soil for bacterial community analysis.

Determination of the effect of plant growth stages, soil variations/types and rice accession on the microbial community composition.

The study investigated how plant growth phases influenced the microbial community composition in rice plants by monitoring plant height weekly. Different sampling times corresponding to various growth stages (24 h, first vegetative), (52 h, last vegetative), the third stage (62 h, reproductive) and the fourth stage (90 h, maturity) were selected. Additionally, the impact of soil type on culturable microbial communities was assessed by analyzing samples from different soil zones. The study also examined the relationship between rice accessions and microbial communities after a 42-day greenhouse incubation period

Pore water analysis and Enumeration of total bacterial counts:

Ten-fold serial dilution of the soil sample for bacterial enumeration using the pour plate method was adopted (Cheesbrough, 2006). The inoculated plates were incubated at 37°C for 24 hours in an incubator and at a room temperature of 28°C for 48 hours for the total number of heterotrophic bacteria. The results are expressed in colonies per gram of sample (CFU/g). Pore water was collected aseptically with sterilized equipment. Centrifugation of soil samples, and the analysis of organic acids using high-performance liquid chromatography (HPLC) and inorganic ions using ion chromatography was done (Bak et al., 1991).

RESULTS

Physico-chemical Properties of Soil Samples from the three Zones in Ebonyi State

The result of the physico-chemical properties of the soil samples collected from rice field at different locationin Ebonyi State is presented in Table 2. It showed that the soil sample from

Ebonyi North and Ebonyi South had a higher sand fraction (54.00 % and 54.00 %) compared to the sample from Ebonyi Central (40.00 %). While, silt was higher in Ebonyi Central (30.00 %), both Ebonyi North and South samples had sandy-loam texture while Central was more of clay-loam in texture.

Ebonyi South recorded the highest Phosphorus, organic carbon, and organic matter contents (50.80 mg/kg, 2.31 % and 3.98 %) but Ebonyi North samples recorded the highest calcium and magnesium content (8.00 mg/kg and 4.80 mg/kg respectively). The result of the 2-way analysis of variance showed significant variation ($p<0.001$) among the physicochemical properties in in sample. However, there was no significant difference in the physicochemical contents of the soil across the locations, hence $p> 0.05$ (Table 2).

Concentration of Organic and Inorganic Ions

Tables 3, 4 and 5 shows the results of organic and inorganic ions detected in the pore water of rhizosphere (planted) and bulk soil (unplanted) from Ebonyi North, Central and South soil respectively, at stages 1- 4. Pore water analyses showed that acetate, lactate, formate, chloride and propionate concentrations were significantly ($p <0.05$) higher in the planted pots across the three senatorial zones compared to the unplanted pots. The concentrations of malate, nitrate, and sulphate were similar in soil samples collected from different areas from rhizospere (planting boxes) and bulk soil (unplanting boxes).

The 2-way Anova result showed that there was significant difference in the ion content among the planted soil sample across the location but the unplanted soil showed no significant variation. Also there was no significant difference in the ion content across the three locations profiles (Table 6).

Mean microbial population of Rhizospheric bacteria in planted and unplanted soil samples from the different sampling locations in Ebonyi State.

The microbial community structure of soil samples showed that there was abundance of microorganisms in the rhizosphere of both soil. The highest mean microbial load was recorded in sampling Stage 1; 32 (DAP) $15.8x10\pm3.3x10^6$ CFU/g in planted against $10.7x10\pm2.0x10^6$ CFU/g in unplanted soil samples, while the lowest mean values were obtained on sampling stage 4 (90 DAP) which recorded $13.5x10\pm3.5x10^6$ CFU/g in planted and $8.1x10\pm0.7x10^6$ CFU/g in unplanted soils (Table 7).

Effect of Rice accession in shaping the microbial population in root rhizosphere

The result of rice accessions (Faro 44) shaping the microbial population on rice rhizosphere from the three sampled locations in Ebonyi State showed that on 34 days after planting (DAP), Ebonyi South sampled soil recorded the highest number of colonies ($1.5 \times 10^7\pm2.0 \times 10^5$ CFU/g), while Ebonyi North soil samples recorded the lowest ($1.2 \times 10^7\pm1.0 \times 10^5$ CFU/g). On 52 DAP; microbial population was lowest in soil samples collected from Ebonyi North zone ($1.1 \times 10^7\pm5.7x10^1$ CFU/g), while Ebonyi South soil samples had the highest colony count ($1.4 \times 10^7\pm1.1x10^1$ CFU/g). Similar trend was observed on 62 and 90 DAP although there were generally a decline in microbial counts across the region as shown in

Figure 2. The difference in microbial population across the three zones was statistically significant mostly in Ebonyi North.

The microbial colonies as obtained from rice (Faro 52) soil samples across the three sampled locations showed that microbial counts was higher on soil sample from Ebonyi North ($1.7 \times 10^7 \pm 1.0 \times 10^6$ CFU/g) followed by Ebonyi Central ($1.4x10^7 \pm 3.0x10^5$) and then Ebonyi South ($1.0x10^7 \pm 4.0x10^5$) respectively. The same was observed on days 52, 62 and 90 after planting although there was a general decrease in microbial population across the location as the length of days goes by as shown in Figure 3. There was a significant difference ($p<0.05$) in the colony count of the soil sample at some points, across the locations.

The result from figure 4 showed that soil sample from Ebonyi North had significantly ($p<0.05$) higher microbial load on 34 DAP ($2.0 \times 10^7 \pm 2.0x10^5$ CFU/g), 52 DAP ($2.0x10^7 \pm 2.6x10^1$ CFU/g), 62 DAP and 90 DAP ($1.9x10^7 \pm 2.2x10^2$CFU/g and $1.8x10^7 \pm 5.0x10^1$ CFU/g respectively) followed by Ebonyi South ($1.8x10^7 \pm 5.1x10^3$ CFU/g) on 34 DAP, $1.7x10^7 \pm 1.7x10^2$ CFU/g on 52 DAP, $1.6x10^7 \pm 5.7x10^1$ CFU/g on 62 DAP and $1.5x10^7 \pm 4.6x10^1$ CFU/g on 90 days after planting. Meanwhile, Ebonyi Central samples recorded the lowest microbial counts across the sampled locations (Fig 4)

Figure 5 revealed that on 34 DAP, there was a significant difference ($p<0.05$) in the microbial colony count, with highest microbial population found in soil samples from Ebonyi South zone ($2.1x10^7 \pm 1.0x10^5$ CFU/g) followed by Ebonyi Central sample ($1.9x10^7 \pm 1.5x10^2$ CFU/g) while Ebonyi North sample recorded the lowest colony count ($1.2 \times 10^7 \pm 5.7x10^4$ CFU/g). The microbial load followed the same manner on 52, 62 and 90 DAP with Ebonyi North sample having the lowest colony count ($1.0x10^7 \pm 2.8x10^1$ CFU/g) while Ebonyi South sample had the highest colony count ($1.9x10^7 \pm 4.3x10^1$ CFU/g) as shown in Fig. 5

Effect of different Rice accession on influencing the growth performance (height)

The result as obtained from figure 6 showed that across the locations, there was no significant difference in the rice (Faro 44) height which were 22.5 cm within three sampling locations respectively, on day 1. However, there was a significant ($p<0.05$) difference in rice height after the first measurement on 34 days after planting (DAP). The height was higher in Ebonyi South (46 cm), followed by Ebonyi Central (43 cm) while, Ebonyi North sample recorded the lowest plant height (31.5 cm). The same trend was observed on 52, 62 and 90 DAP. On 90 DAP; the height of Faro 44 was 74.5 cm in Ebonyi South, 72.5 cm in Ebonyi central and 53.5 cm respectively as shown in Figure 6.

The result from figure 7 showed that on day 1 after planting, plant heights were approximately equal (20.50 cm respectively). However, on 34 DAP, there were significant variation in plant height with rice planted on soil sample collected from Ebonyi South zone having the highest plant height (37.5 cm) while the rice plant grown on soil samples from Ebonyi North had the lowest height (29.3 cm). Meanwhile, the trend changed from 52- 90 DAP where rice grown on soil samples from Ebonyi Central recorded highest plant height (56.8 cm, 60.8 cm and 67.8 cm on 52, 62 and 90 DAP respectively) as shown in Figure 7.

Figure 8 showed a mean plant height of 19.5 cm across the soil samples on day 1 after planting, but on the 34 DAP samples from Ebonyi North supported higher plant height (49.0 cm) followed by Ebonyi Central (48.8 cm) and Ebonyi South (47.0 cm). Meanwhile, on 52 DAP and 62 DAP, plant height was observed to be higher on soil sample collected from Ebonyi South (67.0 cm and 70.3 cm respectively) but on the 90 DAP, plant highest height was recorded in Ebonyi Central (76.0 cm) while the least was recorded by rice growing on Ebonyi North soil sample as shown in Figure 8

The result from figure 9 showed that although plant height was relatively equal on day 1 after planting (20.50 cm each), there was observed variation from 34 to 90 DAP. On the 34 DAP the variation was not significant but on 52 to 90 DAP, there was significant ($p<0.05$) variation in height with Ebonyi North recording higher plant height compared to other places on day 52 after planting (62.5 cm), day 62 after planting (69.3 cm) and day 90 after planting (74.0 cm) as shown in Figure 9

DISCUSSION

The analysis of soil samples from rice fields in Ebonyi State revealed variations in physico-chemical properties across different zones. Ebonyi North and South exhibited higher sand content compared to Ebonyi Central, while silt content was higher in Ebonyi Central. The soil textures ranged from sandy-loam in the North and South to clay-loam in the Central zone. Ebonyi South had the highest levels of phosphorus, organic carbon, and organic matter, whereas Ebonyi North had elevated calcium and magnesium levels. The soil pH was mildly acidic, below 6.0

The study has shown that proper soil management practices are essential for sustaining agricultural productivity, environmental health, and overall economic development. Soil health assessment plays a crucial role in maintaining biological diversity, environmental quality, and plant and animal well-being. Understanding soil properties is vital for assessing fertility status and monitoring soil behaviour (Ashenafi et al., 2010, Muche et al., 2015, Onweremadu & Oti, 2005).

The study also observed differences in microbial populations in the rhizosphere of rice plants across the sampled zones. While Ebonyi South and North had higher microbial loads, the growth performance of rice plants did not always align with microbial abundance. Enwezor et al., (1990) contended that factors such as soil pH and concentrations of organic and inorganic ions in the soil may influence plant growth, also Hassan and Overstreet, (1952) and Cramer et al., (1986) corroborates the findings by stating that microbial activities in the rhizosphere can impact mineral acquisition by roots at various growth stages.,

Furthermore, the study highlighted the role of plant-driven selection in shaping rhizosphere microbial communities. Plant growth factors secreted by microorganisms, such as indole-acetic acid and cytokines, can promote plant growth. (Zhang et al, 2009) The interaction between indigenous rhizosphere bacteria and plant roots influences gene expression and

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nutrient uptake. Nutritional status, growth stage, and root exudates play key roles in microbial community dynamics. (Hassan & Overstreet, 1952; Cramer et al., 1986).

In conclusion, the physico-chemical properties of soil samples in Ebonyi State vary across zones, impacting microbial populations and plant growth. Proper soil management practices are essential for sustainable agriculture and economic prosperity. Understanding the complex interactions between plants, microbes, and soil is crucial for optimizing agricultural productivity and environmental sustainability.

CONCLUSION

The study emphasizes the significance of intensifying rice cultivation to address global food security needs, especially in developing countries. It highlights the presence of sand in soil samples, mild acidic pH levels, poor water content, and the influence of indigenous microorganisms on rice cultivation. The study reveals that different rice accessions perform variably based on soil conditions and microbial interactions, suggesting the importance of selecting adapted cultivars for optimal nutrient uptake and increased yields. Farmers are encouraged to consider the study's findings to enhance productivity and food security in Ebonyi State.

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APPENDICES

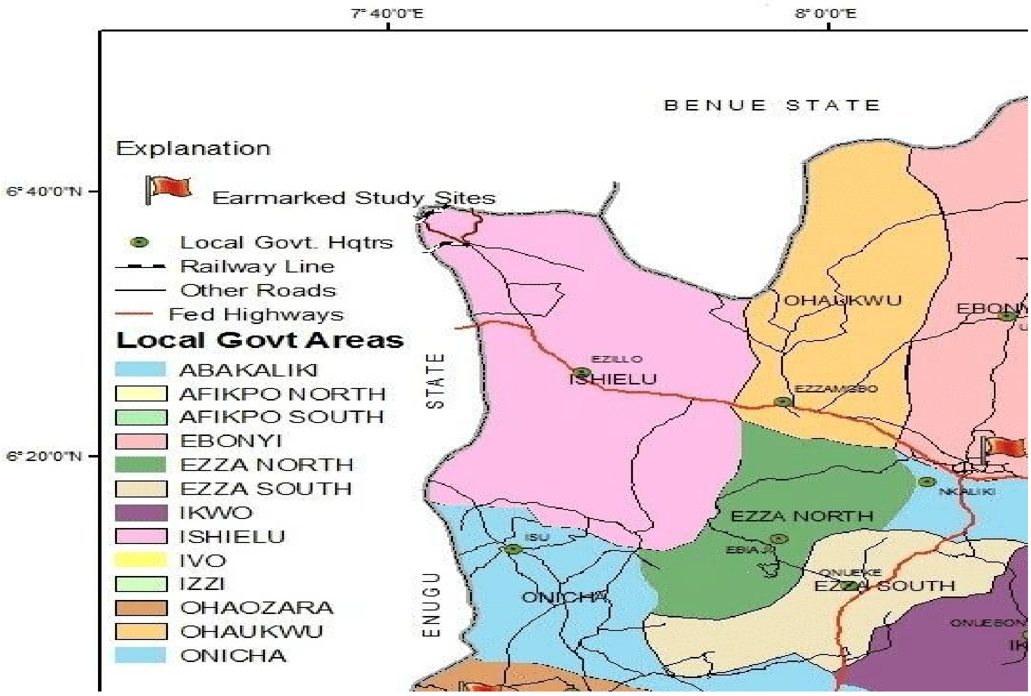

Figure 1: Map of Ebonyi State showing Ikwo, Abakaliki and Afikpo

Table 1: Physico-Chemical Properties of Soil Sample from the three Zones of the State

	Zones		
Parameter	**Ebonyi North**	**Ebonyi Central**	**Ebonyi South**
% Sand	54.00	40.00	54.00
% Silt	25.00	30.00	28.00
% Clay	21.00	30.00	18.00
Texture	Sandy – Loam	Clay-loam	Sandy-loam
pH (H_2O)	5.40	5.80	5.30
P (mg/kg)	30.20	18.80	50.80
% N	1.40	0.070	0.182
% OC	1.37	0.85	2.31
% OM	2.36	1.46	3.98
Ca	8.00	7.40	3.20
Mg	4.80	2.00	1.20
K	0.184	0.297	0.200
Na	0.235	0.209	0.191

OC=Organic Carbon, OM=Organic Matter

Table 2:Two-way Anova Table of Physicochemical Characteristics of the Soil Samples

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Parameter	12	8943	745.2	21.780	3.61e-09 ***
Location	2	41	20.6	0.602	0.557
Residual	21	719	34.2		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 3: Concentrations of organic acids and inorganic ions detected in the pore water of rhizosphere (planted) and bulk soil (unplanted) from Ebonyi North Soil at stages 1-4

Ion	Category	34	52	62	90
Acetate	Planted	0.44a	0.49a	0.49a	0.53a
	Unplanted	0.02b	0.01b	ND	0.01b
Lactate	Planted	0.96b	1.40a	1.16b	1.25ab
	Unplanted	0.16c	0.02e	0.04d	0.04d
Malate	Planted	69.24f	70.12e	102.5c	120.89b
	Unplanted	85.95d	101.30c	117.90b	147.13a
Formate	Planted	0.14b	0.10b	0.30a	0.39a
	Unplanted	0.03d	0.08c	0.05cd	0.04d
Chloride	Planted	12.69d	31.85a	29.05a	34.90a
	Unplanted	12.04d	14.48c	16.45bc	18.98b
Nitrate	Planted	0.02c	0.01c	0.04b	ND
	Unplanted	0.14a	0.05b	0.14a	0.24a
Propionate	Planted	0.06d	1.16a	0.38c	0.95b
	Unplanted	ND	ND	0.03d	ND
Sulfate	Planted	0.03a	0.02a	0.02a	0.03a
	Unplanted	0.02a	0.02a	0.03a	0.04a

(Values indicate the mean ion in millimolar concentrations. Values having the same alphabets are not different ANOVA, P =0.05). ND= Not detected

Table 4: Concentrations of organic acids and inorganic ions detected in the pore water of rhizosphere (planted) and bulk soil (unplanted) from Ebonyi Central Soil at stages 1-4

Ions	category	34 days	52 days	62 days	90 days
Acetate	Planted	0.44b	0.50a	0.48a	0.54a
	Unplanted	0.03c	0.01c	ND	0.01c
Lactate	Planted	0.98b	1.41a	1.18a	1.25a
	Unplanted	0.18c	0.02d	0.03d	0.04d
Malate	Planted	69.28c	70.18c	101.5b	121.89b
	Unplanted	86.95c	102.30b	116.90b	148.13a
Formate	Planted	0.13b	0.10b	0.31a	0.40a
	Unplanted	0.02c	0.09bc	0.05c	0.04c
Chloride	Planted	12.69c	30.95a	29.05a	34.90a
	Unplanted	12.05c	14.49bc	16.47b	19.10b
Nitrate	Planted	0.02c	0.01c	0.05b	ND
	Unplanted	0.13a	0.05b	0.13a	0.24a
Propionate	Planted	0.06c	1.17a	0.36b	0.96a
	Unplanted	ND	ND	0.03c	ND
Sulfate	Planted	0.03a	0.02a	0.02a	0.03a
	Unplanted	0.02a	0.02a	0.03a	0.05a

(Values indicate the mean ion in millimolar concentrations. Values having the same alphabets are not different ANOVA, P = 0.05). ND= Not detected

Table 5: concentrations of organic acids and inorganic ions detected in the pore water of rhizosphere (planted) and bulk soil (unplanted) from Ebonyi South Soil at stages 1-4

Ion	Category	34	52	62	90
Acetate	Planted	0.43a	0.48a	0.48a	0.51a
	Unplanted	0.02b	0.01b	ND	0.01b
Lactate	Planted	0.97b	1.41a	1.15ab	1.24a
	Unplanted	0.16c	0.01d	0.03d	0.04d
Malate	Planted	69.23c	70.13c	102.5b	121.89b
	Unplanted	85.97c	101.31c	118.90a	147.13a
Formate	Planted	0.14b	0.10b	0.30a	0.39a
	Unplanted	0.03d	0.09c	0.05c	0.04cd
Chloride	Planted	12.70c	31.85a	29.05ac	34.91a
	Unplanted	12.04c	14.48bc	16.46b	18.98b
Nitrate	Planted	0.02c	0.01c	0.05b	ND
	Unplanted	0.13a	0.05b	0.14a	0.23a
Propionate	Planted	0.07c	1.17a	0.38b	0.95b
	Unplanted	ND	ND	0.03c	ND
Sulfate	Planted	0.03a	0.02a	0.02a	0.03a
	Unplanted	0.02a	0.02a	0.03a	0.04a

(Values indicate the mean ion in millimolar concentrations. Values having the same alphabets are not different ANOVA, P =0.05). ND= Not detected

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Table 6: Two-way Anova Table showing interaction in parameters between plant and unplanted soil samples acros locations

Parameter	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Planted	1	24.6	24.552	4.750	0.0319 *
Unplanted	1	3.8	3.771	0.730	0.3952
Planted:Unplanted	1	0.1	0.149	0.029	0.8656
Location	1	0.2	0.219	0.042	0.8374
Residuals	92	475.5	5.169		

Table 7: Mean value of the microbial counts between planted and unplanted soil samples

Sampling Stages	Sampling type	Microbial load ($x10^6$ CFUg)
Stage 1	**Planted**	$15.8x10 \pm 3.3x10^6$
	Unplanted	$10.7x10 \pm 2.0x10^6$
Stage 2	**Planted**	$14.9x10 \pm 3.4x10^6$
	Unplanted	$10.6x10 \pm 1.0x10^6$
Stage 3	**Planted**	$14.2x10 \pm 3.5x10^6$
	Unplanted	$8.6X10 \pm 0.8x10^6$
Stage 4	**Planted**	$13.5x10 \pm 3.5x10^6$
	Unplanted	$8.1x10 \pm 0.7x10^6$

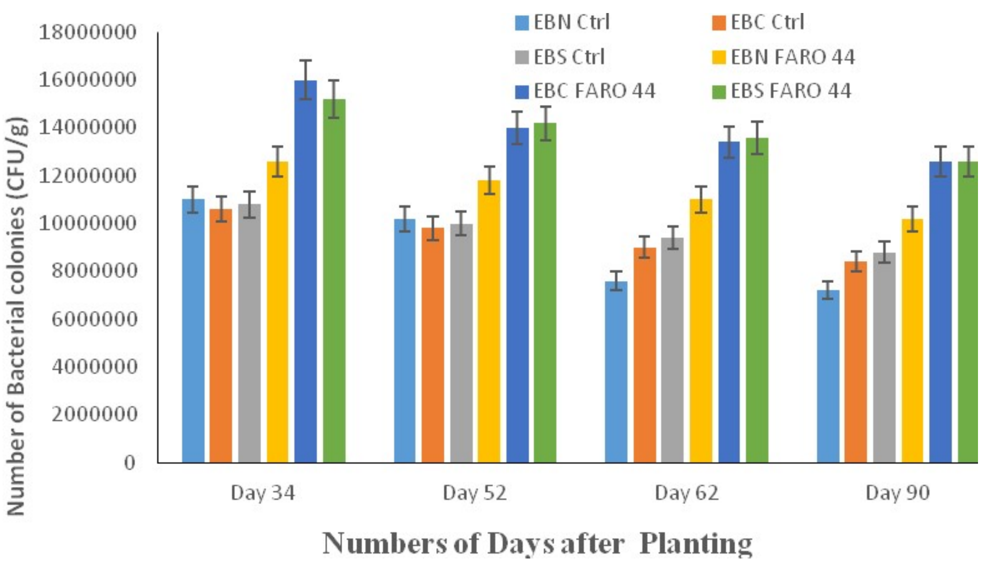

Figure 2: Effect of rice accession (Faro 52) on microbial population in root rhizosphere at different stages of plant growth.

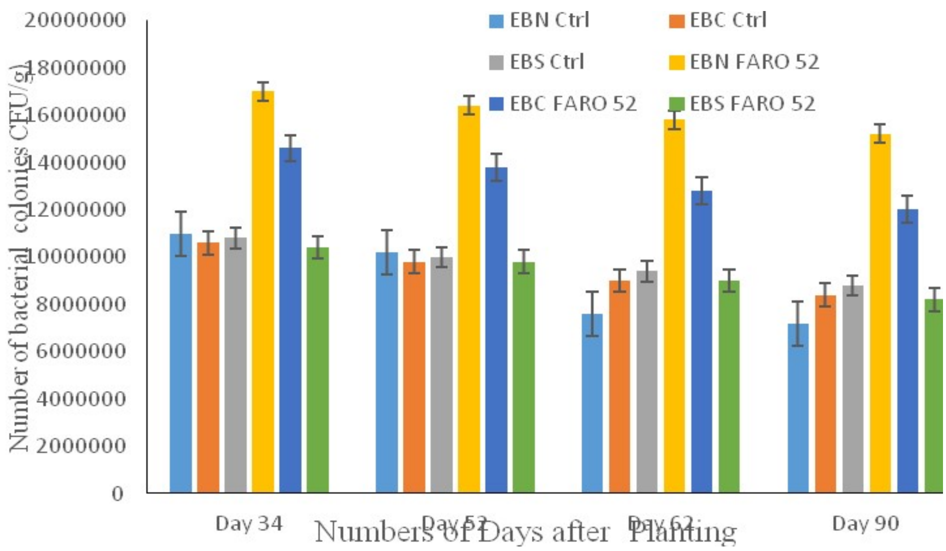

Figure 3: Effect of rice accession (Faro 52) on microbial population in root rhizosphere at different stages of plant growth.

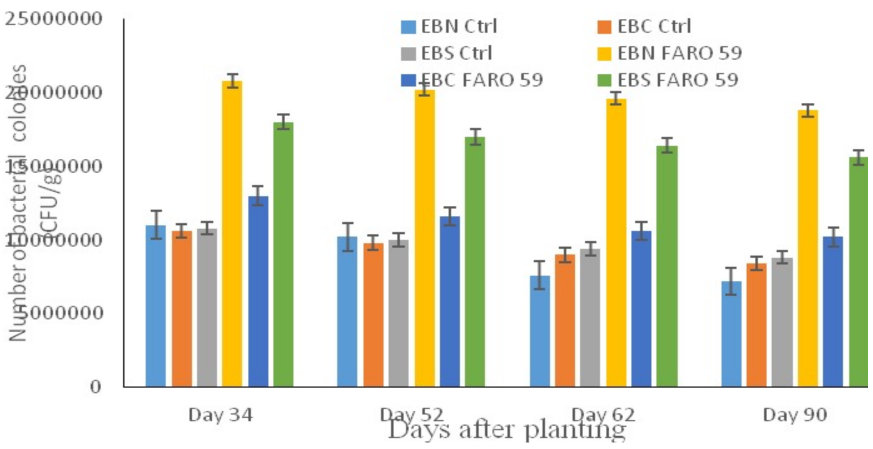

Figure 4: Effect of rice accession (Faro 59) on microbial population in root rhizosphere

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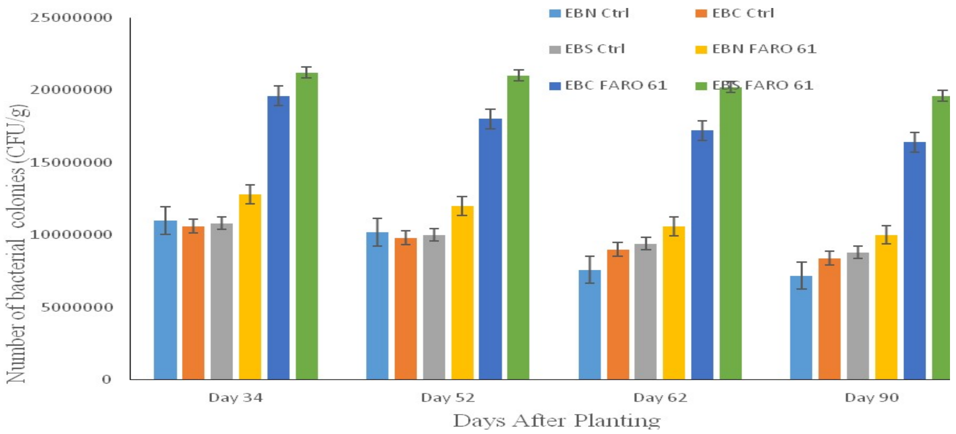

Figure 5: Effect of rice accession (Faro 61) on microbial population in root rhizosphere

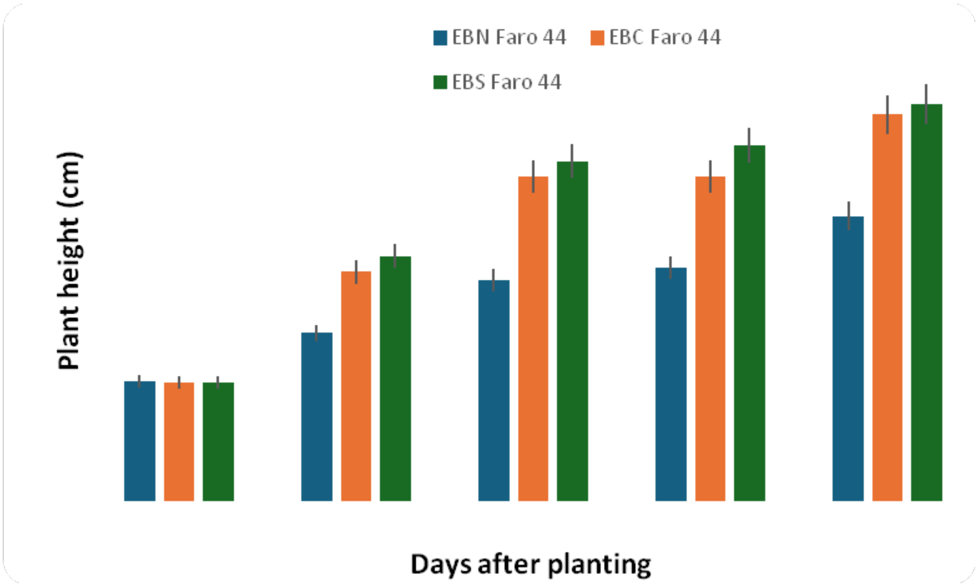

Figure 6: Effect of Rice accession (Faro 44) influencing the growth performance(height)

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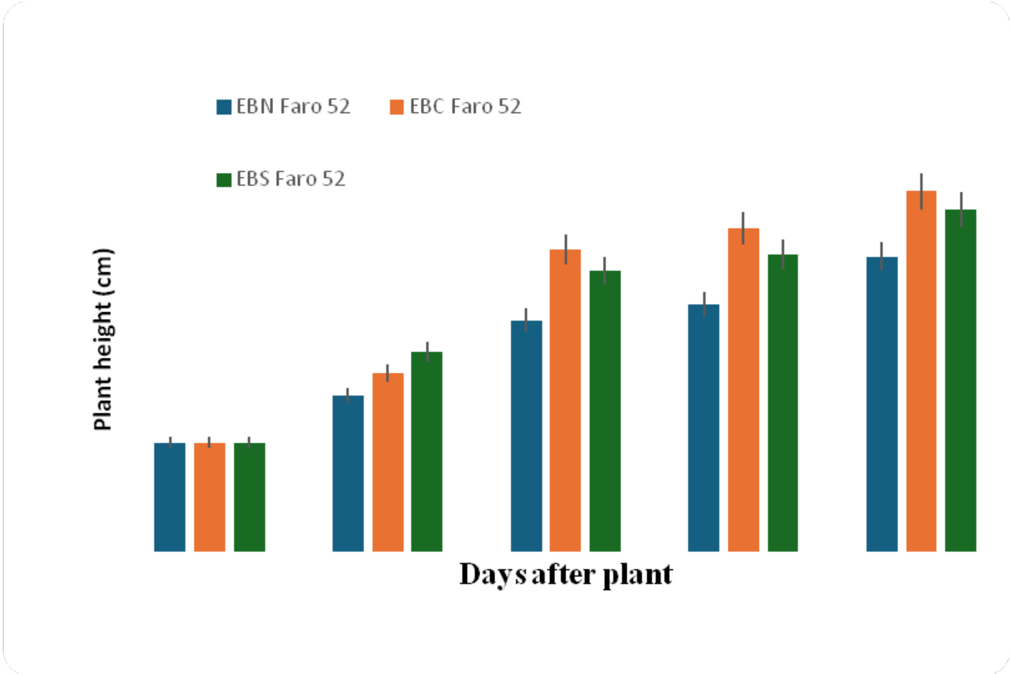

Figure 7: Effect of Rice accession (Faro 52) influencing the growth performance (height)

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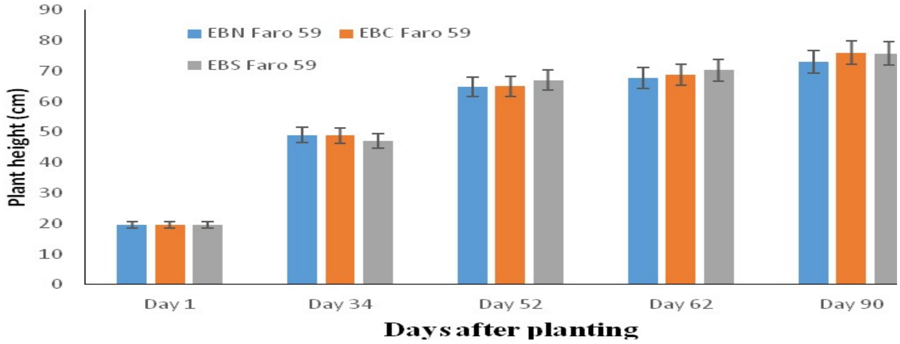

Figure 8: Effect of Rice accession (Faro 59) influencing the growth performance (height)

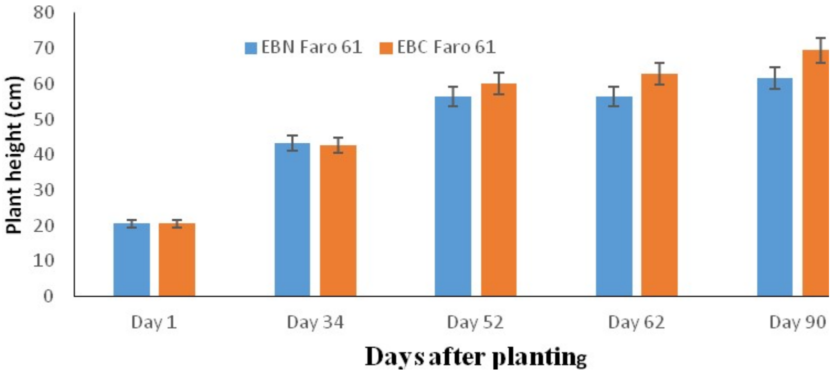

Figure 9: Effect of Rice accession (Faro 61) influencing the growth performance (height)