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Water Quality Parameters of Sodic Soil Ponds Fertilized with Cattle Dung and Poultry Manure

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted from August to November 2023 at the Instructional Fish Farm, College of Fisheries, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj Ayodhya, Uttar Pradesh. The study aimed to assess water quality parameters. The experimental design included fifteen earthen ponds (8m × 8m × 1m), divided into five treatments with three replicates each. The treatments were as follows: (T1) control with pond bottom soil base, (T2) pond bottom soil with cattle dung at 20 t/ha, (T3) pond bottom soil with cattle dung at 15 t/ha, (T4) pond

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bottom soil with poultry droppings at 10 t/ha, and (T5) pond bottom soil with poultry droppings at 7.5 t/ha. Over the 90-day experimental period each pond evaluated the effects of cattle dung andpoultry droppings on water quality parameter. Results demonstrated that the treatment with poultry droppings at 10 t/ha (T4) significantly enhanced water quality, proving to be superior to treatments with cattle dung, followed by treatment T2 (20 t/ha cattle dung).

Keywords: Organic manure; water quality parameter; poultry dropping; cow dung.

1. INTRODUCTION

Global production from aquaculture and fishing is at an all time high. In the future, the sector will play an even more important role in providing food and nutrition security.

India is the third-largest fish producing nation. An estimated 17.54 million tons of fish be produced overall in FY 2022– 2023, of which 13.11 million tons will come from the inland sector and 4.43 million tons from the marine sector. In 2023, Uttar Pradesh made significant strides in fish production, reaching a record high. The state produced approximately 915,000 metric tons of fish, an increase from the 809,000 metric tons recorded in 2022. Uttar Pradesh was also recognized for its achievements in inland fisheries, earning the "Best State-Inland Fisheries Award" at the Global Fisheries Conference in 2023. (NFDB, 2023).

Sodic water is defined as having a high percentage of sodium salts in its overall salt content. High alkalinity and sodium saturation in the soil result from using sodic water for agricultural purposes, which has high sodium ion content. According to National Remote Sensing Agency (NRSA) project on ‘Mapping of salt-affected soils of India on 1:250,000 scale’, the area under salt-affected soils in the country is 6.727 million hectare [1,2].

Applying variously sourced organic fertilizers to sodic soil ponds can boost primary productivity and hence improve the production. Cattle dung manure can serve as a complete fertilizer in ponds. To keep this in mind, the present study was planned and conducted in order to observe that by using cattle dung and poultry dropping in sodic soil we can decrease the sodicity of soil and increase fish production of a pond with the following objectives: To study the water quality parameters of experiment units.

2. MATERIALS AND METHODS

This section deals with requisites and procedures, during various experiment it work carried out during the study period.

2.1 Chemicals, Plastic Ware and Glassware

In the present study, analytical grade chemicals and high quality plastic and glass wares were used throughout the experiment.

Site of experiment: The present study was conducted at Instructional Fish Farm College of Fisheries, Acharya Narendra Deva University of Agriculture and Technology, Ayodhya Uttar Pradesh. The experimental set up earthen pond (8m×8m×1m).

2.2 Experimental Details

The experiment was conducted for 90 days period in the earthen pond. Each group were having three (triplicate) earthen sodic soil condition pond. After pond preparation weekly water quality parameters and soil quality were measured.

List 1. Treatment details

Sr No.	Treatment No	Treatment Detail
1	T 1 (control)	Traditional soil base
2	T2	Soil base + cattle dung @ 20 t/ha.
3	T3	Soil base + cattle dung @ 15 t/ha.
4	T4	Soil base + poultry dropping @ 10 t/ha.
5	T5	Soil base + poultry dropping @ 7.5 t/ha.

2.2.1 Ploughing

Ploughing was completed in two days with help of grape hoe. Pond ploughing is primarily done to improve pond water quality and productivity. Over time, organic matter accumulates on the pond bottom, leading to nutrient buildup, their exchange, and increased sedimentation. Ploughing helps to break up this organic matter and sediment, promoting better water circulation.

2.2.2 Liming

After ploughing liming was done @ 250kg/h. $CaCO_3$ was applied in 8×8×1 m pond to 1.6 kg lime was applied. Liming a pond is a common practice in aquaculture and pond management to adjust water pH and improve water quality.

2.2.3 Water filling and manuring

Ground water was filled up with the help of tubewell, Instructional Fish Farm, College of Fisheries. Initially, ponds were filled up to a depth of 1.0 feet, and the water level was subsequently raised to 1.0 meter after adding manure with different doses of lime and manure. In the T2 pond, 128 kg of cattle dung was applied to an 8×8×1 m pond, with 38 kg (30% of the total) used as a basal dose 15 days before stocking and the remaining 90 kg applied in equal installments of 30 kg per month. In the T3 pond, 96 kg of cattle dung was used in the same size pond, with 28 kg (30%) as a basal dose before stocking and the remaining 68 kg applied in equal installments of 22 kg per month. In the T4 pond, 64 kg of poultry droppings were applied, with 19 kg (30%) as a basal dose before stocking and the remaining 45 kg applied in equal installments of 15 kg per month. In the T5 pond, 48 kg of poultry droppings were used, with 14 kg (30%) as a basal dose before stocking and the remaining 34 kg applied in equal installments of 11 kg per month.

2.2.4 Sampling schedule

Physico-chemical parameters of tank water was analyzed on weekly interval basis as per the procedure of APHA (2005). In addition, fish growth parameters like length and weight, and percentage of survival was measured on monthly basis. Soil parameters were analyzed pH, Electrical conductivity (EC), Exchangeable Sodium Percentage (ESP), Organic carbon percentage (OC%), nitrogen, phosphorous and potassium. Nitrogen, P, K, OC and ESP. A= Final weight of the dry residue + dish in gm B= Initial weight of the dish in gm V = volume of the water sample taken in Ml.

2.3 Water Quality Parameter

2.3.1 Dissolved oxygen

The dissolved oxygen of all the treatments were measured at the collection site by modified Winkler's method. The water samples were collected (without bubbling) in 250 mL glass stoppered bottles, 2 mL of manganese sulfate and 2 mL of alkaline Iodine azide solution were poured at the bottom of the bottle to fix dissolved oxygen. It was thoroughly mixed, and the flocculent precipitate allowed settling. Then 2 mL of concentrated sulphuric acid (H_2SO_4) added through the side of the bottle and shaken well to dissolve the precipitate. Subsequently, 50 mL of the above solution in a conical flask was taken and titrated with 0.025 N sodium thiosulphate solution until pale straw colour appeared. Two or three drops of starch indicator solution (1%) added to the latter, and the sample was further titrated to the colourless endpoint. The dissolved oxygen was determined from the following equation:

Calculations:

$$\text{Dissolved oxygen (mg L}^{-1}\text{)} = \frac{8 \times 100 \times \text{N} \ (0.025) \times \text{v1}}{V}$$

Where, V is volume of the sample taken (mL), V1 is volume of the titrant (sodium thiosulphate solution used in mL) and N is normality of the titrant.

2.3.2 Alkalinity

Total alkalinity was measured by the methyl orange indicator method. The water samples were collected in plastic bottles and analyzed as possible to avoid de-naturation. Sample of 50 mL in an Erlenmeyer's flask was taken, 0.1 ml methyl orange indicator was mixed and titrated against 0.02 N standard sulphuric acids to the orange endpoint. Total alkalinity was estimated by using the following equation:

$Total\ alkalinity\ (mgL{-}1)$ = Volume of acid used (N/50) ×100 / Volume of sample (mL)

Where, V is volume of the sample taken (ml), V1 is volume of the titrant (sodium thiosulphate solution used in ml) and N is normality of the titrant.

2.3.3 Free carbon dioxide (CO_2)

Two drops of phenolphthalein indicator was added to 50 ml of a water sample taken in a flask. Then the sample solution was titrated against standard NaOH (0.02 N) until a slight pink colour appeared:

$$Free\ CO2\ (mgL - 1) = V1\ /\ V2 * 100$$

Where, V1 is volume of titrant used and V2 is volume of sample taken.

2.3.4 Total hardness procedure

The burette was filled with standard EDTA solution to the zero level. 50mL sample water was taken in flask and 1mL Ammonia buffer was added then 5 to 6 drops of Erichrome black – T indicator was added. The solution turned into wine red colour. The initial readings were noted. The content was titrated against EDTA solution. At the end point colour changed from wine red to blue colour. The final reading was recorded.

Calculation:

$$Total\ hardness\ of\ water\ mg/L\ (CaCO3) = mL\ of\ EDTA\ used\ /\ mL\ of\ sample$$

3. RESULTS AND DISCUSSION

3.1 Physico-Chemical Properties of Water

The optimum water quality parameters are required all living species to function optimally have permissible limits.

3.1.1 pH

The pH values observed during the experiment have been presented in Table 2. Initially in all the treatments the water pH was above 8.0 and in all the treatments including control the pH values were not varying significantly. On weekly basis it was observed that pH was decreasing from its initial values. On every month cattle dung and poultry dropping were added in the trial ponds. In 14^{th} week the pH values in T2 were varying between 7.45±0.07 in T5 to 7.19±0.10.

According to Santhosh and Singh (2007), the appropriate pH range for carp culture special Rohu is between 6.7 and 9.5, and the ideal pH level is between 7.5 and 8.5.[3] reported pH between 7 to 8.5 is ideal for biological productivity, fishes can become stressed in water with a pH ranging from 4.0 to 6.5 and 9.0 to 11.0 and death is almost certain at a pH of less than 4.0 or greater than 11.0. In this experiment the pH was formed to vary between 7.19±0.10 to 8.44±.32. In the above experiment though variation in pH was observed but the variation is within the limit hence doesn't cause any adverse effect on growth parameter. Ideally, an aquaculture pond should have a pH between 6.5 and 9 [4].

3.1.2 Temperature

Water temperature during the experimental periods have been presented in Table 3. The highest temperature was recorded in T1 (31.73 ±0.317) in first week and lowest was recorded in T3 pond (24.56±0.548) in 14^{th} week of experiment. Temperature has a direct impact on critical factors like as growth, oxygen demand, food requirements, and food conversion efficiency. According to Jhingran [5], carp survive well in water at temperatures ranging from 18.3 to 37^0C, and for culture, a temperature range of 25 to 35 ^{0}C has been shown to be optimal. According to Bhatnagar et al. [6] reported 28-32^0C as a suitable temperature range for tropical big carp. According to Santhosh and Singh (2007), the ideal water temperature for carp cultivation is between 24 and 30^0C. Temperatures below 20^0C are sub-fatal for fish development and survival, while temperatures above 35^0C are lethal for most fish species. In this experiment the temperature were within the optimum limits. Temperature were varying significantly among all the treatment. This shows that the experiment was conducted under suitable conditions.

3.1.3 Dissolved oxygen

The dissolved oxygen values observed during the experimental period have been presented in the Table 4. The dissolved oxygen values were varying between 7.66±0.33ppm to 4.16±0.166. The maximum values were observed in T2 in 11^{th} week of experiment (7.66±0.333) ppm and minimum value (4.16±0.166) ppm were recorded in T1 pond during 1^{st} week. During 1^{st} week of experimental trail the dissolved oxygen were 4.16± 0.166 ppm. In T1 where as in all other treatment it was more than 5 ppm in first week. The lower dissolved oxygen in control (T1) may be attributed to the availability of less nutrients in control compared to cattle dung and poultry added trial ponds. The organic manure and fertilizer added in T2, T3, T4, and T5 resulted in growth of phytoplankton resulting into higher dissolved oxygen concentration in trial ponds compared to control.

Table 1. Meteorological data collected during the experimental period 2023

Date	Temperature °C		Relative humidity		Rainfall (mm)
	Min	Max	Morning	Evening	
7/8/2023	25.0	32.0	97.0	71.0	75.8
14/8/2023	24.5	32.0	94.0	74.0	3.4
21/8/2023	27.0	34.0	92.0	70.0	0.0
28/8/2023	25.5	34.0	87.0	70.0	0.0
4/9/2023	24.5	35.0	90.0	56.0	0.0
9/9/2023	24.0	30.5	25.5	24.9	30.8
18/9/2023	25.0	35.5	90.0	62.0	0.0
25/9/2023	24.0	29.5	98.0	68.0	0.0
2/10/2023	22.0	32.0	93.0	65.0	0.0
9/10/2023	23.5	34.0	88.0	57.0	0.0
16/10/2023	21.0	33.5	89.0	50.0	0.0
23/10/2023	15.5	30.5	88.0	54.0	0.0
30/10/2023	15.0	31.0	87.0	54.0	0.0
7/11/2023	14.5	28.5	83.0	56.0	0.0

Source: Department of Agricultural Agro-Meteorology, ANDUAT Kumarganj, Ayodhya (UP)

Table 2. Variation in pH values of water in different treatments during experimental period (Mean ±S.E.)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	8.44^{a}±. 326	8.36^{a}±. 383	8.38^{ab}± .293	8.23^{a}±. 304	7.92^{a}±. 406	8.42^{a}±. 343	7.99^{a}±. 104	7.90^{a}± 0.16	7.52^{a}± 0.053	7.70^{b}± 0.050	7.69^{a}± 0.046	7.66^{a}± 0.288	7.61^{a}± 0.353	7.44^{a}± 0.639
T2	8.38^{a}±. 290	8.26^{a}±. 185	8.26^{ab}± .186	7.81^{a}±. 295	7.91^{a}±. 161	7.96^{a}±. 080	7.36^{a}±. 145	7.70^{a}± 0.08	7.34^{a}± 0.277	7.26^{a}± 0.127	7.99^{a}± 0.110	7.78^{a}±. 269	7.62^{a}± 0.397	7.19^{a}± 0.104
T3	8.32^{a}±. 144	7.60^{a}±. 208	7.93^{ab}± .317	7.96^{a}±. 328	8.15^{a}±. 268	7.84^{a}±. 400	7.40^{a}±. 579	8.10^{a}± 0.26	8.09^{b}± 0.164	8.02^{b}± 0.110	7.76a± 0.388	8.08^{a}± 0.280	8.05^{a}± 0.147	7.7^{a}± 0.115
T4	8.06^{a}±. 166	8.03^{a}±. 033	7.70^{a}±. 100	7.35^{a}±. 273	8.17^{a}±. 280	7.90^{a}±. 000	7.73^{a}±. 060	7.38^{a}± 0.30	7.71^{ab}± 0.056	7.76^{b}± 0.236	7.95^{a}± 0.163	7.91^{a}± 0.143	8.04^{a}± 0.406	7.6^{a}± 0.144
T5	8.00^{a}±. 293	7.60^{a}±. 305	8.50^{b}±. 100	7.78^{a}±. 223	7.93^{a}±. 070	7.74^{a}±. 343	7.79^{a}±. 206	7.41^{a}± 0.20	7.8^{ab}± 0.083	7.67^{b}± 0.113	7.86^{a}± 0.113	7.70^{a}± 0.253	8.08^{a}± 0.317	7.75^{a}± 0.070

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2=Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

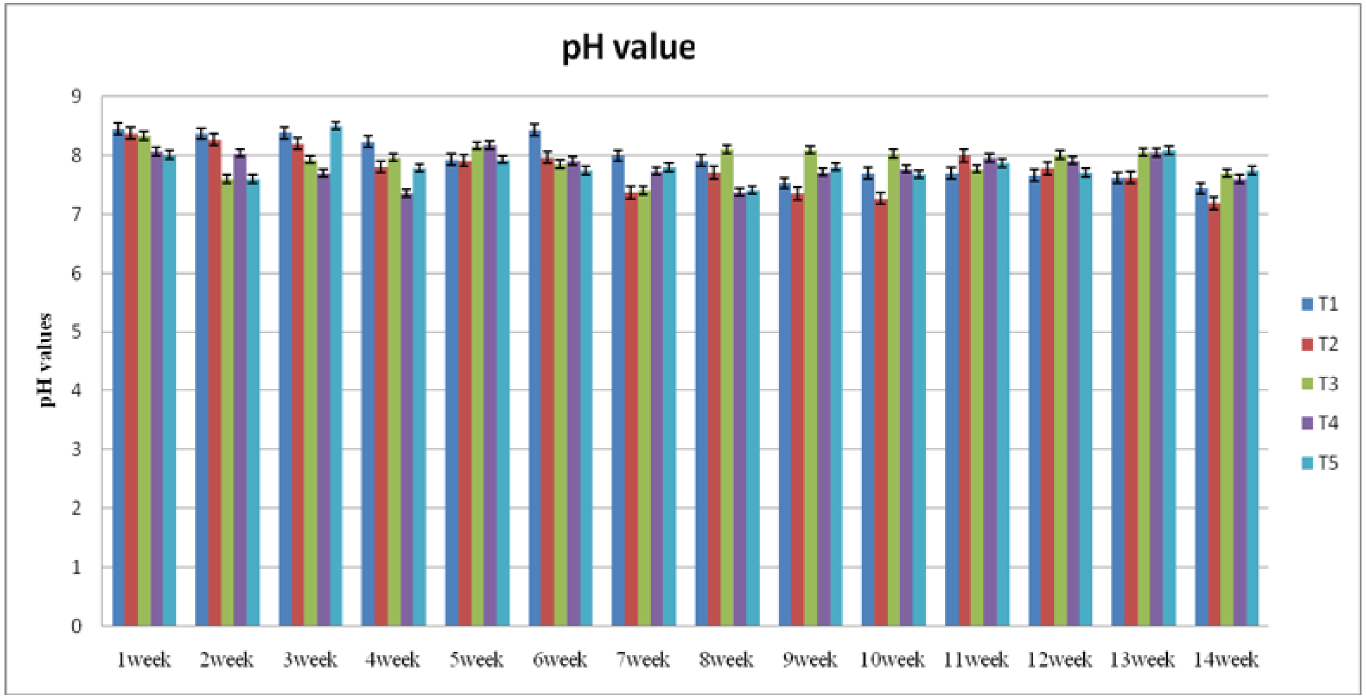

Fig. 1. Variation of pH from T1 to T5 during the experimental period

T1= Traditional Feed +soil base, T2 =Traditional feed+ cattle dung @20T /ha, T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

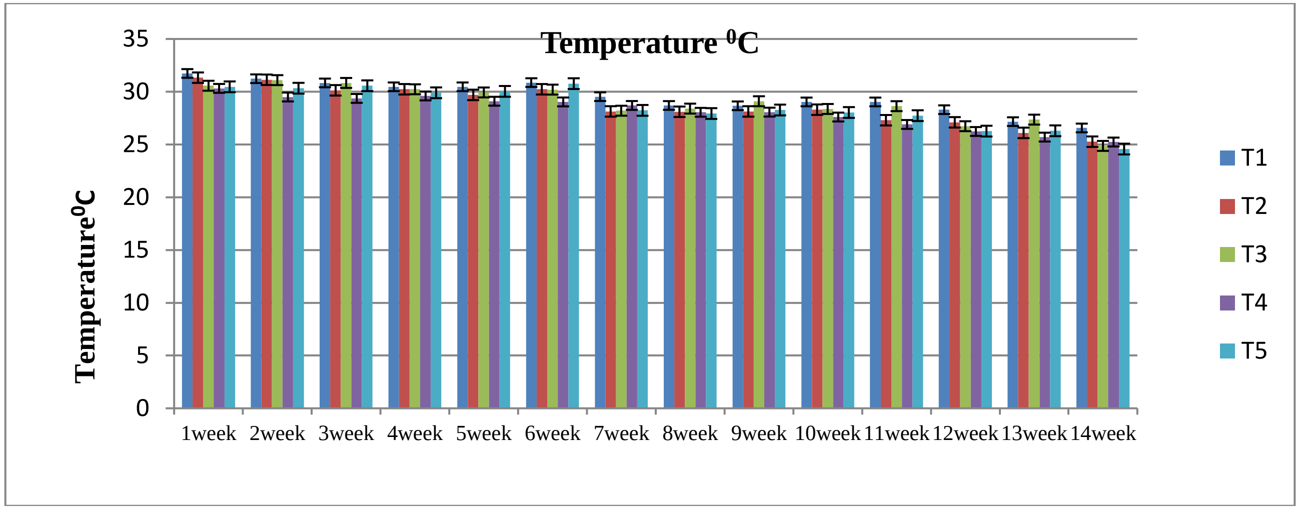

Fig. 2. Variation of temperature from T1 to T5 during the experimental period

T1= Traditional Feed +soil base, T2 =Traditional feed+ cattle dung @20T /ha, T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha, T5 =Traditional feed+ poultry dropping @ 7.5 T /ha

Table 3. Variation in temperature values in different treatments during culture period (Mean ±S.E.)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	31.7^{b}± 0.317	31.23^{b}± 0.440	30.8^{b}± 0.622	30.46^{b}± 0.033	30.46^{a}± 0.033	30.86^{a}± 0.371	29.53^{a}± 0.666	28.70^{a}± 1.100	28.66^{a}± 0.202	29.0^{a}± 0.39	29.03^{a}± 1.183	28.30^{b}± 0.100	27.16^{a}± 0.328	26.56^{a}± 0.120
T2	31.33^{b}± 0.033	31.13^{b}± 0.133	30.13^{ab}± 0.133	30.23^{b}± 0.066	29.70^{a}± 0.200	30.23^{a}± 0.688	28.13^{a}± 0.133	28.10^{a}± 0.288	28.133^{a}± 0.635	28.30^{a}± 0.953	27.30^{a}± 1.053	27.10^{ab}± 0.458	26.10^{a}± 0.602	25.26^{a}± 0.717
T3	30.56^{a}± 0.133	31.10^{b}± 0.400	30.83^{b}± 0.166	30.23^{b}± 0.066	29.93^{a}± 0.635	30.20^{a}± 0.953	28.20^{a}± 0.585	28.40^{a}± 0.288	29.10^{a}± 0.305	28.36^{a}± 0.721	28.63^{a}± 2.793	26.73^{ab}± 0.333	17.35^{a}± 1.393	24.86^{a}± 0.821
T4	30.31^{a}± 0.092	29.50^{a}± 0.152	29.39^{a}± 0.317	29.60^{a}± 0.305	29.10^{a}± 0.305	29.033^{a}± 0.484	28.70^{a}± 0.550	28.05^{a}± 0.453	28.06^{a}± 0.721	27.60^{a}± 1.053	26.90^{a}± 0.800	26.23^{a}± 0.688	25.70^{a}± 1.153	25.23^{a}± 0.633
T5	30.46^{a}± 0.266	30.33^{a}± 0.233	30.56^{b}± 0.33	29.90^{a}± 0.200	30.03^{a}± 0.635	30.766^{a}± 0.968	28.23^{a}± 0.296	27.93^{a}± 0.721	28.26^{a}± 0.622	28.03^{a}± 0.68	27.73^{a}± 1.092	26.26^{a}± 0.785	26.30^{a}± 0.650	24.56^{a}± 0.548

Different subscript in a column denotes significantly differing values at P<0.05 % significance level; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 =Traditional feed+ poultry dropping @ 7.5 T/ha

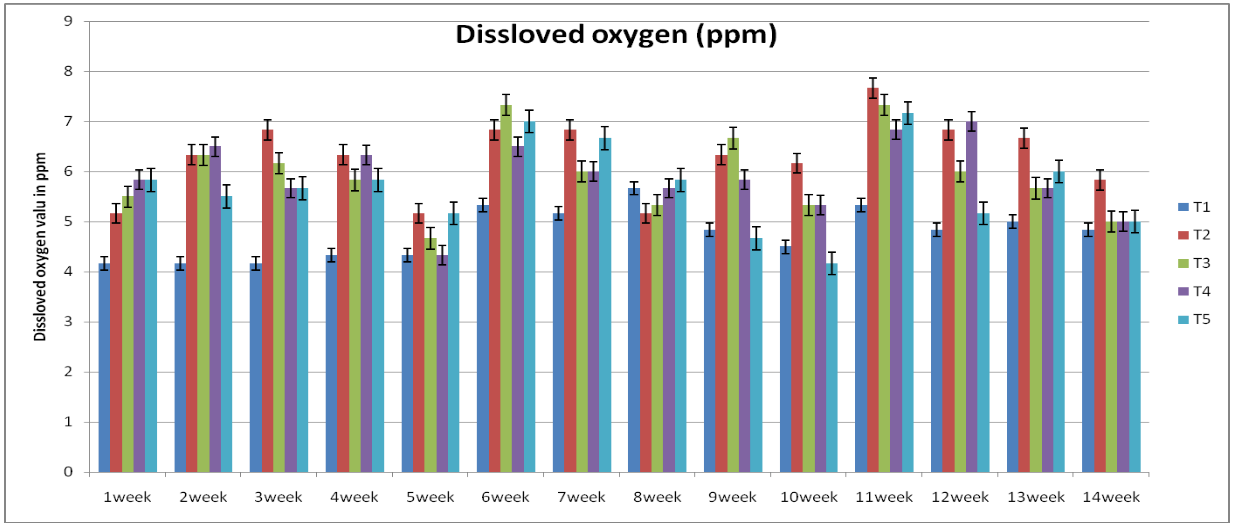

Fig. 3. Variation of dissolved oxygen from T1 to T5 during the experimental period

T1= Traditional Feed +soil base, T2 =Traditional feed+ cattle dung @20T /ha,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 =Traditional feed+ poultry dropping @ 7.5 T /ha

Table 4. Dissolved Oxygen (mg/litre) values in different treatments (Mean ±SE)

Treatment \ Week	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	4.16^{a}± 0.166	4.16^{a}± 0.166	4.16^{a}± 0166	4.33^{a}± 0.166	4.33^{a}± 0.333	5.33^{a}± 0.166	5.16^{a}± 0.166	5.66^{a}± 0.333	4.83^{a}± 0.166	4.50^{ab}± 0.500	5.33^{a}± 0.166	4.83^{a}± 0.166	5.00^{a}± 0.000	4.83^{a}± 0.166
T2	5.16^{b}± 0.166	6.33^{bc}± 0.166	6.83^{c}± 0.166	6.33^{b}± 0.33	5.16^{a}± 0.166	6.83^{b}± 0.166	6.83^{b}± 0.166	5.16^{a}± 0.166	6.33^{bc}± 0.166	6.16^{c}± 0.166	7.66^{c}± 0.333	6.83^{c}± 0.166	6.66^{c}± 0.166	5.83^{b}± 0.166
T3	5.50^{b}± 0.000	6.33^{bc}± 0.166	6.16^{b}± 0.166	5.83^{b}± 0.333	4.66^{a}± 0.666	7.33^{b}± 0.333	6.00^{ab}± 0.000	5.33^{a}± 0.333	6.66^{c}± 0.333	5.33^{bc}± 0.166	7.33^{bc}± 0.166	6.00^{b}± 0.100	5.66^{b}± 0.166	5.00^{a}± 0.010
T4	5.83^{b}± 0.440	6.50^{c}± 0.288	5.66^{b}± 0.166	6.33^{b}± 0.166	4.33^{a}± 0.333	6.50^{b}± 0.500	6.00^{ab}± 0.500	5.66^{a}± 0.333	5.83^{b}± 0.166	5.33^{b}c± 0.333	6.83^{b}± 0.166	7.00^{c}± 0.500	5.66^{b}± 0.166	5.00^{a}± 0.010
T5	5.83^{b}± 0.166	5.50^{b}± 0.500	5.66^{b}± 0.33	5.83^{b}± 0.333	5.16^{a}± 0.166	7.00^{b}± 0.500	6.66^{b}± 0.333	5.83^{a}± 0.166	4.66^{a}± 0.166	4.16^{a}± 0.166	7.16^{bc}± 0.166	5.16^{a}± 0.166	6.00^{b}± 0.000	5.00^{a}± 0.100

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

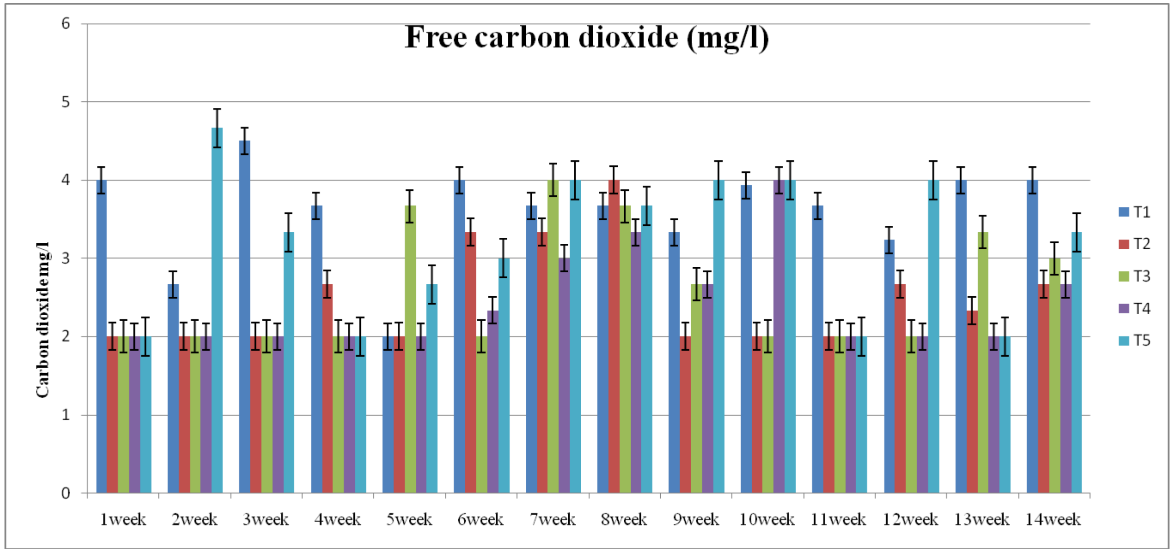

Fig. 4. Variation of carbon dioxide from T1 to T5 during the experimental period

T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

Table 5. Free carbon dioxide values in all treatment (Mean± SE)

Treatment \ Week	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	4.00^{a}± 0.000	2.66^{a}± 0.66	4.50^{b}± 0.500	3.66^{b}± 0.166	2.00^{a}± 0.000	4.00^{c}± 0.000	3.66^{a}± 0.333	3.66^{a}± 0.333	3.33^{ab}± 0.333	3.93^{b}± 0.066	3.66^{b}± 0.116	3.23^{bc}± 0.233	4.00^{c}± 0.000	4.00^{a}± 0.02
T2	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.66^{a}± 0.666	2.00^{a}± 0.000	3.33^{bc}± 0.666	3.33^{a}± 1.333	4.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.66^{ab}± 0.666	2.33^{ab}± 0.333	2.66^{a}± 0.66
T3	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	3.66^{b}± 0.333	2.00^{a}± 0.000	4.00^{a}± 0.000	3.66^{a}± 0.333	2.66^{ab}± 0.666	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{bc}± 0.000	3.00^{b}± 0.04
T4	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.33^{ab}± 0.166	3.00^{a}± 0.500	3.33^{a}± 0.333	2.66^{ab}± 0.666	4.00^{b}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.00^{a}± 0.000	2.66^{a}± 0.66
T5	2.00^{a}± 0.000	4.66^{b}± 1.333	3.33^{b}± 0.666	2.00^{a}± 0.000	2.66^{a}± 0.666	3.00^{abc}± 0.500	4.00^{a}± 0.000	3.66^{a}± 0.166	4.00^{b}± 0.000	4.00^{b}± 0.000	2.00^{a}± 0.000	4.00^{c}± 0.000	2.00^{a}± 0.000	3.33^{a}± 0.6

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

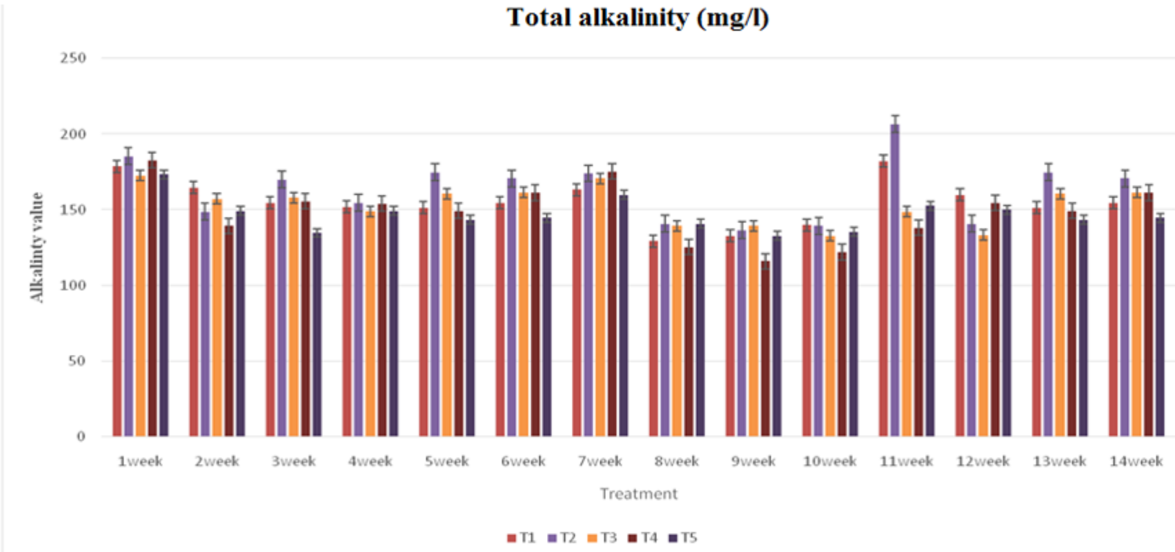

Fig. 5. Variation of total alkalinity from T1 to T5 during the experimental period

T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

Table 6. Total alkalinity values in all treatment (Mean± SE)

Treatment \ Week	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	$178^{a}\pm$ 2.66	$164.6^{a}\pm$ 6.3	$154.6^{a}\pm$ 12.8	$152^{a}\pm$ 6.1	$151^{a}\pm$ 4.66	$154^{a}\pm$ 4.8	$163^{a}\pm$ 5.20	$129^{a}\pm$ 10.34	$132^{ab}\pm$ 9.8	$140^{a}\pm$ 7.2	$182^{ab}\pm$ 13.3	$160^{b}\pm$ 4.0	$151^{a}\pm$ 4.6	$154^{a}\pm$ 4.8
T2	$185^{a}\pm$ 8.7	$148.6^{a}\pm$ 5.6	$170^{a}\pm$ 7.0	$154^{a}\pm$ 10.4	$174^{a}\pm$ 15.5	$170^{a}\pm$ 19.4	$174^{a}\pm$ 4.2	$140^{a}\pm$ 4.6	$136^{ab}\pm$ 2.9	$139^{a}\pm$ 1.7	$176^{b}\pm$ 6.3	$140^{ab}\pm$ 4.0	$174^{a}\pm$ 15.5	$170^{a}\pm$ 19.4
T3	$172^{a}\pm$ 14.8	$157.3^{a}\pm$ 12.7	$158^{a}\pm$ 9.8	$151^{a}\pm$ 6.6	$160^{a}\pm$ 13.3	$161^{a}\pm$ 15.7	$170^{a}\pm$ 1.4	$139^{a}\pm$ 1.76	$139^{b}\pm$ 5.2	$132^{a}\pm$ 4.8	$148^{ab}\pm$ 13.9	$133^{a}\pm$ 6.5	$160^{a}\pm$ 13.3	$161^{a}\pm$ 15.7
T4	$182^{a}\pm$ 3.7	$139.3^{a}\pm$ 4.0	$15.65^{a}\pm$ 4.6	$154^{a}\pm$ 4.1	$149^{a}\pm$ 8.7	$161^{a}\pm$ 7.0	$175^{a}\pm$ 3.52	$125^{a}\pm$ 5.81	$116^{a}\pm$ 2.3	$122^{a}\pm$ 1.1	$138^{a}\pm$ 4.1	$154^{ab}\pm$ 3.5	$149^{a}\pm$ 8.7	$161^{a}\pm$ 7.0
T5	$173^{a}\pm$ 14.7	$149.3^{a}\pm$ 8.7	$134.6^{a}\pm$ 2.9	$149^{a}\pm$ 8.11	$143^{a}\pm$ 6.5	$144^{a}\pm$ 6.3	$160^{a}\pm$ 4.04	$140^{a}\pm$ 3.52	$132^{ab}\pm$ 7.6	$135^{a}\pm$ 8.9	$152^{ab}\pm$ 12.2	$150^{ab}\pm$ 11.7	$143^{a}\pm$ 6.5	$144^{a}\pm$ 6.3

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2=Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

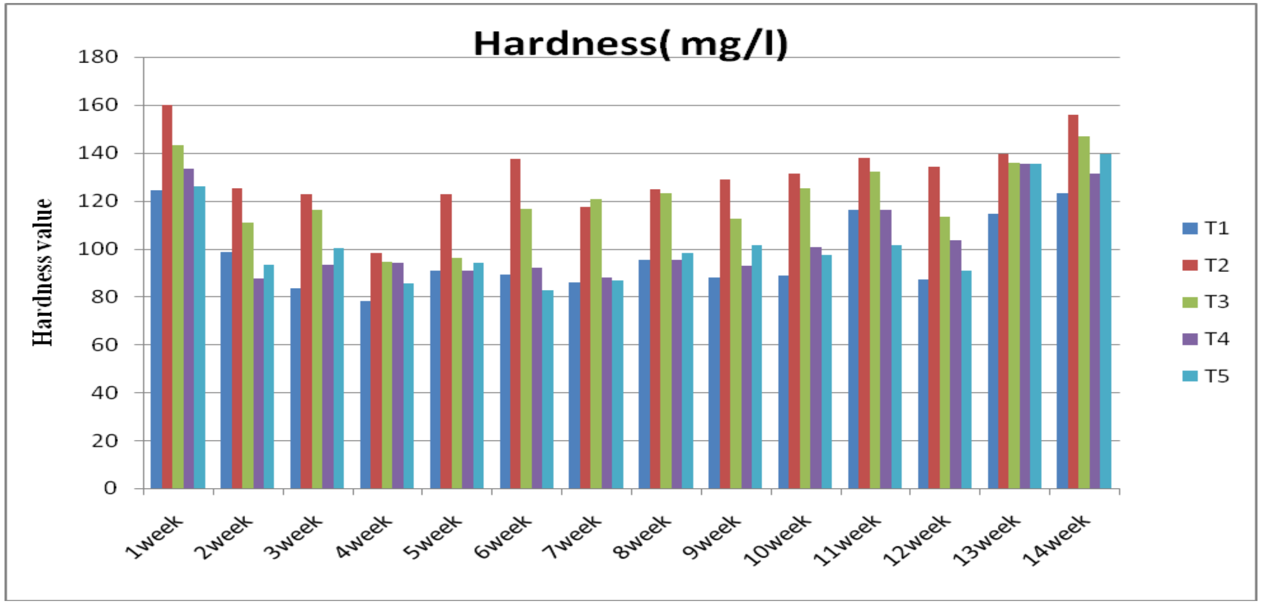

Fig. 6. Variation of hardness from T1 to T5 during the experimental period

Table 7. Hardness values in all treatment (Mean ± SE)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	124.3^{a}± 11.2	98.6^{a}± 1.3	83.3^{a}± 2.9	78.0^{a}± 4.6	90.6^{a}± 8.3	89.3^{a}± 12.2	86.0^{a}± 7.0	95.3^{a}± 4.3	88.0^{a}± 9.1	88.6^{a}± 1.3	116.0^{ab}± 10.5	87.3^{a}± 5.9	114.6^{a}± 18.7	123.3^{a}± 26.6
T2	160.0^{b}± 2.3	125.3^{a}± 11.3	122.6^{a}± 19.2	98.0^{a}± 24.6	122.6^{a}± 12.7	137.3^{b}± 7.4	117.3^{a}± 19.4	124.6^{b}± 15.0	128.6^{b}± 15.6	131.3^{b}± 0.6	138.0^{b}± 4.1	134.0^{c}± 7.5	139.3^{a}± 1.7	156.0^{a}± 6.4
T3	143.3^{ab}± 95.6	110.6^{a}± 15.7	116.0^{a}± 13.3	94.6^{a}± 20.9	96.0^{a}± 14.18	116.6^{ab}± 13.2	120.6^{a}± 10.7	123.3^{b}± 4.0	112.6^{ab}± 13.6	125.3^{b}± 7.5	132.0^{ab}± 3.0	113.3^{bc}± 9.6	136.6^{a}± 10.7	147.3^{a}± 4.0
T4	133.3^{a}± 53.3	87.6^{a}± 20.4	93.3^{a}± 16.8	94.0^{a}± 12.4	90.6^{a}± 11.7	92.0^{a}± 11.5	88.0^{a}± 6.4	95.3^{a}± 5.9	92.6^{a}± 5.2	100.6^{a}± 1.7	116.0^{ab}± 8.0	103.3^{ab}± 2.9	135.3^{a}± 21.4	131.3^{a}± 15.9
T5	126.0^{a}± 9.4	93.3^{a}± 11.5	100.3^{a}± 7.3	85.3^{a}± 16.2	94.0^{a}± 13.0	82.6^{a}± 6.3	86.6^{a}± 2.9	98.0^{a}± 3.0	101.3^{ab}± 2.4	97.3^{a}± 5.4	101.3^{a}± 14.8	90.6^{ab}± 7.4	135.3^{a}± 15.9	139.3^{a}± 14.2

Different subscript in a row denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

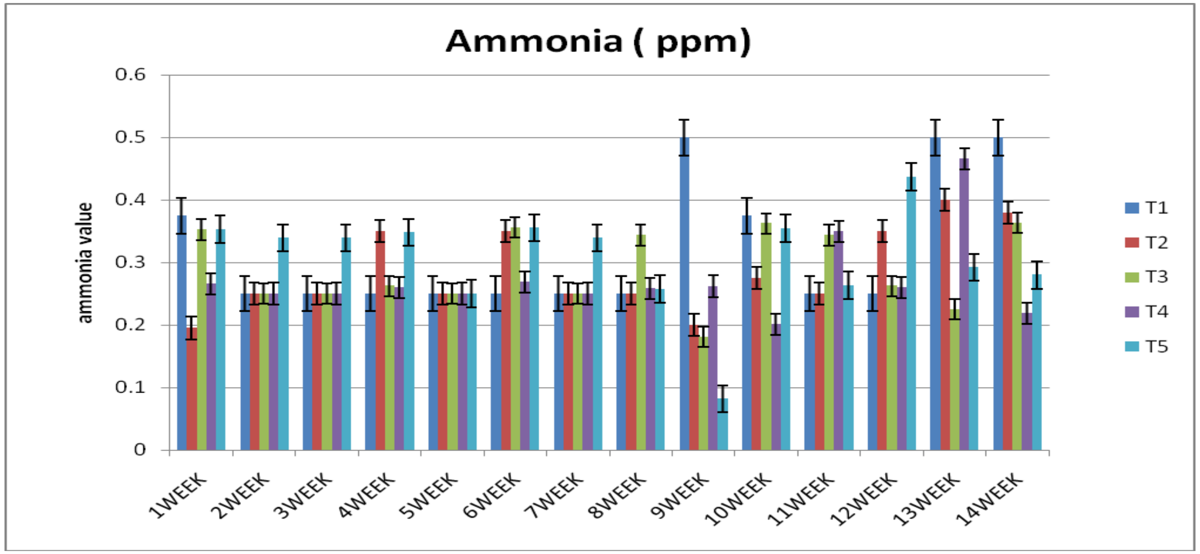

Fig. 7. Variation of ammonia from T1 to T5 during the experimental period

Table 8. Ammonia values in all treatment (Mean± SE)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	$0.25^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.01	$0.5^{a}\pm$ 0.0	$0.35^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.0	$0.25^{c}\pm$ 0.0	$0.25^{b}\pm$ 0.0
T2	$0.19^{a}\pm$ 0.7	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.0	$0.35^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.0	$0.35^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.01	$0.2^{a}\pm$ 0.1	$0.27^{a}\pm$ 0.02	$0.25^{a}\pm$ 0.0	$0.35^{ab}\pm$ 0.07	$0.40^{abc}\pm$ 0.07	$0.38^{ab}\pm$ 0.13
T3	$0.25^{a}\pm$ 0.7	$0.25^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.26^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.35^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.0	$0.34^{a}\pm$ 0.07	$0.18^{a}\pm$ 0.09	$0.36^{a}\pm$ 0.07	$0.34^{a}\pm$ 0.07	$0.26^{a}\pm$ 0.01	$0.22^{a}\pm$ 0.09	$0.36^{ab}\pm$ 0.07
T4	$0.26^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.0	$0.26^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.26^{a}\pm$ 0.01	$0.25^{a}\pm$ 0.0	$0.25^{a}\pm$ 0.01	$0.26^{a}\pm$ 0.01	$0.20^{a}\pm$ 0.07	$0.34^{a}\pm$ 0.07	$0.26^{a}\pm$ 0.01	$0.46^{bc}\pm$ 0.03	$0.21^{a}\pm$ 0.08
T5	$0.25^{a}\pm$ 0.07	$0.33^{a}\pm$ 0.08	$0.33^{a}\pm$ 0.08	$0.35^{a}\pm$ 0.07	$0.25^{a}\pm$ 0.0	$0.35^{a}\pm$ 0.07	$0.33^{a}\pm$ 0.08	$0.25^{a}\pm$ 0.0	$0.08^{a}\pm$ 0.08	$035^{a}\pm$ 0.07	$0.26^{a}\pm$ 0.01	$0.43^{b}\pm$ 0.06	$0.29^{ab}\pm$ 0.04	$0.28^{ab}\pm$ 0.03

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

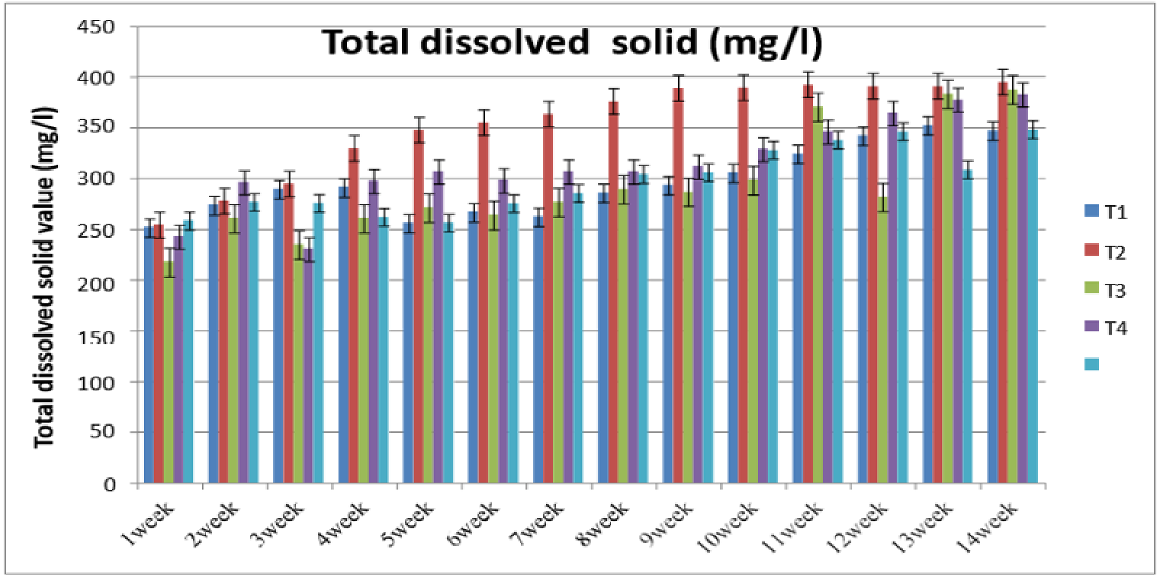

Fig. 8. Variation of total dissolved solid from T1 to T5 during the experimental period

T1= Traditional Feed +soil base,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

Table 9. Total values in all treatment (Mean ±SE)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	225^{a}± 25.6	284^{a}± 4.6	289^{b}± 3.33	237^{a}± 45.6	256^{a}± 1.0	266^{a}± 3.3	262^{c}± 2.3	241^{a}± 1.6	256^{a}± 3.3	241^{b}± 1.6	231^{c}± 1.6	241^{d}± 1.6	212^{c}± 6.0	200^{a}± 6.6
T2	252^{a}± 004	342^{b}± 10.6	318^{b}± 31.3	324^{a}± 38.1	290^{c}± 3.3	300^{b}± 4.0	231^{b}± 2.6	291^{b}± 3.3	306^{c}± 6.6	305^{b}± 2.6	312^{b}± 0.6	311^{c}± 1.6	323^{ab}± 11.3	323^{a}± 5.7
T3	284^{a}± 30.3	304^{ab}± 04	241^{a}± 11.6	260^{a}± 1.15	271^{c}± 2.3	264^{a}± 4.0	276^{d}± 1.6	289^{b}± 5.6	286^{b}± 1.6	288^{a}± 2.0	288^{a}± 0.6	281^{a}± 1.6	276^{a}± 8.0	303^{a}± 1.2
T4	242^{a}± 1.33	296^{a}± 12	230^{a}± 3.33	297^{a}± 19.6	306^{d}± 2.6	298^{b}± 12.0	206^{a}± 2.6	306^{c}± 3.3	311^{c}± 3.6	293^{a}± 3.3	309^{b}± 3.6	300^{b}± 0.6	294^{ab}± 4.6	302^{a}± 5.4
T5	241^{a}± 7.3	322^{ab}± 22	300^{a}± 2	312^{a}± 92.3	314^{d}± 2.0	307^{c}± 1.3	300^{a}± 0.6	296^{bc}± 6.6	303^{c}± 3.0	306^{b}± 2.0	313^{b}± 1.6	305^{bc}± 5.0	340^{bc}± 33.1	304^{a}± 7.6

Different script in a row denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

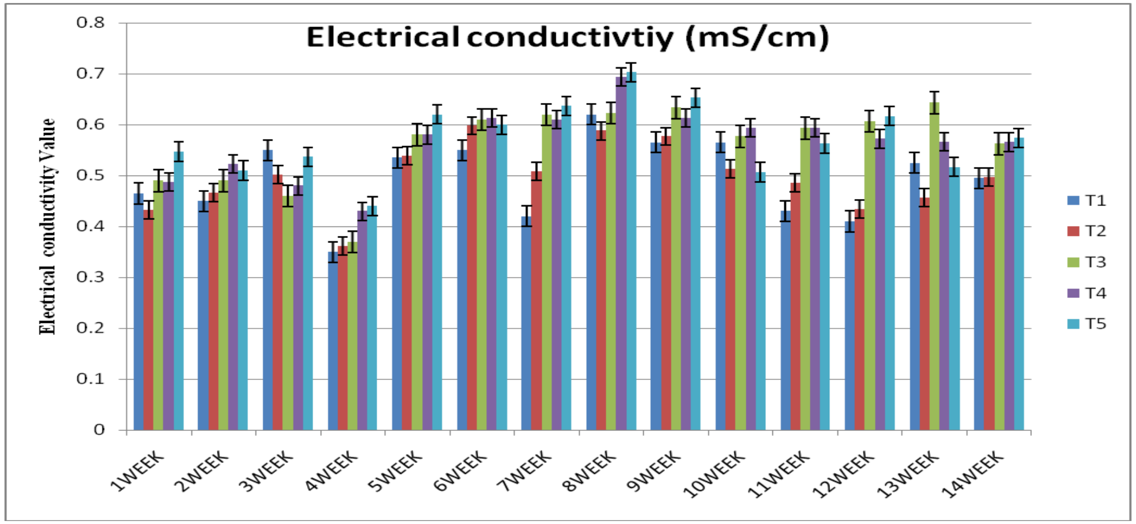

Fig. 9. Variation of electrical conductivity from T1 to T5 during the experimental period

T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

Table 10. Electrical conductivity values in all treatment (Mean± SE)

Week / Treatment	1week	2week	3week	4week	5week	6week	7week	8week	9week	10week	11week	12week	13week	14week
T1	0.46^{a}± 0.0	0.45^{a}± 0.1	0.55^{c}± 0.1	0.35^{a}± 0.01	0.53^{a}± 0.02	0.55^{a}± 0.1	0.42^{a}± 0.01	0.62^{ab}± 0.04	0.56^{a}± 0.00	0.56^{a}± 0.00	0.43^{a}± 0.01	0.41^{a}± 0.00	0.52^{a}± 0.11	0.49^{a}± 0.10
T2	0.433^{a}± 0.01	0.46^{ab}± 0.02	0.50^{abc}± 0.02	0.36^{a}± 0.1	0.53^{a}± 0.05	0.59^{ab}± 0.03	0.50^{ab}± 0.02	0.58^{a}± 0.01	0.57^{ab}± 0.02	0.51^{a}± 0.09	0.48^{ab}± 0.02	0.43^{a}± 0.01	0.45^{a}± 0.06	0.49^{a}± 0.01
T3	0.49^{ab}± 0.01	0.49^{ab}± 0.02	0.46^{a}± 0.02	0.37^{a}± 0.01	0.58^{a}± 0.04	0.61^{b}± 0.01	0.62^{bc}± 0.05	0.62^{ab}± 0.05	0.63^{ab}± 0.02	0.57^{a}± 0.01	0.59^{b}± 0.04	0.60^{b}± 0.06	0.64^{a}± 0.05	0.56^{b}± 0.02
T4	0.48^{ab}± 0.01	0.52^{b}± 0.02	0.48^{ab}± 0.01	0.43^{a}± 0.02	0.58^{a}± 0.05	0.61^{b}± 0.01	0.61^{bc}± 0.03	0.70^{b}± 0.05	0.61^{ab}± 0.02	0.59^{a}± 0.04	0.59^{b}± 0.03	0.57^{b}± 0.04	0.56^{a}± 0.06	0.56^{b}± 0.01
T5	0.54^{b}± 0.03	0.51^{ab}± 0.01	0.53^{bc}± 0.01	0.44^{a}± 0.05	0.62^{a}± 0.02	0.60^{ab}± 0.00	0.63^{c}± 0.04	0.70^{b}± 0.06	0.65^{b}± 0.02	0.56^{a}± 0.03	0.56^{b}± 0.04	0.61^{b}± 0.04	0.51^{a}± 0.02	0.57^{b}± 0.01

Different subscript in a column denotes significantly differing values at P<0.05 % significance level ; T1= Traditional Feed +soil base ,T2 =Traditional feed+ cattle dung @20T /ha ,T3= Traditional feed+ cattle dung @15T /ha, T4= Traditional feed+ poultry dropping @ 10 T/ha,T5 Traditional feed+ poultry dropping @ 7.5 T /ha

Dissolved Oxygen levels more than 5ppm are required to maintain good fish production. It is evident from the table that dissolved oxygen except control treatment were higher than 5.0ppm. The dissolved oxygen observation also shows that the dissolved oxygen level remains near to 4.0 most of the time in sodic soil ponds when remain unfertilized with manure and nitrogen and phosphorous fertilizers. Fish feeding, decreased growth, and increased fish mortality are caused by oxygen low dissolved in water, either directly or indirectly [7]. Dissolved oxygen influences the growth, survival, distribution, behavior, and physiology of fish, shrimp, and other aquatic organisms [8]. According to Banerjea (1967) Dissolved oxygen between 3.0-5.0 ppm in ponds is unproductive and for average or good production it should be above 5.0 ppm According to Bhatnagar and Singh [9] and Bhatnagar et al. [6].

3.1.4 Free carbon dioxide

The free carbon dioxide value have been presented the Table 5. The free carbon dioxide values were varying between 4.50±0.5 mgL^{-1} to 2.0±0.01mgL^{-1} Maximum in T1 (4.50±0.500) mgL^{-1} pond in 3rd week and minimum in (2.0±0.1) mgL^{-1} all treatment T2, T3, T4 and T5 are same. The value of free carbon dioxide was more in T1, though it was well below that harmful limits.

According to Boyd [10], fish avoid free CO_2 levels as low as 5 mg L^{-1}, although most species may survive in waters with up to 60 mg L^{-1} CO_2, as long as DO concentrations are high. Swann (1997) proposed that fish can withstand concentrations of 10mg L^{-1} if dissolved oxygen levels are high and water sustaining healthy fish populations has less than 5 ppm of free CO_2. According to Ekubo and Abowei [3], tropical fish can withstand CO_2 levels of more than 100 mg L^{-1}, although the optimal amount of CO_2 in fishponds is less than 10 mg L^{-1}. Bhatnagar et al. [6] proposed that 5-8 ppm is required for photosynthetic activity, 12-15 ppm is sub lethal to fish, and 50-60 ppm is lethal to fish. The free carbon dioxide in water supporting a healthy fish population should be less than 5 mg/L. [8] In the above experiment free CO_2 were well within the limits hence doesn't cause any negative effect on fish growth and their survival. The less free CO_2 in the trail ponds may be because of low biomass stocking and photosynthesis activity resulting into decreased CO_2 concentration.

3.1.5 Total alkalinity

The total alkalinity recorded during experiment have been presented in the Table 6. Alkalinity refers to the water's ability to withstand pH variations and is a measure of the total concentration of bases in pond water, including carbonates and bicarbonates. The total alkalinity were varying between 116±2.3 $mgL^{-1}$to 185±8.7 mgL^{-1} the maximum values were observed in T2 (185±8.7) mgL^{-1} in 1st week and minimum values in T4 pond (116±2.3) mgL^{-1} in 9th week. Similar findings have been reported by Wurts and Durborow [4]. an alkalinity of 75 to 200 mg L^{-1}, is desirable in an aquaculture pond. Moyle (1946) gave the range of total alkalinity as 0.0-20.0 ppm for low production, 20.0 - 40.0 ppm low to medium, 40.0 - 90.0 ppm medium to high production and above 90.0 ppm productive. According to Boyd [10], suggested that water with total alkalinities of 20 to 150 mg L^{-1} contain suitable quantities of carbon dioxide to permit plankton production for fish culture.

In this research experiment the alkalinity were within the optimum limits. Alkalinity was similar and not varying significantly among all the treatment. Hence it doesn't cause any adverse effect on growth performance.

3.1.6 Hardness (mg/l)

The hardness values reported in the trial have been presented in the Table 7. The hardness values were varying between 78.0 ±4.6 mg L-1 to 160 ± 2.3 mg L-1.The minimum values were observed in 78±4.60 mg L-1 in T1 4th week of experiment and maximum values 160 ±2.30 mg L-1were recorded in T2 pond during 1st week. Hardness is a measure of divalent calcium and magnesium ions. According to Santhosh and Singh, [8], finding hardness value for fish culture is optimum with a range of 30-180 mg L-1 According to Bhatnagar et al. [6] hardness value of 75-150 ppm are ideal for fish culture, and >300 ppm are deadly to fish life because they raise pH and prevent nutrient availability. In the above experiment though variation in hardness was observed but the variation were in optimum permissible limits so did not produce any adverse effect on growth performance. There is significant difference among all treatment and cause behind this may be effect of cattle dung and poultry dropping.

3.1.7 Ammonia

The ammonia value noted during experiment have been presented in the Table 8. The values were varying between 0.40±0.07 ppm to 0.19±0.7ppm. The maximum values were observed in 0.40±0.07 ppm T1 treatment on 13th week of experiment and minimum values were recorded in 0.19±0.7 ppm T1 pond during 1st week. Ammonia is a byproduct of protein metabolism produced by fish, as well as the bacterial decomposition of organic substances such as waste food, feces, dead planktons, and sewage. The unionized form of ammonia (NH_3) is extremely harmful, although the ionized form (NH_4^+) is not, thus both forms are referred to as total ammonia. According to Santhosh and Singh, [8] maximum tolerance quantity of ammonia for aquatic species is 0.1 mgL-1. In this experiment ammonia was not varying significantly among all the treatment. The finding of this experiment shows that for fish ammonia is as reported by other, is within the limit researcher we can say that in this work ammonia doesn't cause any adverse effect on growth performance.

3.1.8 Total suspended solid

The total dissolved solid reported in the work is presented in Table 9. The total suspended solid were varying between 323±1.2 mgL^{-1} to 200±6.6 mgL^{-1}.The maximum values were observed in T2 (323 ±1.2) mgL^{-1} in 14th week of experiment minimum value (200±6.6) mgL^{-1} were recorded in T1 during in 14th week of experiment**.**

The concentration of total solid was increasing with the increasing dose of cattle dung and poultry dropping. It is because of dissolved and suspended solid added in the form of cattle dung. Total dissolved solids refer to the solids that are dissolved in water. It is composed of inorganic salts and dissolved minerals. Similar finding have been reported by Garg *et al*. (2010) found that TDS levels ranged from 166.37 to 239 mg/l is optimum for carp culture. Our finding is similar with the finding of other researcher hence it is safe for carp culture and doesn't cause any adverse effect in growth performance.

3.1.9 Electrical conductivity (mS /cm)

The electrical conductivity values reported during research work have been presented in Table 10. The electrical conductivity values were varying between 0.70±0.06 mS/cm to 0.36±0.1mS/cm. The maximum values were observed in in T4 0.70±0.06 mS/cm in 8th week of experiment and minimum values in were recorded T2 in 0.36±0.1mS/cm in 4th week experimental. Conductivity can be used as indicator of primary production (chemical richness) and thus fish production. In this experiment electrical conductivity was varying significantly among the treatment. Sikoki and Veen (2004) reported a conductivity range of 3.8 -10 mS /cm as extremely poor in chemicals, Stone and Thomforde (2004) recommended the desirable range 100-2,000 mS/cm and acceptable range of 30-5,000 mS /cm for pond fish culture.

Ammonia was observed in water to be lowest in T3 0.26±0.02 ppm. The alkalinity of water was observed to be highest in T4 170±0.41. Alkalinity was lowest in T5 (150±3.7) followed by T1 (154±4.0) and T2 (156±5.9) treatment. In this experiments the lowest hardness was recorded in treatment T4 (100±4.7) ppm and highest was observed in treatments T2 (121±4.2). The concentration of total solids was increasing with the increasing dose of cattle dung and poultry dropping. The lowest concentration of total solids was observed in T1 (273±8.1) and was highest in T2 (299±6.1) ppm. Similar result have been reported by Jhingran [6] In the present study the physico-chemical parameters of water in different manure treatments and control pond remain within the favorable limits as required for the carps culture practices [10,11]. In the present study higher concentration of dissolved oxygen in some of the treated ponds were found to be associated with the maximum abundance of phytoplankton which suggest that it was due to the photosynthetic activities of the algae [12-14].

4. CONCLUSION

In conclusion, treatment T4, using poultry droppings @10/ha, proved to be the most effective for enhancing water quality. This approach demonstrates the benefits of organic amendments in promoting sustainable and cost-effective production by improving environmental conditions and nutrient availability in rearing ponds. Poultry droppings were more effective than cattle dung in improving water quality parameters.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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