CHAPTER- 5

ANALYSIS OF RESULTS

5.1 Impact Analysis of Results obtained

Here, both environmental and socioeconomic impacts are considered. Environmental impacts are more desirable to learn as we are growing food crops for human consumption and as such it should have low and acceptable toxicity values. Socio-economic impacts are considered in order to ascertain overall development in the area which is under effluent irrigation for more than two decades. Table 5.1 represents list of impacts considered in this chapter.

Table 5.1 List of Environmental and Socioeconomic Impacts

Environmental Impacts	Socioeconomic impacts
(I) Crop	**Nos. of respondents: 30**
(a) Quantitative aspects	(a) Education Level
(b) Qualitative aspects	(b) Land Holdings
(i) Protein Content	(c) Crop production
(ii) Heavy metals (Pb, Cu, Zn, Mn, Fe)	(d) Cropping Intensity
(II) Soil	(e) Herd milk production
(a) Salinity	(f) Public health
(b) Heavy metals	
(III) Ground water	
(a) Contaminating heavy metals	
(b) Nitrate level and other contaminating substances	
(IV) Public health (Two Workers)	
(a) Lead level in body	
(b) Bilirubin* level in body	
(c) S.G.P.T.** level in body	
(d) Differential Leucocyte Count	
(e) Platelet Count	

* Bilirubin is breakdown product of hemoglobin. It is required to be determined if patient has liver diseases such as cirrhosis, hepatitis and gallstones or a blocked bile duct. Total serum bilirubin is sum of direct (conjugated) bilirubin plus indirect (unconjugated) bilirubin. Jaundice occurs due to high level bilirubin.

** S.G.P.T. (Serum Glutamic Pyruvic Transaminase) refers to an enzyme that is normally present in liver and heart cells and is released into blood when the liver or heart is damaged. Blood SGPT levels are thus elevated with liver damage and causes chronic hepatitis, liver cirrhosis, liver cancer, more so in liver death.

5.2 Quantitative Aspects (Yield) of Wheat

Table 5.2, Table 5.3 and Table 5.4 represent wheat yield obtained during three successive replications. Fig. 5.1 shows wheat yield response to various treatments for each replication.

Table 5.2 Wheat Yield (kg/ha) Analysis (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4978.16	4328.83	4412.08	4795.01	3180.03	4645.17	4844.96
N2	4328.83	5177.95	3929.25	4378.78	3762.75	4012.49	3846
N3	4462.02	4844.96	4478.68	4611.87	3612.91	4428.73	4145.69

Table 5.3 Wheat Yield (kg/ha) Analysis (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	5316.3	4638.97	4420.12	3845.36	5705.64	4312.57	4153.65
N2	5465.26	4215.36	4582.42	4206.97	5124.78	4250.92	4563.71
N3	5265.34	4215.21	4322.51	4003.68	5124.28	4435.28	4392.03

Table 5.4 Wheat Yield (kg/ha) Analysis (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	5326.52	4675.62	4431.18	4298.29	5865.24	4512.39	4200.16
N2	5625.98	4352.21	4756.34	4322.58	5378.96	5143.27	4651.54
N3	5305.28	4452.01	4410.21	4158.75	5268.21	4487.13	4431.37

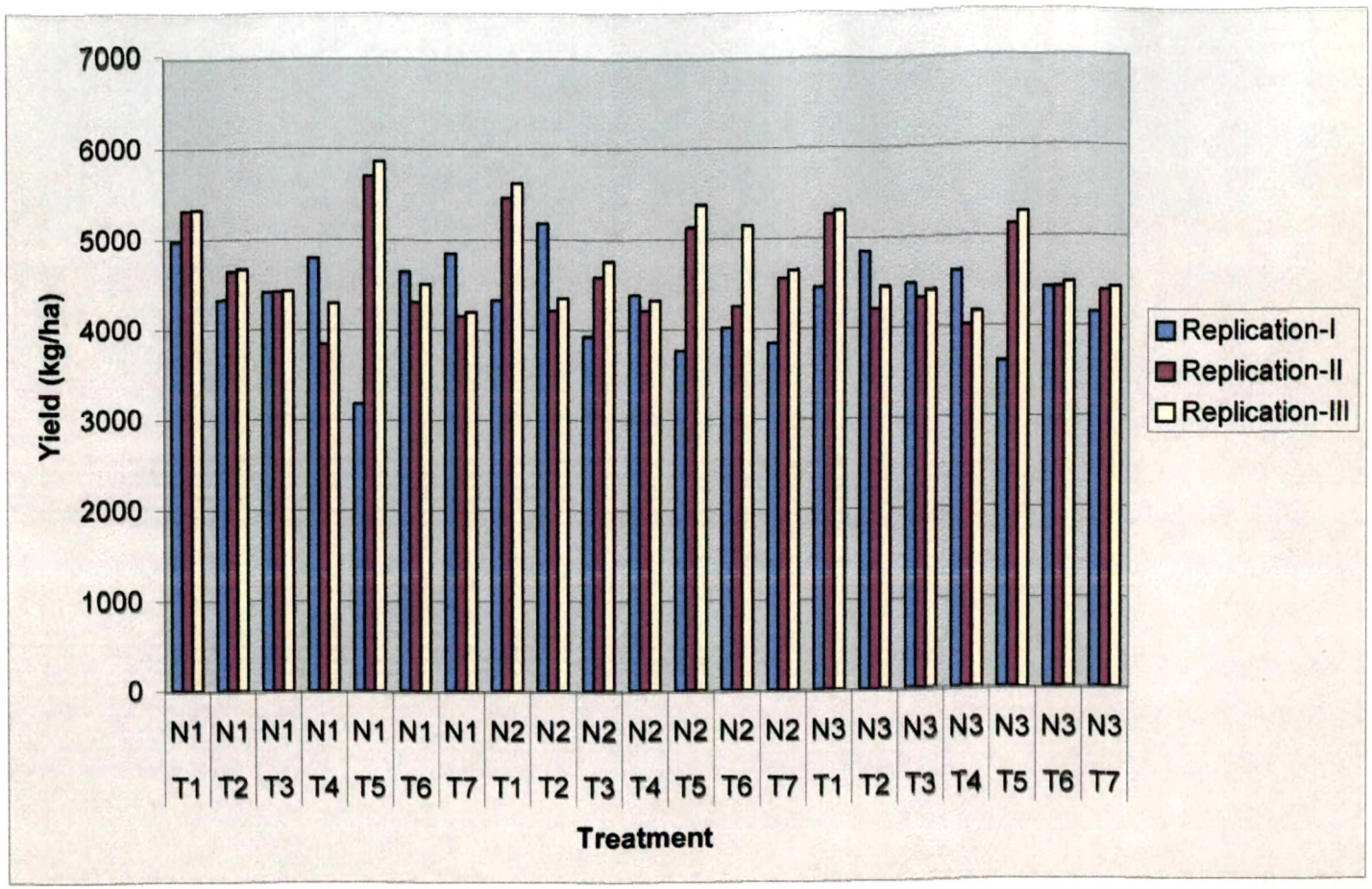
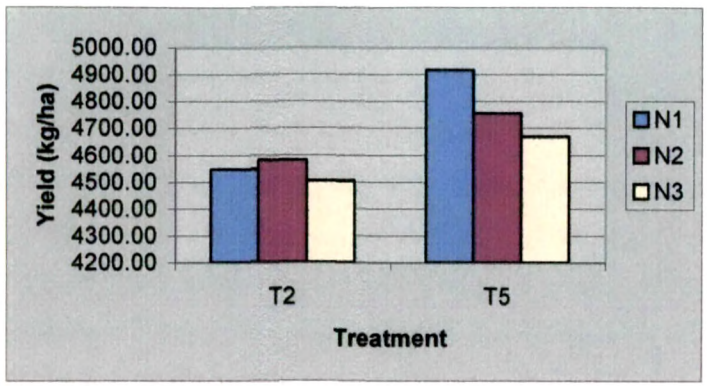


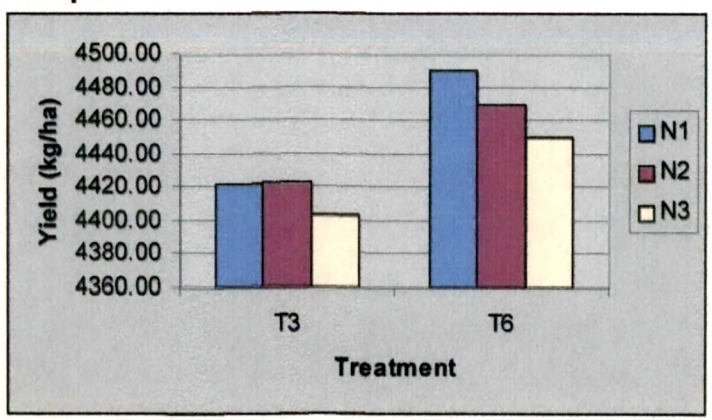
Fig. 5.1 Wheat Yield Response to Various Treatments

Fig. 5.2 shows comparison of wheat yield levels among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

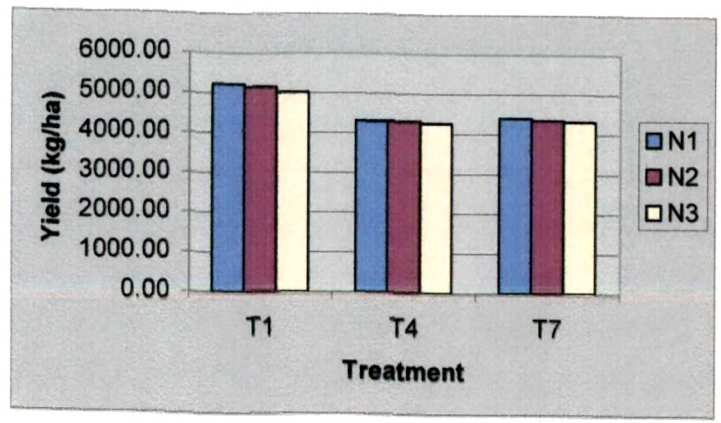


Fig. 5.2 Comparison of Wheat Yield Levels among Group-A, B and C

Table 5.5 and Table 5.6 represent two factor ANOVA and ANOVA Table for wheat yield respectively. Post hoc analysis for factor 2 (irrigation treatments) is shown in Table 5.7. Table 5.8 shows p-Values for Pairwise t-Tests. Fig. 5.3 and Fig. 5.4 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.5 Two factor ANOVA (Wheat Yield)

Means (kg/ha):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	5206.99	4547.81	4421.13	4312.89	4916.97	4490.04	4399.59	4613.63
	N2	5140.02	4581.84	4422.67	4302.78	4755.50	4468.89	4353.75	4575.06
	N3	5010.88	4504.06	4403.80	4258.10	4668.47	4450.38	4323.03	4516.96
		5119.30	4544.57	4415.87	4291.25	4780.31	4469.77	4358.79	4568.55

Table 5.6 ANOVA Table (Wheat Yield)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	99462.41	2.00	49731.21	0.17	0.85
Factor 2	4524334.85	6.00	754055.81	2.50	0.04
Interaction	81712.71	12.00	6809.39	0.02	1.00
Error	12643969.77	42.00	301046.90		
Total	17349479.75	62.00			

Table 5.7 Post hoc analysis for Factor 2 (Wheat Yield)

Tukey simultaneous comparison t-values (d.f. = 42)

		T4	T7	T3	T6	T2	T5	T1
	(kg/ha)	4291.25	4358.79	4415.87	4469.77	4544.57	4780.31	5119.30
T4	4291.25							
T7	4358.79	0.26						
T3	4415.87	0.48	0.22					
T6	4469.77	0.69	0.43	0.21				
T2	4544.57	0.98	0.72	0.50	0.29			
T5	4780.31	1.89	1.63	1.41	1.20	0.91		
T1	5119.30	3.20	2.94	2.72	2.51	2.22	1.31	

critical values for experimentwise error rate:

0.05	3.10
0.01	3.72

Table 5.8 p-Values for Pairwise t-Tests (Wheat Yield)

		T4	T7	T3	T6	T2	T5	T1
	(kg/ha)	4291.25	4358.79	4415.87	4469.77	4544.57	4780.31	5119.30
T4	4291.25							
T7	4358.79	0.80						
T3	4415.87	0.63	0.83					
T6	4469.77	0.49	0.67	0.84				
T2	4544.57	0.33	0.48	0.62	0.77			
T5	4780.31	0.07	0.11	0.17	0.24	0.37		
T1	5119.30	0.00	0.01	0.01	0.02	0.03	0.20	

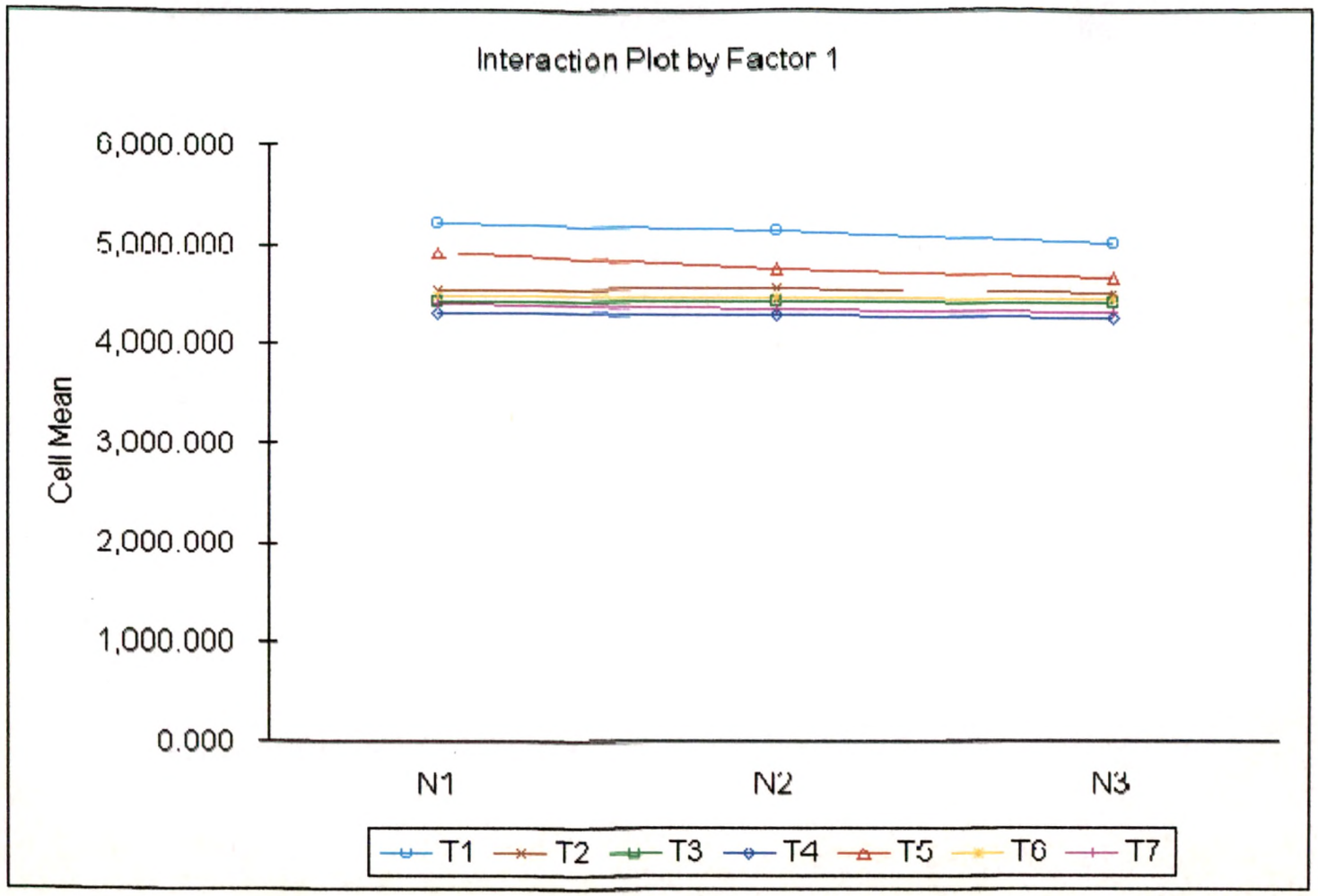


Fig 5.3 Interaction Plot by Factor 1 (Wheat Yield in kg/ha)

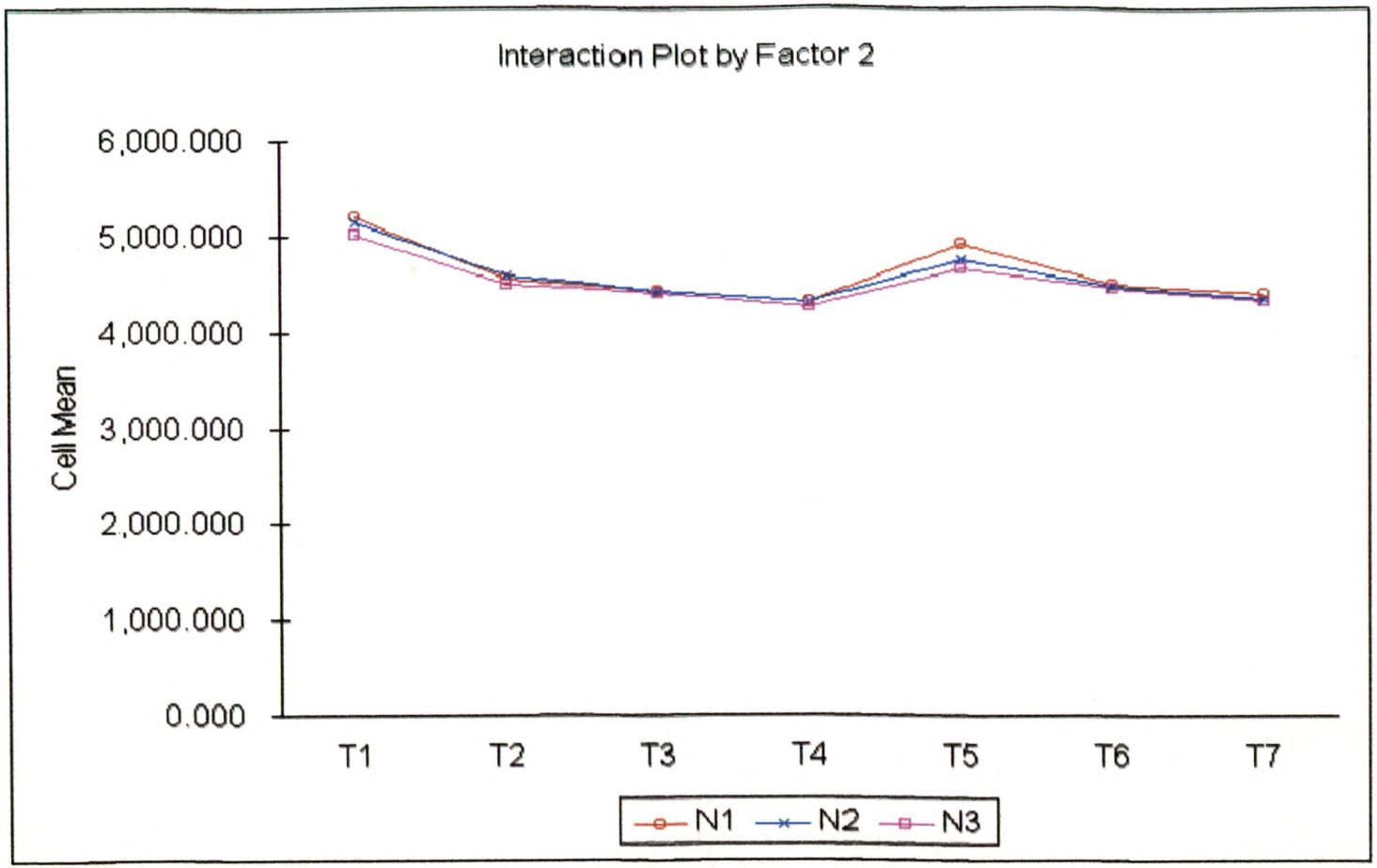


Fig 5.4 Interaction Plot by Factor 2 (Wheat Yield in kg/ha)

5.3 Quantitative Aspects (Yield) of Greengram

Table 5.9, Table 5.10 and Table 5.11 represent greengram yield obtained during three successive replications. Fig. 5.5 shows greengram yield response to various treatments for each replication.

Table 5.9 Greengram Yield (kg/ha) Analysis (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	753.22	803.66	747.22	666.31	933.03	576.07	1093.86
N2	489.16	1171.28	894.9	1060.56	1030.43	724.91	1147.31
N3	703.44	645.5	672.97	1105.85	1158.13	564.25	1003.93

Table 5.10 Greengram Yield (kg/ha) Analysis (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	698.20	1254.57	743.95	736.55	1048.26	978.24	497.64
N2	985.13	1186.23	689.95	485.75	1114.27	774.84	480.94
N3	735.64	1347.65	856.37	442.58	945.26	856.76	528.49

Table 5.11 Greengram Yield (kg/ha) Analysis (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	756.00	1287.26	781.69	710.22	1119.56	1205.36	611.28
N2	735.65	1164.87	680.24	506.84	1154.25	994.67	554.64
N3	780.51	1324.84	705.42	464.77	986.51	902.48	614.44

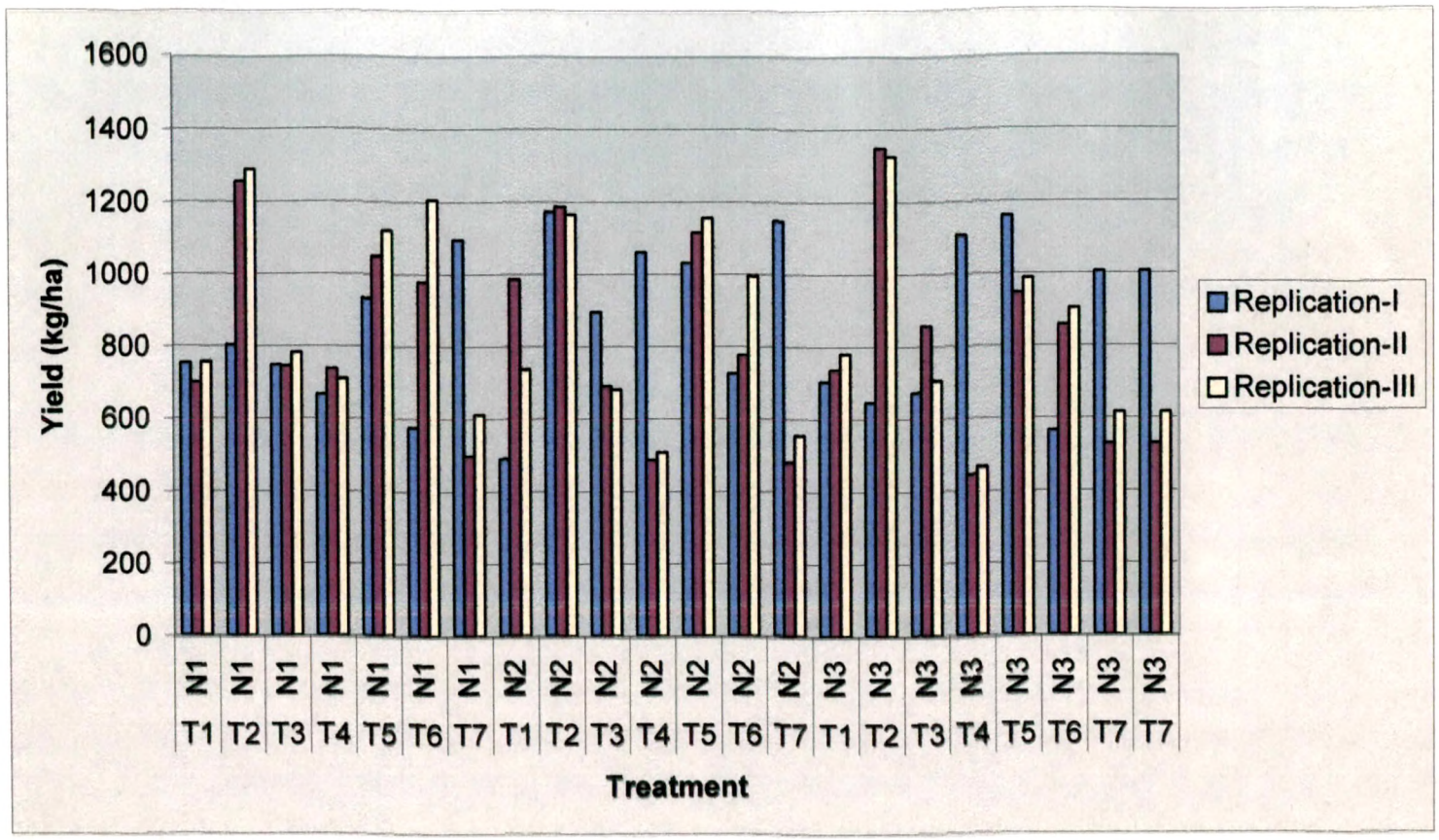
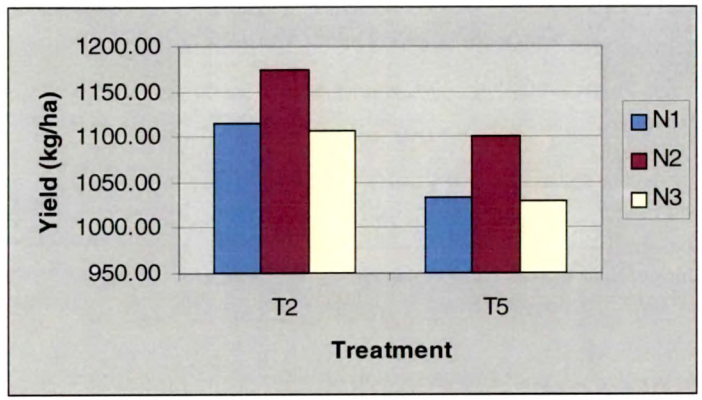


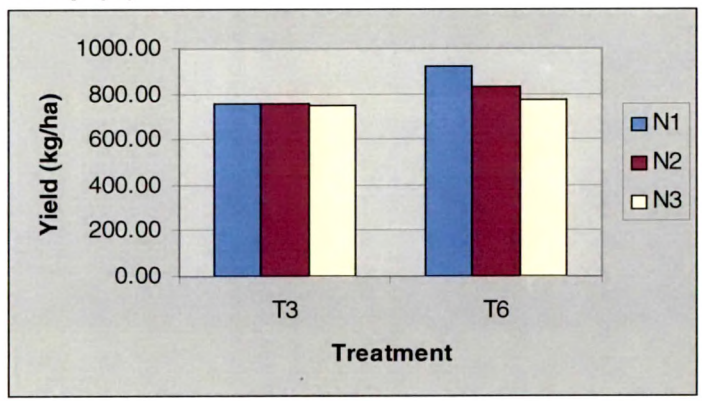
Fig. 5.5 Greengram Yield Response to Various Treatments

Fig. 5.6 shows comparison of greengram yield levels among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group (A)



Group (B)



Group (C)

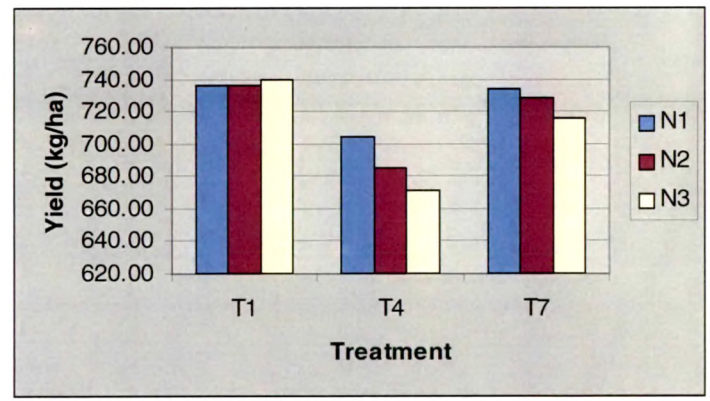


Fig. 5.6 Comparison of Greengram Yield Levels among Group-A, B and C

Table 5.12 and Table 5.13 represent two factor ANOVA and ANOVA Table for greengram yield respectively. Post hoc analysis for factor 2 (irrigation treatments) is shown in Table 5.14. Table 5.15 shows p-Values for Pairwise t-Tests. Fig. 5.7 and Fig. 5.8 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.12 Two factor ANOVA (Greengram Yield)

Means (kg/ha):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	735.81	1115.16	757.62	704.36	1033.62	919.89	734.26	857.25
	N2	736.65	1174.13	755.03	684.38	1099.65	831.47	727.63	858.42
	N3	739.86	1106.00	744.92	671.07	1029.97	774.50	715.62	825.99
		737.44	1131.76	752.52	686.60	1054.41	841.95	725.84	847.22

Table 5.13 ANOVA Table (Greengram Yield)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	14209.82	2.00	7104.91	0.14	0.87
Factor 2	1669240.34	6.00	278206.72	5.57	0.00
Interaction	37943.35	12.00	3161.95	0.06	1.00
Error	2099585.59	42.00	49990.13		
Total	3820979.11	62.00			

Table 5.14 Post hoc Analysis for Factor 2 (Greengram Yield)

Tukey simultaneous comparison t-values (d.f. = 42)

		T4	T7	T1	T3	T6	T5	T2
	(kg/ha)	686.60	725.84	737.44	752.52	841.95	1054.41	1131.76
T4	686.60							
T7	725.84	0.37						
T1	737.44	0.48	0.11					
T3	752.52	0.63	0.25	0.14				
T6	841.95	1.47	1.10	0.99	0.85			
T5	1054.41	3.49	3.12	3.01	2.86	2.02		
T2	1131.76	[illegible]	[illegible]	[illegible]	3.60	2.75	0.73	

critical values for experimentwise error rate:

0.05	3.10
0.01	[illegible]

Table 5.15 p-values for pairwise t-tests (Greengram Yield)

		T4	T7	T1	T3	T6	T5	T2
	(kg/ha)	686.60	725.84	737.44	752.52	841.95	1054.41	1131.76
T4	686.60							
T7	725.84	0.71						
T1	737.44	0.63	0.91					
T3	752.52	0.54	0.80	0.89				
T6	841.95	0.15	0.28	0.33	0.40			
T5	1054.41	0.00	0.00	0.00	0.01	0.05		
T2	1131.76	0.00	0.00	0.00	0.00	0.01	0.47	

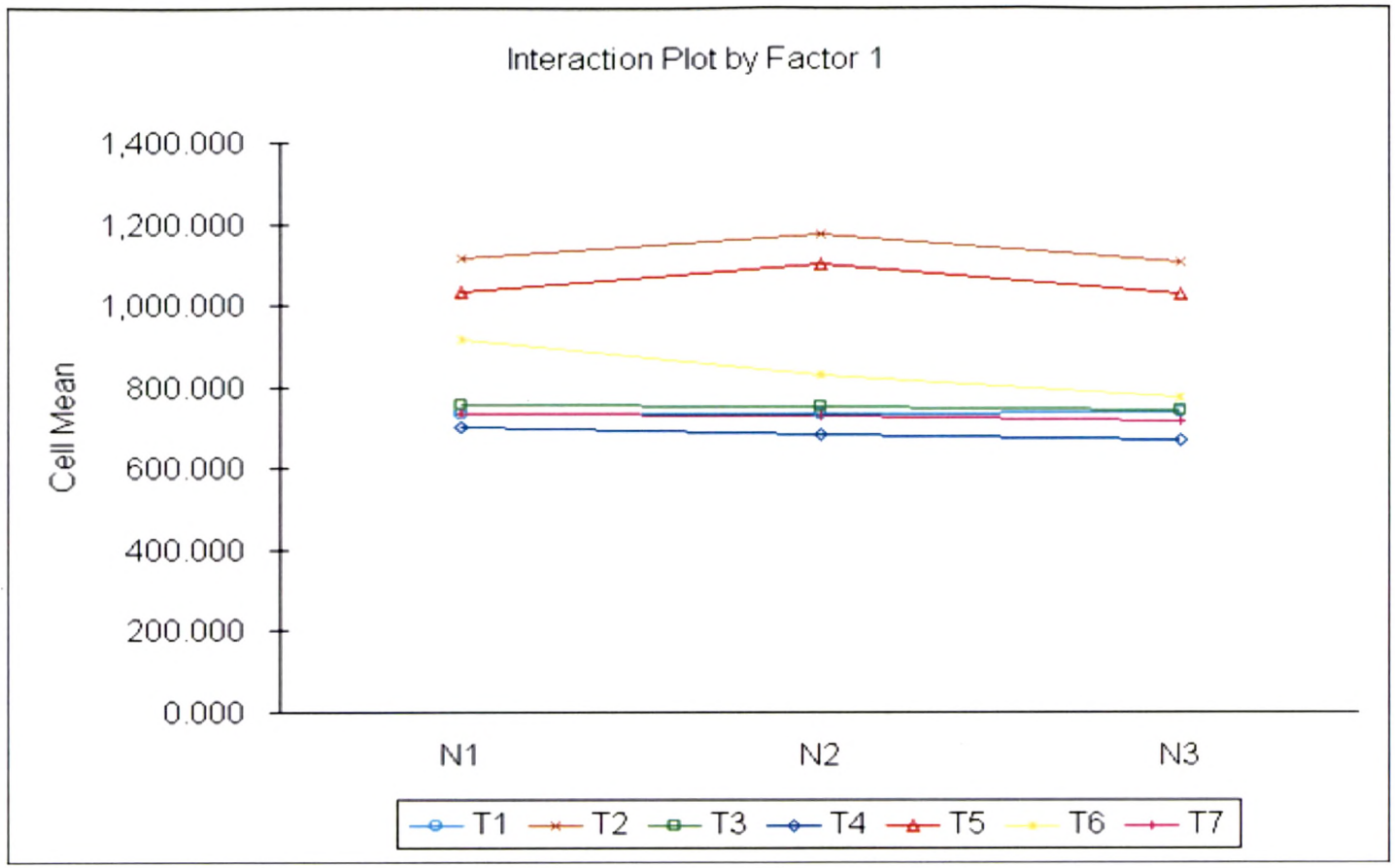


Fig 5.7 Interaction Plot by Factor 1 (Greengram Yield in kg/ha)

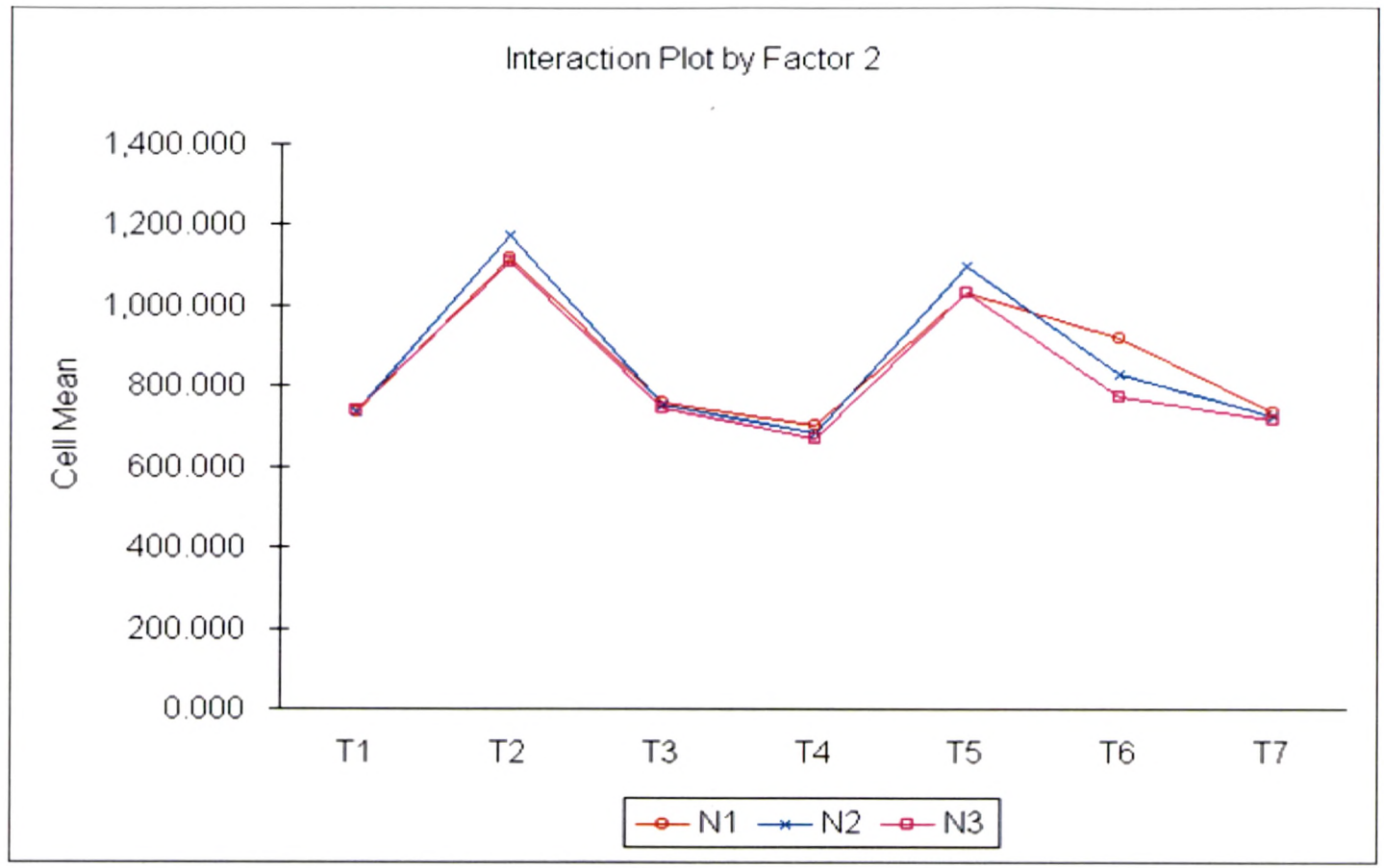


Fig 5.8 Interaction Plot by Factor 2 (Greengram Yield in kg/ha)

5.4 Qualitative Aspects of Wheat

5.4.1 Protein Content in Wheat

Table 5.16, Table 5.17 and Table 5.18 represent analysis of protein content in wheat grains during three successive replications. Fig. 5.9 shows protein content level in wheat grains response to various treatments for each replication.

Table 5.16 Analysis of Protein Content (%) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	12.8	13.0	12.8	13.2	12.9	12.7	13.2
N2	13.0	12.9	14.2	13.4	12.7	13.4	12.8
N3	12.8	13.9	13.2	13.2	12.9	13.9	13.5

Table 5.17 Analysis of Protein Content (%) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	14.1	13.8	13.8	13.9	13.9	13.9	13.5
N2	14.0	13.8	13.6	12.8	13.9	13.3	13.0
N3	14.0	13.8	13.6	12.7	14.1	13.7	13.4

Table 5.18 Analysis of Protein Content (%) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	16.4	16.2	15.6	14.3	15.8	14.9	13.8
N2	16.2	16.2	14.2	15.1	15.8	14.8	14.8
N3	16.3	15.1	15.2	14.8	15.2	13.9	13.5

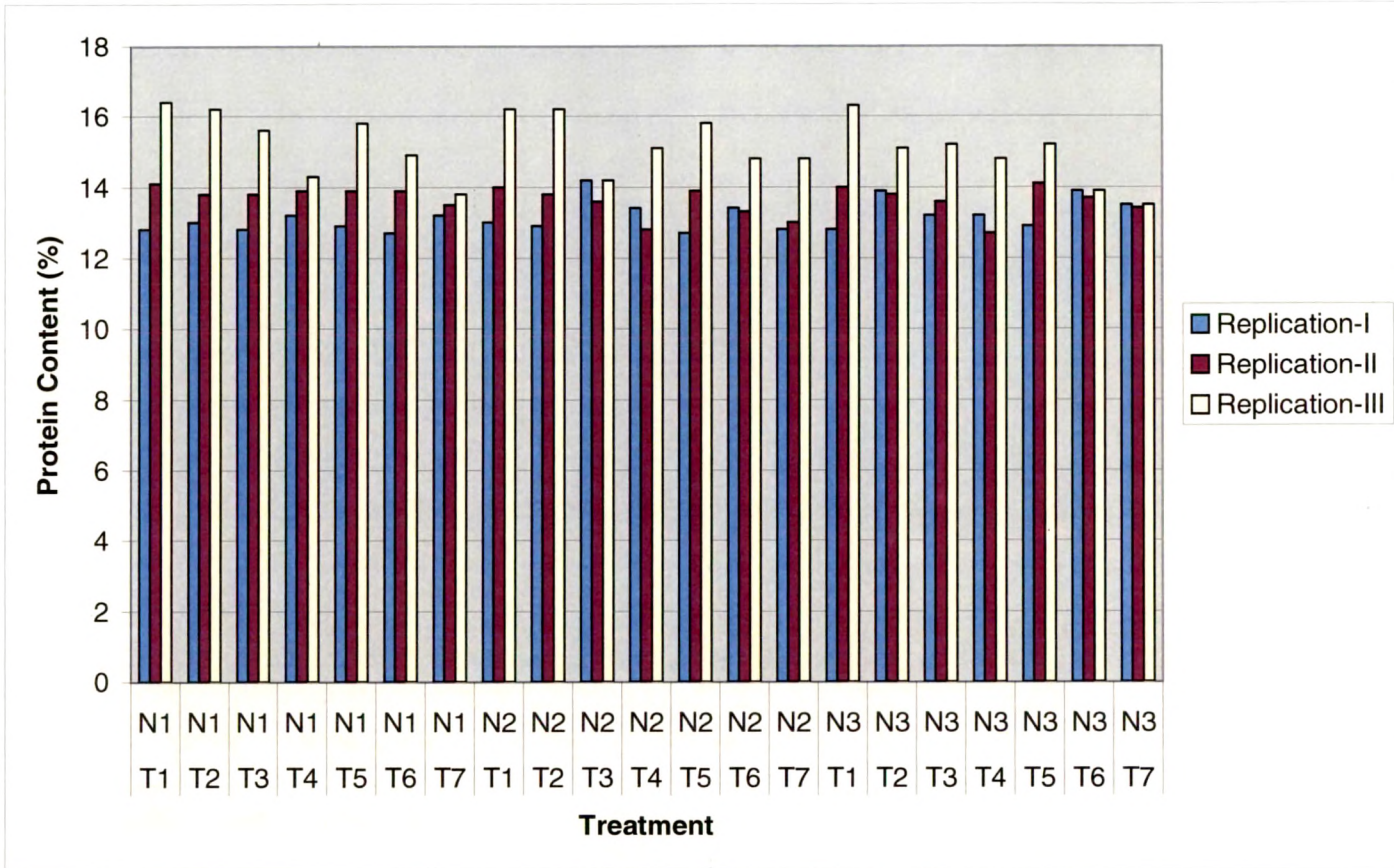
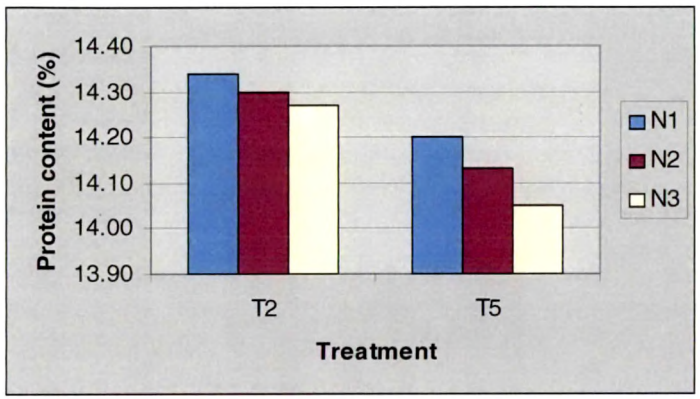


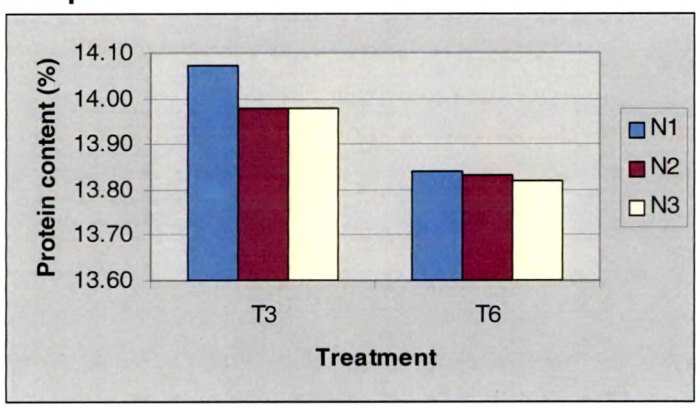
Fig. 5.9 Protein Content Level in Wheat

Fig. 5.10 shows comparison of protein content level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

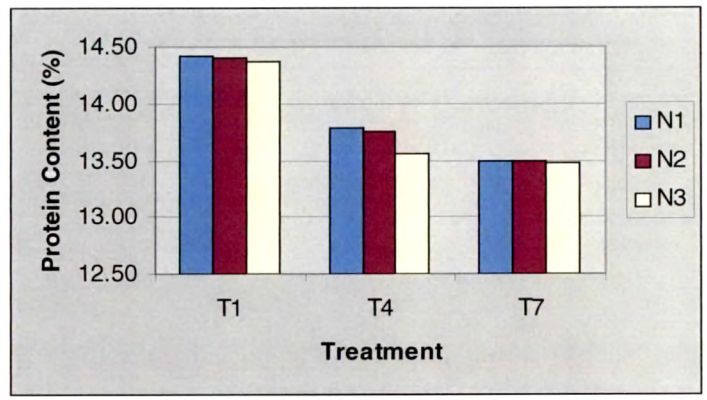


Fig. 5.10 Comparison of Protein content Level in Wheat among Group-A, B and C

Table 5.19 and Table 5.20 represent two factor ANOVA and ANOVA Table for protein content level in wheat respectively. Fig. 5.11 and Fig. 5.12 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.19 Two factor ANOVA (Wheat-Protein Content)

		Factor 2							
Means (%):		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	14.43	14.33	14.07	13.80	14.20	13.83	13.50	14.02
	N2	14.40	14.30	14.00	13.77	14.13	13.83	13.53	14.00
	N3	14.37	14.27	14.00	13.57	14.07	13.83	13.47	13.94
		14.40	14.30	14.02	13.71	14.13	13.83	13.50	13.99

Table 5.20 ANOVA Table (Wheat-Protein Content)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.08	2.00	0.04	0.03	0.97
Factor 2	5.65	6.00	0.94	0.64	0.69
Interaction	0.07	12.00	0.01	0.00	1.00
Error	61.47	42.00	1.46		
Total	67.28	62.00			

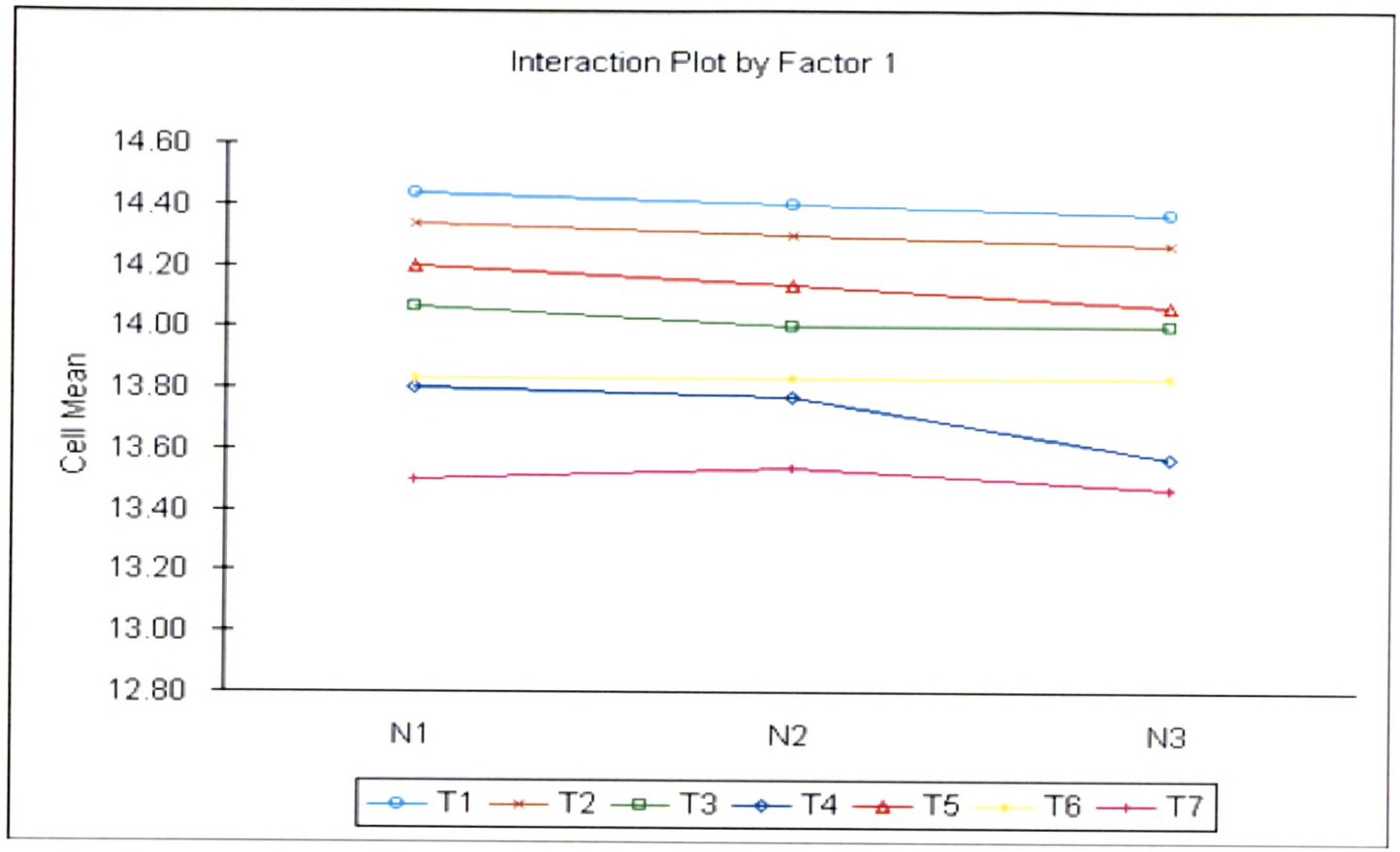


Fig 5.11 Interaction Plot by Factor 1 (Wheat-Protein Content in %)

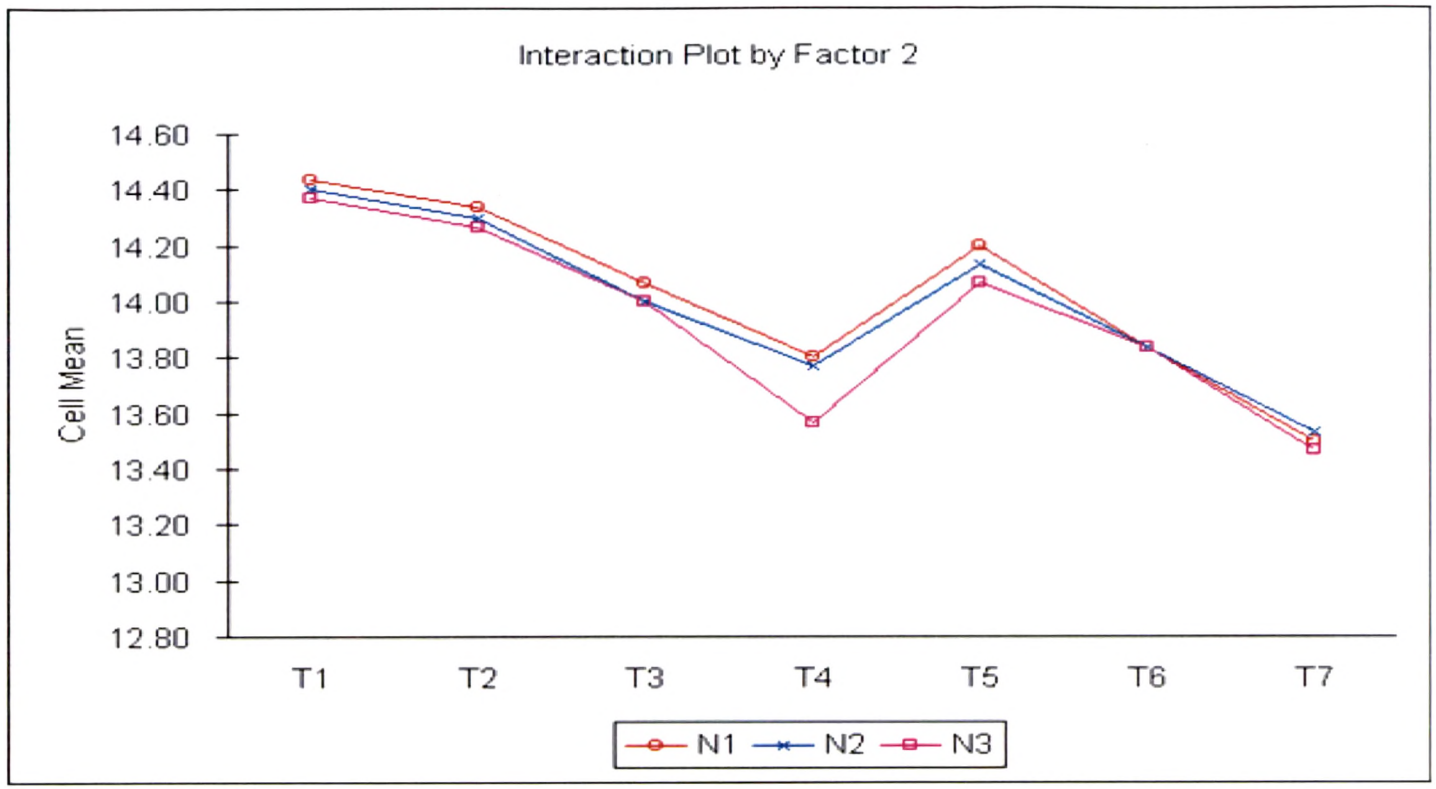


Fig 5.12 Interaction Plot by Factor 2 (Wheat-Protein Content in %)

5.4.2 Heavy Metals in Wheat

5.4.2.1 Lead (Pb)

Table 5.21, Table 5.22 and Table 5.23 represent analysis of heavy metal (Pb) in wheat grains during three successive replications. Fig. 5.13 shows Pb level in wheat grains response to various treatments for each replication.

Table 5.21 Analysis of Heavy Metal Pb (ppm) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.36	0.38	0.3	0.00	0.44	0.34	0.00
N2	0.23	0.31	0.42	0.00	0.25	0.37	0.00
N3	0.39	0.25	0.41	0.00	0.45	0.48	0.00

Table 5.22 Analysis of Heavy Metal Pb (ppm) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.92	0.86	0.86	0.68	0.80	0.76	0.63
N2	0.98	0.87	0.79	0.65	0.87	0.74	0.61
N3	0.86	0.88	0.77	0.64	0.78	0.69	0.58

Table 5.23 Analysis of Heavy Metal Pb (ppm) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.94	0.87	0.89	0.72	0.82	0.81	0.67
N2	0.94	0.88	0.84	0.70	0.92	0.79	0.65
N3	0.89	0.94	0.83	0.68	0.81	0.71	0.63

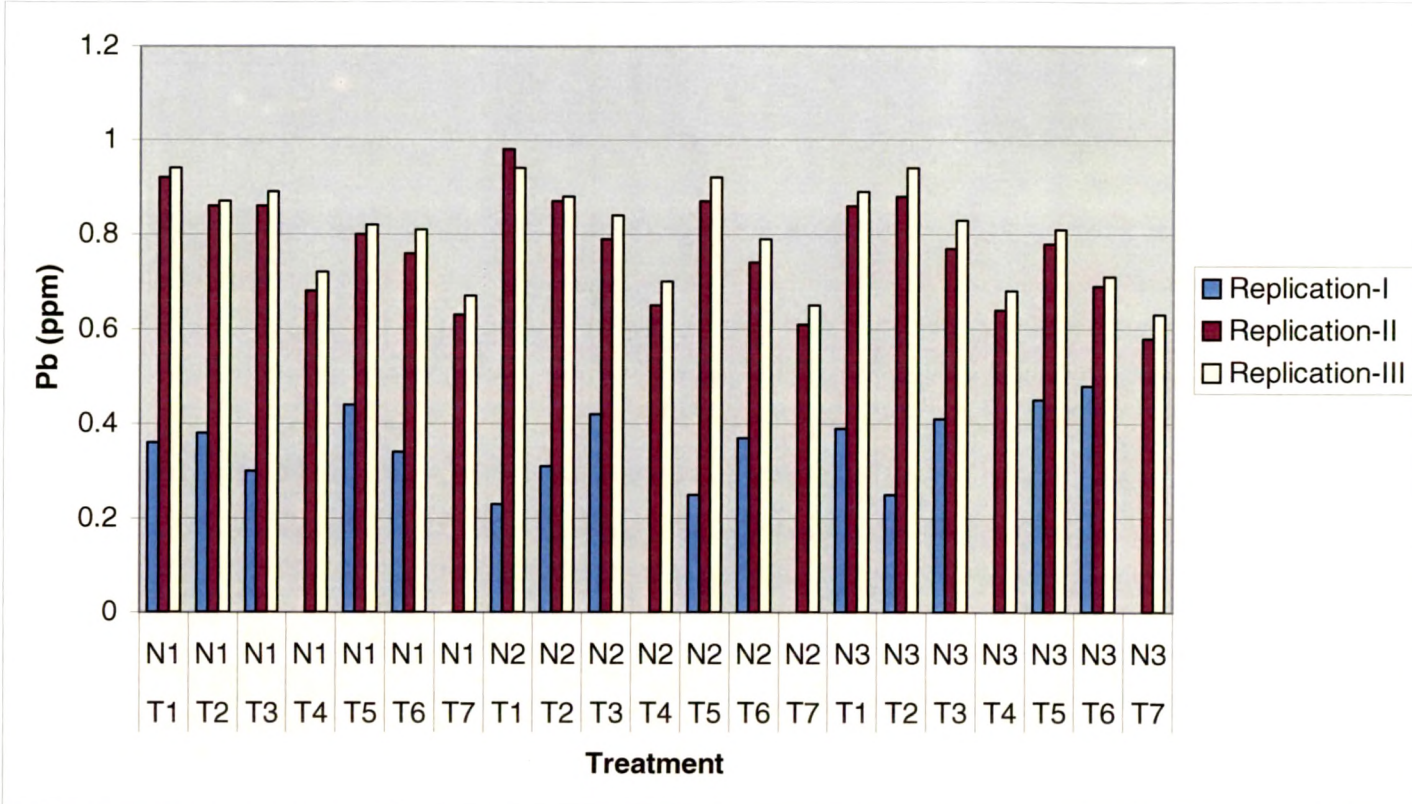
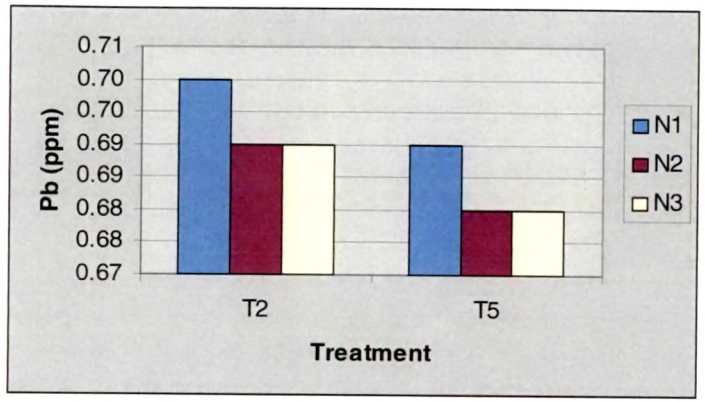


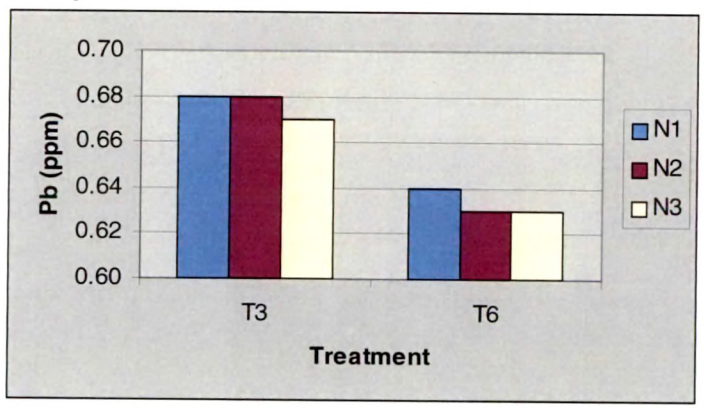
Fig. 5.13 Pb level in wheat

Fig. 5.14 shows comparison of Pb level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

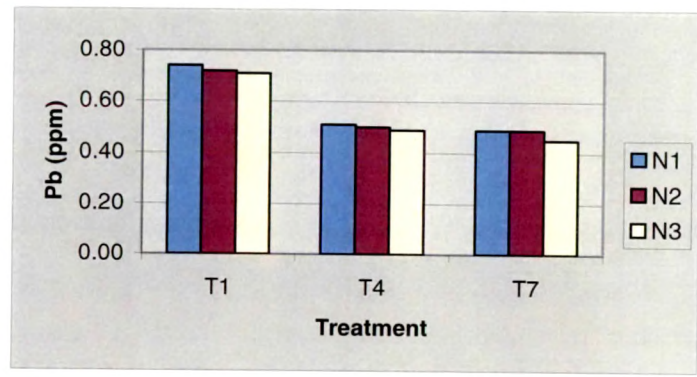


Fig. 5.14 Comparison of Pb level in wheat among Group-A, B and C

Table 5.24 and Table 5.25 represent two factor ANOVA and ANOVA Table for Pb level in wheat respectively. Fig. 5.15 and Fig. 5.16 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.24 Two Factor ANOVA (Pb Level in Wheat)

Factor 2

Means (ppm):

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.74	0.70	0.68	0.47	0.69	0.64	0.43	0.62
	N2	0.72	0.69	0.68	0.45	0.68	0.63	0.42	0.61
	N3	0.71	0.69	0.67	0.44	0.68	0.63	0.40	0.60
		0.72	0.69	0.68	0.45	0.68	0.63	0.42	0.61

Table 5.25 ANOVA Table (Pb Level in Wheat)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.00	2.00	0.00	0.02	0.98
Factor 2	0.82	6.00	0.14	1.36	0.25
Interaction	0.00	12.00	0.00	0.00	1.00
Error	4.26	42.00	0.10		
Total	5.09	62.00			

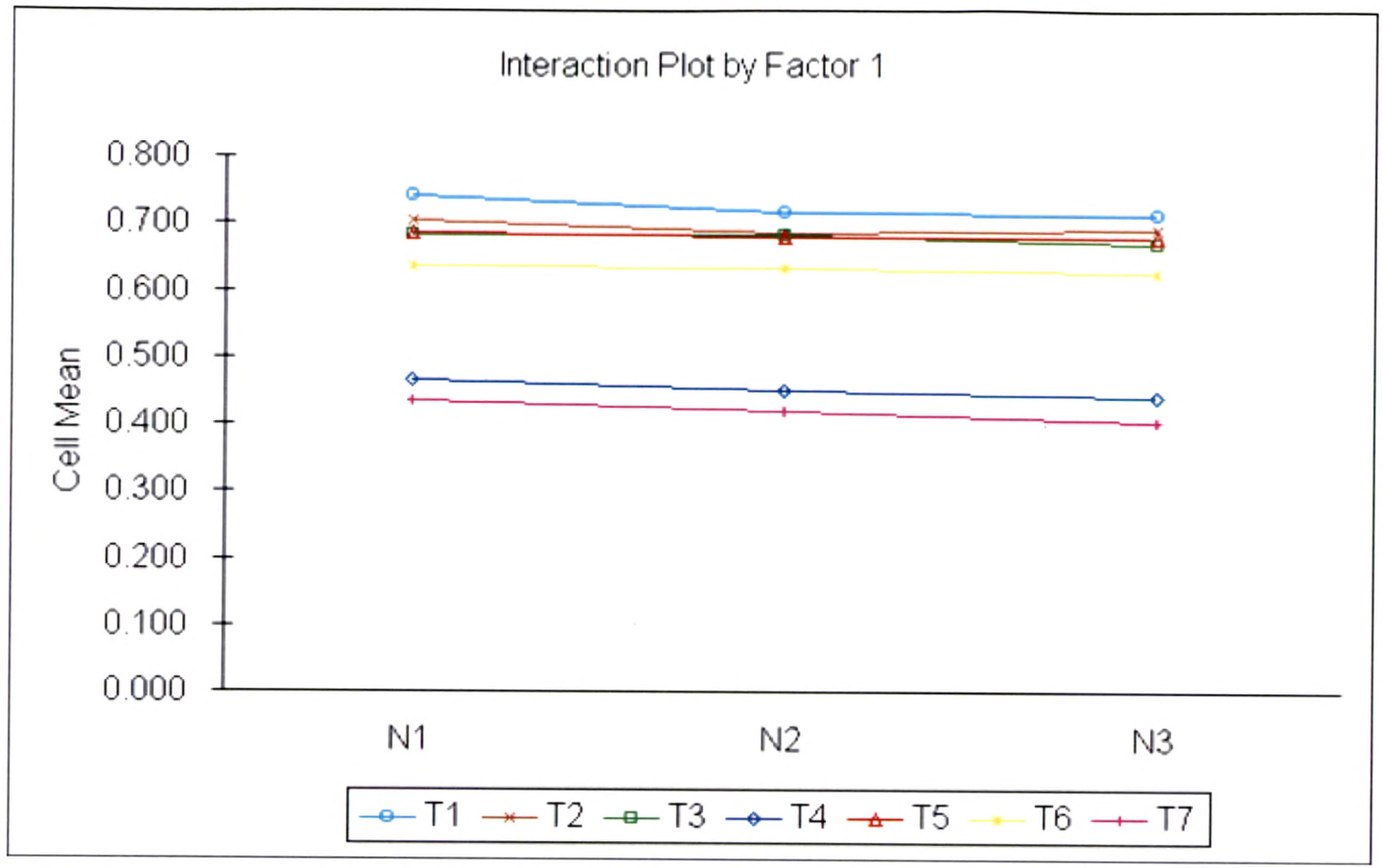


Fig 5.15 Interaction Plot by Factor 1 [Pb Level (ppm) in Wheat]

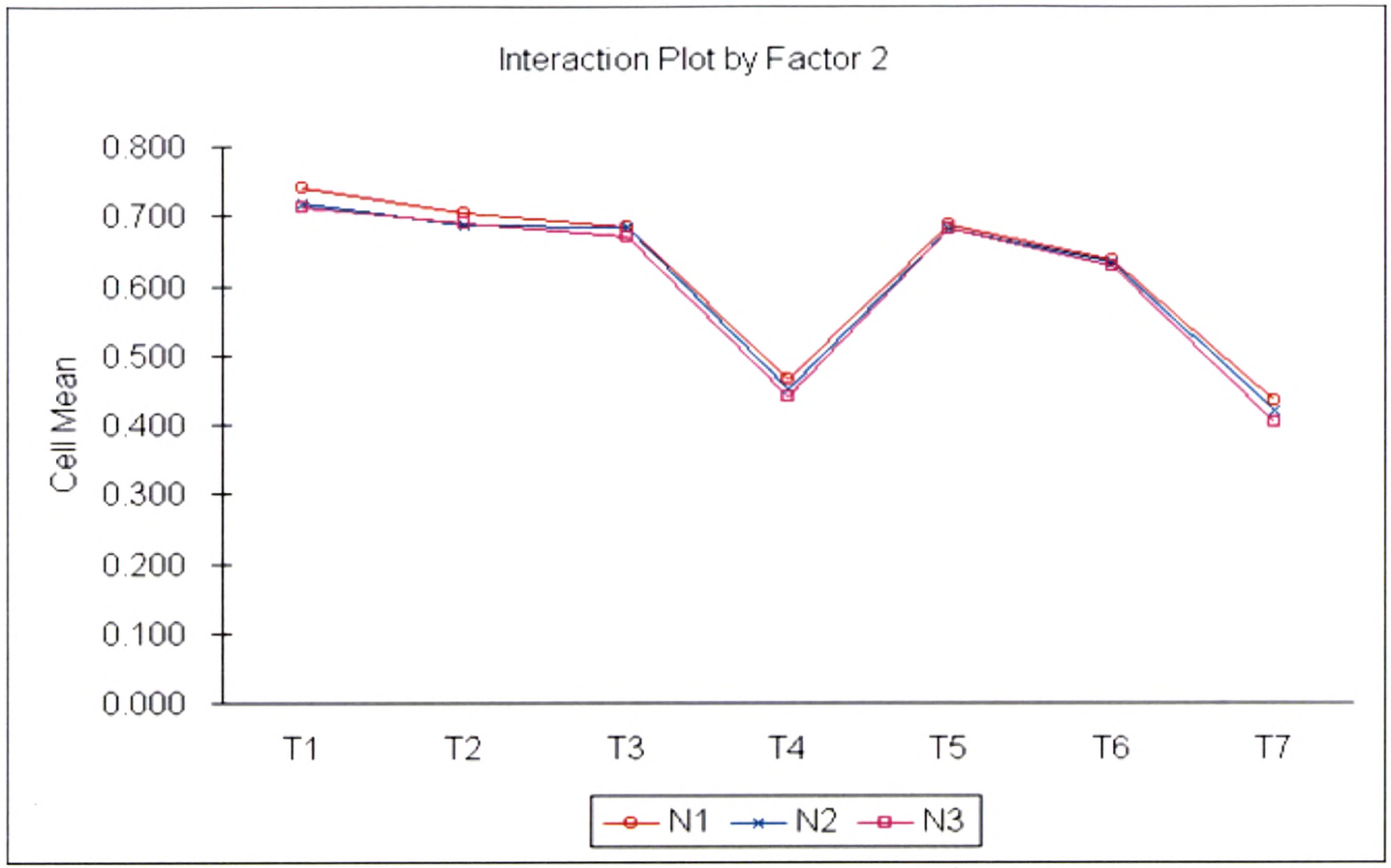


Fig 5.16 Interaction Plot by Factor 2 [Pb Level(ppm) in Wheat]

5.4.2.2 Copper (Cu)

Table 5.26, Table 5.27 and Table 5.28 represent analysis of heavy metal (Cu) in wheat grains during three successive replications. Fig. 5.17 shows Cu level in wheat grains response to various treatments for each replication.

Table 5.26 Analysis of Heavy Metal Cu (ppm) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.72	0.30	0.60	0.55	0.58	0.60	0.00
N2	0.45	0.41	0.48	0.00	0.51	0.80	0.28
N3	0.00	0.34	0.42	0.51	0.53	0.70	0.65

Table 5.27 Analysis of Heavy Metal Cu (ppm) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.97	0.98	0.75	0.71	0.80	0.74	0.85
N2	1.05	0.91	0.81	0.84	0.83	0.60	0.71
N3	1.10	0.94	0.83	0.65	0.81	0.67	0.50

Table 5.28 Analysis of Heavy Metal Cu (ppm) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.02	0.99	0.78	0.78	0.84	0.75	0.91
N2	1.06	0.94	0.83	0.98	0.86	0.70	0.77
N3	1.18	0.96	0.85	0.66	0.83	0.70	0.60

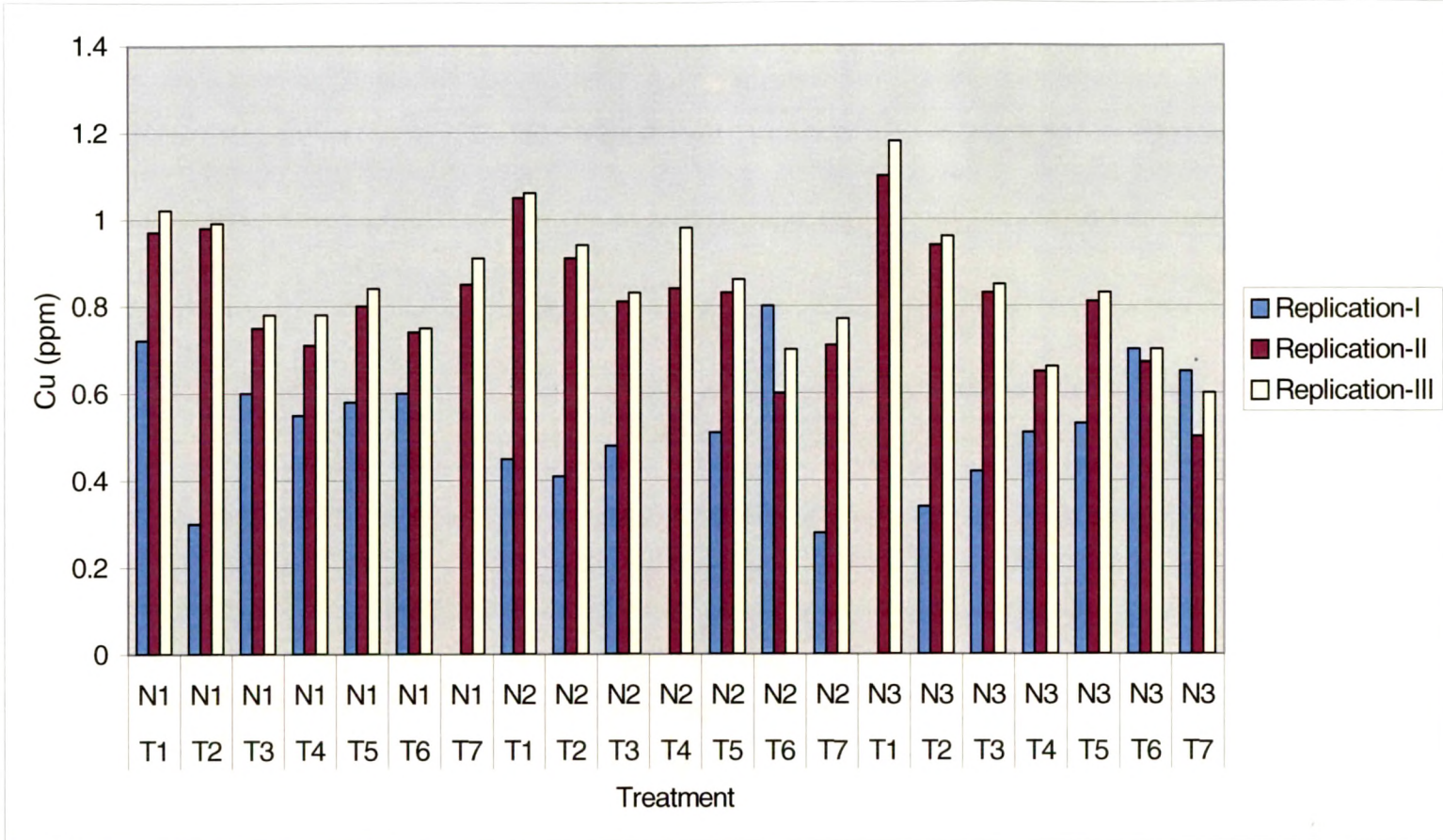
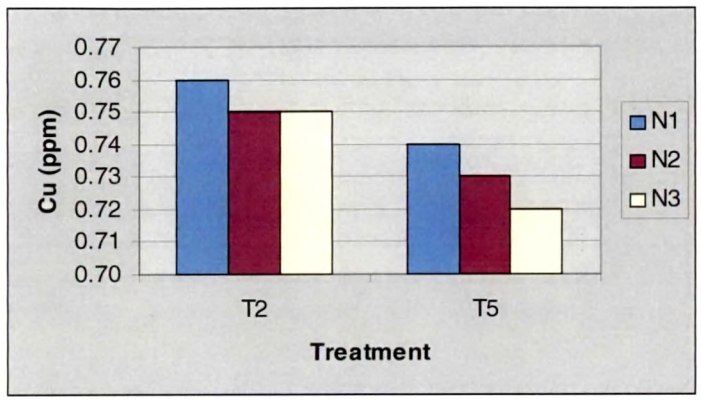


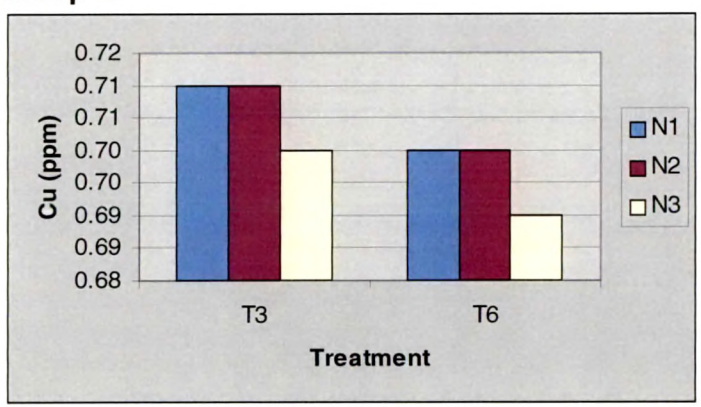
Fig. 5.17 Cu level in wheat

Fig. 5.18 shows comparison of Cu level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

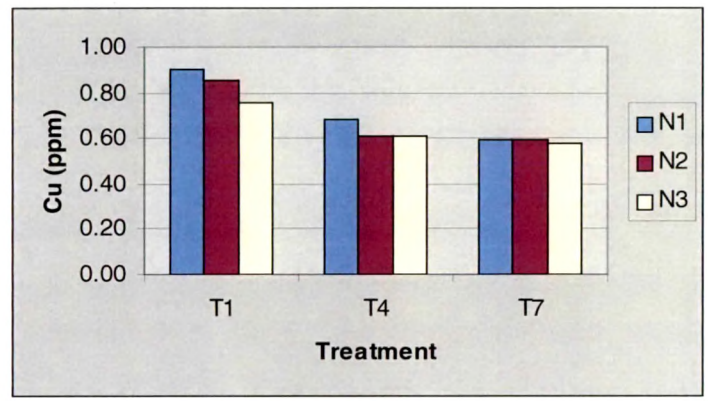


Fig. 5.18 Comparison of Cu Level in Wheat among Group-A, B and C

Table 5.29 and Table 5.30 represent two factor ANOVA and ANOVA Table for Cu level in wheat respectively. Fig. 5.19 and Fig. 5.20 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.29 Two factor ANOVA (Cu Level in Wheat)

Factor 2

Means (ppm):

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.90	0.76	0.71	0.68	0.74	0.70	0.59	0.72
	N2	0.85	0.75	0.71	0.61	0.73	0.70	0.59	0.71
	N3	0.76	0.75	0.70	0.61	0.72	0.69	0.58	0.69
		0.84	0.75	0.71	0.63	0.73	0.70	0.59	0.71

Table 5.30 ANOVA Table (Cu Level in Wheat)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.01	2.00	0.01	0.09	0.92
Factor 2	0.37	6.00	0.06	0.71	0.64
Interaction	0.03	12.00	0.00	0.03	1.00
Error	3.60	42.00	0.09		
Total	4.01	62.00			

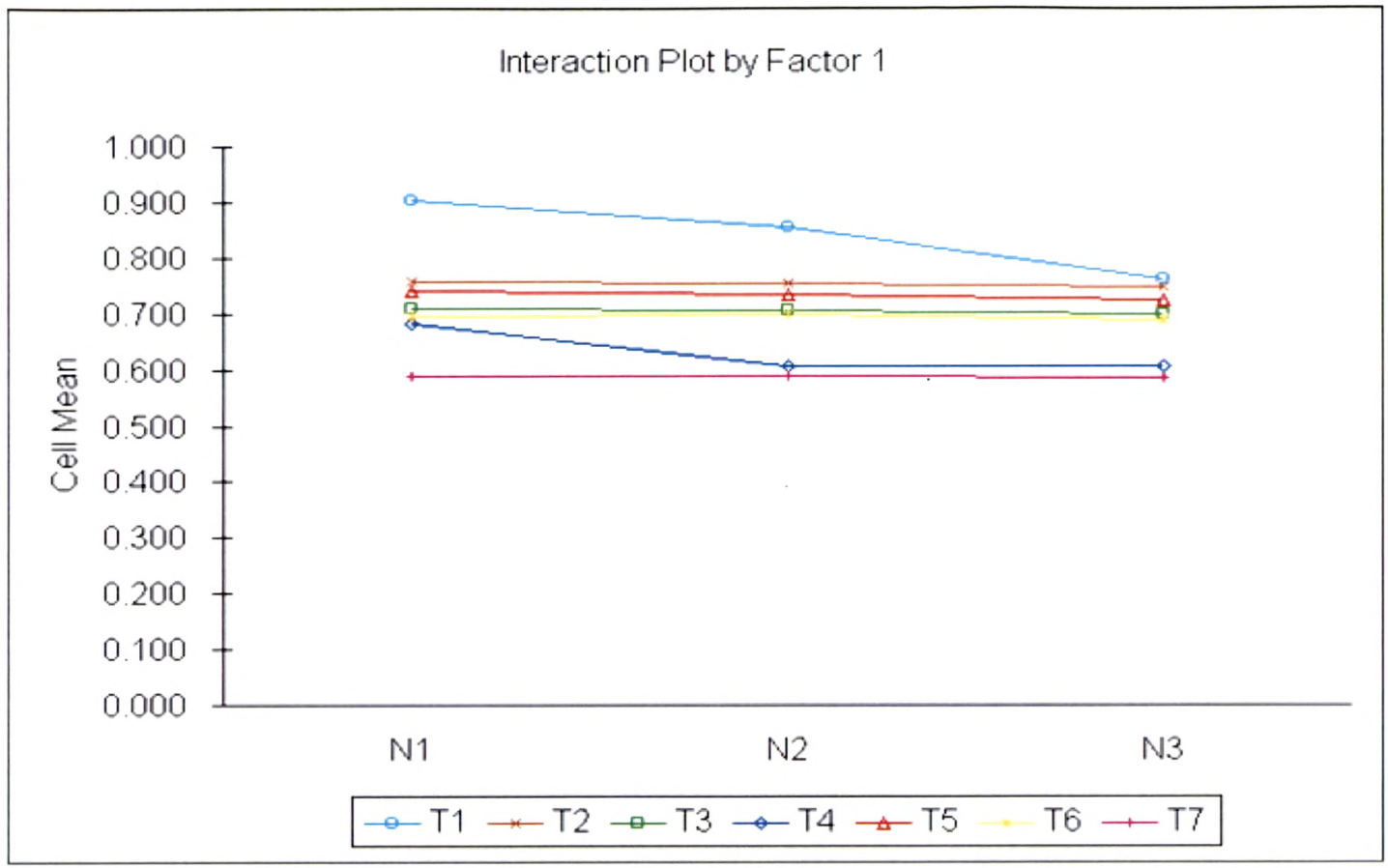


Fig 5.19 Interaction Plot by Factor 1 [Cu Level (ppm) in Wheat]

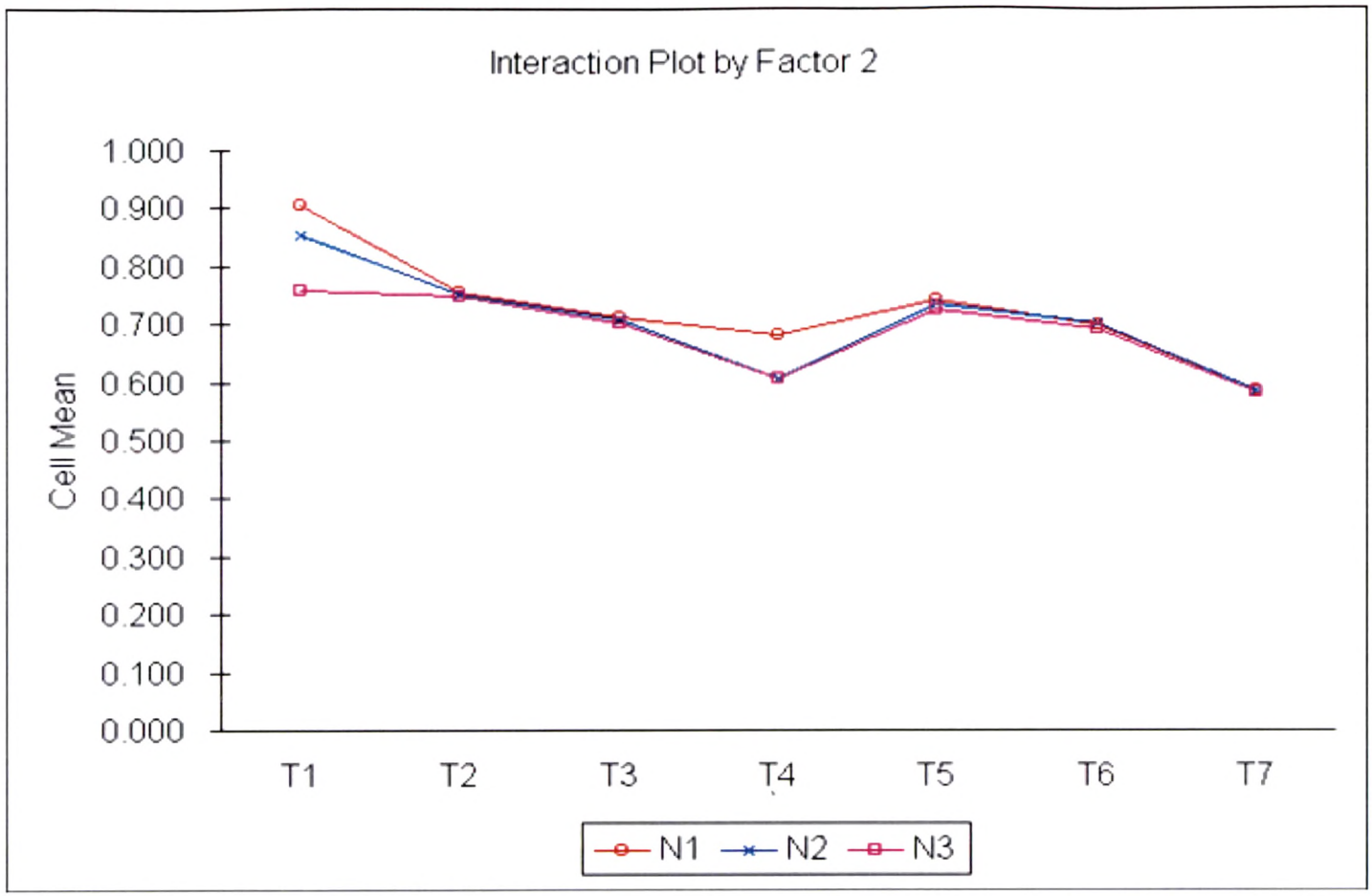


Fig 5.20 Interaction Plot by Factor 2 [Cu Level (ppm) in Wheat]

5.4.2.3 Zinc (Zn)

Table 5.31, Table 5.32 and Table 5.33 represent analysis of heavy metal (Zn) in wheat grains during three successive replications. Fig. 5.21 shows Zn level in wheat grains response to various treatments for each replication.

Table 5.31 Analysis of Heavy Metal Zn (ppm) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	7.0	5.2	4.5	4.1	5.1	6.4	5.0
N2	6.1	5.4	4.6	6.8	5.4	5.3	6.8
N3	6.1	6.3	6.0	4.8	5.2	5.8	5.9

Table 5.32 Analysis of Heavy Metal Zn (ppm) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.9	9.9	9.6	9.2	9.7	8.5	8.2
N2	9.9	9.9	9.4	7.6	9.6	8.9	6.8
N3	9.8	9.5	8.8	8.2	9.6	8.4	7.4

Table 5.33 Analysis of Heavy Metal Zn (ppm) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	10.2	11.1	10.2	9.8	10.0	9.0	8.7
N2	10.9	10.9	10.1	8.6	9.7	9.5	8.1
N3	10.8	10.2	9.2	8.9	9.9	9.4	7.9

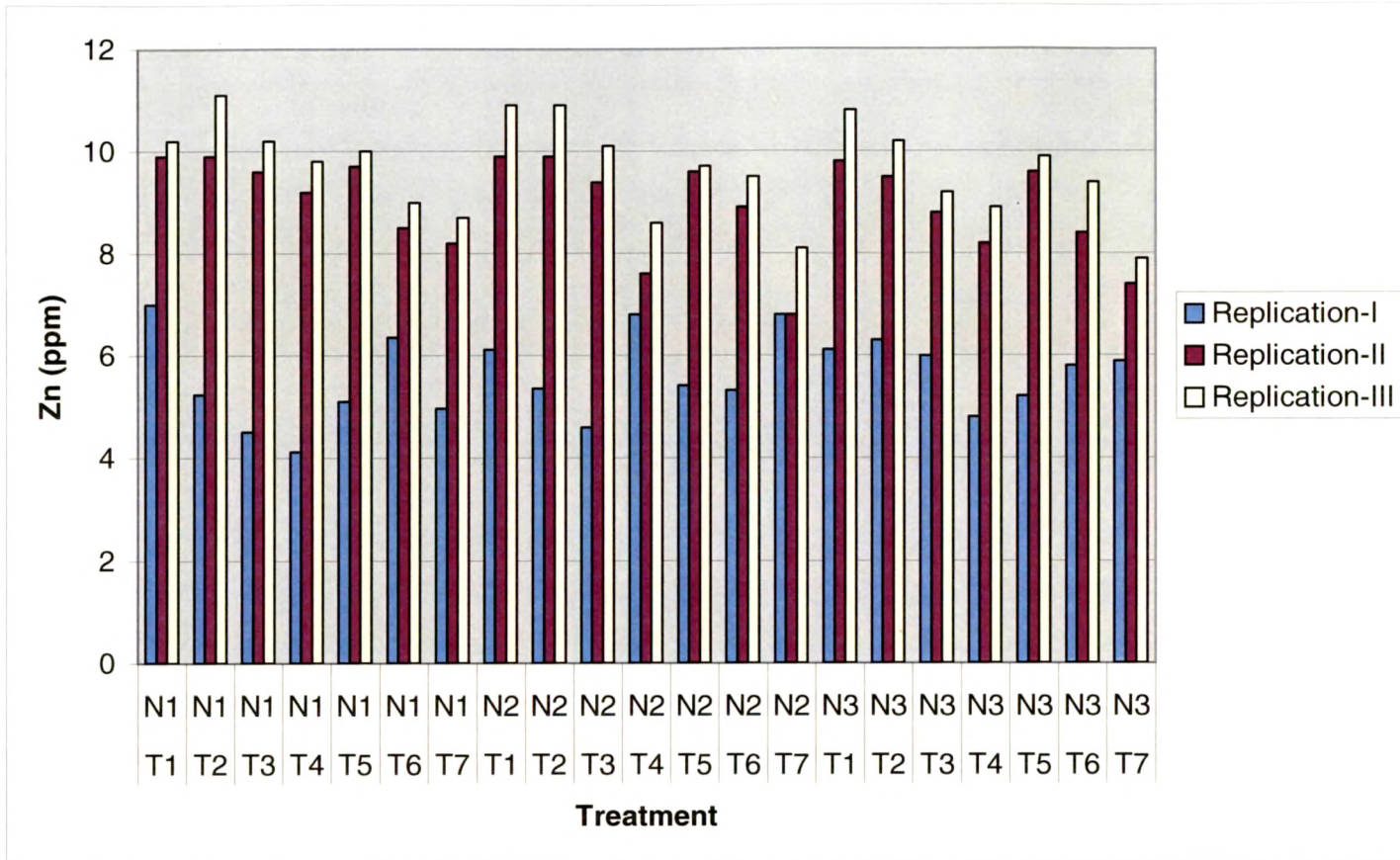
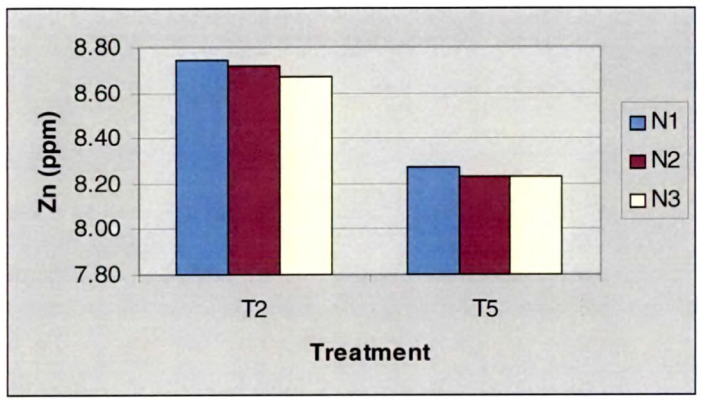


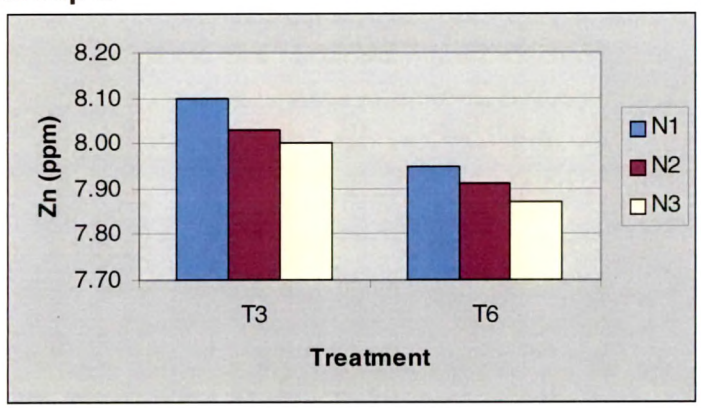
Fig. 5.21 Zn Level in Wheat

Fig. 5.22 shows comparison of Zn level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

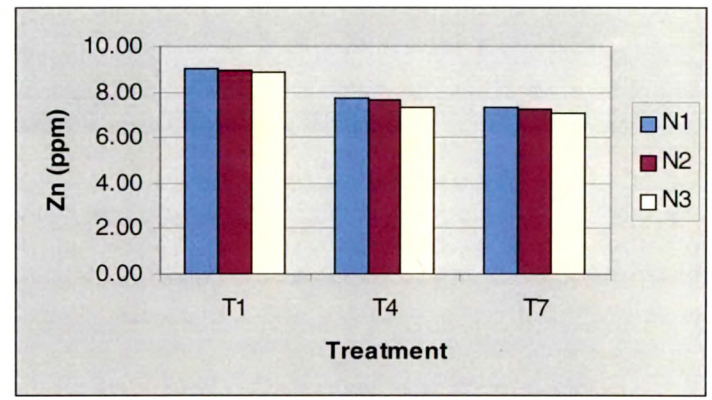


Fig. 5.22 Comparison of Zn Level in Wheat among Group-A, B and C

Table 5.34 and Table 5.35 represent two factor ANOVA and ANOVA Table for Zn level in wheat respectively. Fig. 5.23 and Fig. 5.24 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.34 Two factor ANOVA (Zn Level in Wheat)

Factor 2

Means (ppm):

Factor 1	T1	T2	T3	T4	T5	T6	T7	
N1	9.03	8.74	8.10	7.70	8.27	7.95	7.29	8.15
N2	8.97	8.72	8.03	7.67	8.23	7.91	7.23	8.11
N3	8.90	8.67	8.00	7.30	8.23	7.87	7.06	8.00
	8.97	8.71	8.04	7.56	8.24	7.91	7.19	8.09

Table 5.35 ANOVA Table (Zn Level in Wheat)

Source	*SS*	*Df*	*MS*	*F*	*p-value*
Factor 1	0.25	2.00	0.12	0.02	0.98
Factor 2	20.69	6.00	3.45	0.64	0.69
Interaction	0.19	12.00	0.02	0.00	1.00
Error	224.74	42.00	5.35		
Total	245.87	62.00			

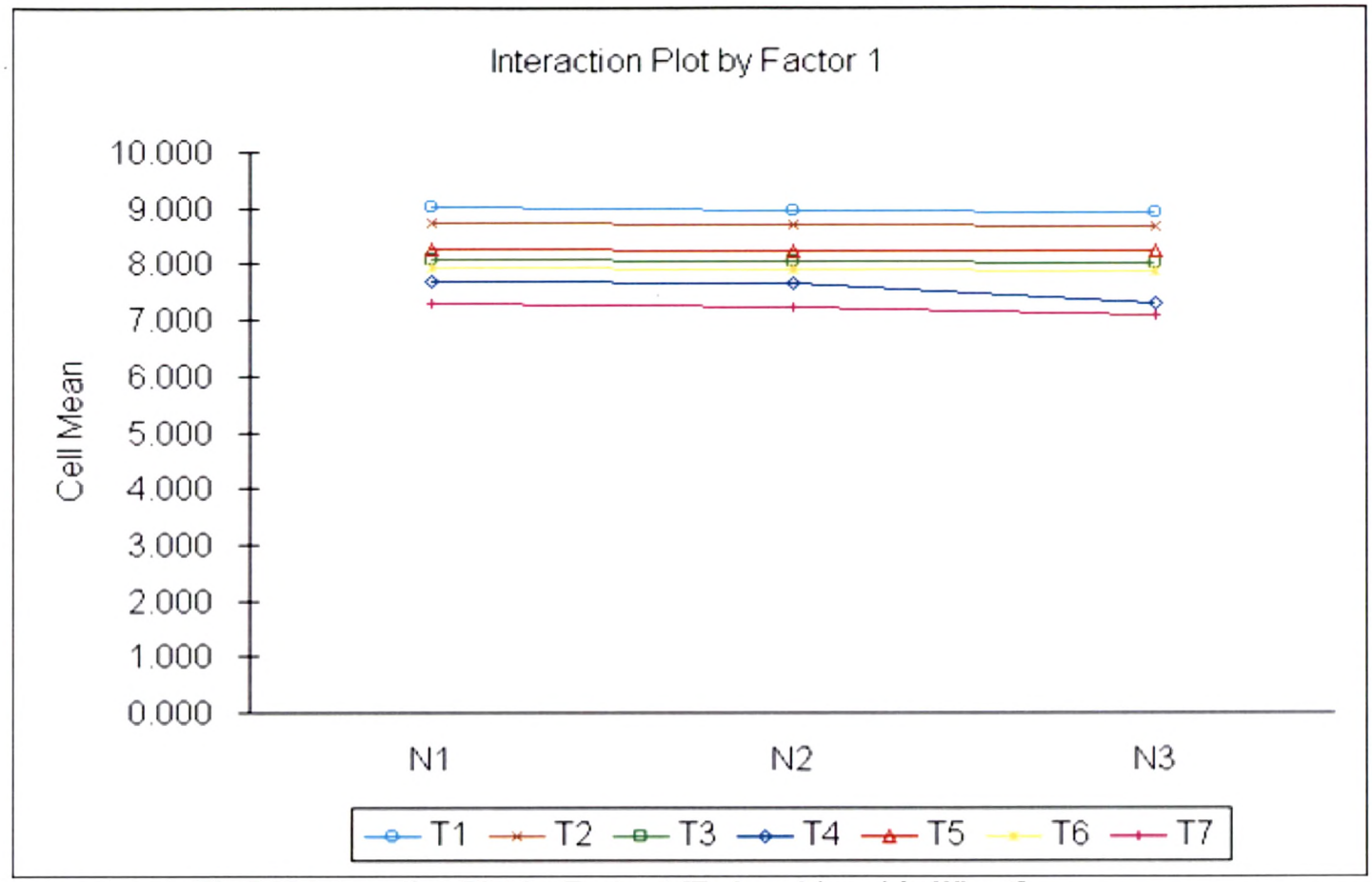


Fig 5.23 Interaction Plot by Factor 1 [Zn Level (ppm) in Wheat]

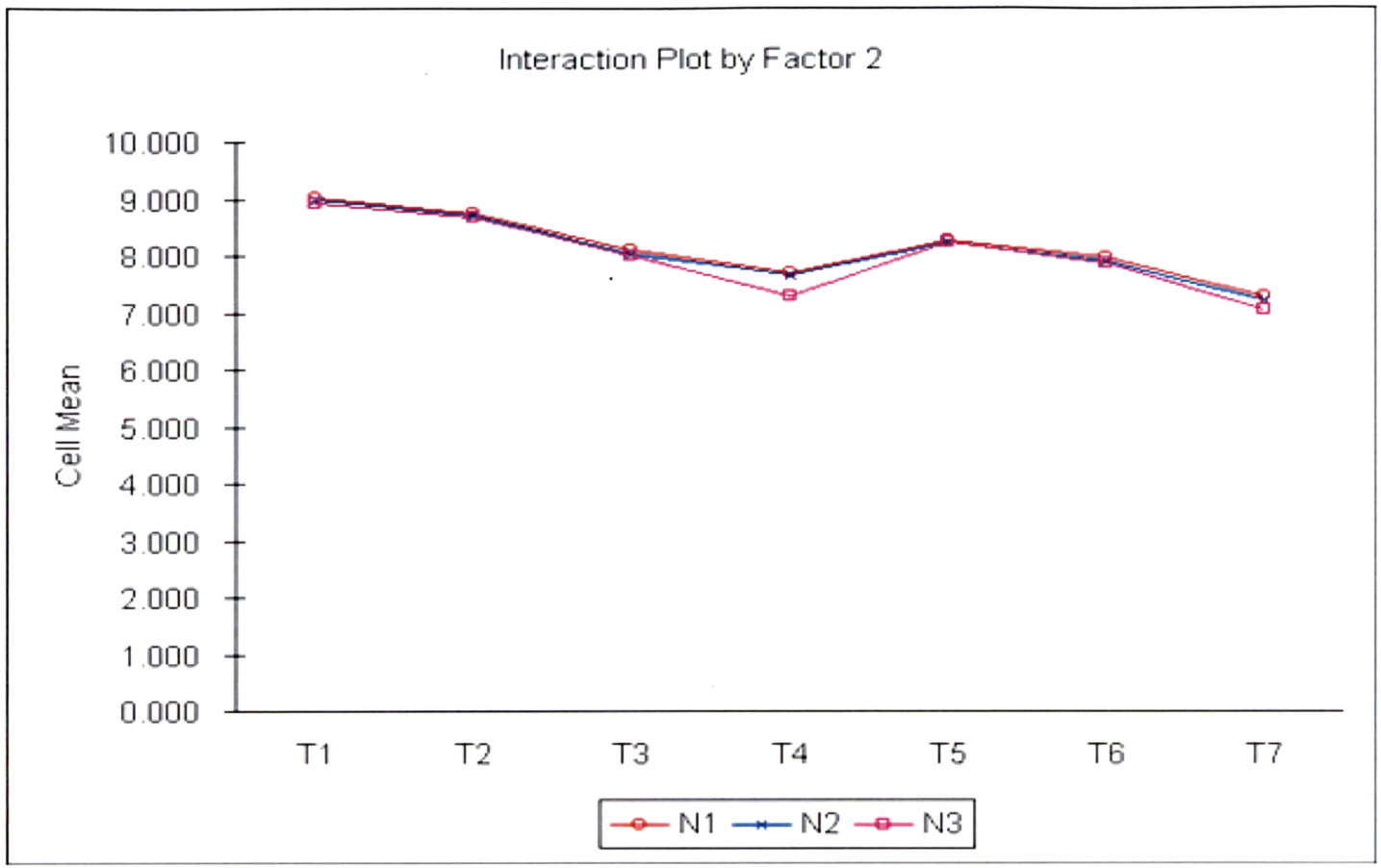


Fig 5.24 Interaction Plot by Factor 2 [Zn Level (ppm) in Wheat]

5.4.2.4 Manganese (Mn)

Table 5.36, Table 5.37 and Table 5.38 represent analysis of heavy metal (Mn) in wheat grains during three successive replications. Fig. 5.25 shows Mn level in wheat grains response to various treatments for each replication.

Table 5.36 Analysis of Heavy Metal Mn (ppm) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	15.8	16.1	16.2	16.9	15.8	19.9	19.6
N2	18.7	18.2	19.1	17.9	18.8	17.9	19.0
N3	19.9	18.9	17.8	17.0	16.9	19.8	18.2

Table 5.37 Analysis of Heavy Metal Mn (ppm) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	29.2	28.5	27.9	27.2	28.5	25.4	25.8
N2	27.1	27.1	26.4	26.5	26.1	26.4	25.4
N3	26.1	26.2	26.9	27.3	27.9	25.8	25.1

Table 5.38 Analysis of Heavy Metal Mn (ppm) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	29.9	29.4	28.9	28.0	29.1	27.2	26.2
N2	29.0	28.4	27.2	27.6	28.3	28.0	26.1
N3	28.2	28.5	27.9	27.5	28.3	26.6	27.1

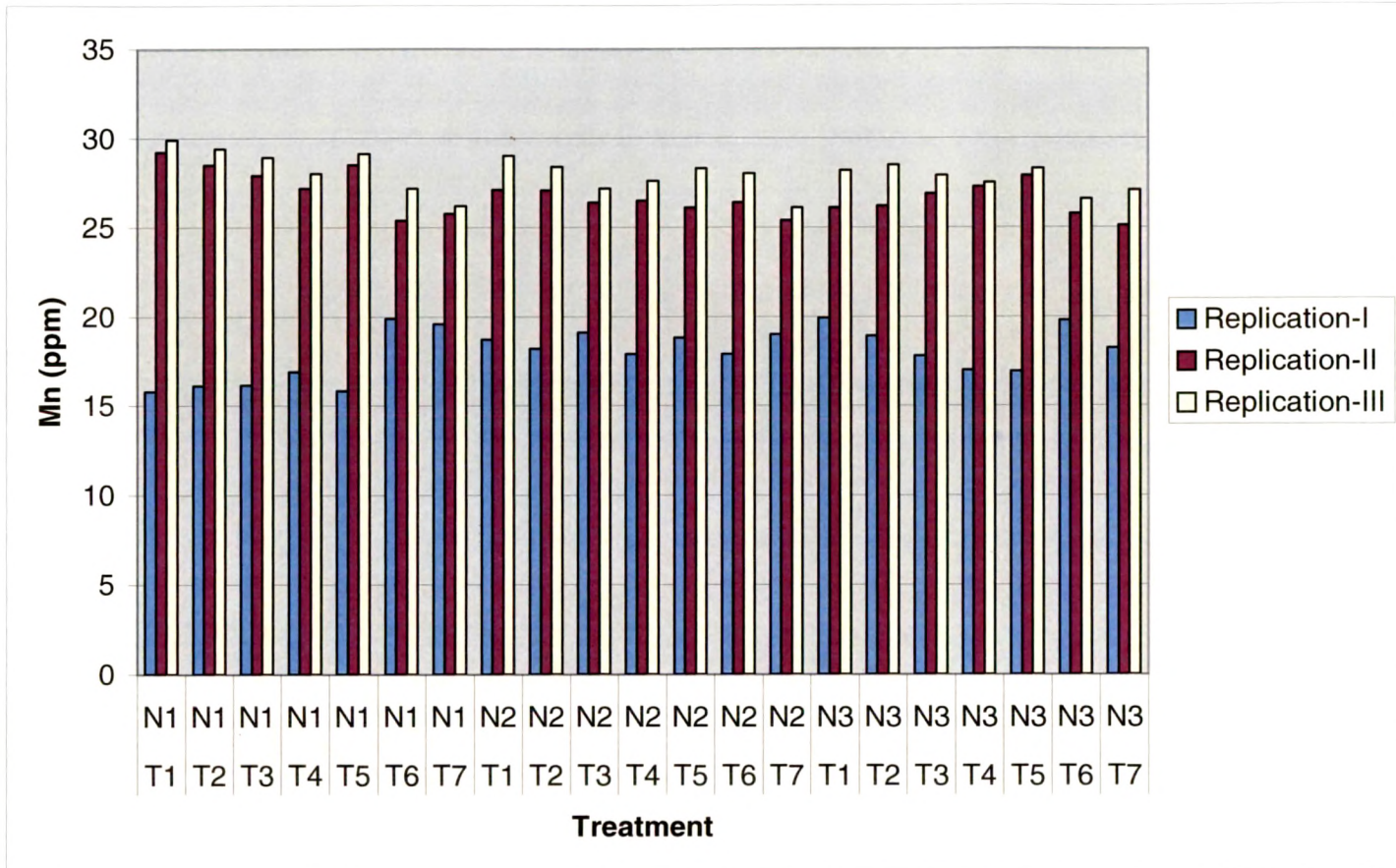
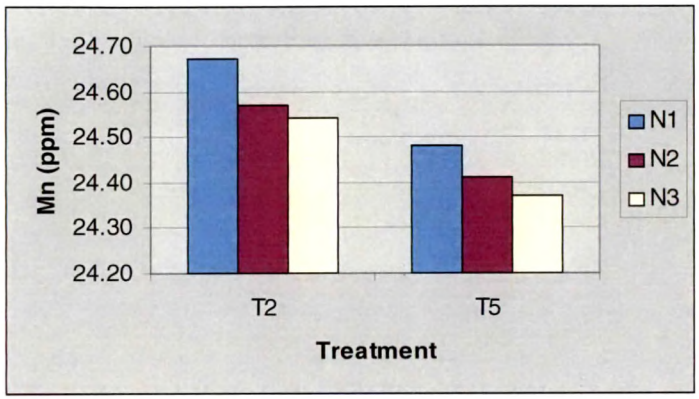


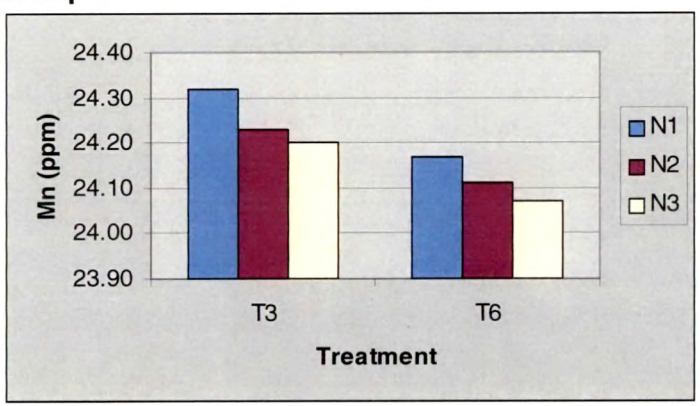
Fig. 5.25 Mn Level in Wheat

Fig. 5.26 shows comparison of Mn level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

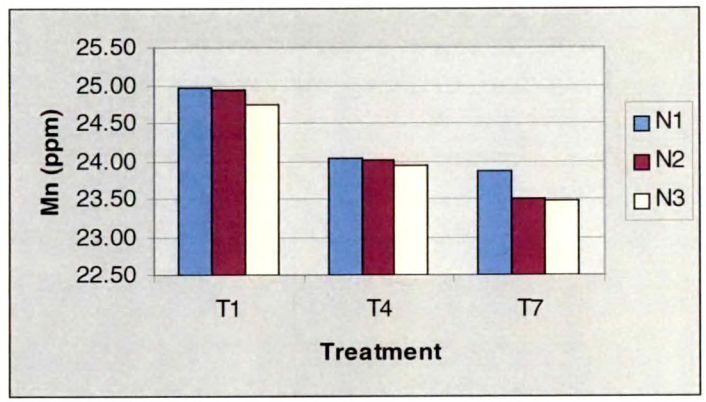


Fig. 5.26 Comparison of Mn Level in Wheat among Group-A, B and C

Table 5.39 and Table 5.40 represent two factor ANOVA and ANOVA Table for Mn level in wheat respectively. Fig. 5.27 and Fig. 5.28 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.39 Two factor ANOVA (Mn Level in Wheat)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	24.97	24.67	24.32	24.03	24.48	24.17	23.86	24.36
	N2	24.94	24.57	24.23	24.01	24.41	24.11	23.50	24.25
	N3	24.74	24.54	24.20	23.93	24.37	24.07	23.47	24.19
		24.88	24.59	24.25	23.99	24.42	24.11	23.61	24.27

Table 5.40 ANOVA Table (Mn Level in Wheat)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.29	2.00	0.15	0.00	1.00
Factor 2	9.34	6.00	1.56	0.05	1.00
Interaction	0.18	12.00	0.01	0.00	1.00
Error	1314.62	42.00	31.30		
Total	1324.43	62.00			

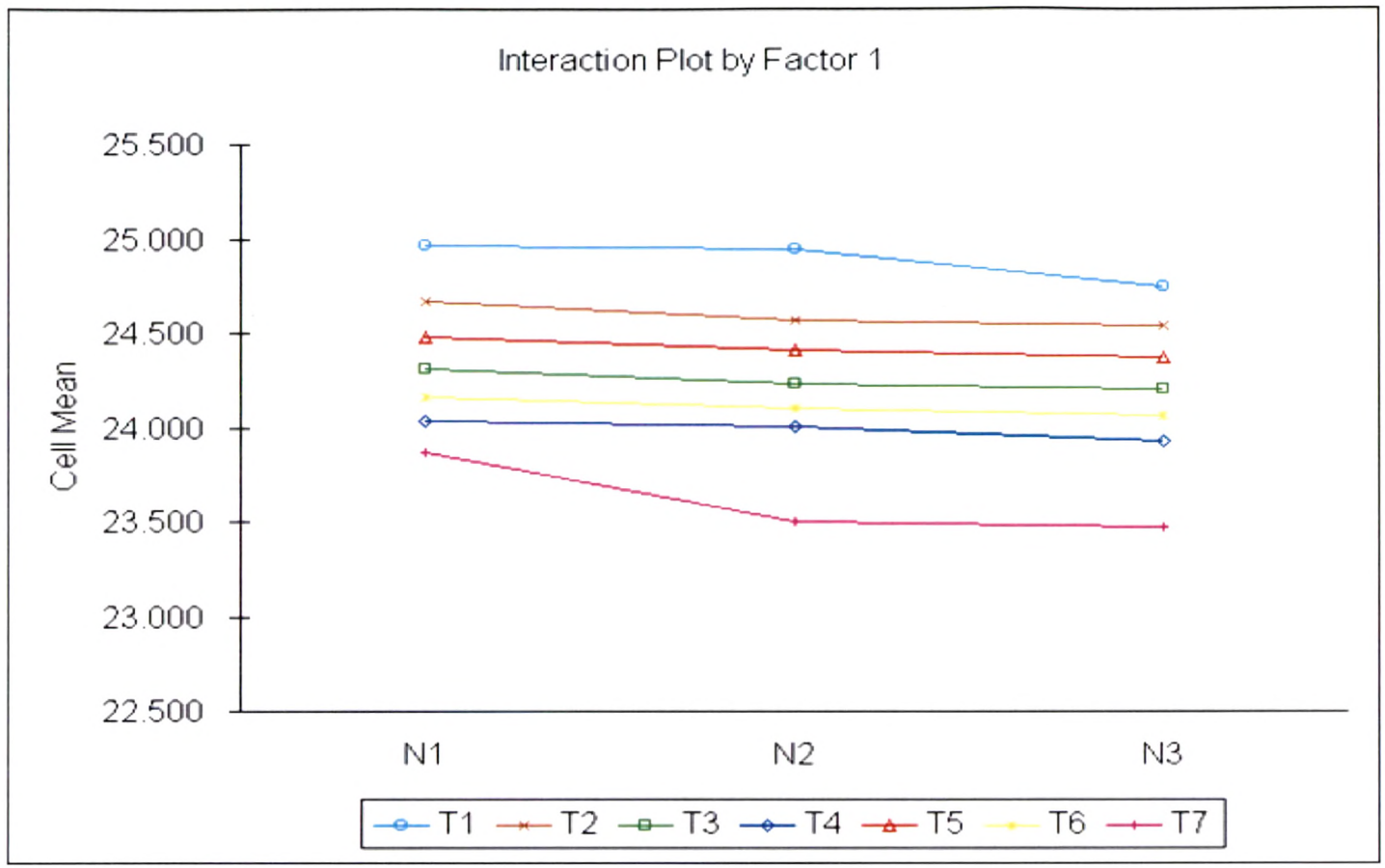


Fig 5.27 Interaction Plot by Factor 1 [Mn Level (ppm) in Wheat]

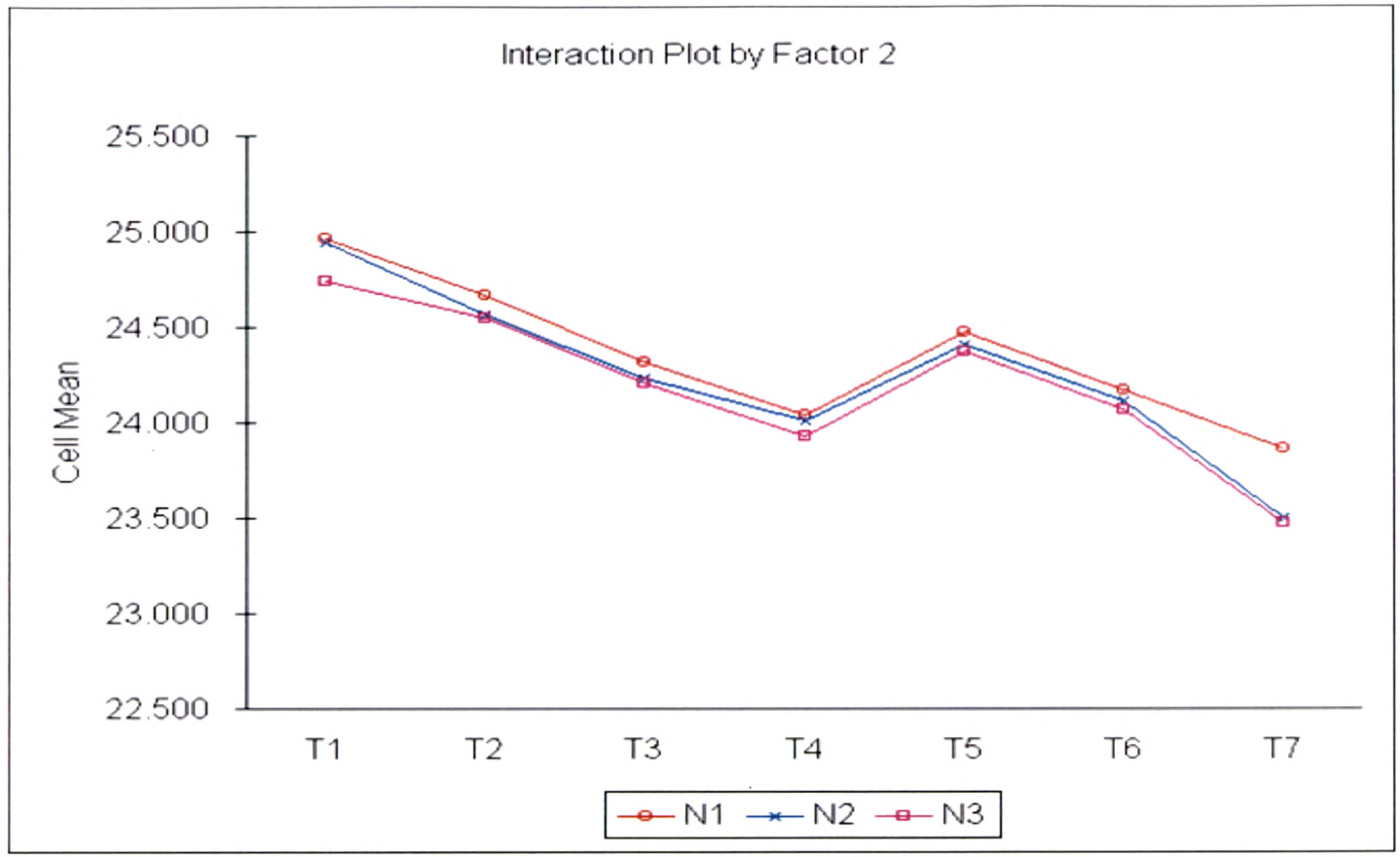


Fig 5.28 Interaction Plot by Factor 2 [Mn Level (ppm) in Wheat]

5.4.2.5 Iron (Fe)

Table 5.41, Table 5.42 and Table 5.43 represent analysis of heavy metal (Fe) in wheat grains during three successive replications. Fig. 5.29 shows Fe level in wheat grains response to various treatments for each replication.

Table 5.41 Analysis of Heavy Metal Fe (ppm) in Wheat (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.71	1.30	2.01	2.22	2.81	2.20	1.89
N2	1.30	1.40	1.24	1.48	1.40	1.50	1.88
N3	1.30	1.09	1.72	2.08	2.19	2.32	2.22

Table 5.42 Analysis of Heavy Metal Fe (ppm) in Wheat (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.50	4.40	2.90	3.10	3.10	3.30	3.00
N2	4.50	4.30	3.60	3.20	4.20	3.70	2.80
N3	4.50	4.50	3.50	3.00	3.00	3.10	2.30

Table 5.43 Analysis of Heavy Metal Fe (ppm) in Wheat (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.80	5.00	4.20	3.20	4.50	3.20	3.20
N2	5.10	4.90	4.10	3.60	4.50	3.50	3.10
N3	5.00	4.90	3.70	3.10	4.10	3.20	3.10

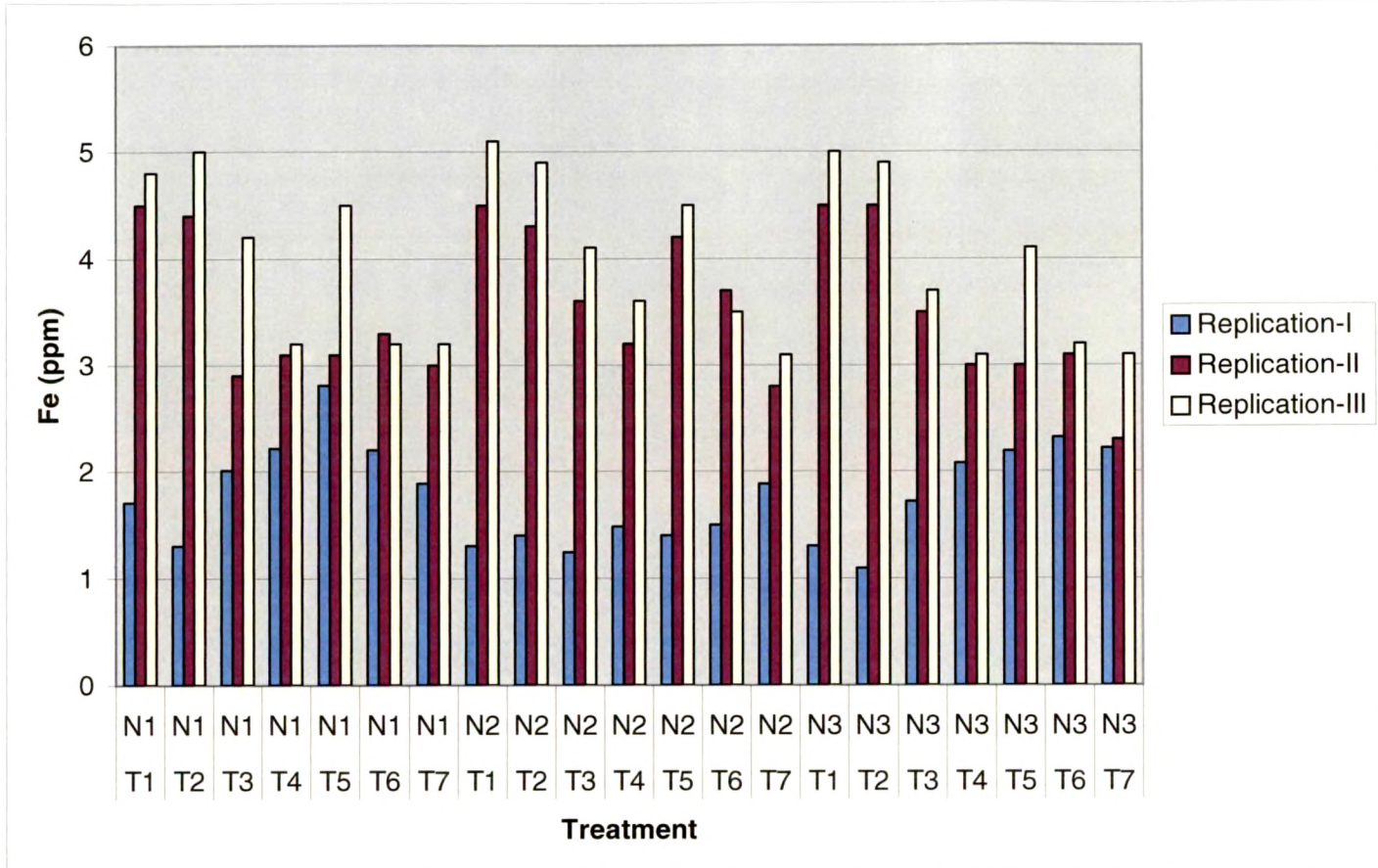
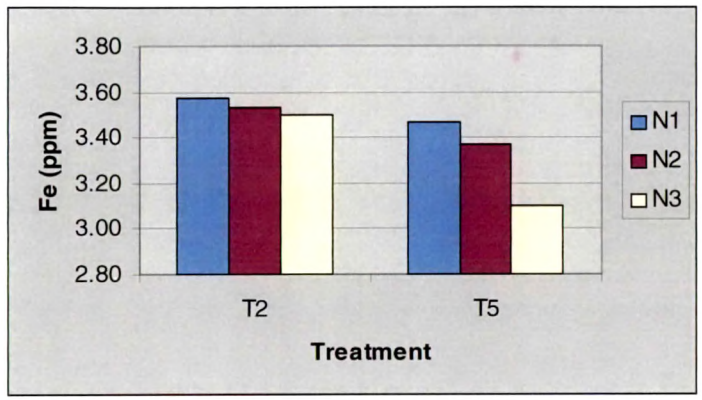


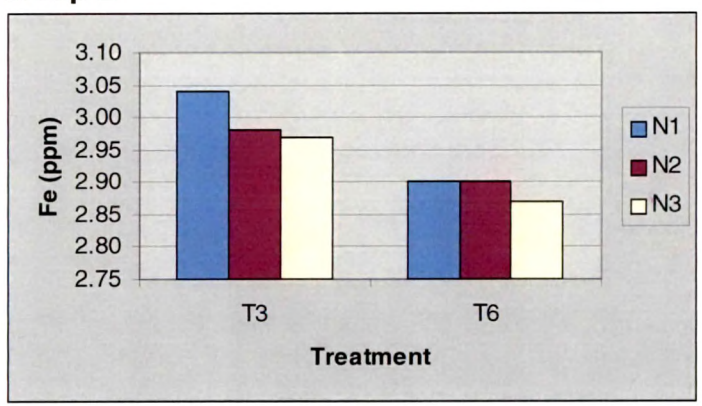
Fig. 5.29 Fe Level in Wheat

Fig. 5.30 shows comparison of Fe level in wheat among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

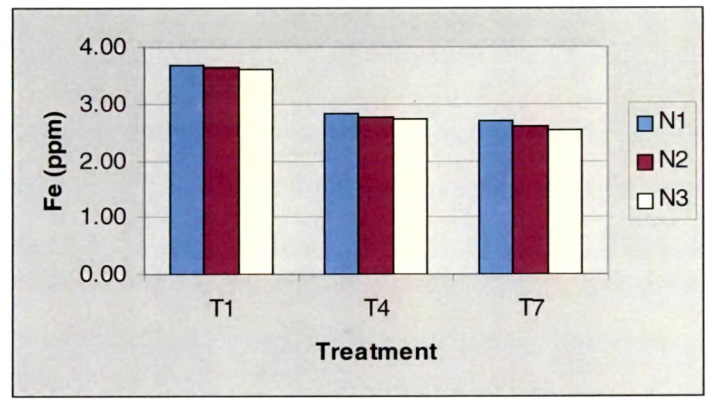


Fig. 5.30 Comparison of Fe Level in Wheat among Group-A, B and C

Table 5.44 and Table 5.45 represent two factor ANOVA and ANOVA Table for Mn level in wheat respectively. Fig. 5.31 and Fig. 5.32 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.44 Two factor ANOVA (Wheat-Fe)

Factor 2

Means (ppm):

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	3.67	3.57	3.04	2.84	3.47	2.90	2.70	3.17
	N2	3.63	3.53	2.98	2.76	3.37	2.90	2.59	3.11
	N3	3.60	3.50	2.97	2.73	3.10	2.87	2.54	3.04
		3.63	3.53	3.00	2.78	3.31	2.89	2.61	3.11

Table 5.45 ANOVA Table (Wheat-Fe)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.16	2.00	0.08	0.05	0.96
Factor 2	8.25	6.00	1.37	0.77	0.60
Interaction	0.14	12.00	0.01	0.01	1.00
Error	74.86	42.00	1.78		
Total	83.41	62.00			

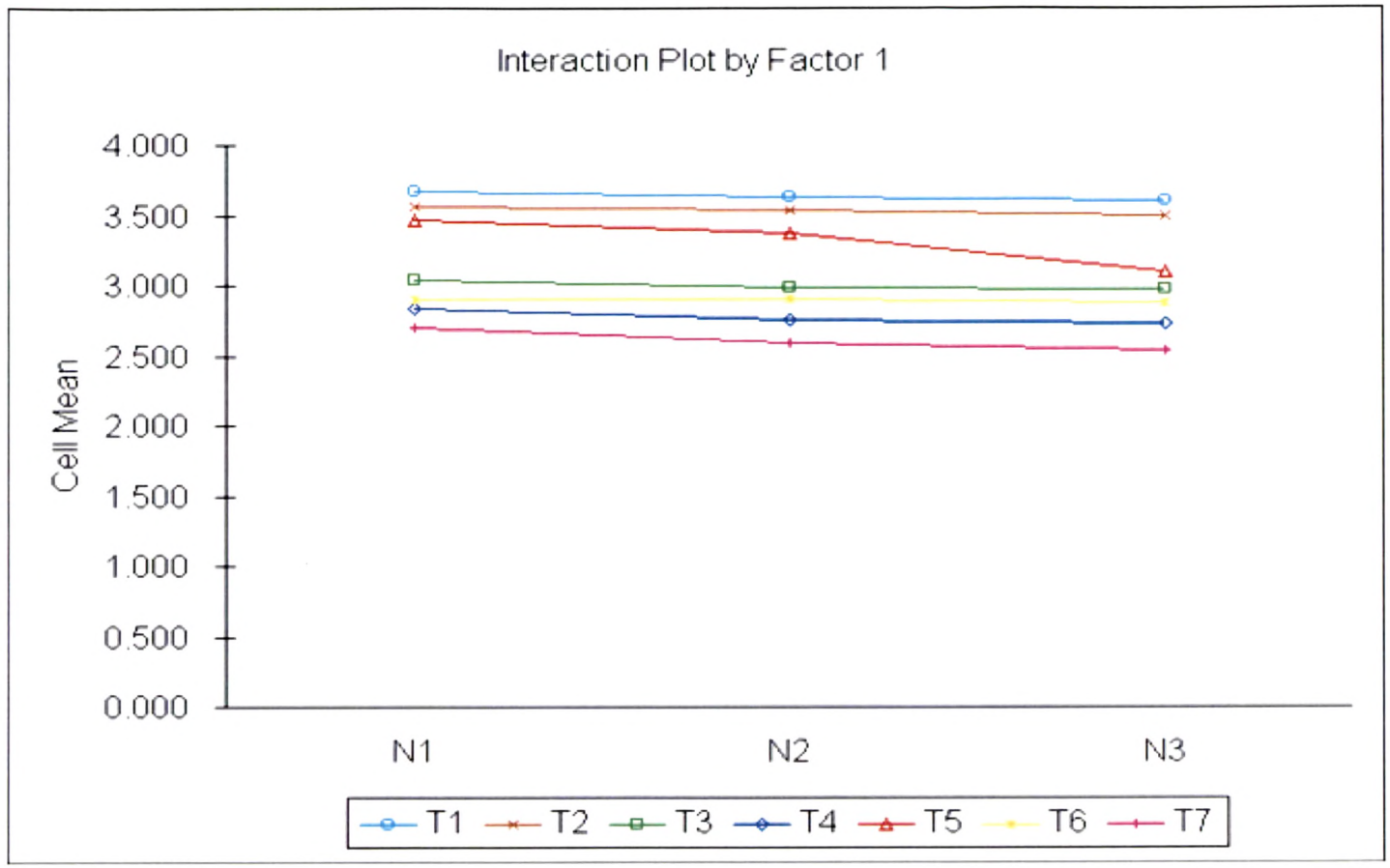


Fig 5.31 Interaction Plot by Factor 1 [Fe Level (ppm) in Wheat]

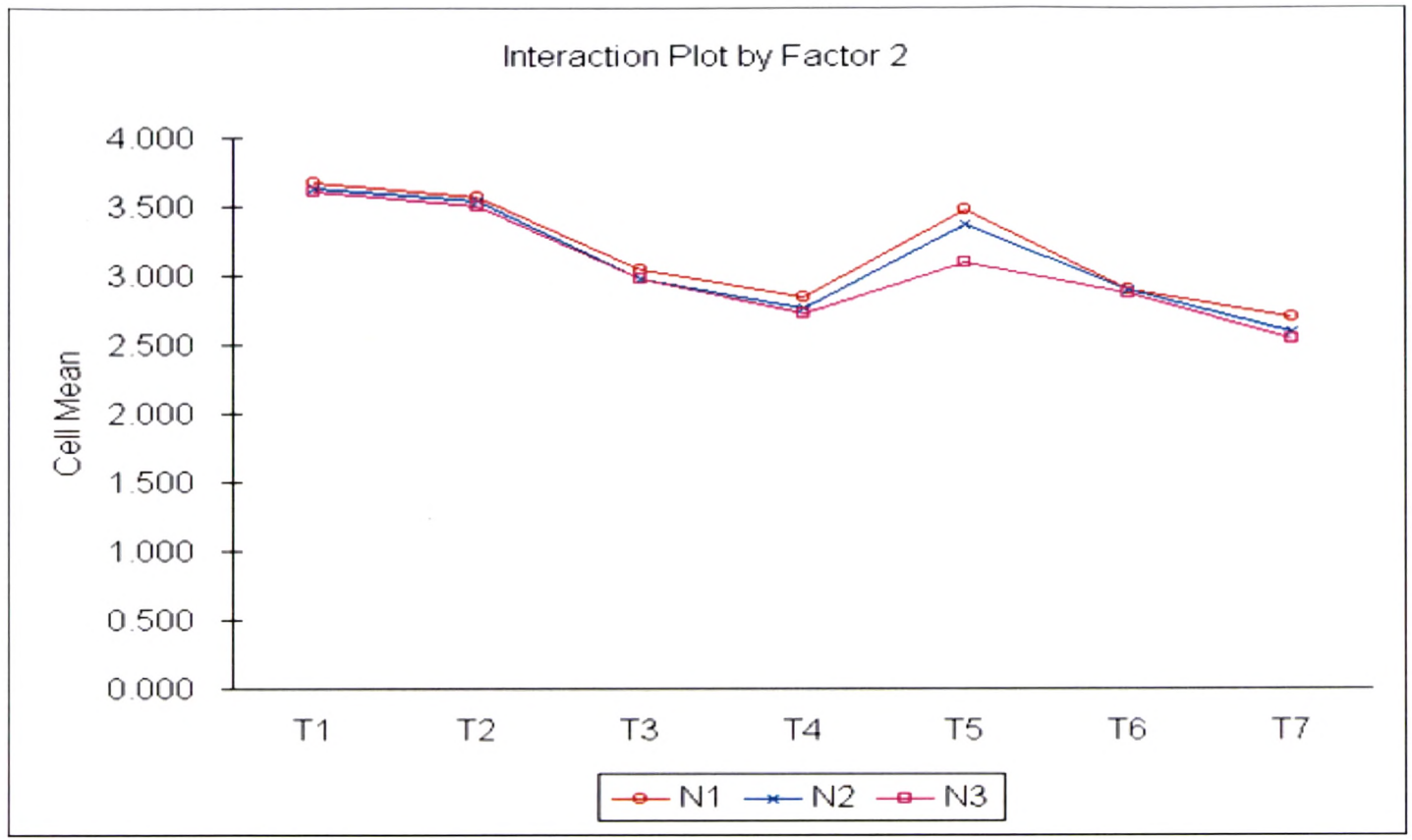


Fig 5.32 Interaction Plot by Factor 2 [Fe Level (ppm) in Wheat]

5.5 Qualitative Aspects of Greengram

5.5.1 Protein Content in Greengram

Table 5.46, Table 5.47 and Table 5.48 represent analysis of protein content in greengram grains during three successive replications. Fig. 5.33 shows protein content level in greengram grains response to various treatments for each replication.

Table 5.46 Analysis of Protein Content (%) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	21.5	21.8	21.2	21.1	20.9	21.1	20.8
N2	21.1	21.5	20.8	21.0	21.4	21.6	20.9
N3	21.5	22.0	21.8	21.0	22.0	22.8	20.7

Table 5.47 Analysis of Protein Content (%) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	24.8	23.8	23.8	23.7	24.1	23.8	22.1
N2	24.6	24.5	24.1	22.8	23.9	23.2	21.0
N3	24.1	24.0	23.2	22.1	23.5	22.8	22.2

Table 5.48 Analysis of Protein Content in (%) Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	25.2	25.4	24.4	23.9	24.7	24.1	23.2
N2	25.5	24.9	24.4	24.0	24.2	24.1	23.9
N3	25.5	24.8	24.4	23.1	24.0	23.1	22.5

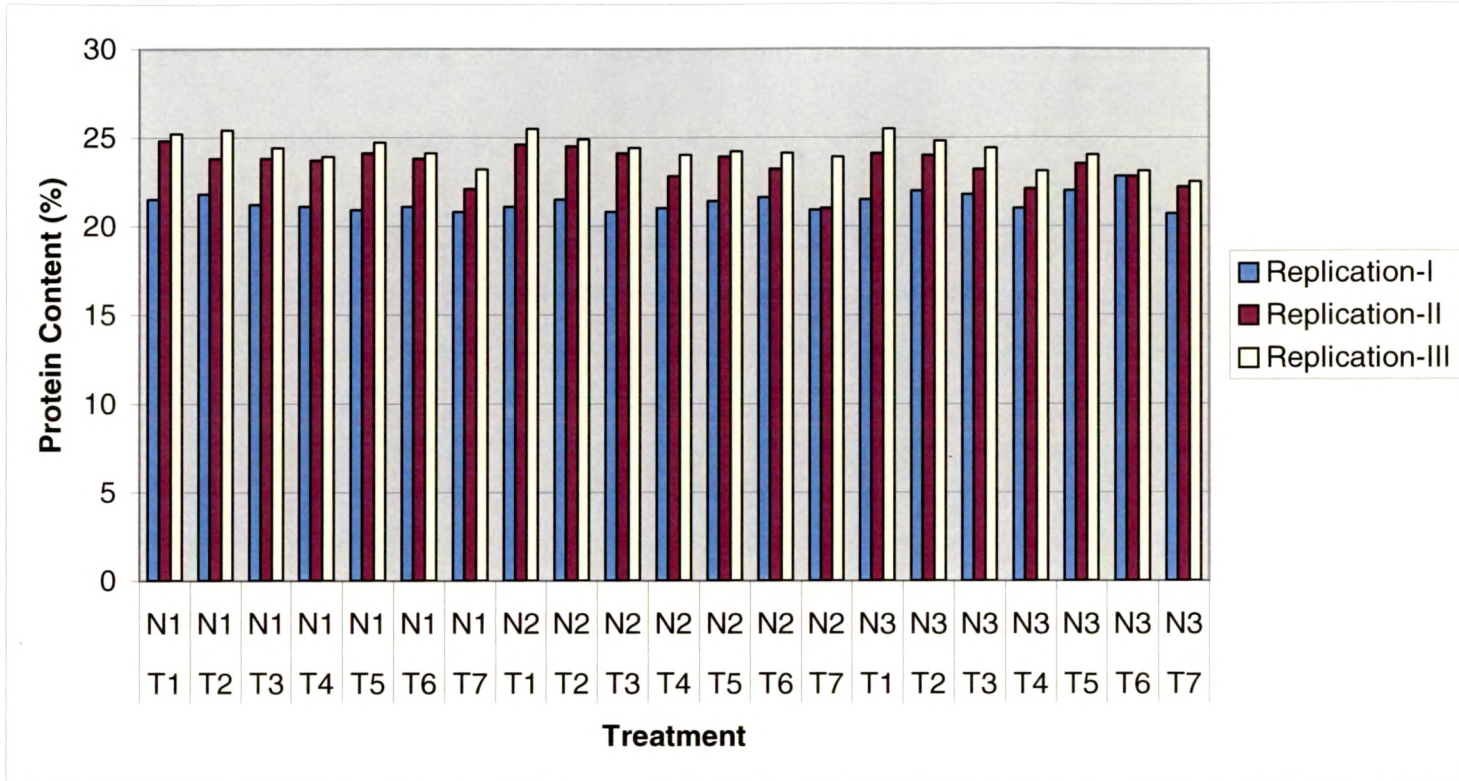
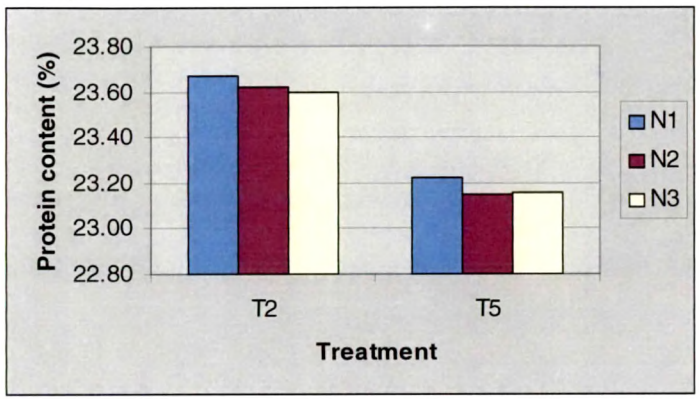


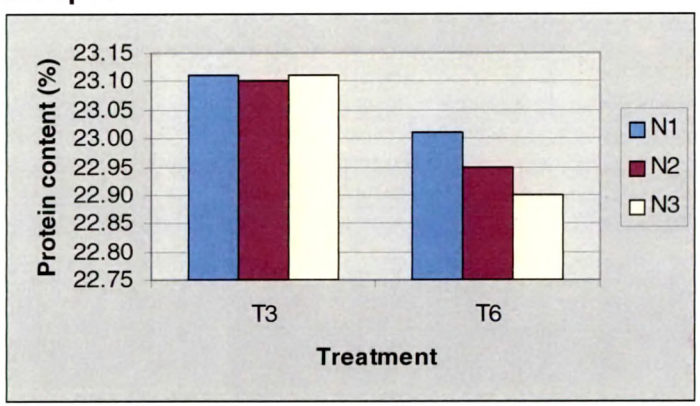
Fig. 5.33 Protein Content Level in Greengram

Fig. 5.34 Shows comparison of Protein Content Level in Greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

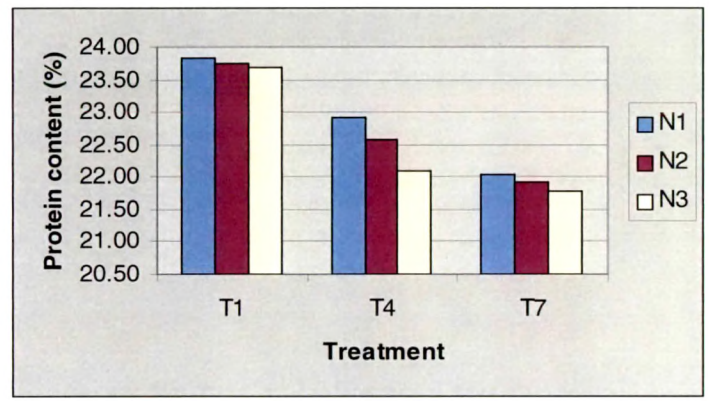


Fig. 5.34 Comparison of Protein Content Level in Greengram among Group-A, B and C

Table 5.49 and Table 5.50 represent two factor ANOVA and ANOVA Table for Protein content level in greengram respectively. Fig. 5.35 and Fig. 5.36 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.49 Two factor ANOVA (Greengram-Protein Content)

Factor 2

Means: (%)

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	23.83	23.67	23.13	22.90	23.23	23.00	22.03	23.11
	N2	23.73	23.63	23.10	22.60	23.17	22.97	21.93	23.02
	N3	23.70	23.60	23.13	22.07	23.17	22.90	21.80	22.91
		23.76	23.63	23.12	22.52	23.19	22.96	21.92	23.01

Table 5.50 ANOVA Table (Greengram-Protein Content)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.441	2	0.2205	0.09	.9181
Factor 2	21.717	6	3.6195	1.41	.2353
Interaction	0.772	12	0.0644	0.02	1.0000
Error	108.187	42	2.5759		
Total	131.117	62			

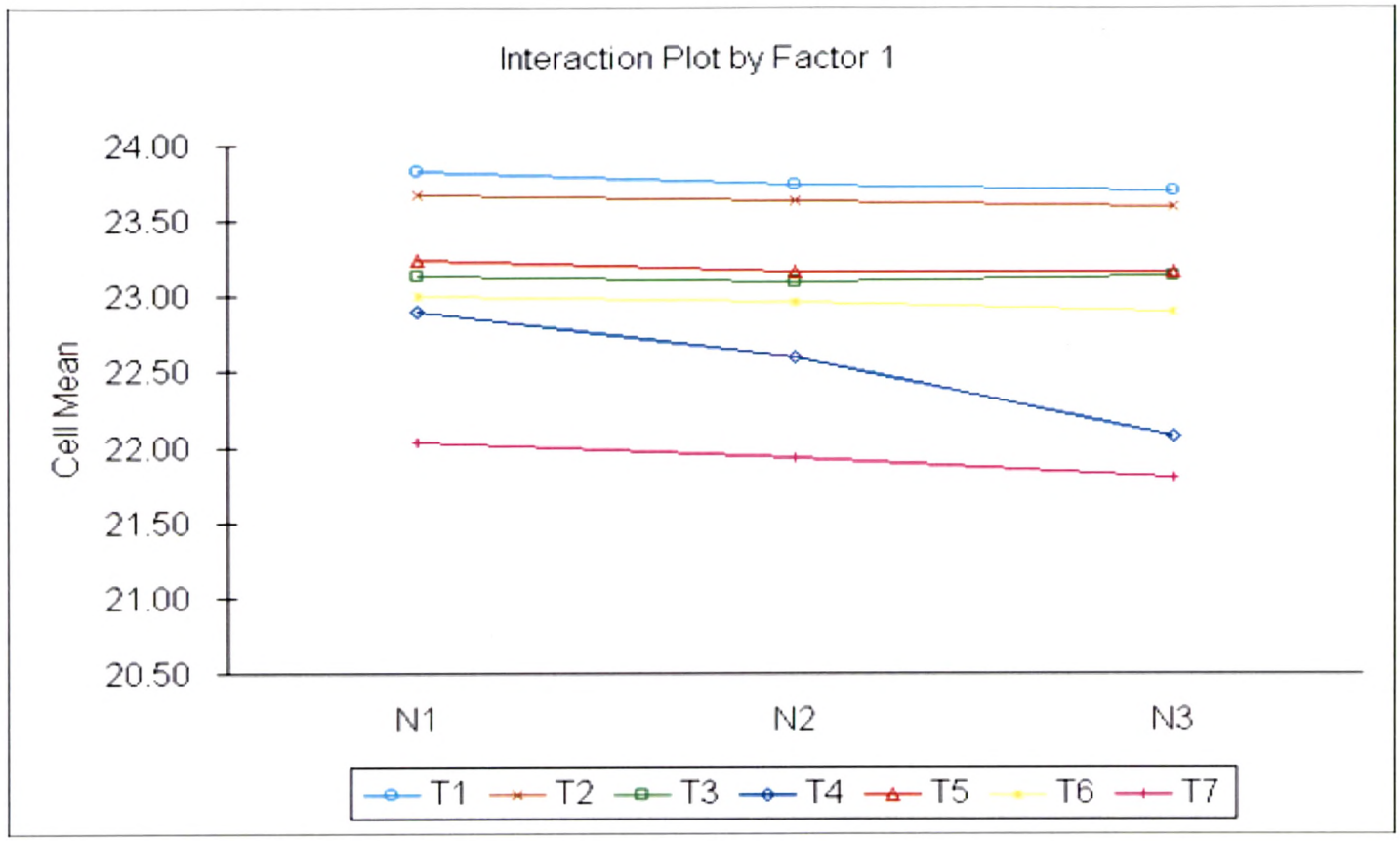


Fig 5.35 Interaction Plot by Factor 1 [Protein Content Level in Greengram]

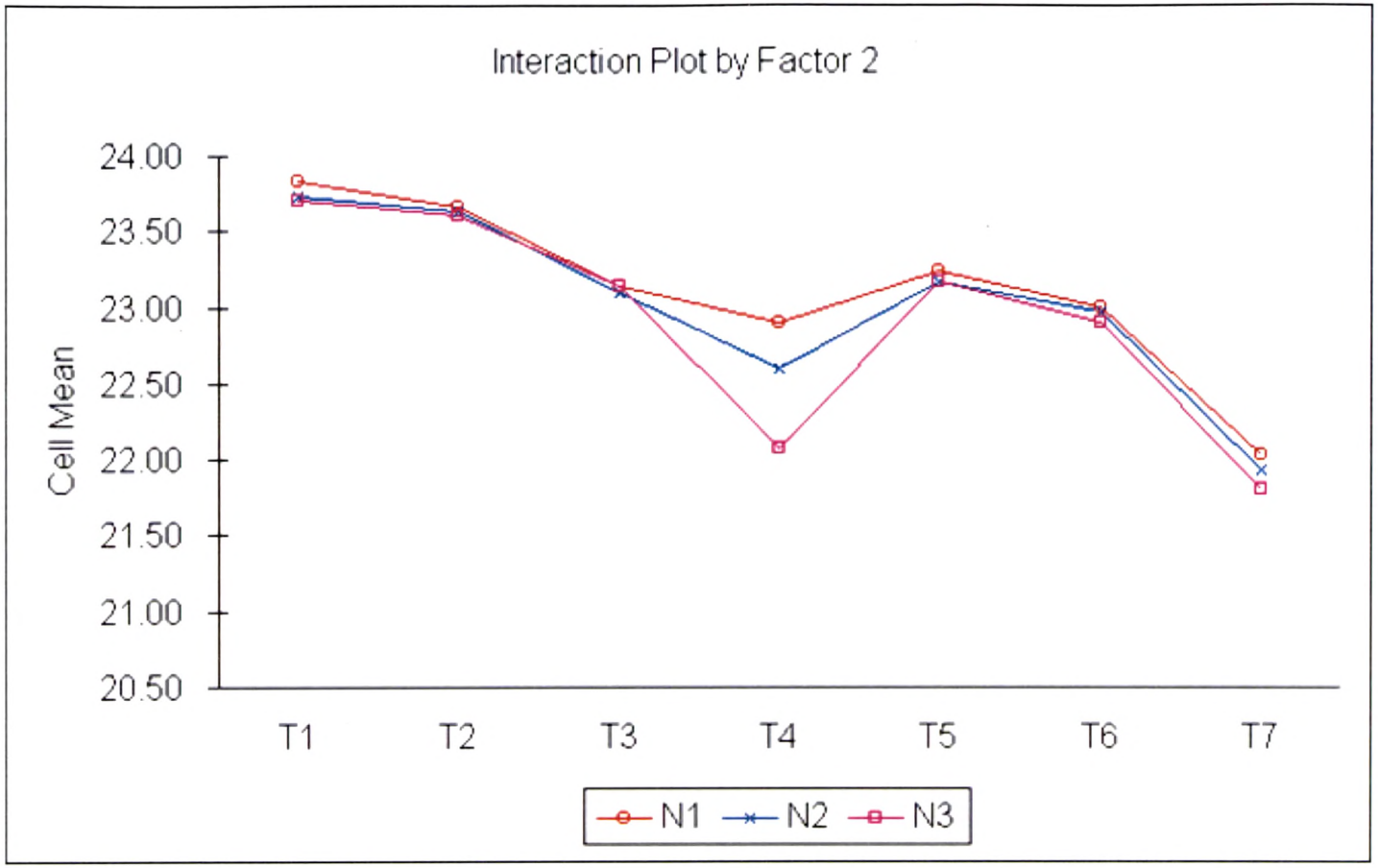


Fig 5.36 Interaction Plot by Factor 2 [Protein Content Level in Greengram]

5.5.2 Heavy Metals in Greengram

5.5.2.1 Lead (Pb)

Table 5.51, Table 5.52 and Table 5.53 represent analysis of heavy metal (Pb) in greengram grains during three successive replications. Fig.5.37 shows Pb level in greengram grains response to various treatments for each replication.

Table 5.51 Analysis of Heavy Metal Pb (ppm) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.41	0.00	0.34	0.42	0.00	0.00	0.00
N2	0.00	0.45	0.43	0.00	0.00	0.00	0.00
N3	0.00	0.40	0.00	0.00	0.36	0.47	0.00

Table 5.52 Analysis of Heavy Metal Pb (ppm) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.11	1.07	0.79	0.62	0.94	0.88	0.82
N2	1.10	0.85	0.71	0.85	0.92	0.85	0.79
N3	1.08	0.81	0.90	0.83	0.81	0.68	0.77

Table 5.53 Analysis of Heavy Metal Pb (ppm) in Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.23	1.15	0.85	0.70	1.14	1.04	0.82
N2	1.21	0.90	0.83	0.87	1.11	1.02	0.81
N3	1.18	0.88	1.05	0.84	0.84	0.71	0.80

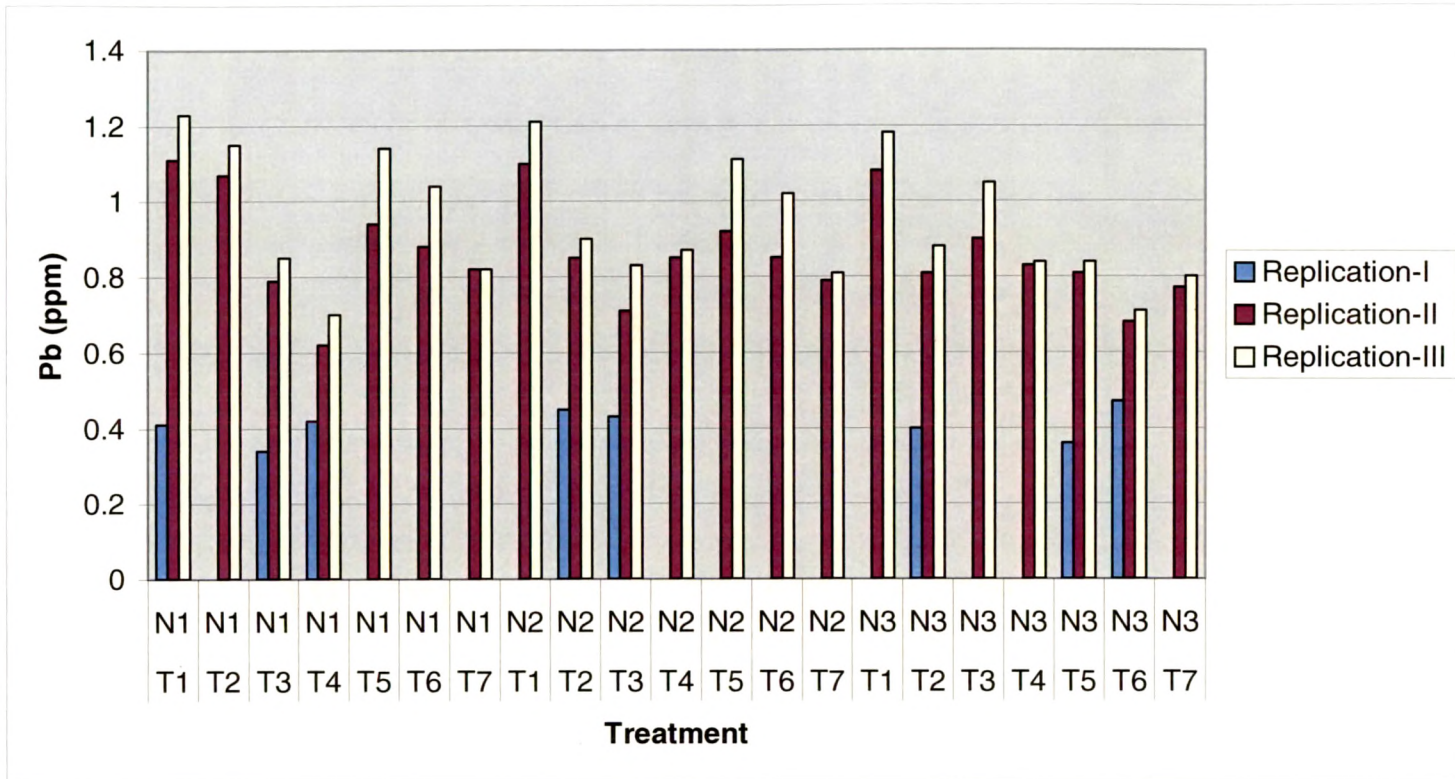
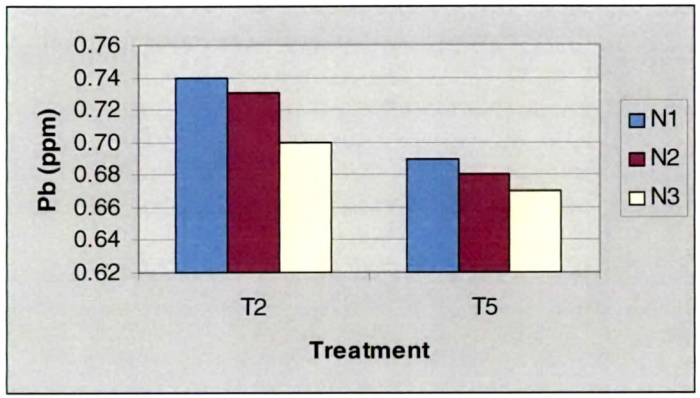


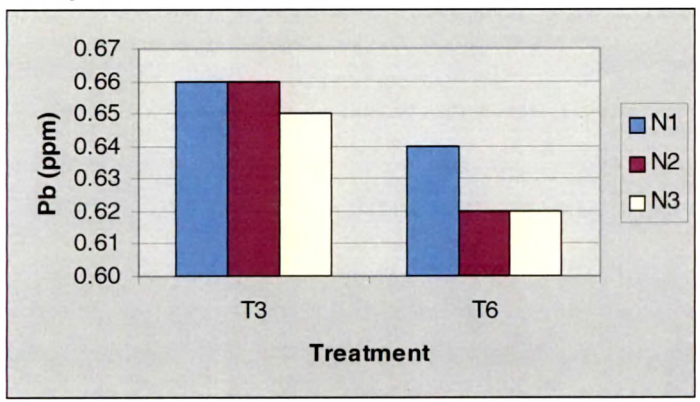
Fig. 5.37 Pb Level in Greengram

Fig. 5.38 shows comparison of Pb level in greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

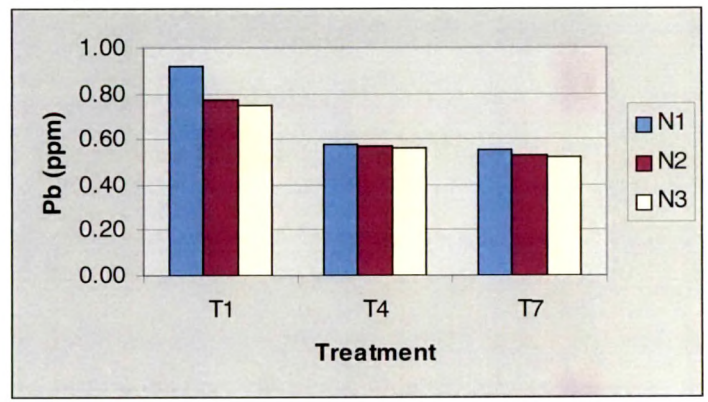


Fig. 5.38 Comparison of Pb Level in Greengram among Group-A, B and C

Table 5.54 and Table 5.55 represent two factor ANOVA and ANOVA Table for Pb level in greengram respectively. Fig. 5.39 and Fig. 5.40 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.54 Two factor ANOVA (Greengram-Pb)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.917	0.740	0.660	0.580	0.693	0.640	0.547	0.682
	N2	0.770	0.733	0.657	0.573	0.677	0.623	0.533	0.652
	N3	0.753	0.697	0.650	0.557	0.670	0.620	0.523	0.639
		0.813	0.723	0.656	0.570	0.680	0.628	0.534	0.658

Table 5.55 ANOVA Table (Greengram-Pb)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.0211	2	0.01053	0.05	.9533
Factor 2	0.4753	6	0.07921	0.36	.9000
Interaction	0.0341	12	0.00284	0.01	1.0000
Error	9.2447	42	0.22011		
Total	9.7751	62			

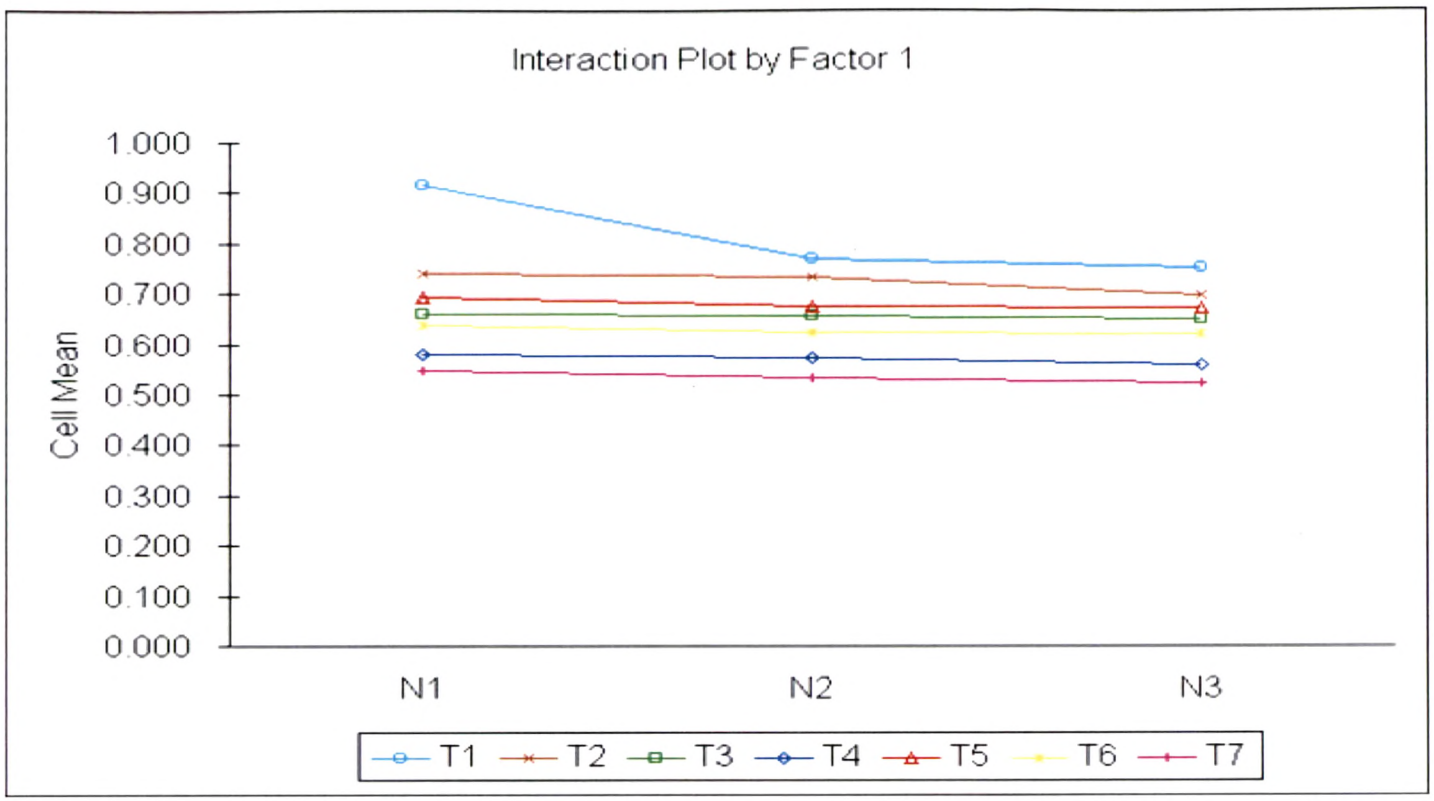


Fig 5.39 Interaction Plot by Factor 1 [Pb Level (ppm) in Greengram]

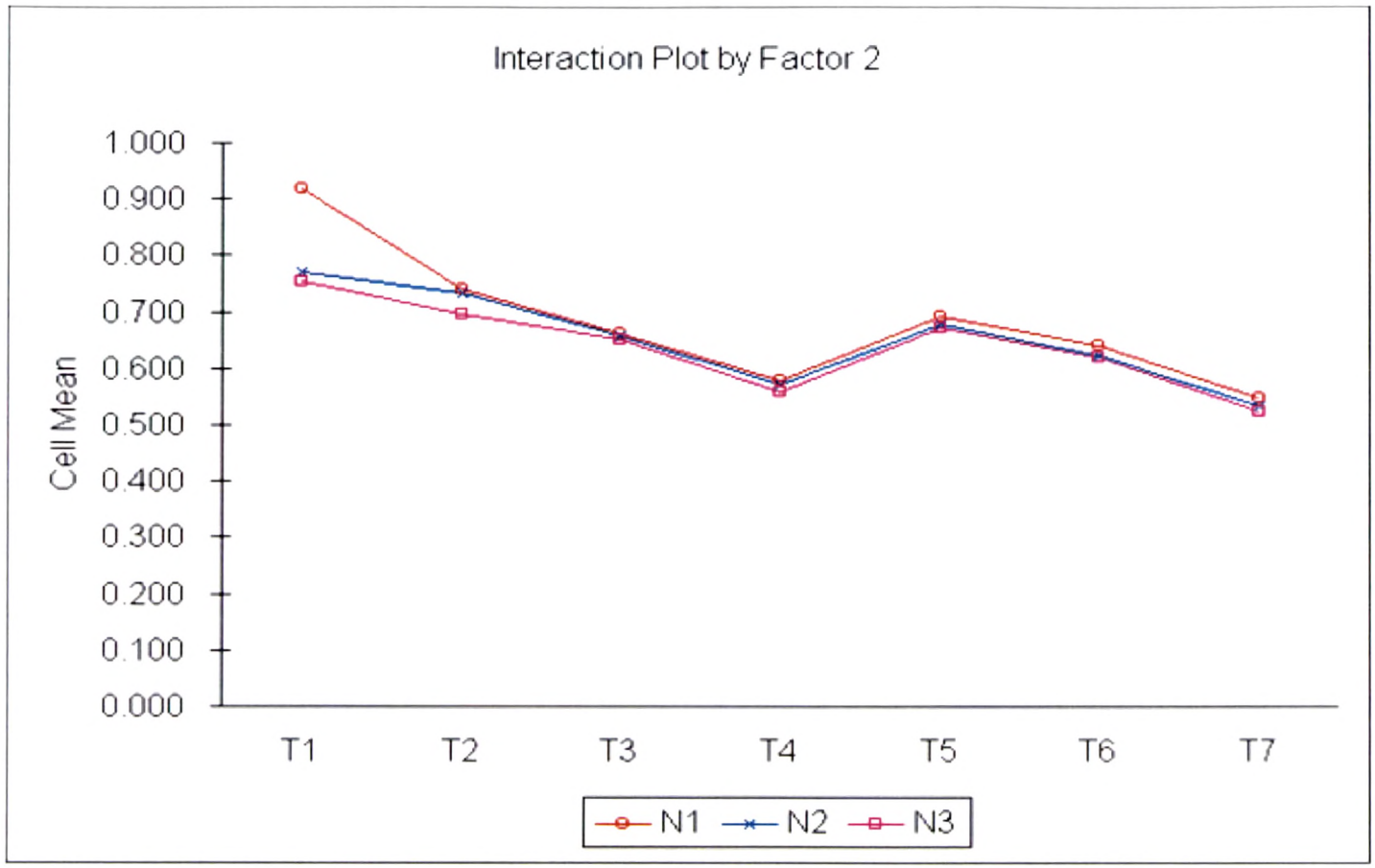


Fig 5.40 Interaction Plot by Factor 2 [Pb Level (ppm) in Greengram]

5.5.2.2 Copper (Cu)

Table 5.56, Table 5.57 and Table 5.58 represent analysis of heavy metal (Cu) in greengram grains during three successive replications. Fig.5.41 shows Cu level in greengram grains response to various treatments for each replication.

Table 5.56 Analysis of Heavy Metal Cu (ppm) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.22	0.21	0.20	0.30	0.31	0.33	0.23
N2	0.28	0.25	0.26	0.29	0.34	0.39	0.35
N3	0.38	0.36	0.40	0.42	0.24	0.27	0.28

Table 5.57 Analysis of Heavy Metal Cu (ppm) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.85	0.81	0.74	0.62	0.74	0.65	0.34
N2	0.81	0.8	0.71	0.61	0.71	0.61	0.25
N3	0.75	0.74	0.63	0.58	0.71	0.64	0.25

Table 5.58 Analysis of Heavy Metal Cu (ppm) in Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.91	0.87	0.78	0.67	0.79	0.68	0.41
N2	0.85	0.81	0.74	0.65	0.75	0.65	0.31
N3	0.81	0.75	0.67	0.47	0.79	0.72	0.25

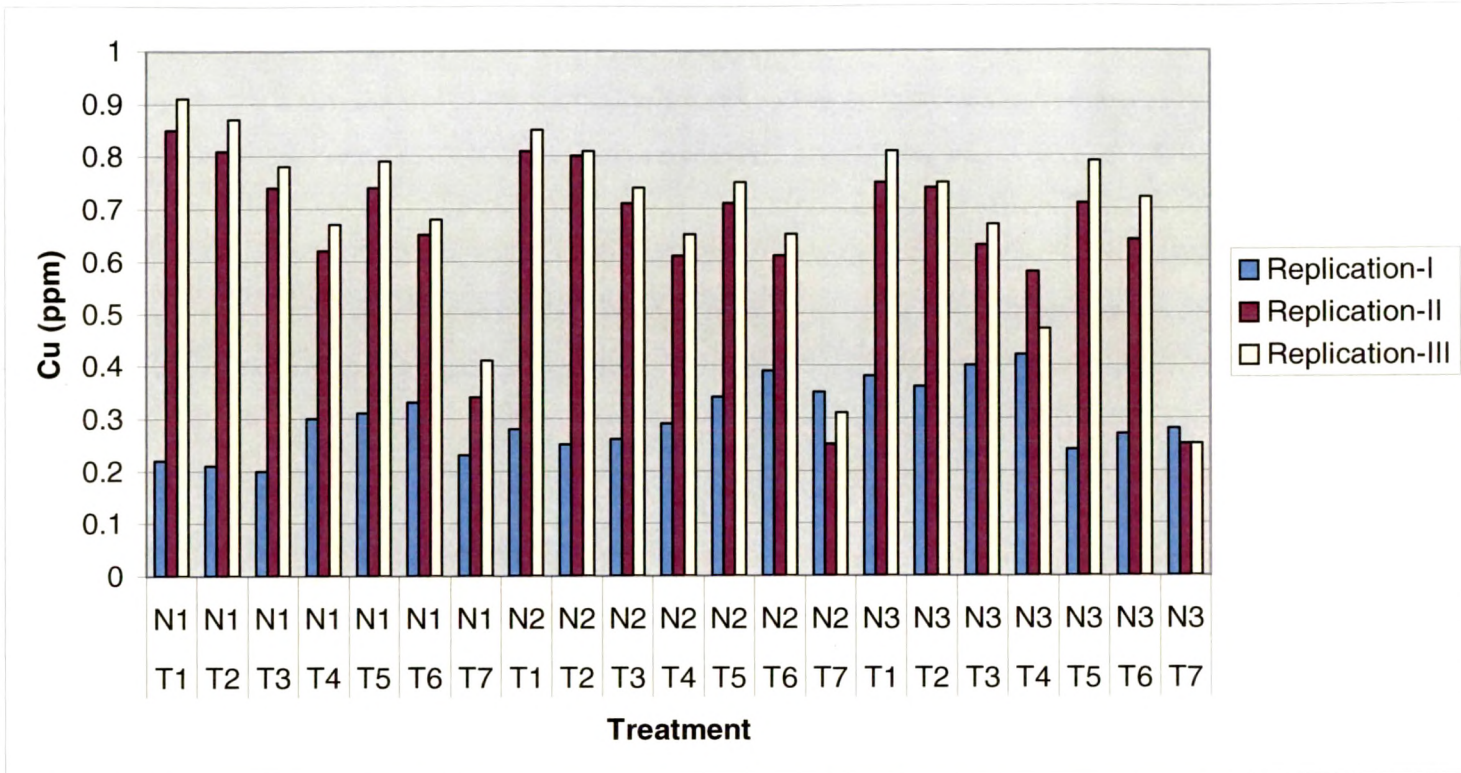
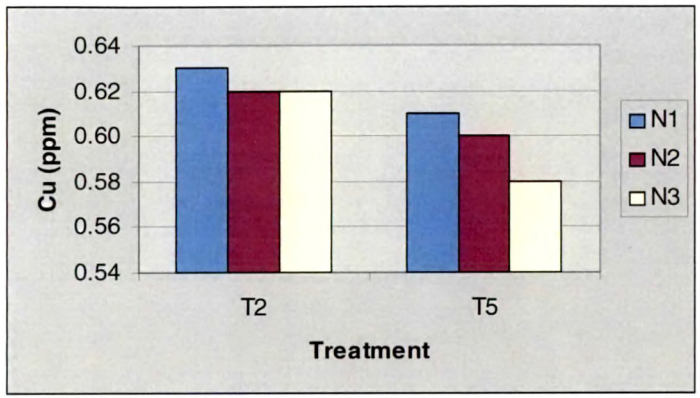


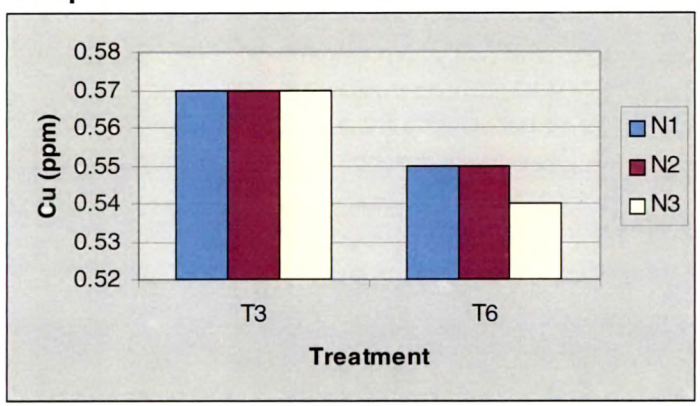
Fig. 5.41 Cu Level in Greengram

Fig. 5.42 shows comparison of Cu level in greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

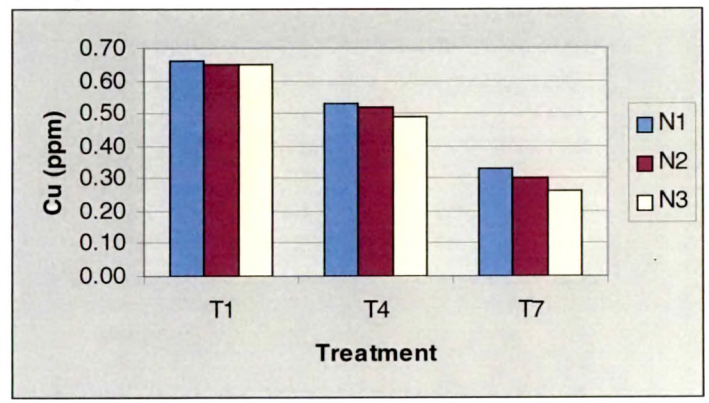


Fig. 5.42 Comparison of Cu Level in Greengram among Group-A, B and C

Table 5.59 and Table 5.60 represent two factor ANOVA and ANOVA Table for Cu level in greengram respectively. Fig. 5.43 and Fig. 5.44 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.59 Two factor ANOVA (Cu Level in Greengram)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.66	0.63	0.57	0.53	0.61	0.55	0.33	0.56
	N2	0.65	0.62	0.57	0.52	0.60	0.55	0.30	0.54
	N3	0.65	0.62	0.57	0.49	0.58	0.54	0.26	0.53
		0.65	0.62	0.57	0.51	0.60	0.55	0.30	0.54

Table 5.60 ANOVA Table (Cu Level in Greengram)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.01	2.00	0.00	0.06	0.94
Factor 2	0.75	6.00	0.13	2.18	0.06
Interaction	0.00	12.00	0.00	0.01	1.00
Error	2.41	42.00	0.06		
Total	3.17	62.00			

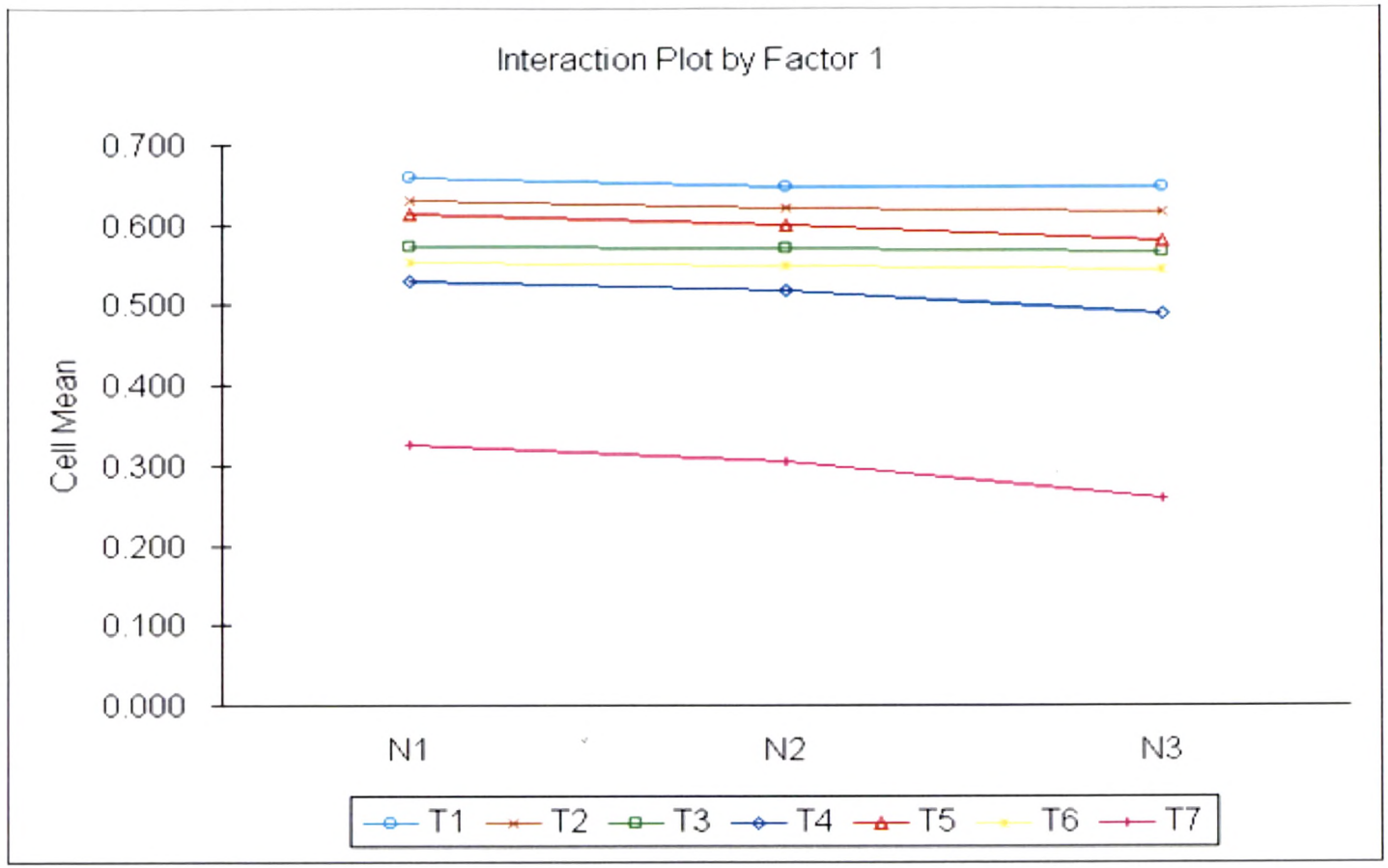


Fig 5.43 Interaction Plot by Factor 1 [Cu Level (ppm) in Greengram]

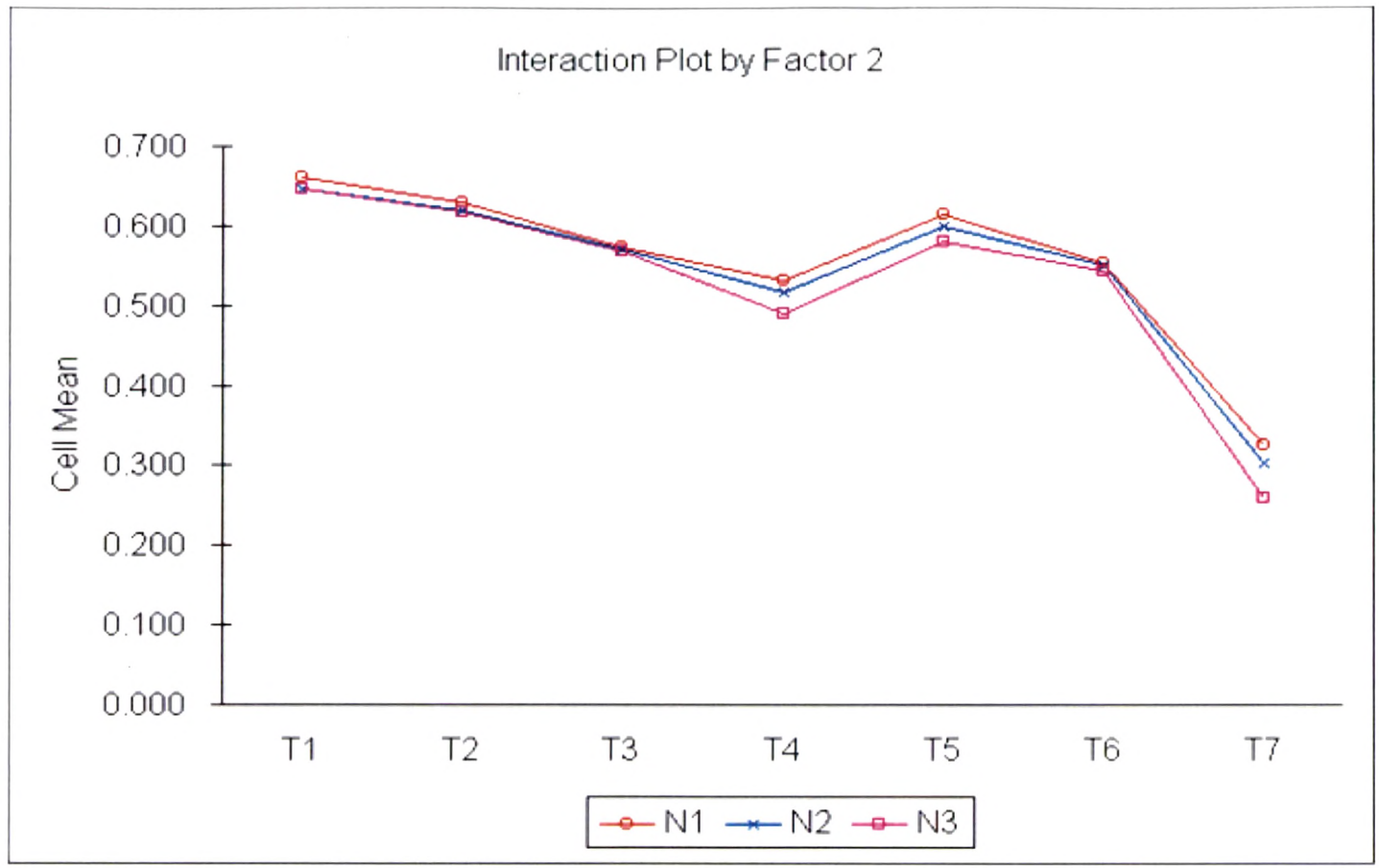


Fig 5.44 Interaction Plot by Factor 2 [Cu Level (ppm) in Greengram]

5.5.2.3 Zinc (Zn)

Table 5.61, Table 5.62 and Table 5.63 represent analysis of heavy metal (Zn) in greengram grains during three successive replications. Fig.5.45 shows Zn level in greengram grains response to various treatments for each replication.

Table 5.61 Analysis of Heavy Metal Zn (ppm) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.10	4.90	5.70	5.80	3.90	3.20	3.71
N2	3.33	3.19	3.99	3.86	4.60	4.35	3.60
N3	4.69	4.71	3.81	4.11	3.28	4.32	4.29

Table 5.62 Analysis of Heavy Metal Zn (ppm) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.93	4.12	3.24	3.06	4.41	4.45	3.56
N2	4.92	4.86	4.08	3.99	3.84	3.86	3.71
N3	4.21	4.03	4.19	3.75	4.52	3.88	2.74

Table 5.63 Analysis of Heavy Metal Zn (ppm) in Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.98	4.17	3.35	3.21	4.58	4.49	4.36
N2	4.99	4.95	4.21	4.02	4.34	3.91	3.74
N3	4.32	4.21	4.21	3.83	4.68	3.91	3.88

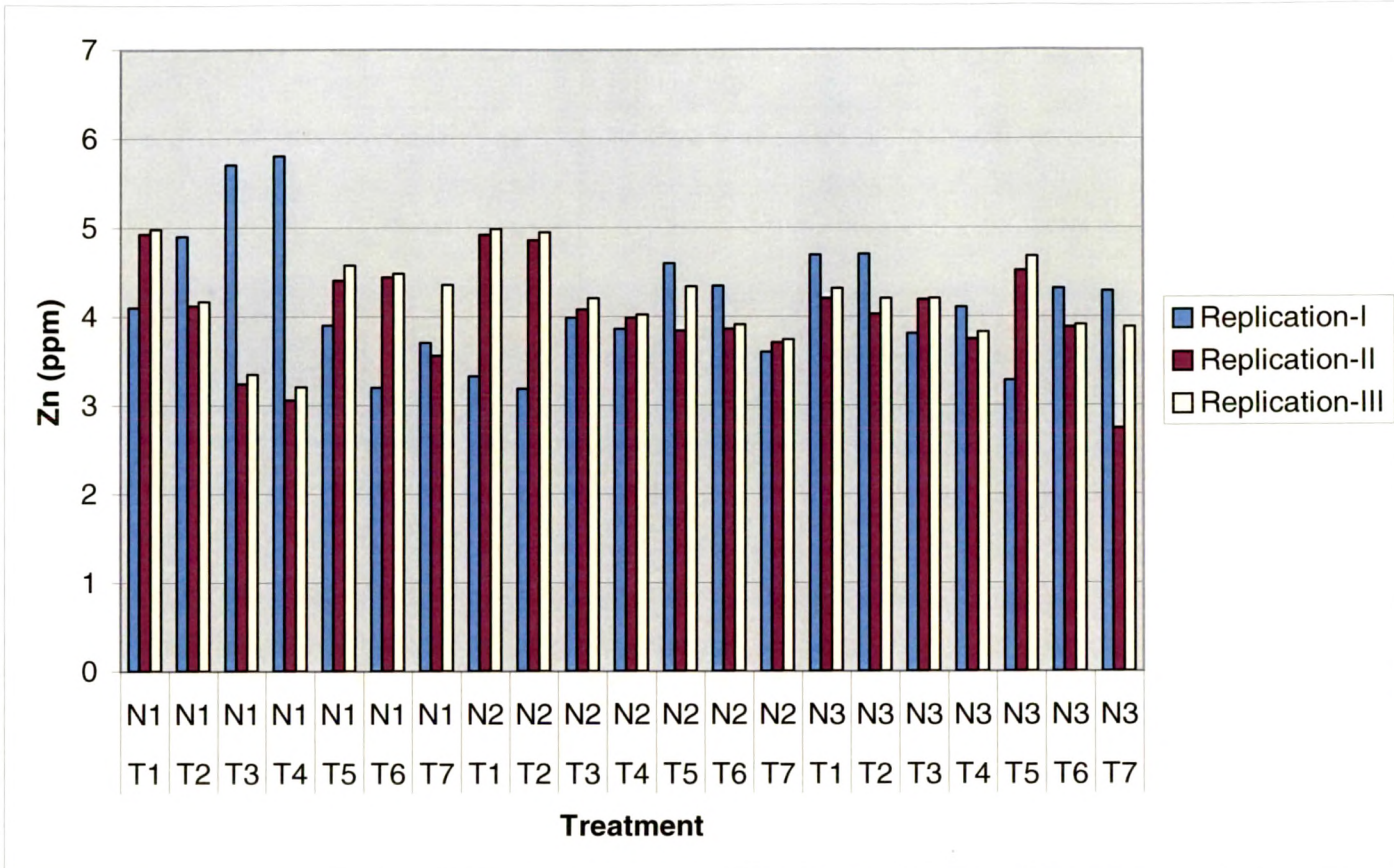
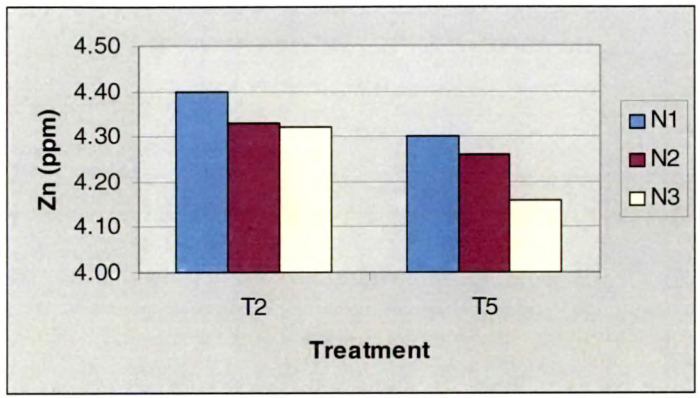


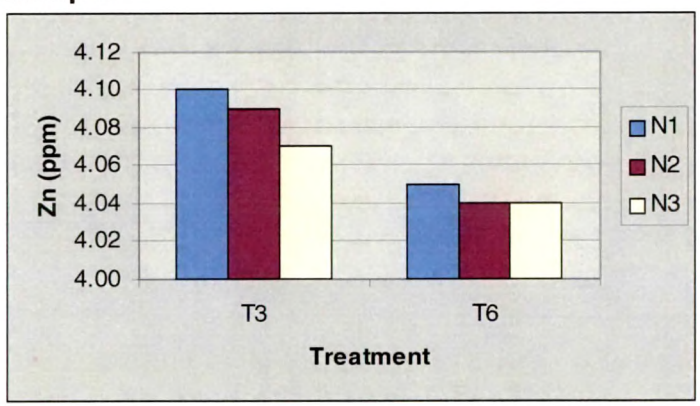
Fig. 5.45 Zn Level in Greengram

Fig. 5.46 shows comparison of Zn level in greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

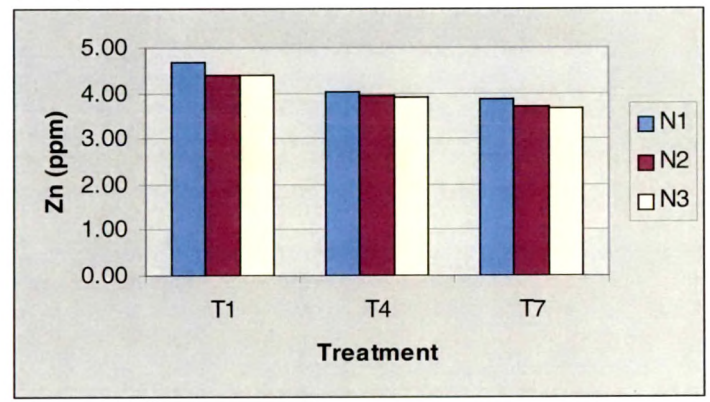


Fig. 5.46 Comparison of Zn Level in Greengram among Group-A, B and C

Table 5.64 and Table 5.65 represent two factor ANOVA and ANOVA Table for Zn level in greengram respectively. Fig. 5.47 and Fig. 5.48 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.64 Two factor ANOVA (Zn Level in Greengram)

Factor 2

Means (ppm):

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	4.67	4.40	4.10	4.02	4.30	4.05	3.88	4.20
	N2	4.41	4.33	4.09	3.96	4.26	4.04	3.68	4.11
	N3	4.41	4.32	4.07	3.90	4.16	4.04	3.64	4.07
		4.50	4.35	4.09	3.96	4.24	4.04	3.73	4.13

Table 5.65 ANOVA Table (Zn Level in Greengram)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.18	2.00	0.09	0.20	0.82
Factor 2	3.52	6.00	0.59	1.33	0.26
Interaction	0.12	12.00	0.01	0.02	1.00
Error	18.52	42.00	0.44		
Total	22.34	62.00			

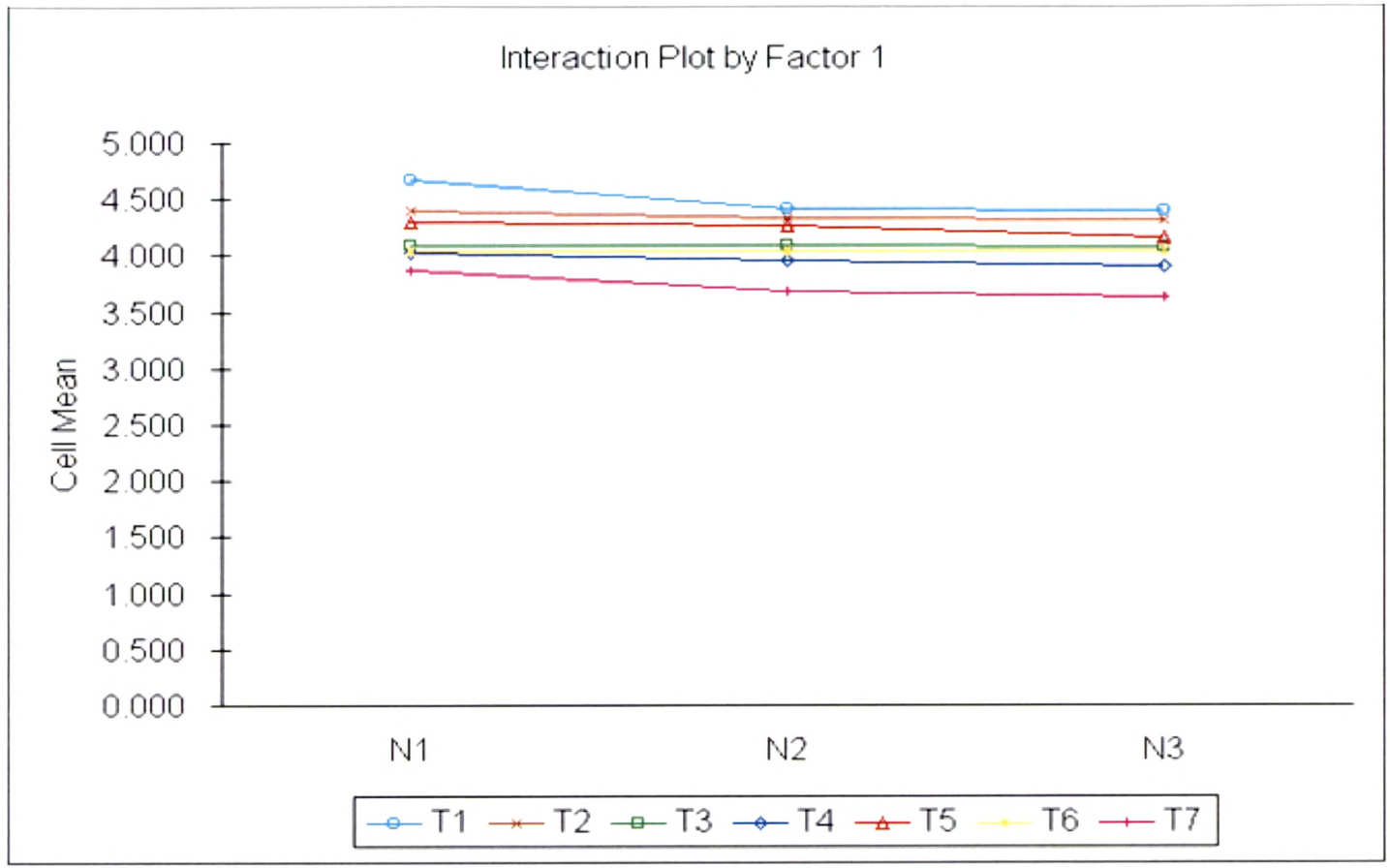


Fig 5.47 Interaction Plot by Factor 1 [Zn Level (ppm) in Greengram]

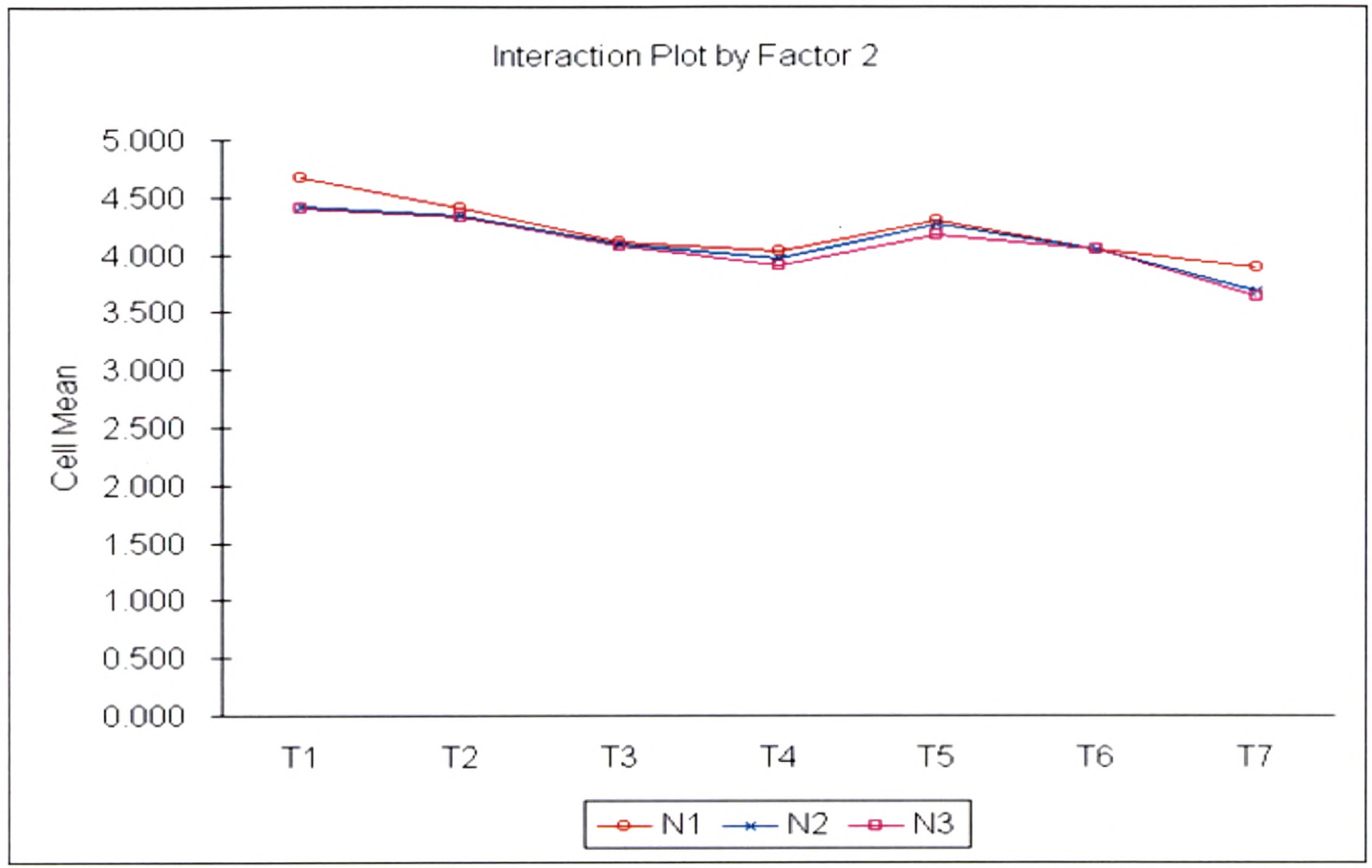


Fig 5.48 Interaction Plot by Factor 2 [Zn Level (ppm) in Greengram]

5.5.2.4 Manganese (Mn)

Table 5.66, Table 5.67 and Table 5.68 represent analysis of heavy metal (Mn) in greengram grains during three successive replications. Fig.5.49 shows Mn level in greengram grains response to various treatments for each replication.

Table 5.66 Analysis of Heavy Metal Mn (ppm) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	3.80	3.63	3.70	3.90	3.56	4.21	3.32
N2	4.12	3.90	3.11	3.81	3.20	3.69	3.75
N3	4.10	3.45	3.90	4.22	3.81	3.20	3.33

Table 5.67 Analysis of Heavy Metal Mn (ppm) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.11	4.07	3.67	3.02	3.95	3.05	3.11
N2	4.12	3.97	3.84	3.02	3.99	3.18	2.88
N3	4.08	3.99	3.45	2.81	3.68	3.49	3.04

Table 5.68 Analysis of Heavy Metal Mn (ppm) in Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.60	4.13	3.71	3.24	4.01	3.22	3.45
N2	4.15	4.06	3.94	3.21	4.04	3.51	3.21
N3	4.12	4.08	3.51	2.99	3.74	3.52	3.10

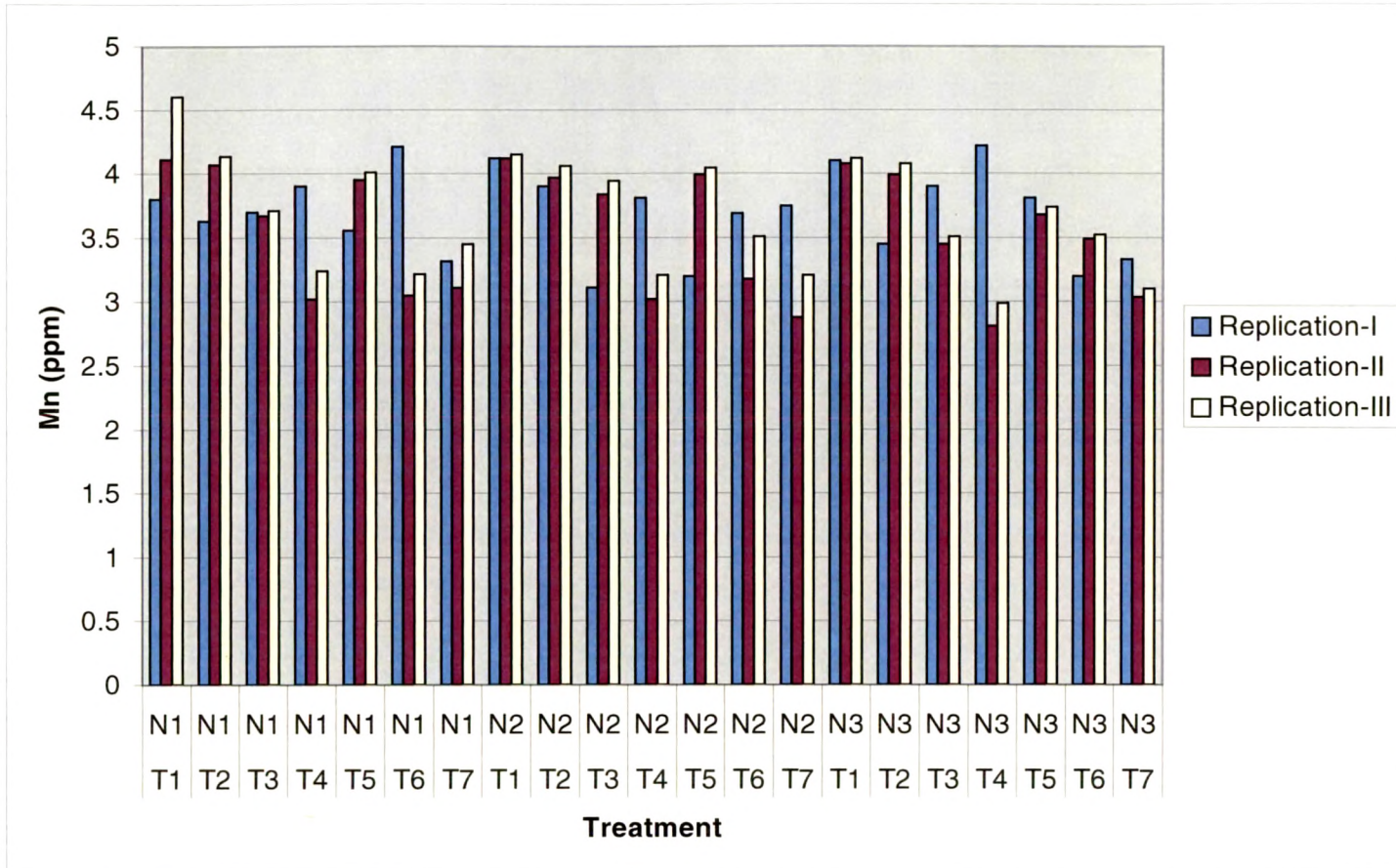
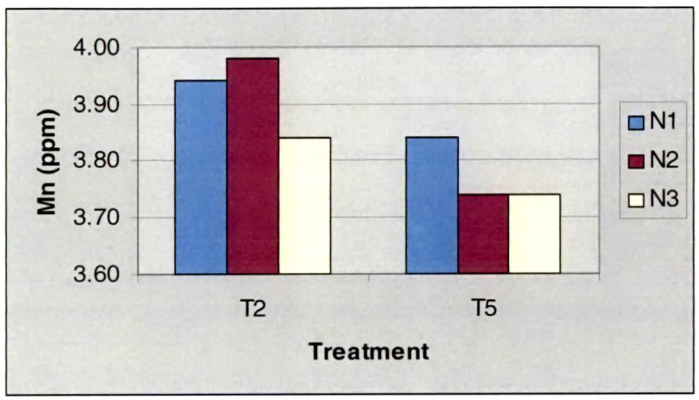


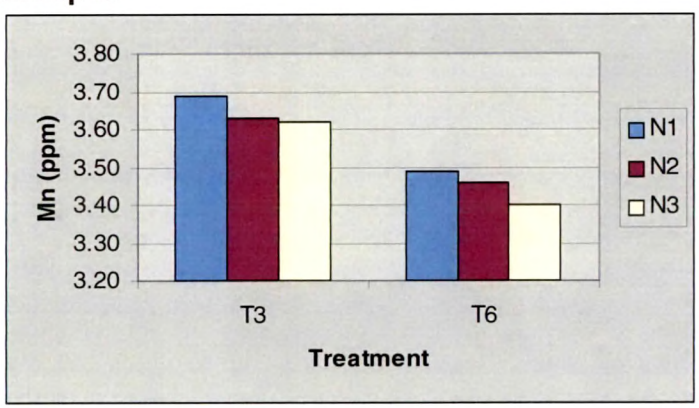
Fig. 5.49 Mn Level in Greengram

Fig. 5.50 shows comparison of Mn level in greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

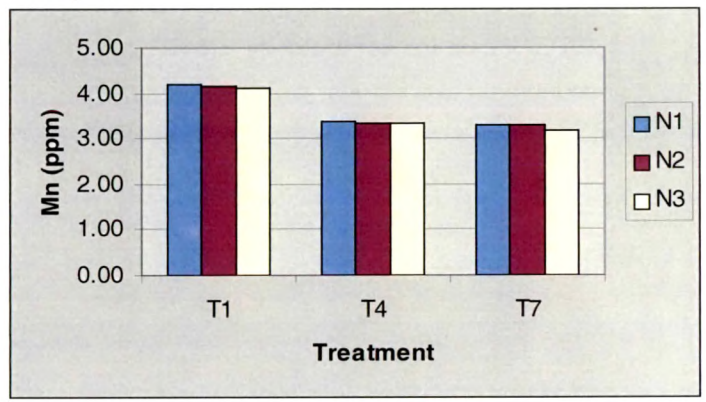


Fig. 5.50 Comparison of Mn Level in Greengram among Group-A, B and C

Table 5.69 and Table 5.70 represent two factor ANOVA and ANOVA Table for Mn level in greengram respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.71. Table 5.72 shows p-values for pairwise t-tests. Fig.5.51 and Fig.5.52 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.69 Two factor ANOVA (Greengram-Mn)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	4.17	3.94	3.69	3.39	3.84	3.49	3.29	3.69
	N2	4.13	3.98	3.63	3.35	3.74	3.46	3.28	3.65
	N3	4.10	3.84	3.62	3.34	3.74	3.40	3.16	3.60
		4.13	3.92	3.65	3.36	3.78	3.45	3.24	3.65

Table 5.70 ANOVA Table (Greengram-Mn)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.08	2.00	0.04	0.33	0.72
Factor 2	5.51	6.00	0.92	7.37	**0.00**
Interaction	0.03	12.00	0.00	0.02	1.00
Error	5.23	42.00	0.12		
Total	10.86	62.00			

Table 5.71 Post hoc analysis for Factor 2 (Mn Level in Greengram)

Tukey simultaneous comparison t-values (d.f. = 42)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	3.24	3.36	3.45	3.65	3.78	3.92	4.13
T7	3.24							
T4	3.36	0.69						
T6	3.45	1.26	0.57					
T3	3.65	2.43	1.74	1.18				
T5	3.78	3.20	2.51	1.94	0.77			
T2	3.92	4.07	3.38	2.81	1.64	0.87		
T1	4.13	5.35	4.66	4.09	2.92	2.15	1.28	

critical values for experiment wise error rate:

0.05	3.10
0.01	3.72

Table 5.72 p-values for pairwise t-tests (Mn Level in Greengram)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	3.24	3.36	3.45	3.65	3.78	3.92	4.13
T7	3.24							
T4	3.36	0.50						
T6	3.45	0.22	0.57					
T3	3.65	0.02	0.09	0.25				
T5	3.78	0.00	0.02	0.06	0.45			
T2	3.92	0.00	0.00	0.01	0.11	0.39		
T1	4.13	0.00	0.00	0.00	0.01	0.04	0.21	

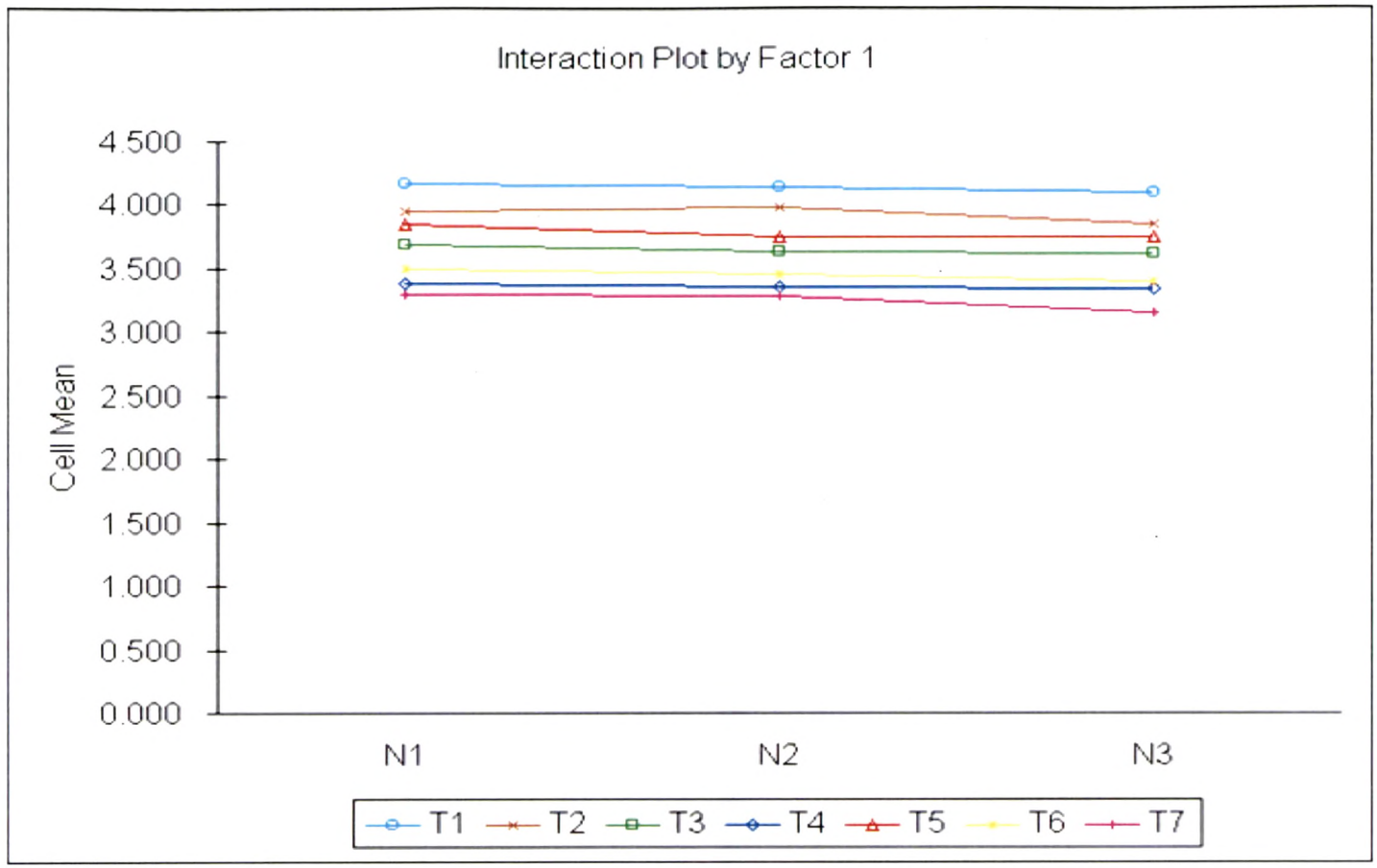


Fig 5.51 Interaction Plot by Factor 1 [Mn Level (ppm) in Greengram]

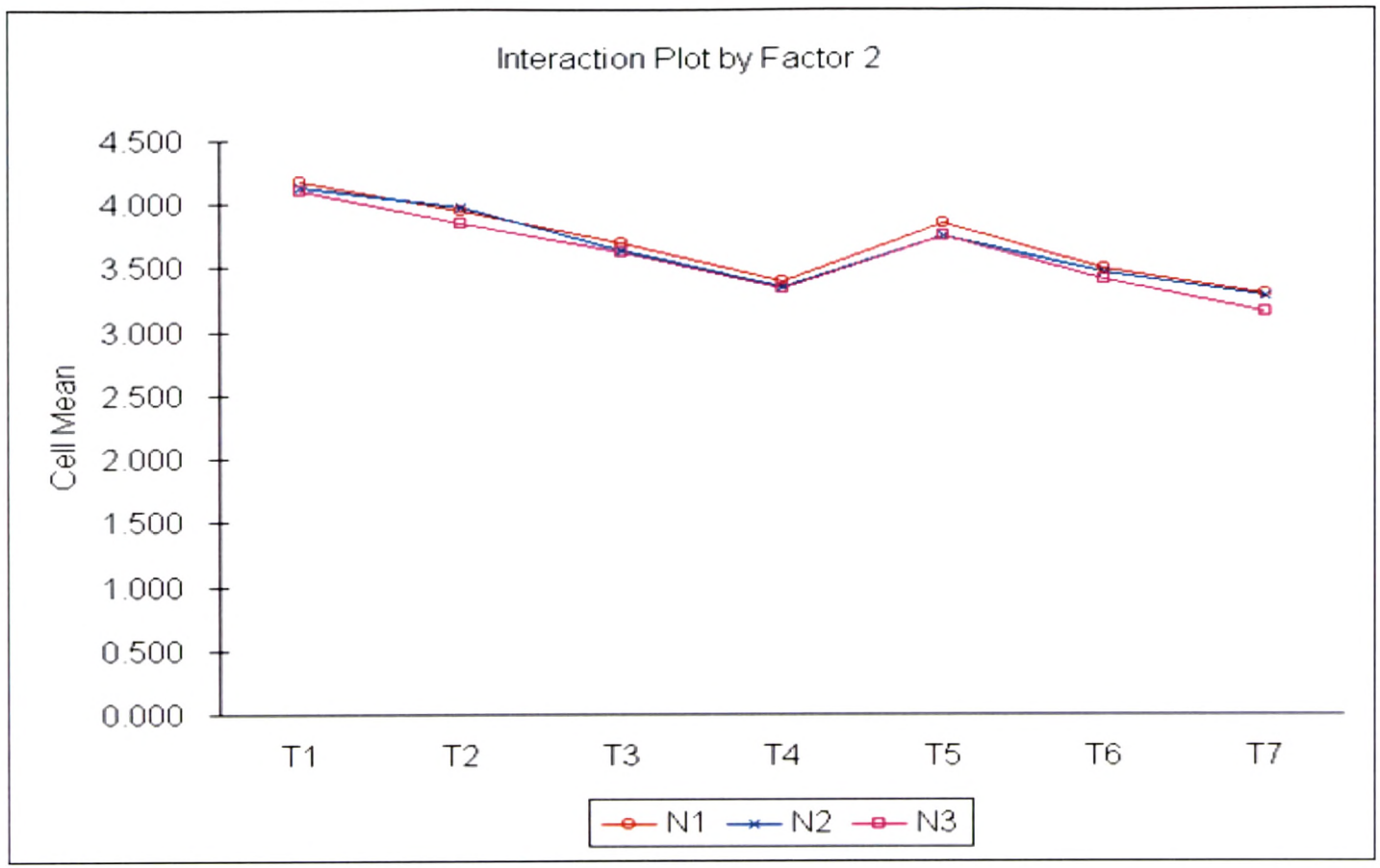


Fig 5.52 Interaction Plot by Factor 2 [Mn Level (ppm) in Greengram]

5.5.2.5 Iron (Fe)

Table 5.73, Table 5.74 and Table 5.75 represent analysis of heavy metal (Fe) in greengram grains during three successive replications. Fig.5.53 shows Fe level in greengram grains response to various treatments for each replication.

Table 5.73 Analysis of Heavy Metal Fe (ppm) in Greengram (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	2.49	2.60	3.01	3.20	3.33	3.16	3.29
N2	2.18	3.19	3.81	3.87	3.90	3.18	3.20
N3	3.19	3.80	3.20	2.99	2.81	2.20	2.32

Table 5.74 Analysis of Heavy Metal Fe (ppm) in Greengram (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.21	3.92	3.38	3.08	3.45	3.22	2.95
N2	4.22	3.62	3.02	3.01	3.17	3.19	2.94
N3	3.75	3.31	3.26	3.19	3.56	3.54	3.05

Table 5.75 Analysis of Heavy Metal Fe (ppm) in Greengram (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.48	4.02	3.68	3.21	3.65	3.35	3.01
N2	4.47	3.71	3.17	2.54	3.33	3.25	3.09
N3	3.86	3.36	3.38	3.21	3.85	3.77	3.46

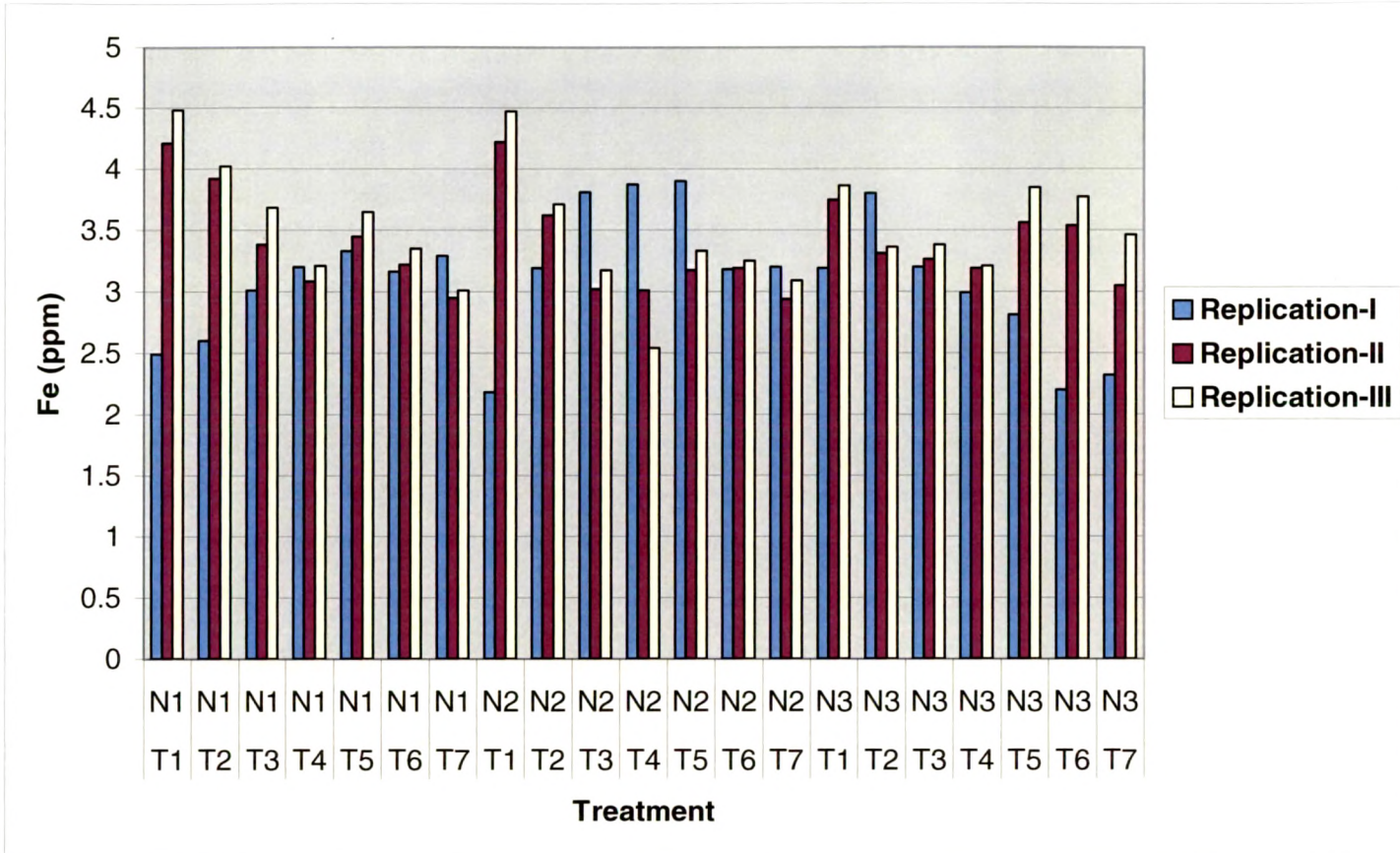
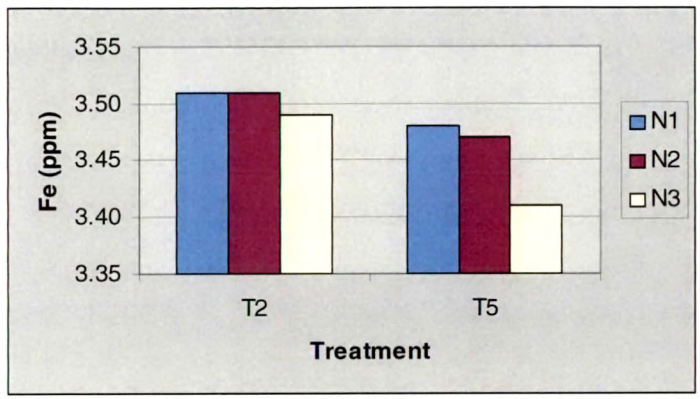


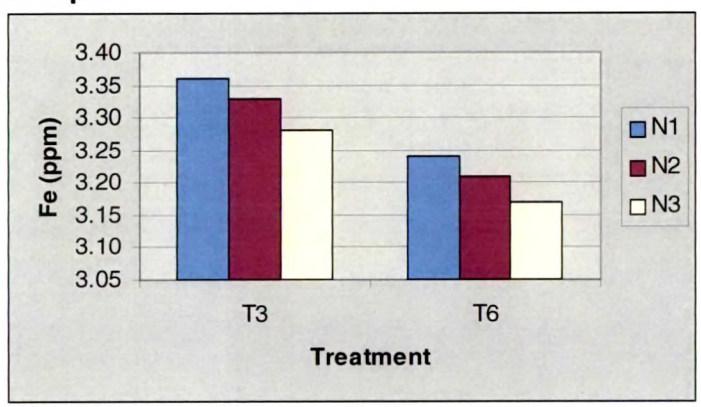
Fig. 5.53 Fe Level in Greengram

Fig. 5.54 shows comparison of Fe level in greengram among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

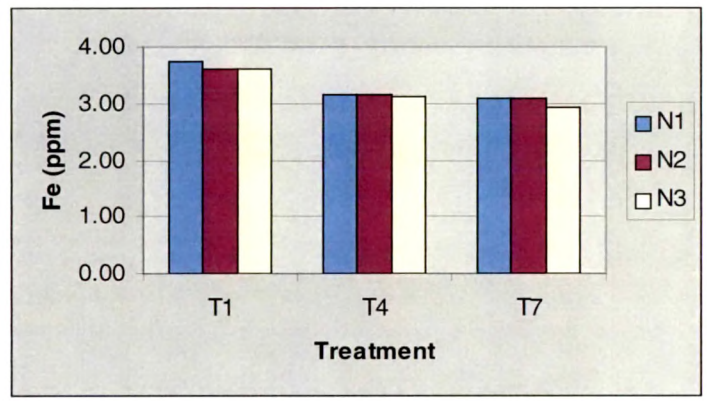


Fig. 5.54 Comparison of Fe Level in Greengram among Group-A, B and C

Table 5.76 and Table 5.77 represent two factor ANOVA and ANOVA Table for Fe level in greengram respectively. Fig. 5.55 and Fig.5.56 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.76 Two factor ANOVA (Fe Level in Greengram)

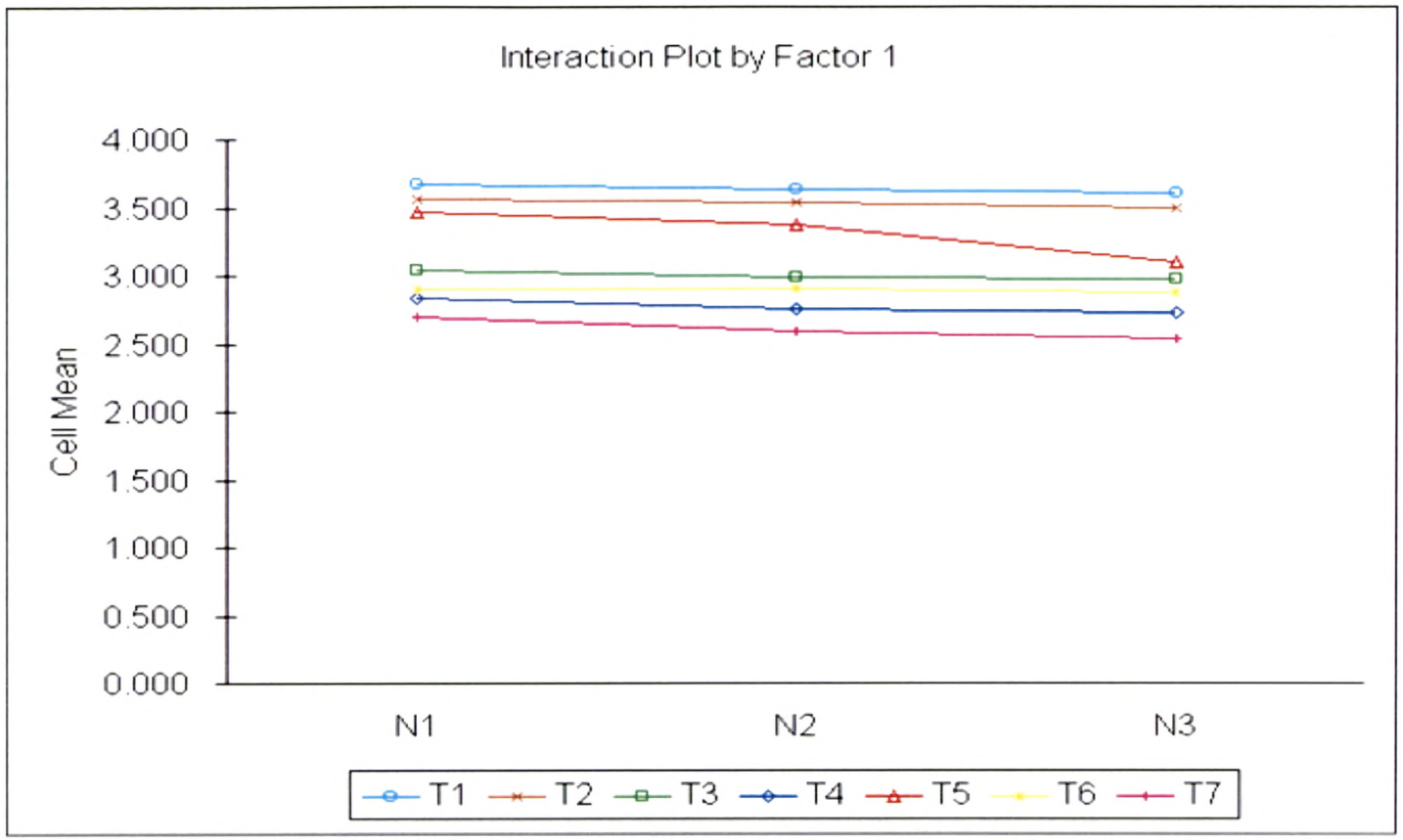
Factor 2

Means (ppm):

		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	3.73	3.51	3.36	3.16	3.48	3.24	3.08	3.37
	N2	3.62	3.51	3.33	3.14	3.47	3.21	3.08	3.34
	N3	3.60	3.49	3.28	3.13	3.41	3.17	2.94	3.29
		3.65	3.50	3.32	3.14	3.45	3.21	3.03	3.33

Table 5.77 ANOVA Table (Fe Level in Greengram)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.06	2.00	0.03	0.11	0.89
Factor 2	2.55	6.00	0.43	1.49	0.20
Interaction	0.03	12.00	0.00	0.01	1.00
Error	11.99	42.00	0.29		
Total	14.64	62.00			


Interaction Plot by Factor 1
Cell Mean
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
N1
N2
N3
T1
T2
T3
T4
T5
T6
T7

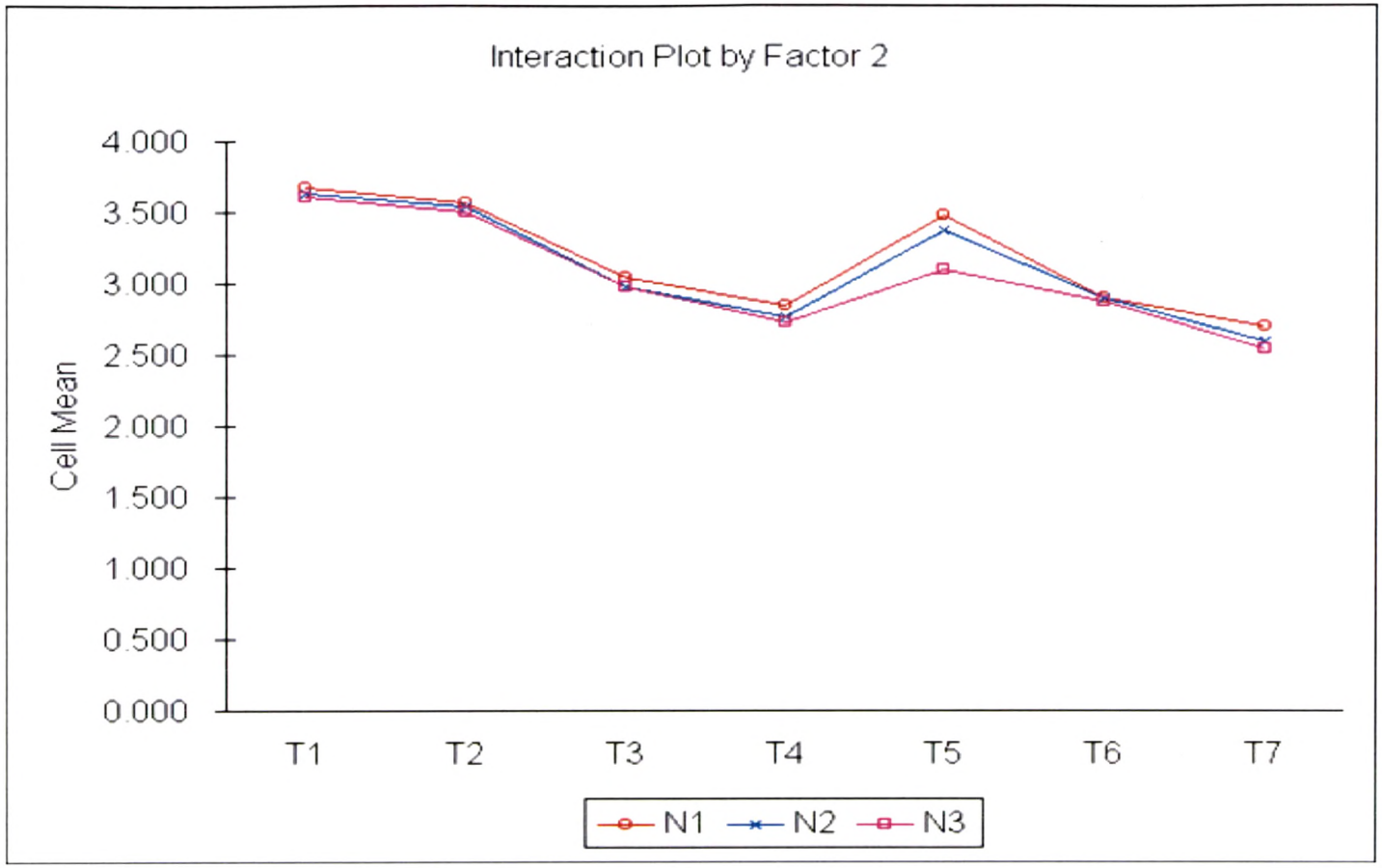


Fig 5.56 Interaction Plot by Factor 2 [Fe Level (ppm) in Greengram]

5.6 Soil Conditions under Wheat Cultivation

5.6.1 EC Level

Table 5.78, Table 5.79 and Table 5.80 represent analysis of Electrical Conductivity (EC) level in soil under wheat cultivation during three successive replications. Fig. 5.57 shows EC level under various treatments for each replication.

Table 5.78 Analysis of EC Level (mmhos/cm) in Soil under Wheat Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.65	0.64	0.41	0.43	0.53	0.36	0.37
N2	0.41	0.76	0.45	0.37	0.44	0.40	0.43
N3	0.39	0.68	0.44	0.37	0.38	0.35	0.43

Table 5.79 Analysis of EC Level (mmhos/cm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.61	0.65	0.82	0.71	0.51	0.53	0.51
N2	0.68	0.55	0.81	0.73	0.54	0.36	0.42
N3	0.58	0.58	0.81	0.71	0.58	0.53	0.38

Table 5.80 Analysis of EC Level (mmhos/cm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.51	0.60	0.75	0.65	0.47	0.51	0.38
N2	0.56	0.54	0.70	0.68	0.47	0.57	0.41
N3	0.57	0.57	0.68	0.69	0.46	0.41	0.44

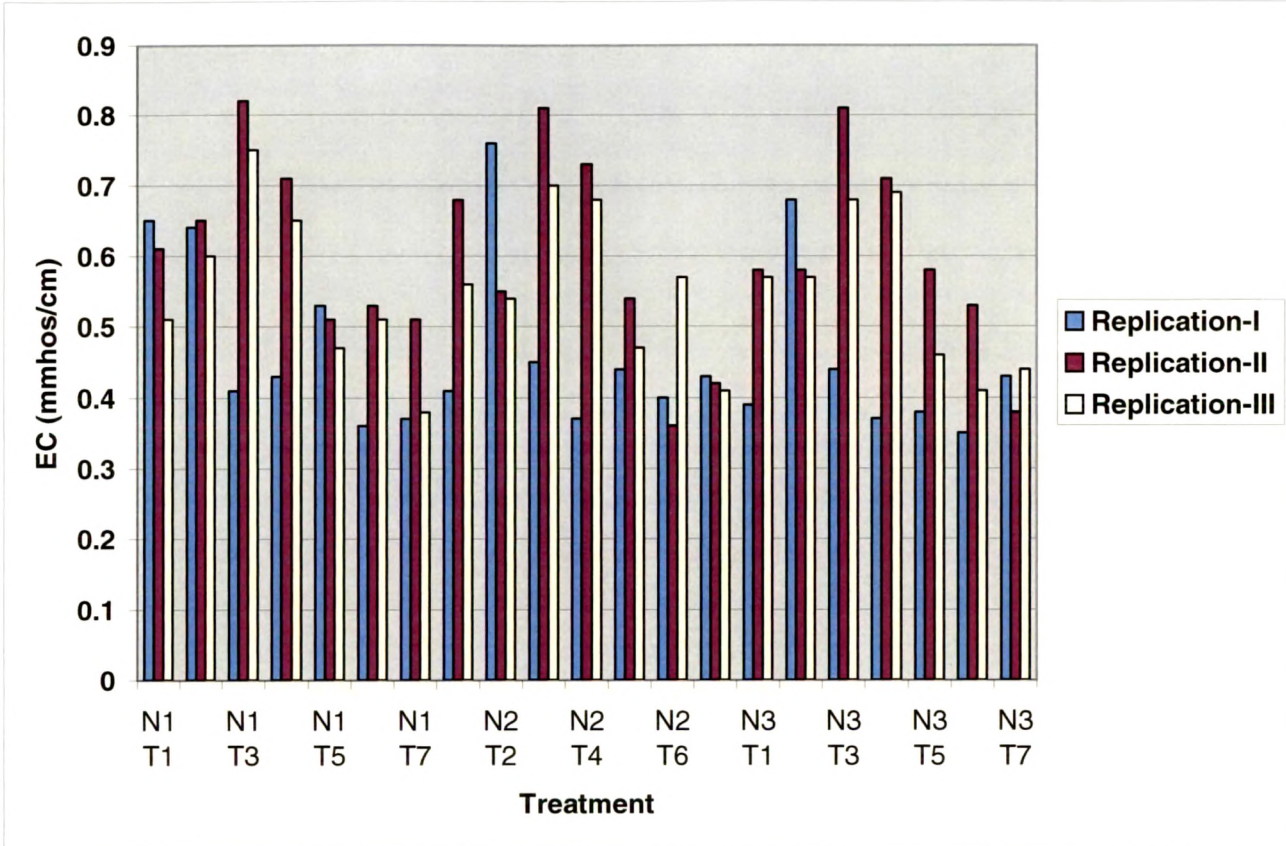
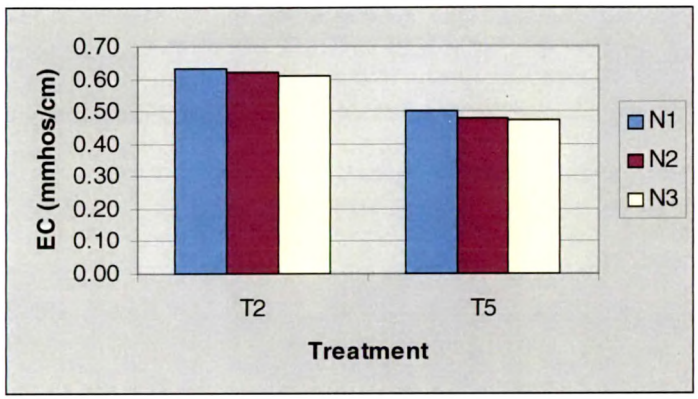


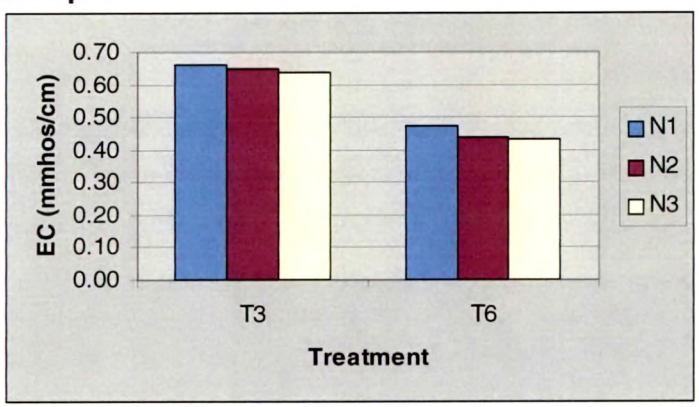
Fig. 5.57 EC Level in Soil under Wheat Cultivation

Fig. 5.58 shows comparison of EC level in soil under wheat cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

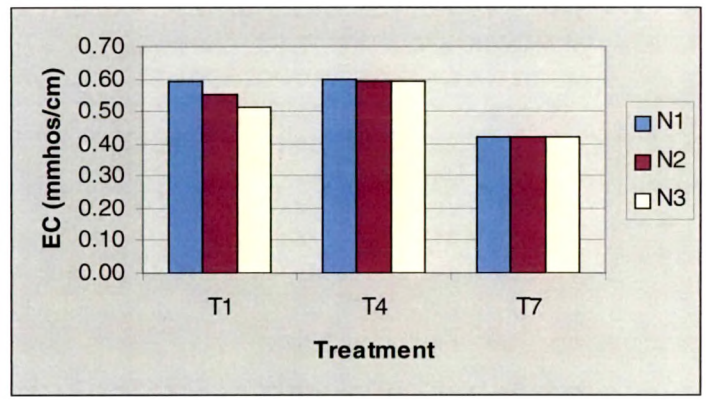


Fig. 5.58 Comparison of EC Level in Soil under Wheat Cultivation among Group-A, B and C

Table 5.81 and Table 5.82 represent two factor ANOVA and ANOVA Table for EC Level in Soil under Wheat Cultivation respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.83. Table 5.84 shows p-values for pairwise t-tests. Fig.5.59 and Fig.5.60 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.81 Two factor ANOVA (EC Level in Soil under Wheat Cultivation)

Means (mmhos/cm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.59	0.63	0.66	0.60	0.50	0.47	0.42	0.55
	N2	0.55	0.62	0.65	0.59	0.48	0.44	0.42	0.54
	N3	0.51	0.61	0.64	0.59	0.47	0.43	0.42	0.53
		0.55	0.62	0.65	0.59	0.49	0.45	0.42	0.54

Table 5.82 ANOVA Table (EC Level in Soil under Wheat Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.01	2.00	0.00	0.26	0.78
Factor 2	0.43	6.00	0.07	4.74	0.00
Interaction	0.01	12.00	0.00	0.03	1.00
Error	0.64	42.00	0.02		
Total	1.08	62.00			

Table 5.83 Post hoc analysis for Factor 2 (EC Level in Soil under Wheat Cultivation)

Tukey simultaneous comparison t-values (d.f. = 42)

		T7	T6	T5	T1	T4	T2	T3
	(mmhos/cm)	0.42	0.45	0.49	0.55	0.59	0.62	0.65
T7	0.42							
T6	0.45	0.48						
T5	0.49	1.17	0.69					
T1	0.55	2.28	1.80	1.11				
T4	0.59	3.00	2.53	1.84	0.73			
T2	0.62	3.44	2.97	2.28	1.17	0.44		
T3	0.65	4.02	3.54	2.85	1.74	1.01	0.57	

critical values for experimentwise error rate:

0.05	3.10
0.01	3.72

Table 5.84 p-values for pairwise t-tests (EC Level in Soil under Wheat Cultivation)

		T7	T6	T5	T1	T4	T2	T3
(mmhos/cm)		0.42	0.45	0.49	0.55	0.59	0.62	0.65
T7	0.42							
T6	0.45	0.63						
T5	0.49	0.25	0.49					
T1	0.55	0.03	0.08	0.27				
T4	0.59	0.00	0.02	0.07	0.47			
T2	0.62	0.00	0.00	0.03	0.25	0.66		
T3	0.65	0.00	0.00	0.01	0.09	0.32	0.57	

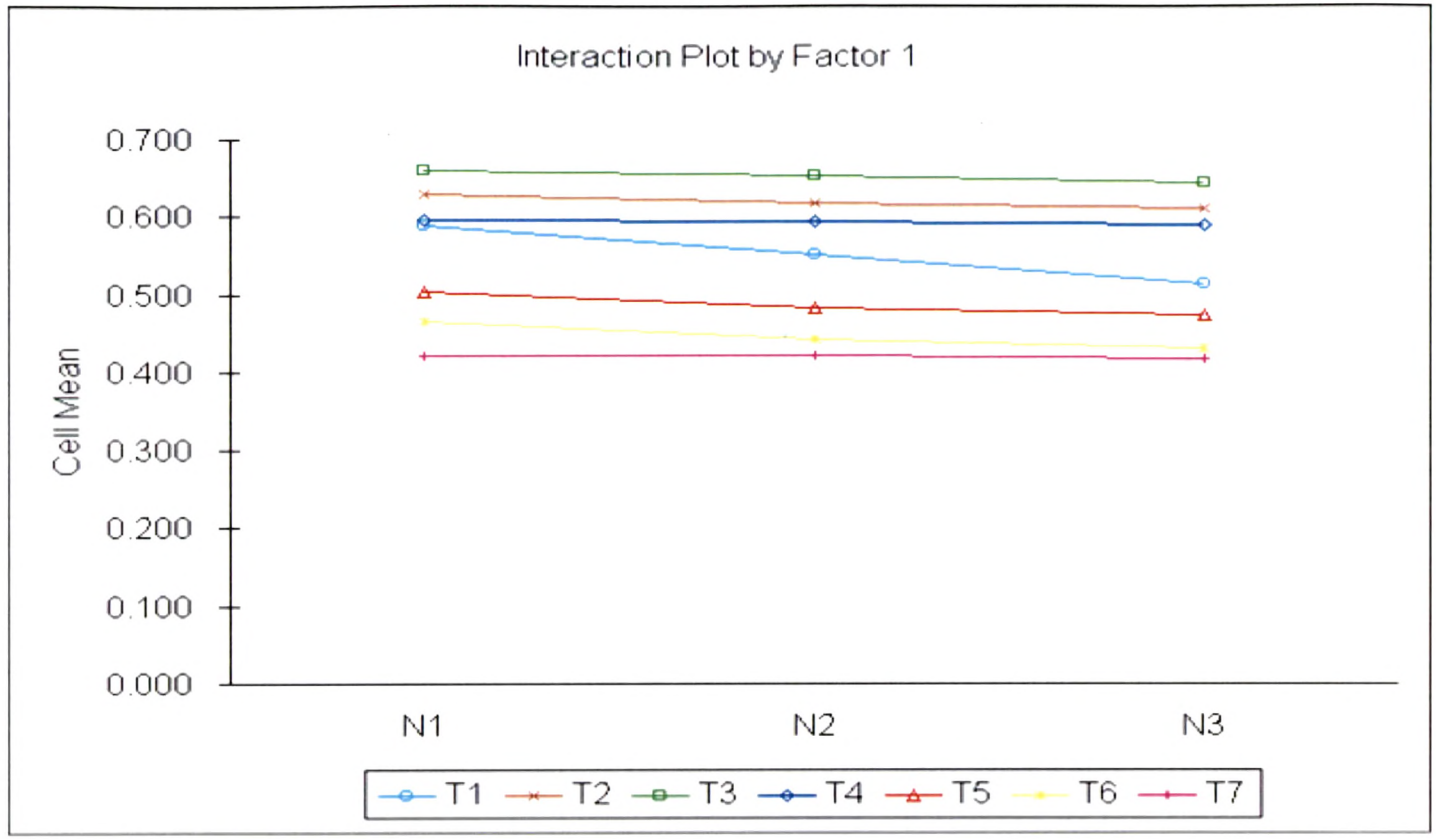


Fig 5.59 Interaction Plot by Factor 1 [EC Level (mmhos/cm) in Soil under Wheat Cultivation]

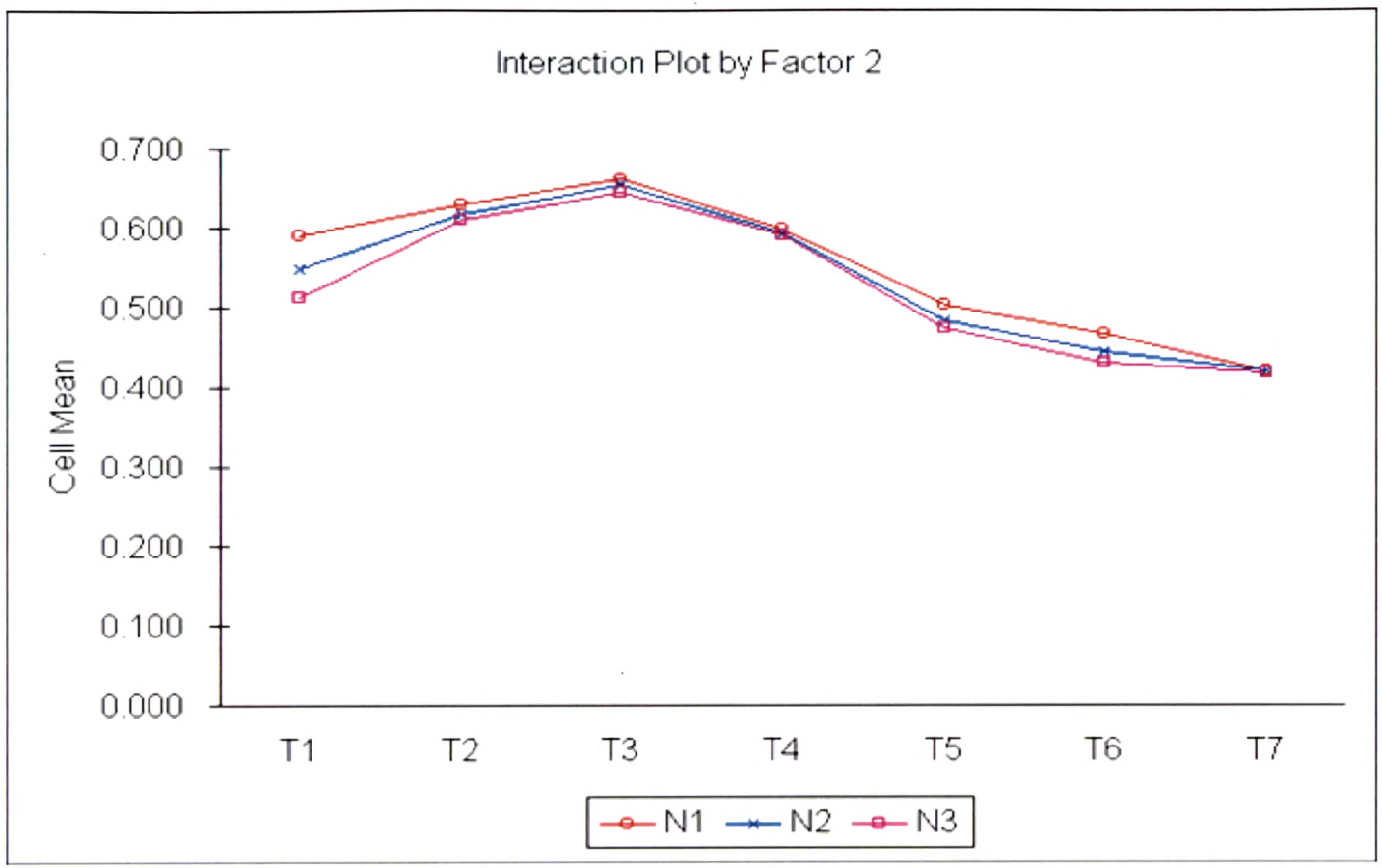


Fig 5.60 Interaction Plot by Factor 2 [EC Level (mmhos/cm) in Soil under Wheat Cultivation]

5.6.2 Heavy Metal Accumulation

5.6.2.1 Lead (Pb)

Table 5.85, Table 5.86 and Table 5.87 represent analysis of Lead (Pb) level in soil under wheat cultivation during three successive replications. Fig. 5.61 shows Pb level under various treatments for each replication.

Table 5.85 Analysis of Pb Level (ppm) in Soil under Wheat Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.78	6.84	7.74	4.12	9.25	9.78	3.87
N2	9.85	9.14	8.91	4.12	8.74	9.12	4.22
N3	8.77	9.36	8.74	6.25	7.12	7.02	4.18

Table 5.86 Analysis of Pb Level (ppm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.89	8.25	7.71	8.15	5.81	6.23	6.23
N2	6.58	6.24	7.02	8.14	7.54	7.21	6.21
N3	7.58	6.05	7.14	7.15	8.15	7.15	5.88

Table 5.87 Analysis of Pb Level (ppm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.95	8.94	7.89	8.26	8.86	6.88	6.98
N2	7.88	8.63	7.21	8.26	7.61	7.36	6.44
N3	7.89	8.54	7.21	7.05	8.32	7.23	6.02

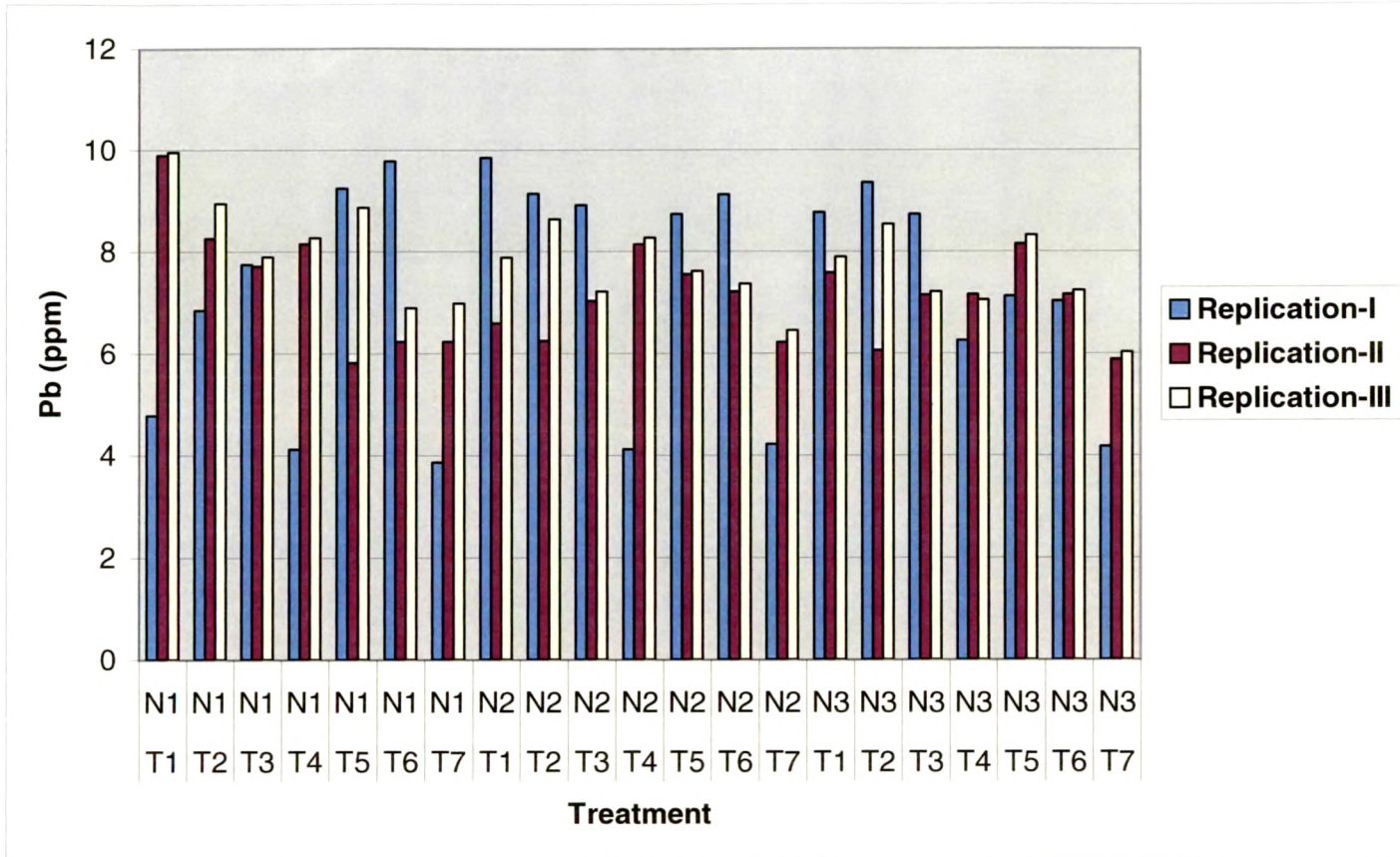
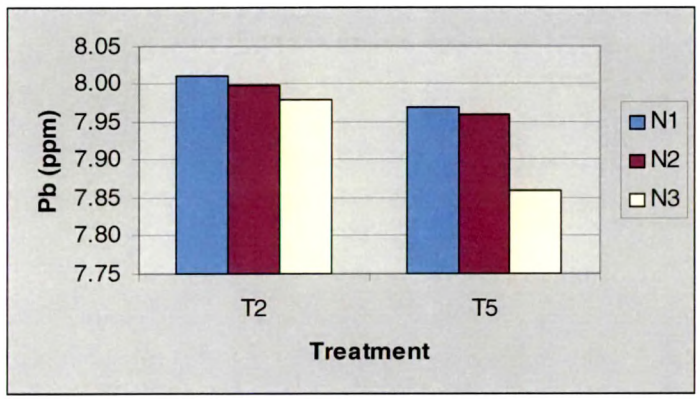


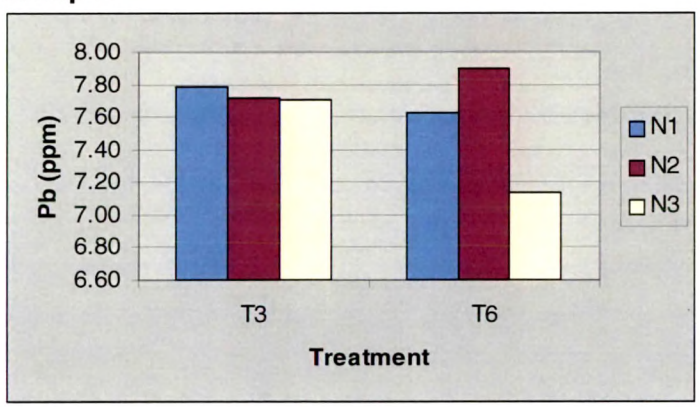
Fig. 5.61 Pb Level in Soil under Wheat Cultivation

Fig. 5.62 shows comparison of Pb Level in Soil under Wheat Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

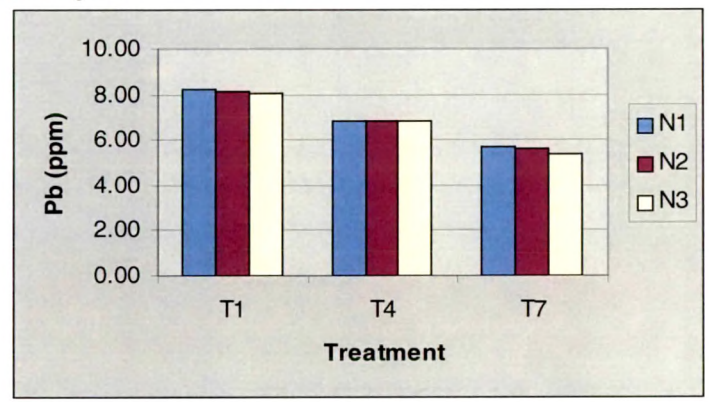


Fig. 5.62 Comparison of Pb Level in Soil under Wheat Cultivation among Group-A, B and C

Table 5.88 and Table 5.89 represent two factor ANOVA and ANOVA Table for Pb Level in Soil under Wheat Cultivation respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.90 Table 5.91 shows p-values for pairwise t-tests. Fig.5.63 and Fig.5.64 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.88 Two factor ANOVA (Pb Level in Soil under Wheat Cultivation)

		Factor 2							
	Means (ppm):	T1	T2	T3	T4	T5	T6	T7	
	N1	8.21	8.01	7.78	6.84	7.97	7.63	5.69	7.45
Factor 1	N2	8.10	8.00	7.71	6.84	7.96	7.90	5.62	7.45
	N3	8.08	7.98	7.70	6.82	7.86	7.13	5.36	7.28
		8.13	8.00	7.73	6.83	7.93	7.55	5.56	7.39

Table 5.89 ANOVA Table (Pb Level in Soil under Wheat Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.42	2.00	0.21	0.09	0.91
Factor 2	45.17	6.00	7.53	3.44	0.01
Interaction	0.73	12.00	0.06	0.03	1.00
Error	91.99	42.00	2.19		
Total	138.30	62.00			

Table 5.90 Post hoc analysis for Factor 2 (Pb Level in Soil under Wheat Cultivation)

Tukey simultaneous comparison t-values (d.f. = 42)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	5.56	6.83	7.55	7.73	7.93	8.00	8.13
T7	5.56							
T4	6.83	1.83						
T6	7.55	2.86	1.03					
T3	7.73	3.11	1.29	0.25				
T5	7.93	3.40	1.58	0.54	0.29			
T2	8.00	3.50	1.67	0.64	0.39	0.09		
T1	8.13	3.69	1.86	0.83	0.57	0.28	0.19	

critical values for experimentwise error rate:

0.05	3.10
0.01	3.72

Table 5.91 p-values for pairwise t-tests (Pb Level in Soil under Wheat Cultivation)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	5.56	6.83	7.55	7.73	7.93	8.00	8.13
T7	5.56							
T4	6.83	0.07						
T6	7.55	0.01	0.31					
T3	7.73	0.00	0.21	0.80				
T5	7.93	0.00	0.12	0.59	0.77			
T2	8.00	0.00	0.10	0.53	0.70	0.93		
T1	8.13	0.00	0.07	0.41	0.57	0.78	0.85	

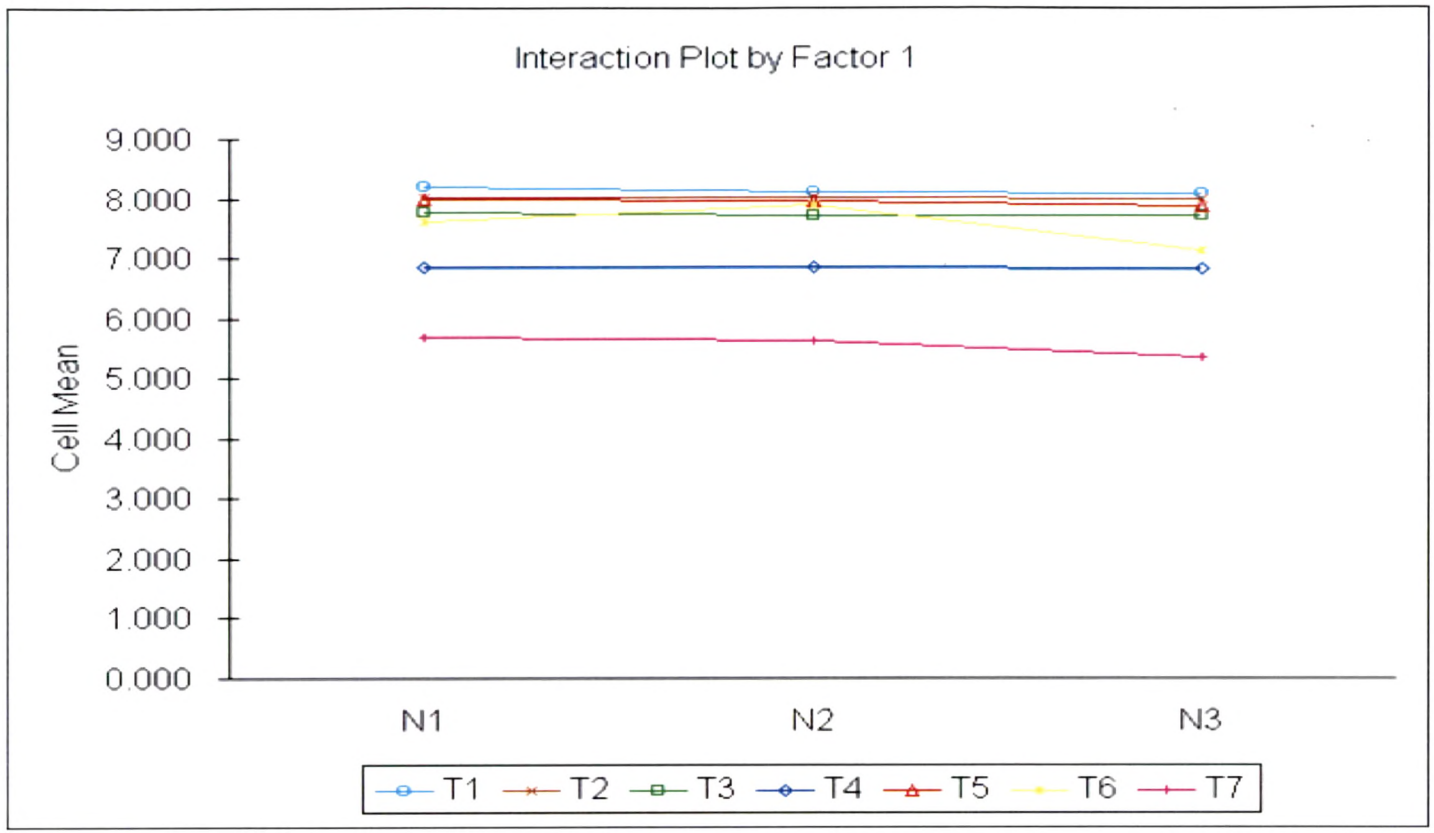


Fig 5.63 Interaction Plot by Factor 1 [Pb Level (ppm) in Soil under Wheat Cultivation]

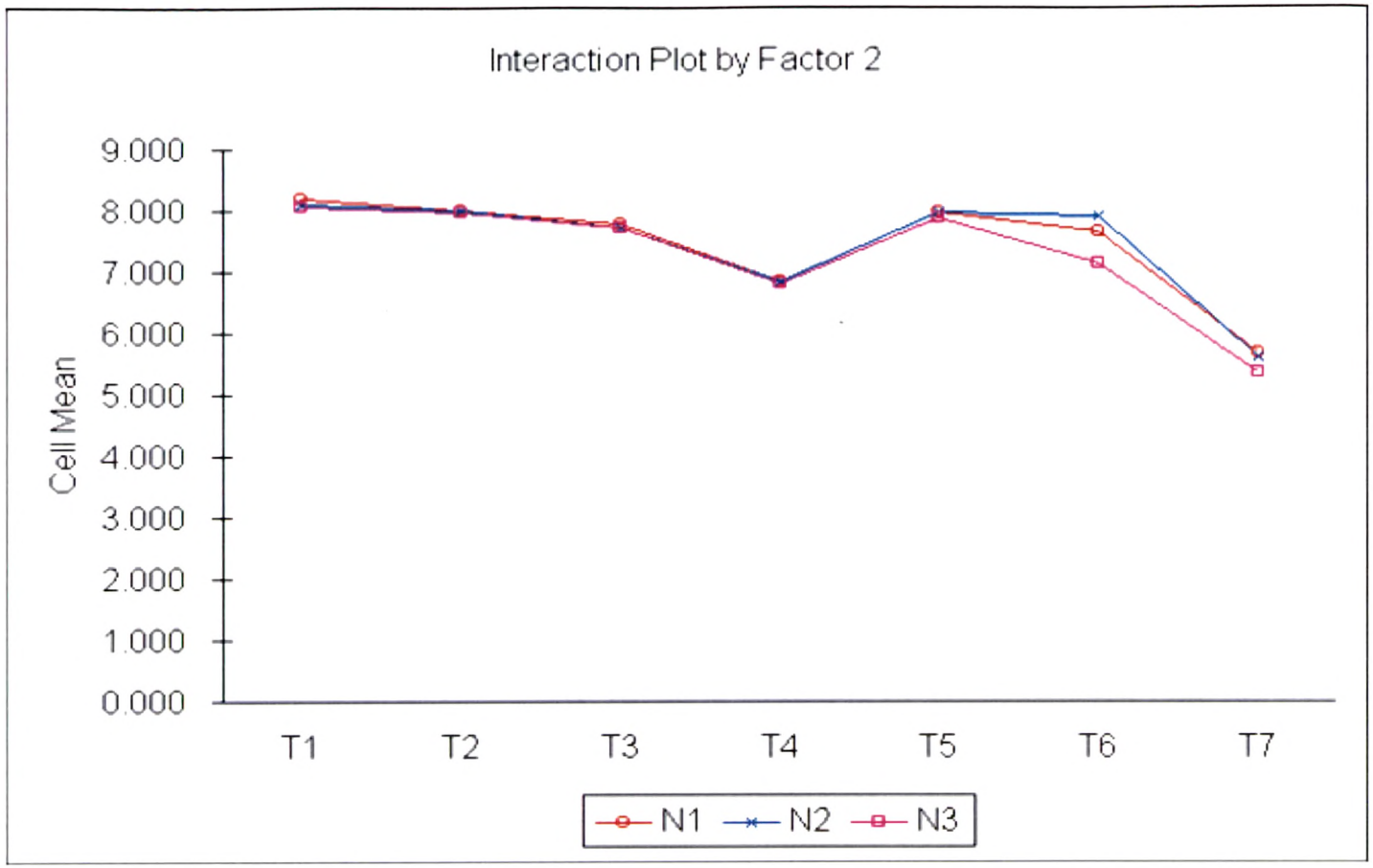


Fig 5.64 Interaction Plot by Factor 2 [Pb Level (ppm) in Soil under Wheat Cultivation]

5.6.2.2 Copper (Cu)

Table 5.92, Table 5.93 and Table 5.94 represent analysis of copper (Cu) level in soil under wheat cultivation during three successive replications. Fig. 5.65 shows Cu level under various treatments for each replication.

Table 5.92 Analysis of Cu Level (ppm) in Soil under Wheat Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.54	1.54	1.22	1.40	1.36	1.4	1.48
N2	1.34	1.62	1.24	1.42	1.44	1.36	1.30
N3	1.68	1.56	1.32	1.26	2.3	1.72	1.56

Table 5.93 Analysis of Cu Level (ppm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.11	0.98	1.03	0.84	0.95	0.80	0.58
N2	1.25	0.97	1.01	0.65	0.91	0.81	0.64
N3	0.96	0.95	0.86	1.04	0.45	0.65	0.51

Table 5.94 Analysis of Cu Level (ppm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.24	1.18	1.09	0.64	1.09	0.88	0.61
N2	1.28	1.11	1.05	0.68	1.02	0.84	0.72
N3	1.07	1.15	0.95	0.38	0.61	0.64	0.54

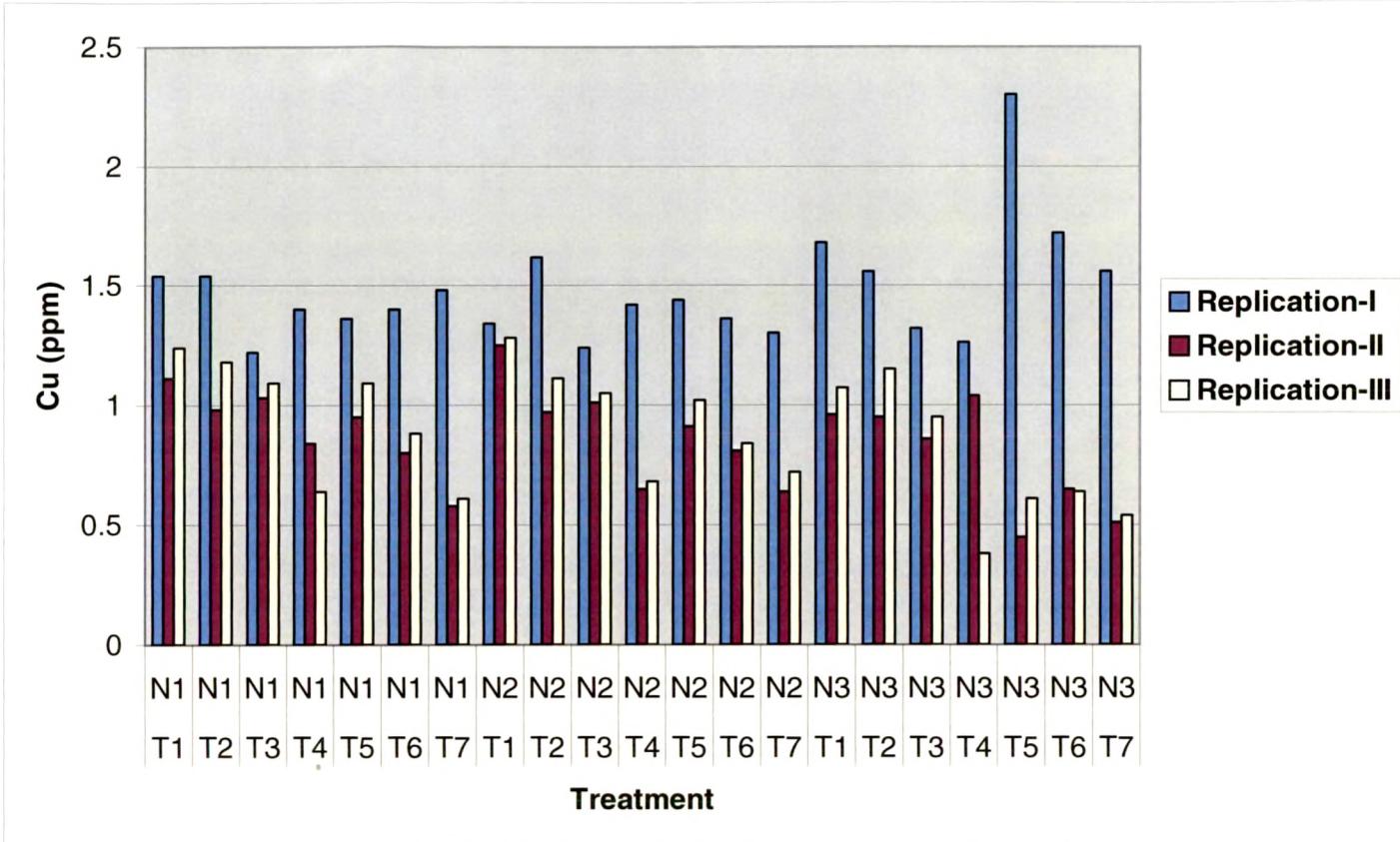
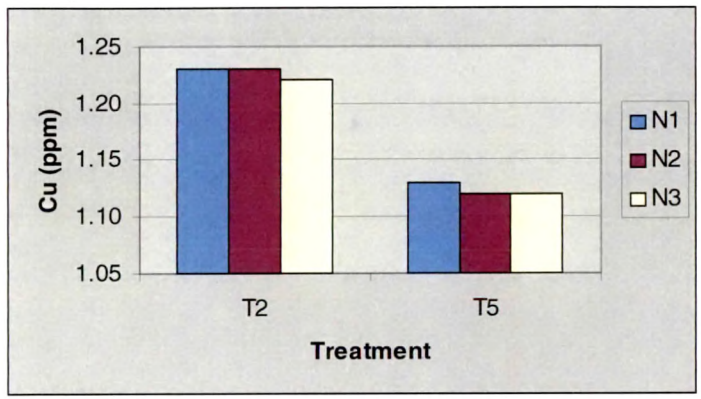


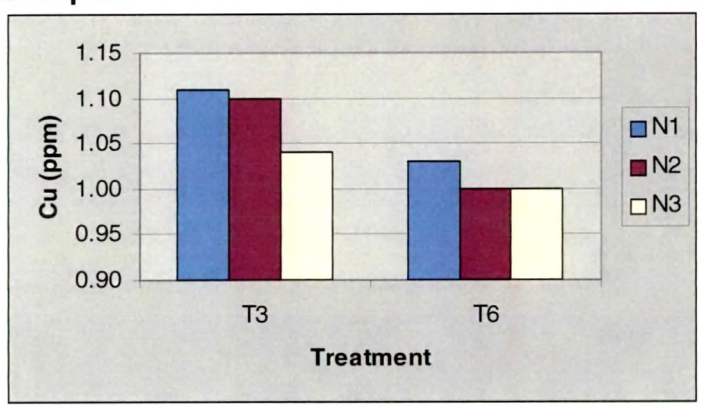
Fig. 5.65 Cu level in Soil under Wheat cultivation

Fig. 5.66 shows comparison of Cu level in Soil under Wheat cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

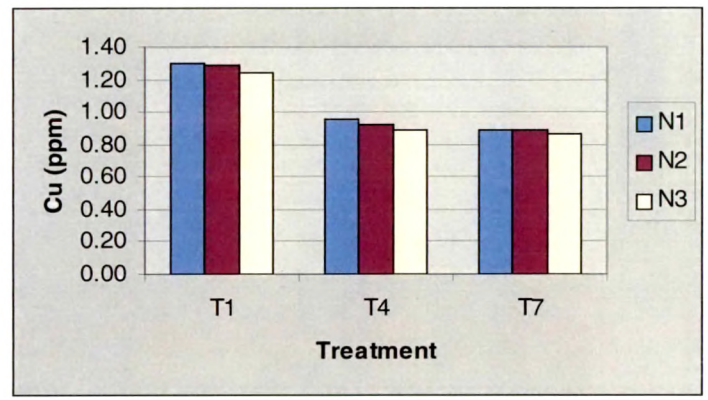


Fig. 5.66 Comparison of Cu level in Soil under Wheat cultivation among Group-A, B and C

Table 5.95 and Table 5.96 represent two factor ANOVA and ANOVA Table for Cu Level in Soil under Wheat Cultivation respectively. Fig.5.67 and Fig.5.68 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.95 Two factor ANOVA (Cu Level in Soil under Wheat Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	1.30	1.23	1.11	0.96	1.13	1.03	0.89	1.09
	N2	1.29	1.23	1.10	0.92	1.12	1.00	0.89	1.08
	N3	1.24	1.22	1.04	0.89	1.12	1.00	0.87	1.06
		1.27	1.23	1.09	0.92	1.13	1.01	0.88	1.08

Table 5.96 ANOVA Table (Cu Level in Soil under Wheat Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.02	2.00	0.01	0.04	0.96
Factor 2	1.17	6.00	0.20	1.13	0.36
Interaction	0.01	12.00	0.00	0.00	1.00
Error	7.28	42.00	0.17		
Total	8.48	62.00			

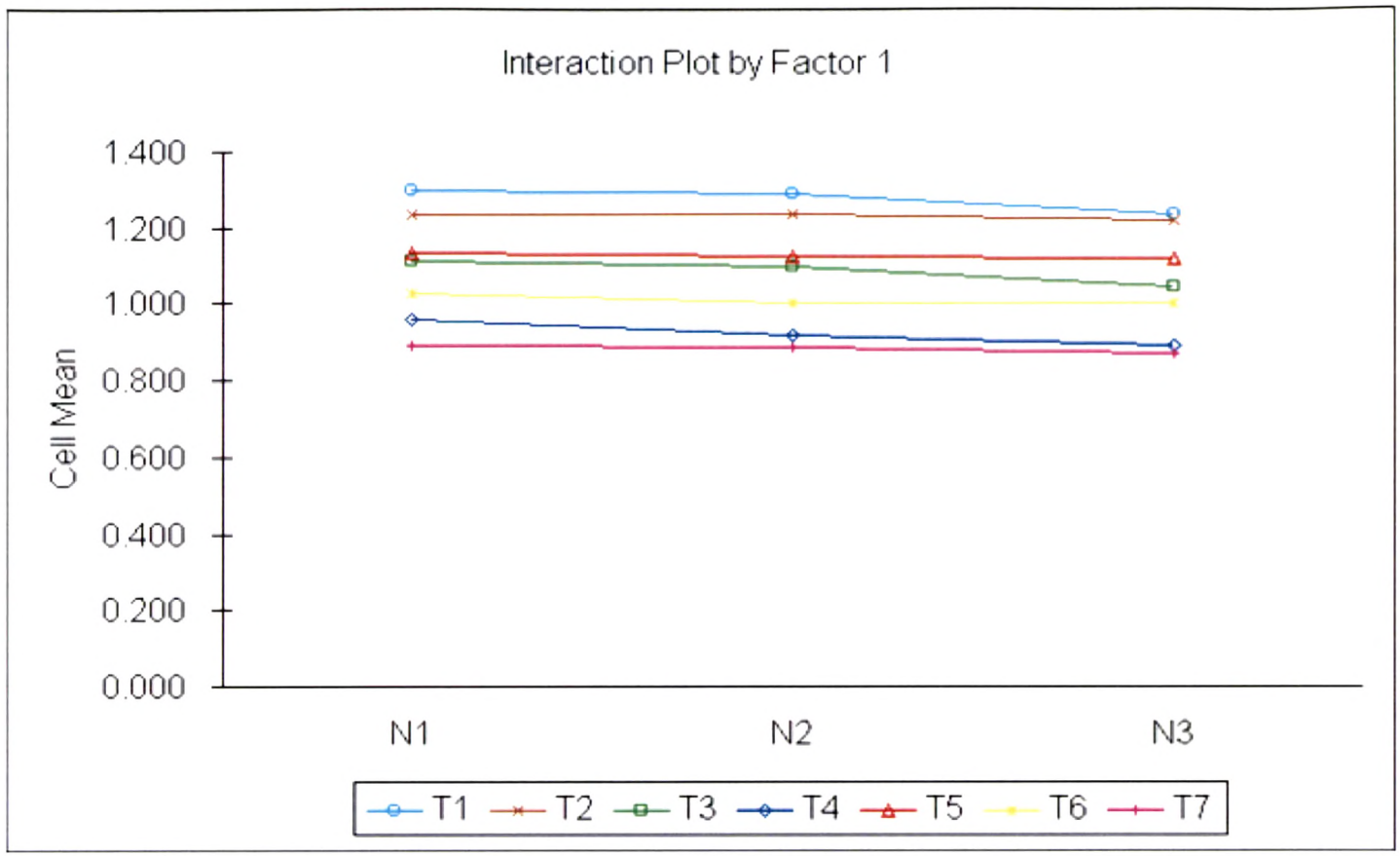


Fig 5.67 Interaction Plot by Factor 1 [Cu Level (ppm) in Soil under Wheat Cultivation]

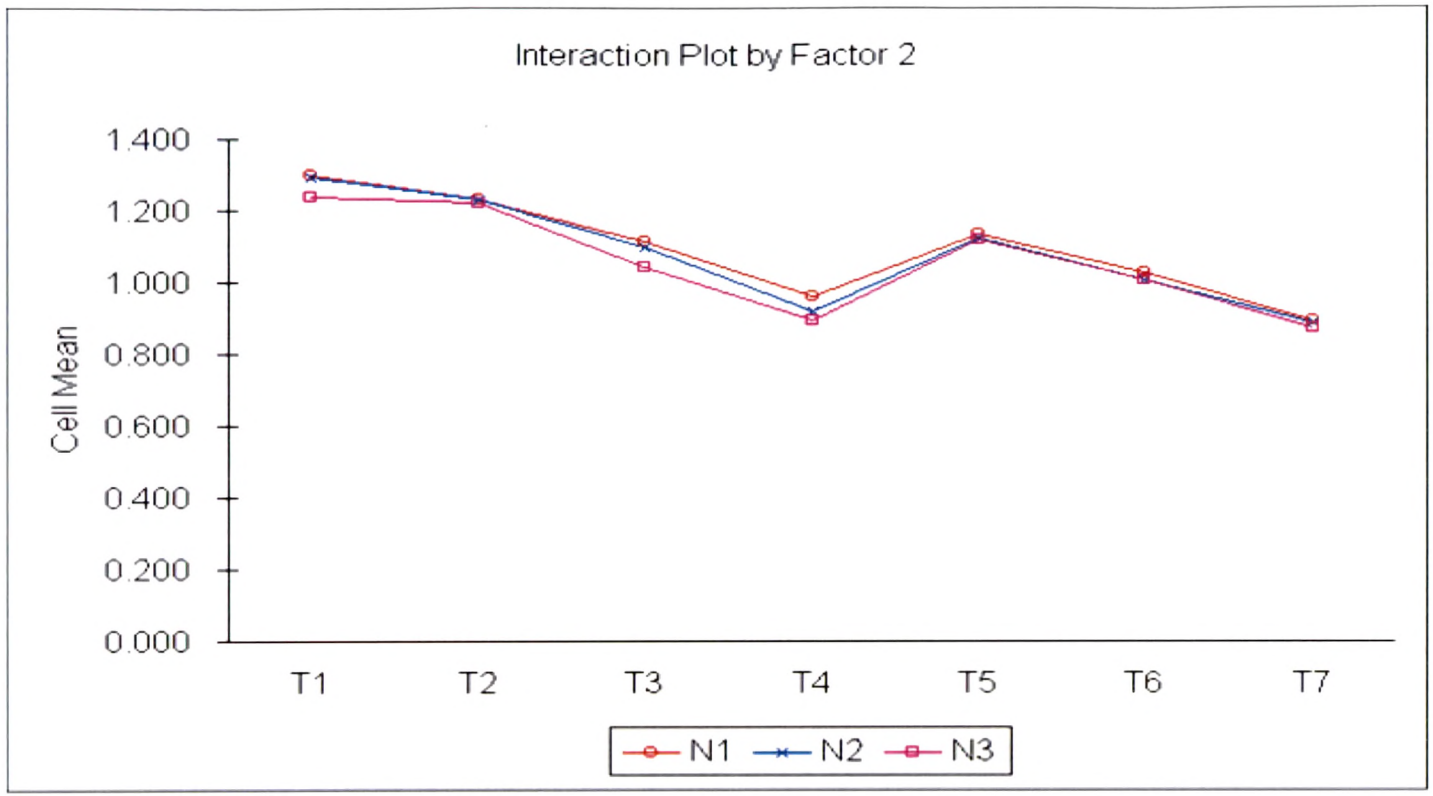


Fig 5.68 Interaction Plot by Factor 2 [Cu Level (ppm) in Soil under Wheat Cultivation]

5.6.2.3 Zinc (Zn)

Table 5.97, Table 5.98 and Table 5.99 represent analysis of Zinc (Zn) level in soil under wheat cultivation during three successive replications. Fig. 5.69 shows Zn level under various treatments for each replication.

Table 5.97 Analysis of Zn Level (ppm) in Soil under Wheat Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.66	2.90	1.48	3.48	1.36	1.22	1.72
N2	1.82	2.18	2.20	1.90	1.54	1.48	1.28
N3	1.72	1.46	1.04	3.96	1.54	5.16	2.08

Table 5.98 Analysis of Zn Level (ppm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	3.09	2.31	2.87	1.45	2.94	2.91	2.31
N2	2.95	2.64	2.51	2.34	*2.85*	2.68	2.41
N3	2.93	2.91	2.98	1.31	2.84	0.91	2.07

Table 5.99 Analysis of Zn Level (ppm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	3.14	2.51	2.90	1.98	2.98	2.94	2.44
N2	3.11	2.79	2.53	2.41	2.89	2.91	2.68
N3	3.08	2.95	3.05	1.25	2.88	0.98	2.19

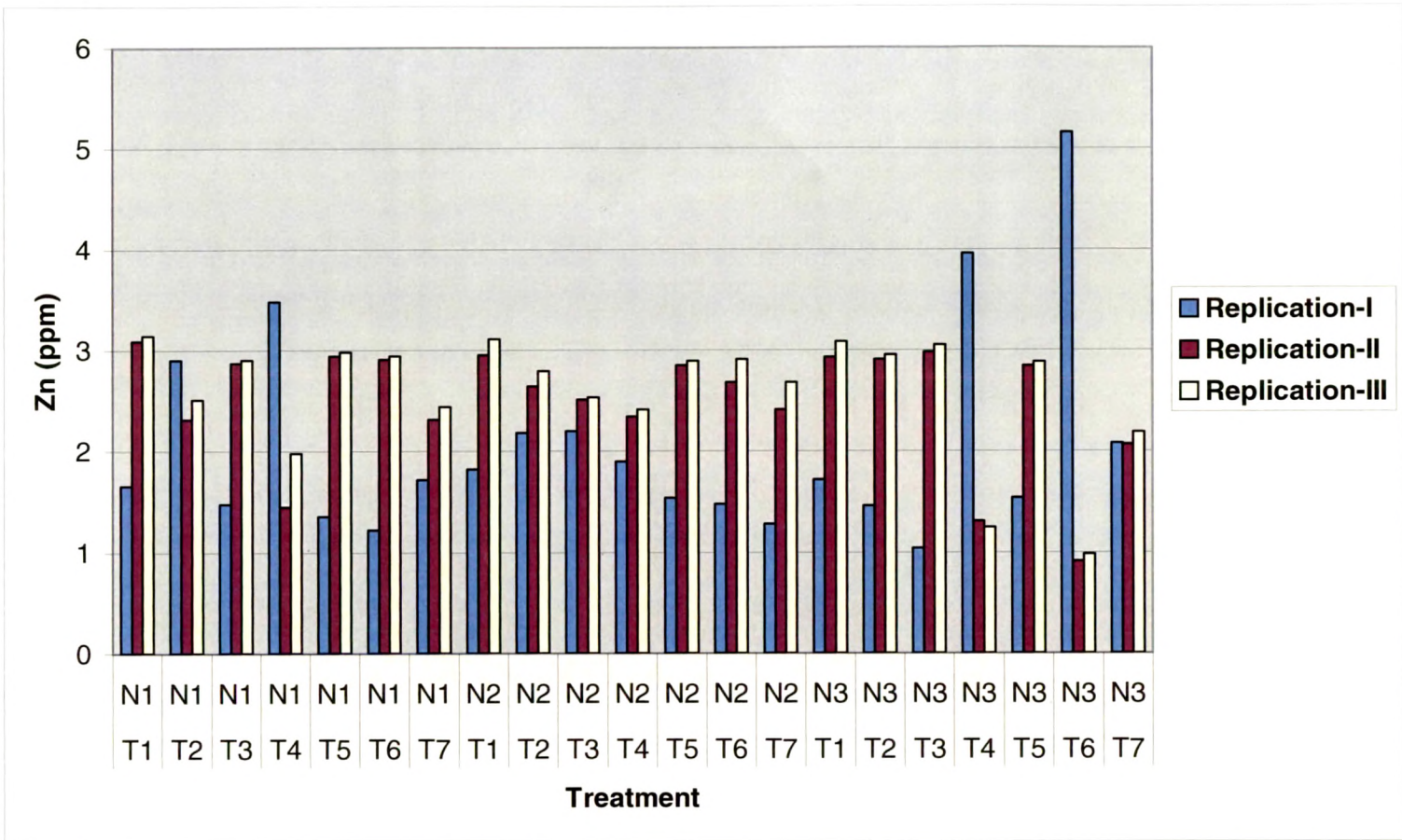
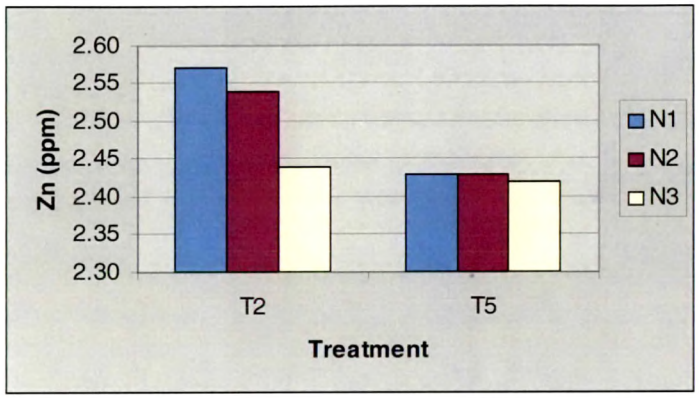


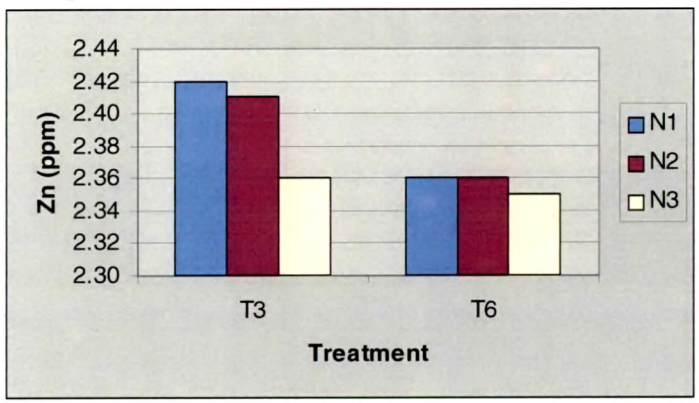
Fig. 5.69 Zn level in Soil under Wheat cultivation

Fig. 5.70 shows comparison of Zn level in Soil under Wheat cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

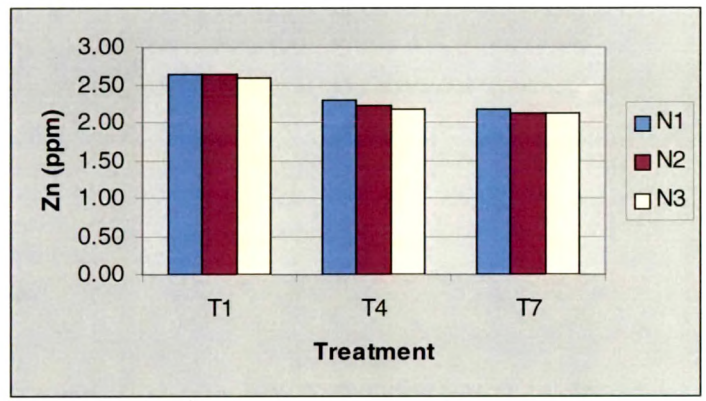


Fig. 5.70 Comparison of Zn level in Soil under Wheat cultivation among Group-A, B and C

Table 5.100 and Table 5.101 represent two factor ANOVA and ANOVA Table for Zn Level in Soil under Wheat Cultivation respectively. Fig.5.71 and Fig.5.72 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.100 Two factor ANOVA (Zn Level in Soil under Wheat Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	2.63	2.57	2.42	2.30	2.43	2.36	2.16	2.41
	N2	2.63	2.54	2.41	2.22	2.43	2.36	2.12	2.39
	N3	2.58	2.44	2.36	2.17	2.42	2.35	2.11	2.35
		2.61	2.52	2.40	2.23	2.42	2.35	2.13	2.38

Table 5.101 ANOVA Table (Zn Level in Soil under Wheat Cultivation)

Source	SS	df	MS	F	p-value
Factor 1	0.04	2.00	0.02	0.02	0.98
Factor 2	1.43	6.00	0.24	0.27	0.95
Interaction	0.03	12.00	0.00	0.00	1.00
Error	36.91	42.00	0.88		
Total	38.41	62.00			

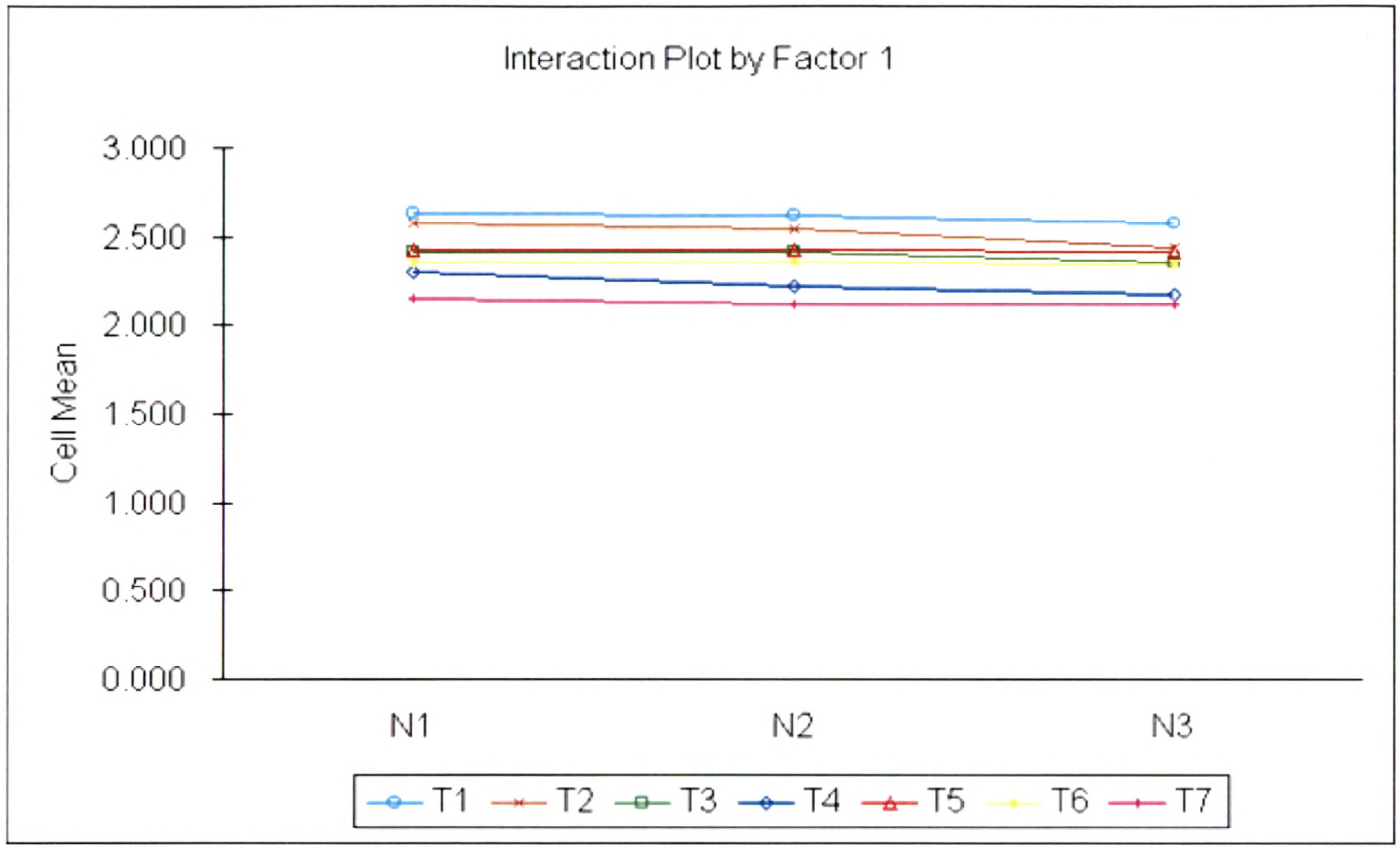


Fig 5.71 Interaction Plot by Factor 1 [Zn Level (ppm) in Soil under Wheat Cultivation]

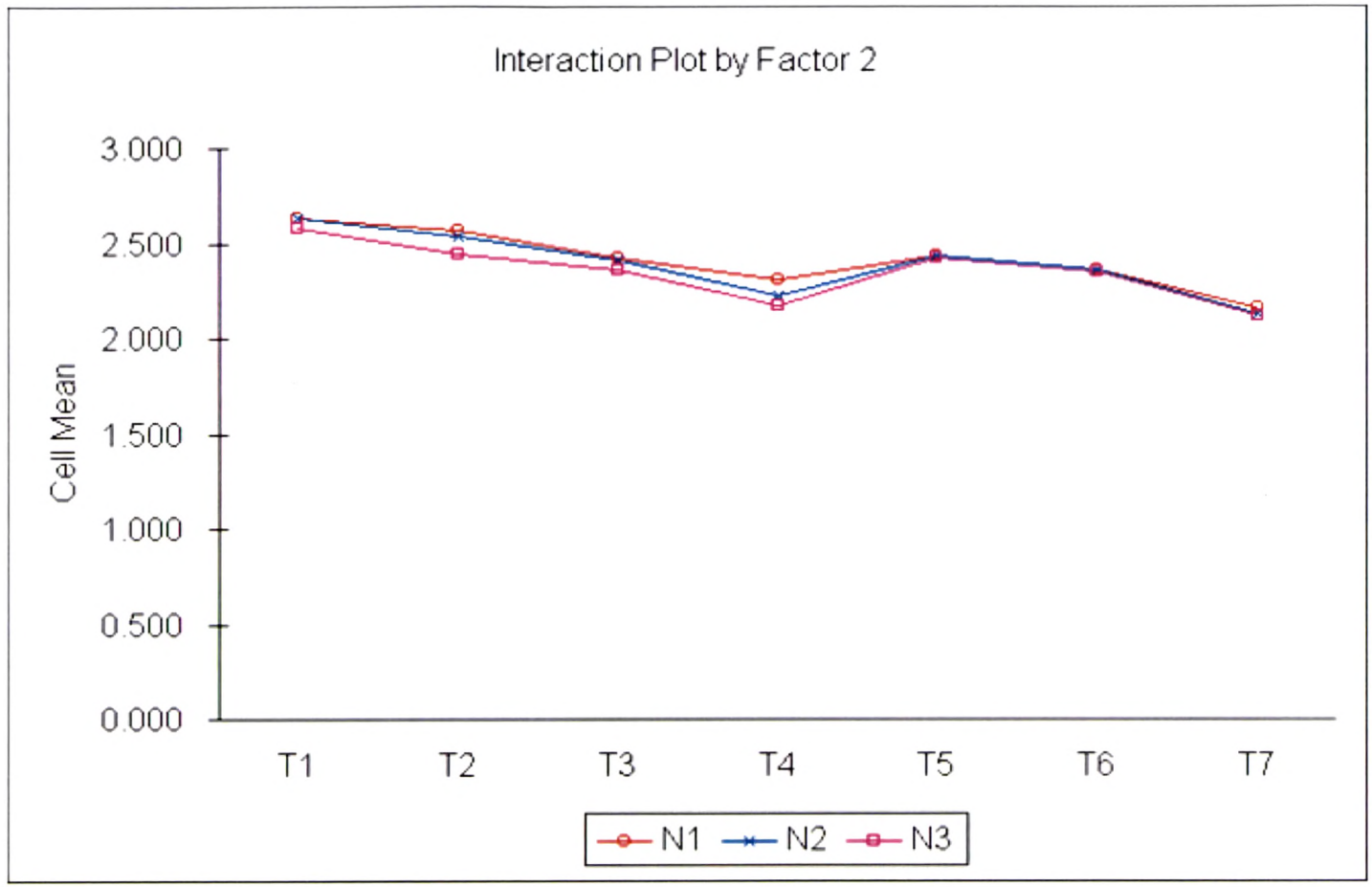


Fig 5.72 Interaction Plot by Factor 2 [Zn Level (ppm) in Soil under Wheat Cultivation]

5.6.2.4 Manganese (Mn)

Table 5.102, Table 5.103 and Table 5.104 represent analysis of manganese (Mn) level in soil under wheat cultivation during three successive replications. Fig. 5.73 shows Mn level under various treatments for each replication.

Table 5.102 Analysis of Mn Level (ppm) in Soil under Wheat Cultivation (Replication-I)

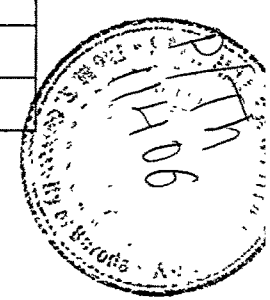
Treatment	T1	T2	T3	T4	T5	T6	T7
N1	10.90	11.44	8.58	9.60	11.14	11.50	10.54
N2	11.34	11.50	6.46	12.12	15.90	10.78	11.48
N3	13.48	13.10	9.16	8.60	8.70	9.48	12.26

Table 5.103 Analysis of Mn Level (ppm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	16.25	15.21	14.58	12.47	14.10	12.17	10.73
N2	15.68	14.87	14.84	10.12	12.13	12.25	10.15
N3	15.44	13.20	13.25	11.29	14.57	12.16	9.58

Table 5.104 Analysis of Mn Level (ppm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	17.56	16.38	14.91	12.49	15.05	12.27	11.41
N2	17.40	15.62	15.42	11.35	12.21	12.36	11.02
N3	15.36	14.25	13.74	12.86	14.87	12.95	10.22



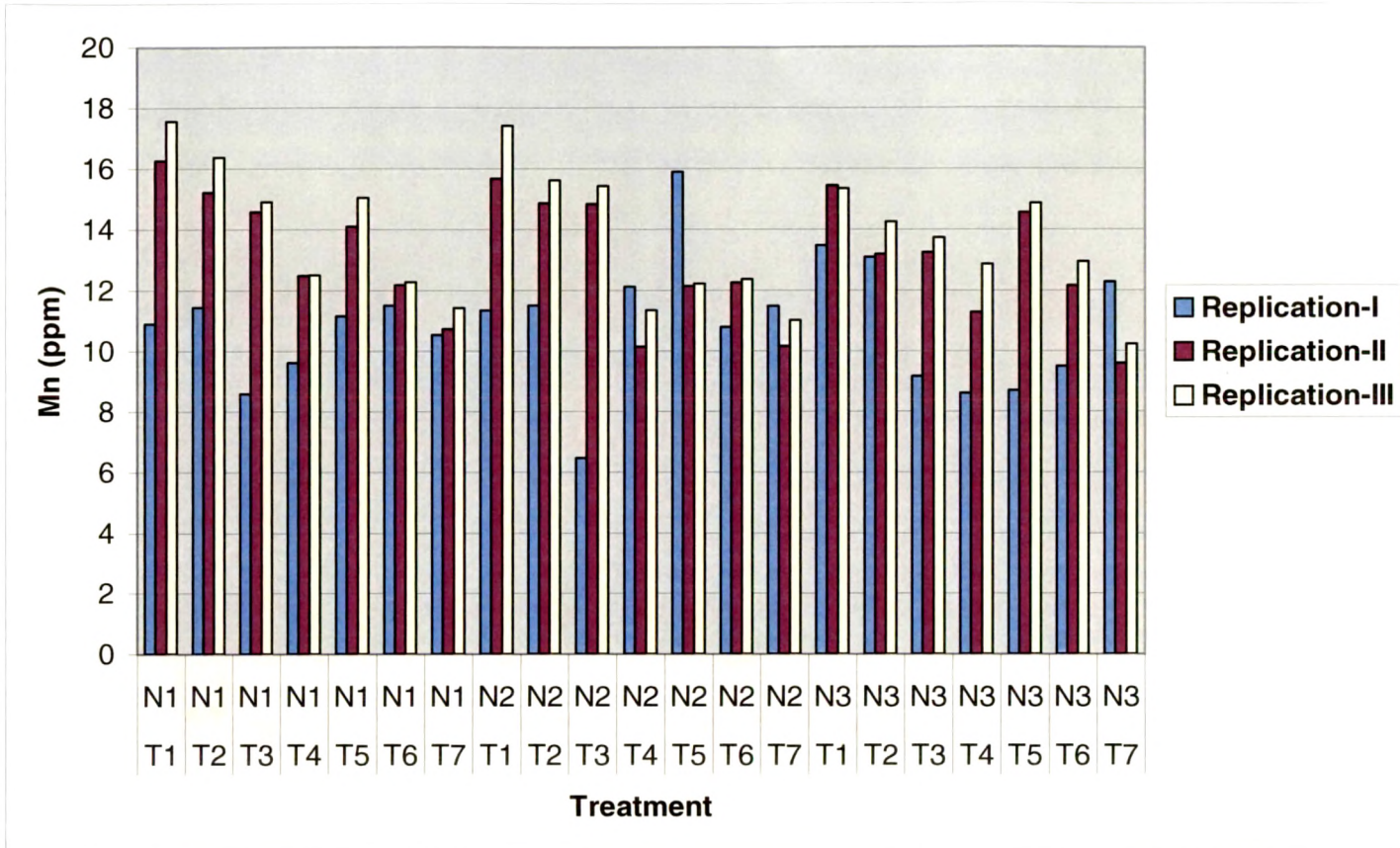
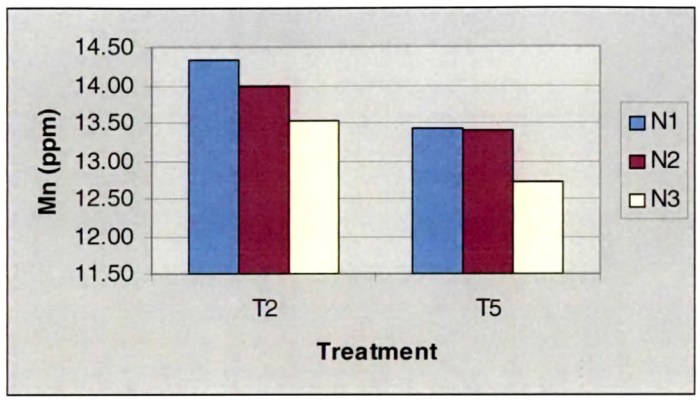


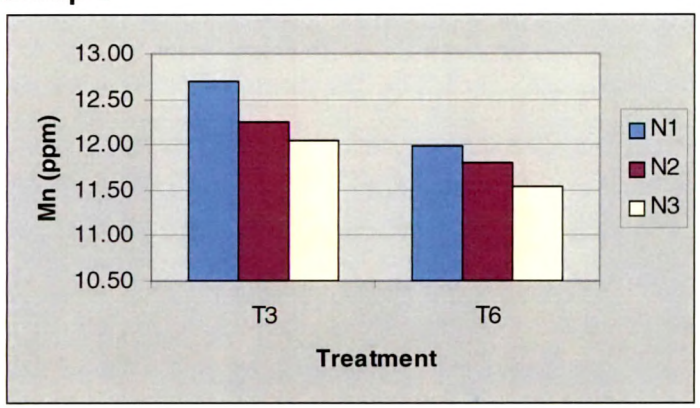
Fig. 5.73 Mn level in Soil under Wheat cultivation

Fig. 5.74 shows comparison of Mn level in Soil under Wheat cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

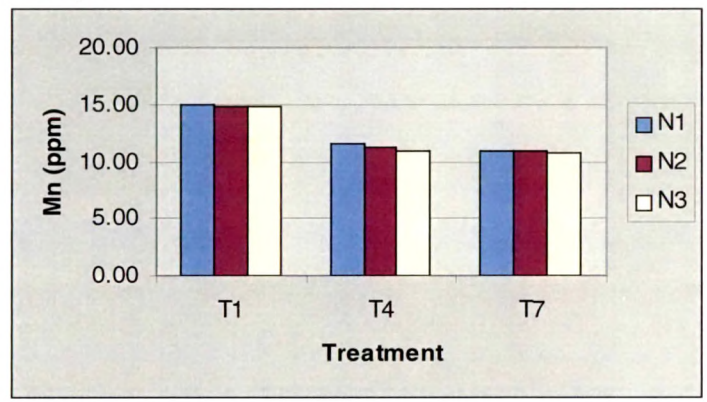


Fig. 5.74 Comparison of Mn level in Soil under Wheat cultivation among Group-A, B and C

Table 5.105 and Table 5.106 represent two factor ANOVA and ANOVA Table for Mn Level in Soil under Wheat Cultivation respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.107 Table 5.108 shows p-values for pairwise t-tests. Fig.5.75 and Fig.5.76 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.105 Two factor ANOVA (Mn Level in Soil under Wheat Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	14.90	14.34	12.69	11.52	13.43	11.98	10.89	12.82
	N2	14.81	14.00	12.24	11.20	13.41	11.80	10.88	12.62
	N3	14.76	13.52	12.05	10.92	12.71	11.53	10.69	12.31
		14.82	13.95	12.33	11.21	13.19	11.77	10.82	12.58

Table 5.106 ANOVA Table (Mn Level in Soil under Wheat Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	2.80	2.00	1.40	0.25	0.78
Factor 2	116.75	6.00	19.46	3.53	0.01
Interaction	0.86	12.00	0.07	0.01	1.00
Error	231.38	42.00	5.51		
Total	351.78	62.00			

Table 5.107 Post hoc analysis for Factor 2 (Mn Level in Soil under Wheat Cultivation)

Tukey simultaneous comparison t-values (d.f. = 42)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	10.82	11.21	11.77	12.33	13.19	13.95	14.82
T7	10.82							
T4	11.21	0.35						
T6	11.77	0.86	0.50					
T3	12.33	1.36	1.01	0.50				
T5	13.19	2.14	1.78	1.28	0.78			
T2	13.95	2.83	2.48	1.97	1.47	0.69		
T1	14.82	3.62	3.26	2.76	2.26	1.48	0.79	

critical values for experimentwise error rate:

0.05 3.10

0.01 3.72

Table 5.108 p-values for pairwise t-tests (Mn Level in Soil under Wheat Cultivation)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	10.82	11.21	11.77	12.33	13.19	13.95	14.82
T7	10.82							
T4	11.21	0.73						
T6	11.77	0.40	0.62					
T3	12.33	0.18	0.32	0.62				
T5	13.19	0.04	0.08	0.21	0.44			
T2	13.95	0.01	0.02	0.06	0.15	0.49		
T1	14.82	0.00	0.00	0.01	0.03	0.15	0.44	

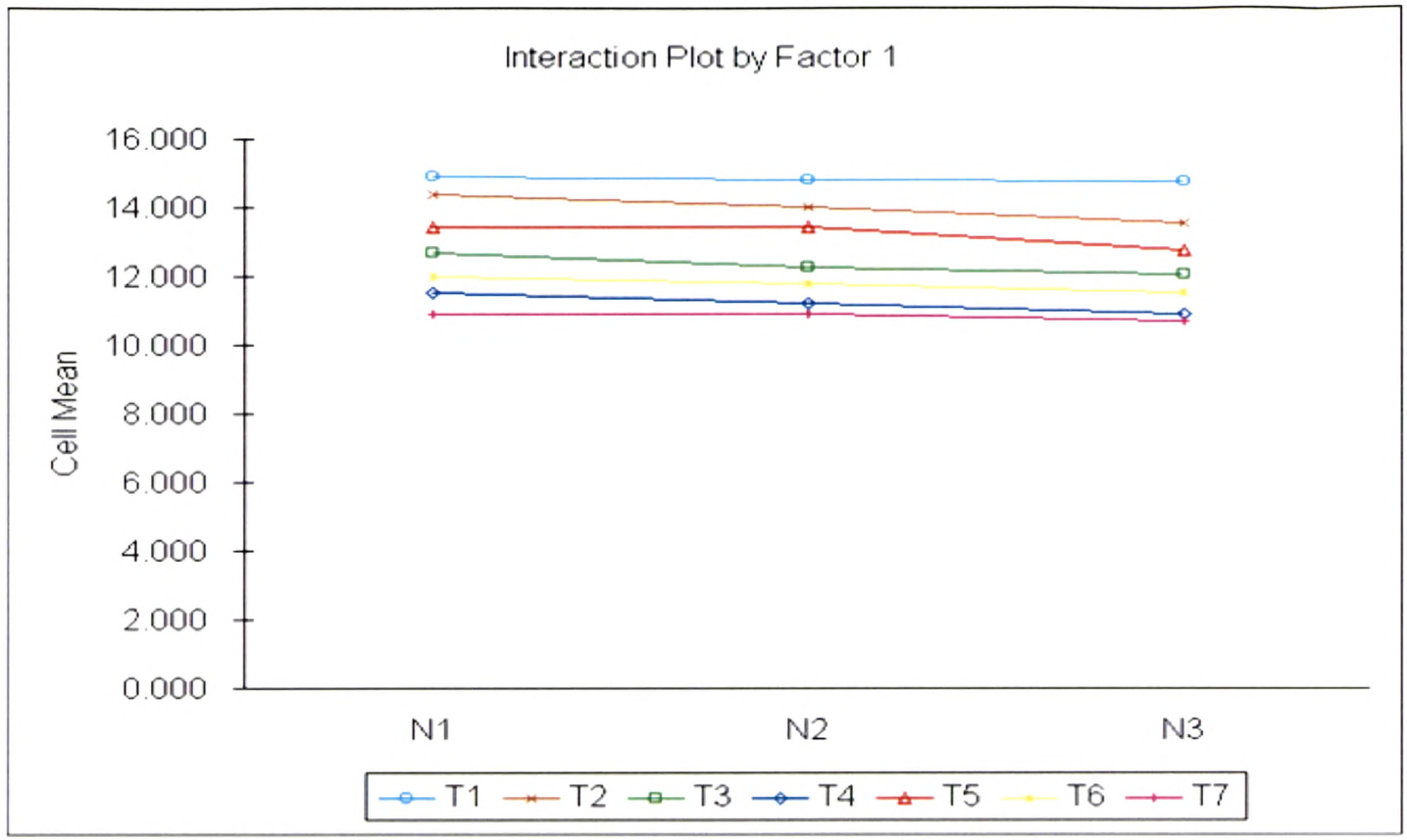


Fig 5.75 Interaction Plot by Factor 1 [Mn Level (ppm) in Soil under Wheat Cultivation]

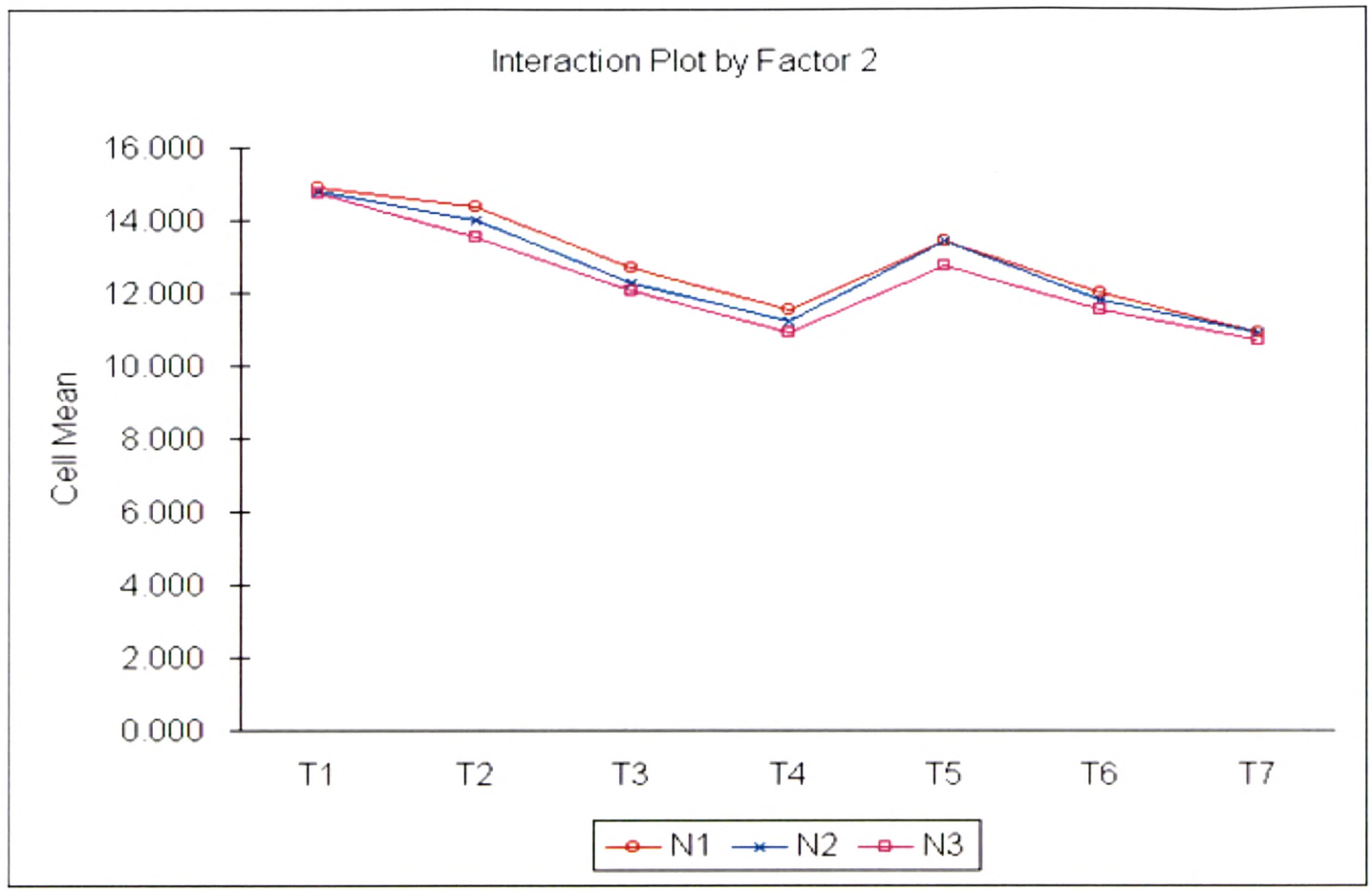


Fig 5.76 Interaction Plot by Factor 2 [Mn Level (ppm) in Soil under Wheat Cultivation]

5.6.2.4 Iron (Fe)

Table 5.109, Table 5.110 and Table 5.111 represent analysis of iron (Fe) level in soil under wheat cultivation during three successive replications. Fig. 5.77 shows Fe level under various treatments for each replication.

Table 5.109 Analysis of Fe Level (ppm) in Soil under Wheat Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.08	11.56	13.94	11.02	8.92	14.24	18.08
N2	13.22	12.2	14.7	11.34	11.3	12.76	10.74
N3	12.94	14.26	11.5	13.96	20.94	13.86	12.16

Table 5.110 Analysis of Fe Level (ppm) in Soil under Wheat Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	16.69	14.51	11.27	10.56	14.68	11.43	7.56
N2	14.56	13.81	11.18	11.32	13.22	11.12	9.46
N3	14.67	12.84	13.01	9.14	8.45	11.15	8.81

Table 5.111 Analysis of Fe Level (ppm) in Soil under Wheat Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	16.98	14.87	13.06	12.53	14.91	11.88	7.85
N2	14.87	14.12	12.26	11.38	13.89	12.56	10.24
N3	14.65	13.02	13.25	10.47	8.91	11.22	9.02

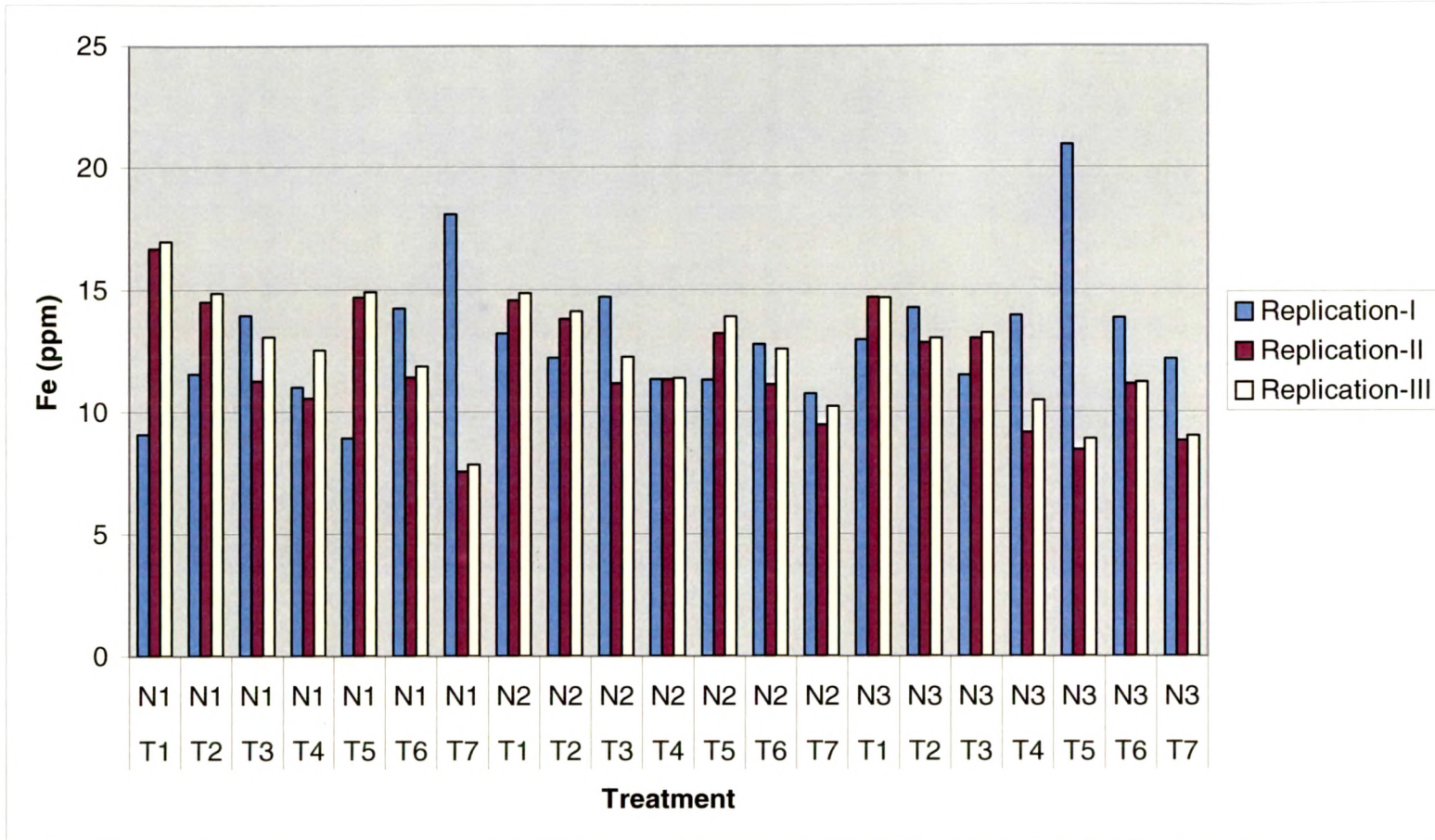
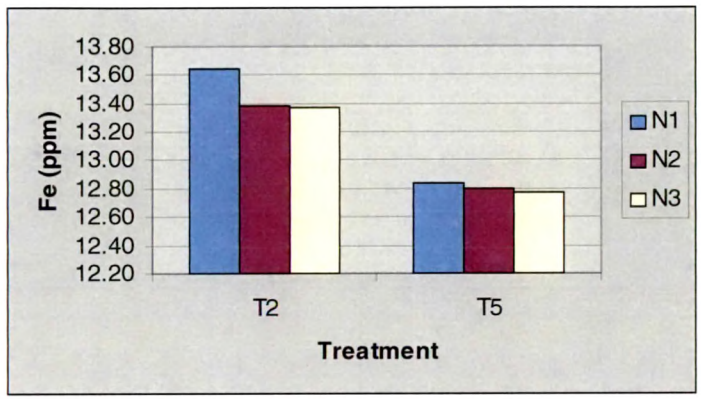


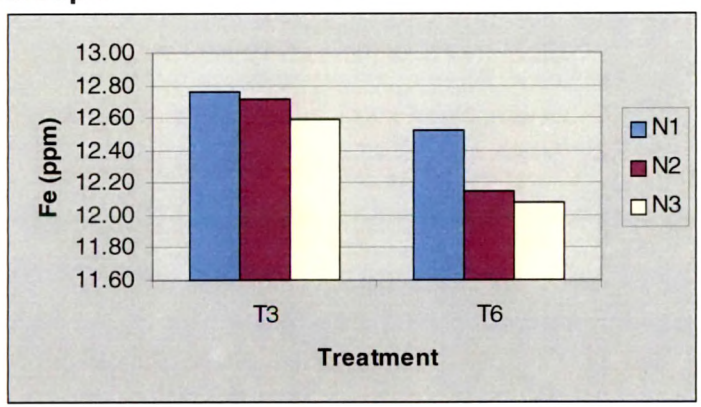
Fig. 5.77 Fe Level in Soil under Wheat Cultivation

Fig. 5.78 shows comparison of Fe Level in Soil under Wheat Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

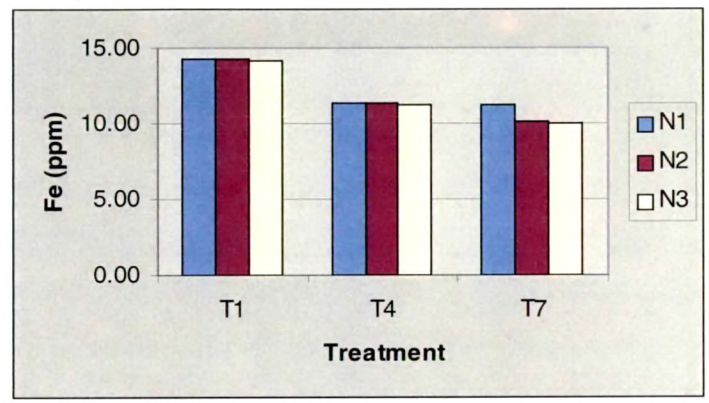


Fig. 5.78 Comparison of Fe Level in Soil under Wheat Cultivation among Group-A, B and C

Table 5.112 and Table 5.113 represent two factor ANOVA and ANOVA Table for Fe Level in Soil under Wheat Cultivation respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.107 Table 5.108 shows p-values for pairwise t-tests. Fig.5.79 and Fig.5.80 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.112 Two factor ANOVA (Fe Level in Soil under Wheat Cultivation)

Means (ppm)

	Factor 2							
	T1	T2	T3	T4	T5	T6	T7	
N1	14.25	13.65	12.76	11.37	12.84	12.52	11.16	12.65
N2	14.22	13.38	12.71	11.35	12.80	12.15	10.15	12.39
N3	14.09	13.37	12.59	11.19	12.77	12.08	10.00	12.30
	14.18	13.47	12.69	11.30	12.80	12.25	10.44	12.45

Table 5.113 ANOVA Table (Fe Level in Soil under Wheat Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	1.39	2.00	0.69	0.10	0.91
Factor 2	86.72	6.00	14.45	2.04	0.08
Interaction	1.67	12.00	0.14	0.02	1.00
Error	297.66	42.00	7.09		
Total	387.44	62.00			

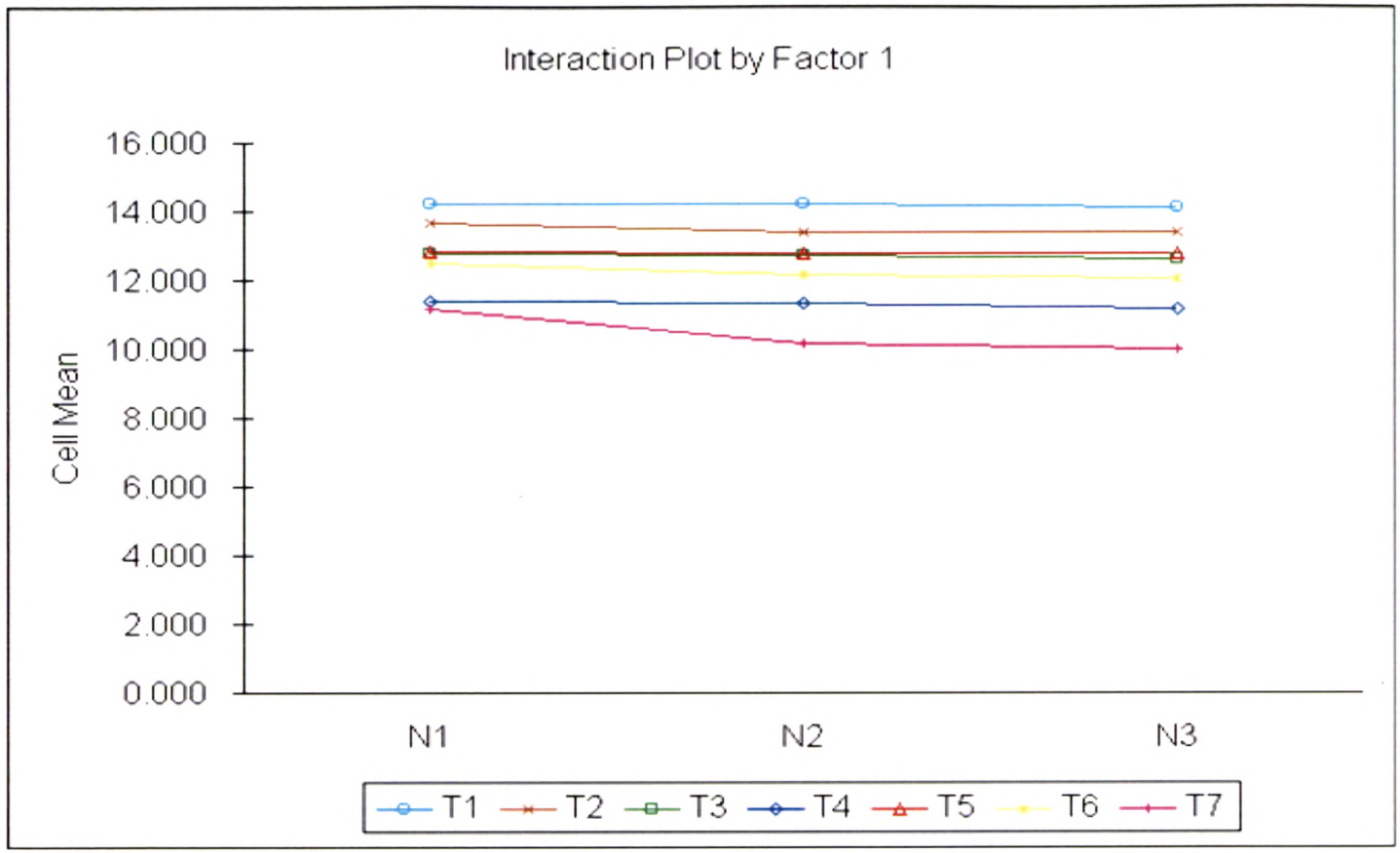


Fig 5.79 Interaction Plot by Factor 1 [Fe Level (ppm) in Soil under Wheat Cultivation]

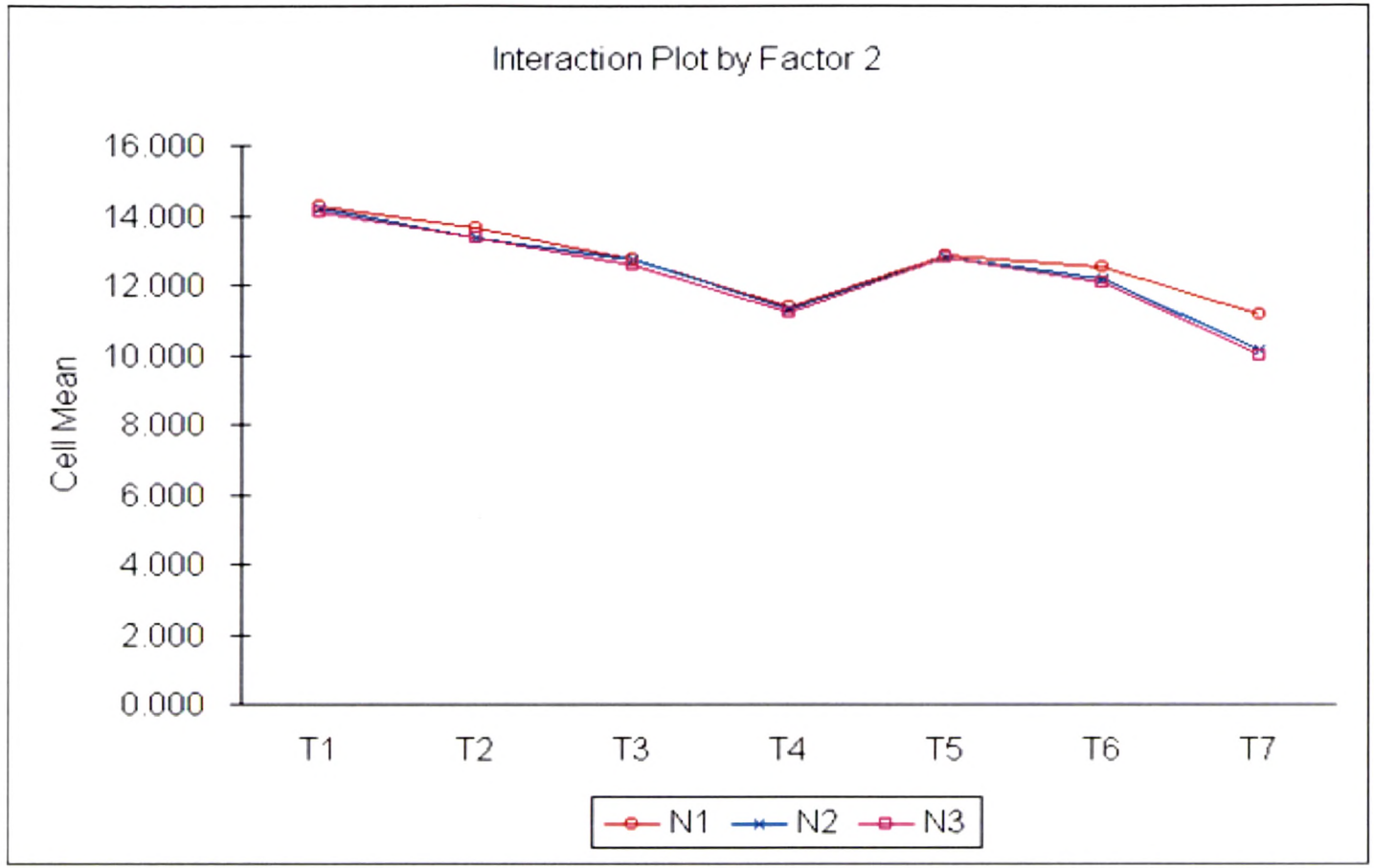


Fig 5.80 Interaction Plot by Factor 2 [Fe Level (ppm) in Soil under Wheat Cultivation]

5.7 Soil Conditions under Greengram Cultivation

5.7.1 EC Level

Table 5.114, Table 5.115 and Table 5.116 represent analysis of Electrical Conductivity (EC) level in soil under greengram cultivation during three successive replications. Fig. 5.81 shows EC level under various treatments for each replication.

Table 5.114 Analysis of EC Level (mmhos/cm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.39	1.35	1.21	0.40	0.73	*0.76*	1.06
N2	0.84	1.12	0.50	0.63	0.83	0.81	0.57
N3	0.82	1.24	0.76	1.31	0.96	1.06	0.93

Table 5.115 Analysis of EC Level (mmhos/cm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.64	0.78	0.91	1.25	0.92	0.73	0.62
N2	0.86	0.85	1.21	1.24	0.82	0.69	0.73
N3	0.85	0.81	1.08	0.74	0.84	0.66	0.41

Table 5.116 Analysis of EC Level (mmhos/cm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.62	0.68	0.81	1.08	0.80	0.64	0.29
N2	0.79	0.78	1.18	0.81	0.66	0.62	0.44
N3	0.78	0.69	0.98	0.61	0.47	0.32	0.32

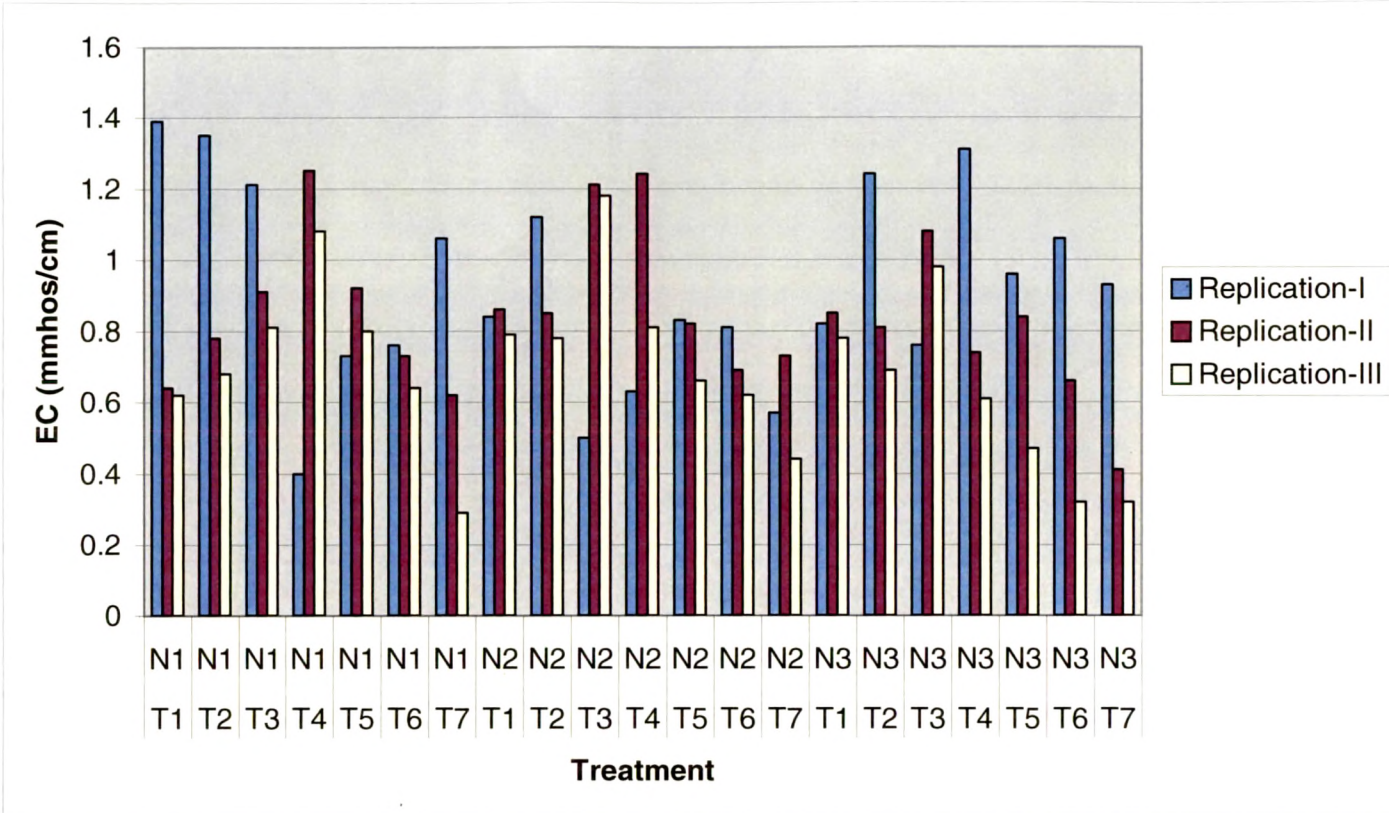
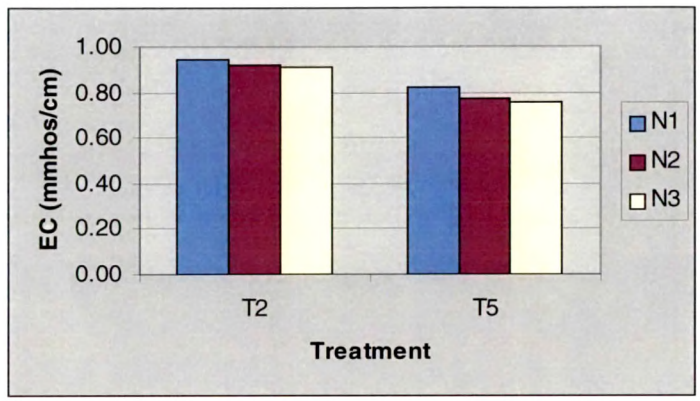


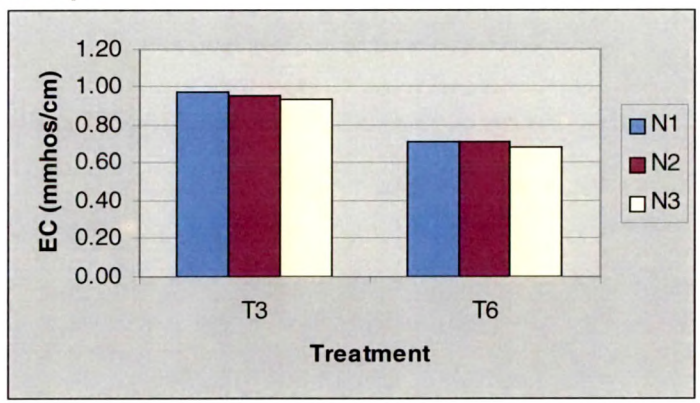
Fig. 5.81 EC Level in soil under Greengram Cultivation

Fig. 5.82 shows comparison of EC Level in soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

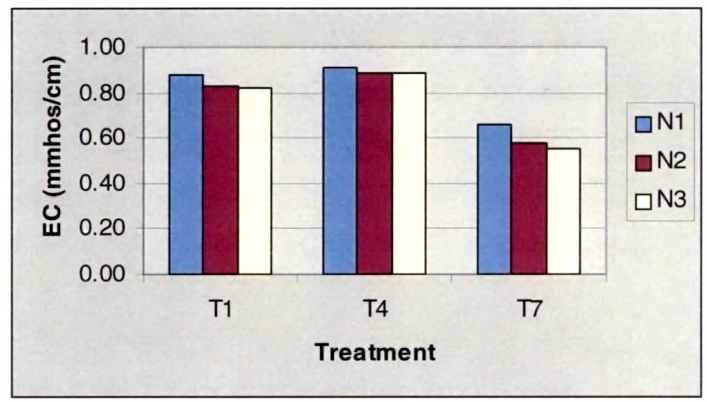


Fig. 5.82 Comparison of EC Level in soil under Greengram Cultivation among Group-A, B and C

Table 5.117 and Table 5.118 represent two factor ANOVA and ANOVA Table for EC Level in Soil under Wheat Cultivation respectively. Fig.5.83 and Fig.5.84 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.117 Two factor ANOVA (EC Level in Soil under Greengram Cultivation)

Means (mmhos/cm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	0.88	0.94	0.98	0.91	0.82	0.71	0.66	0.84
	N2	0.83	0.92	0.96	0.89	0.77	0.71	0.58	0.81
	N3	0.82	0.91	0.94	0.89	0.76	0.68	0.55	0.79
		0.84	0.92	0.96	0.90	0.78	0.70	0.60	0.81

Table 5.118 ANOVA Table (EC Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.03	2.00	0.01	0.17	0.84
Factor 2	0.92	6.00	0.15	1.98	0.09
Interaction	0.01	12.00	0.00	0.01	1.00
Error	3.25	42.00	0.08		
Total	4.21	62.00			

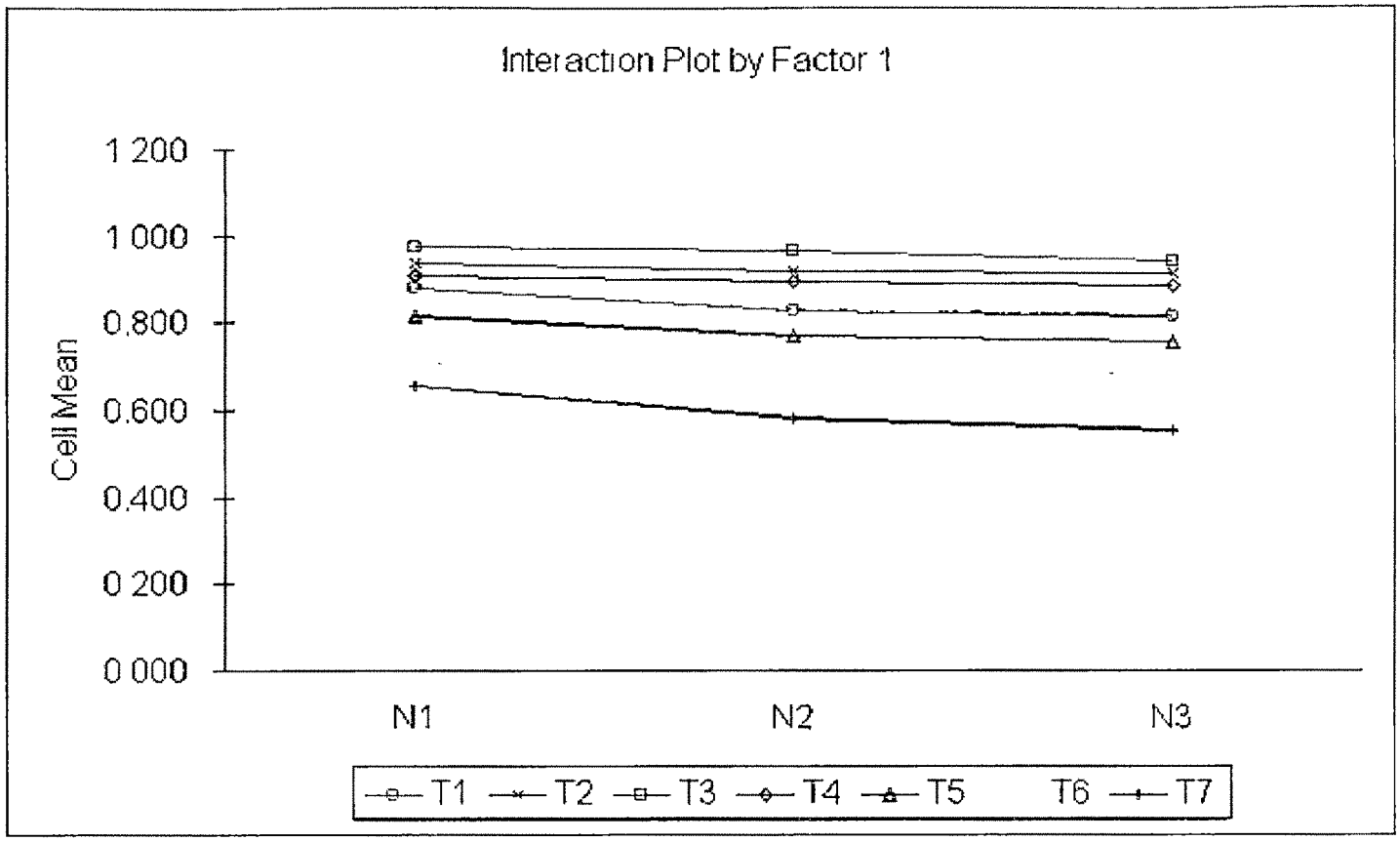


Fig 5.83 Interaction Plot by Factor 1 [EC Level (mmhos/cm) in Soil under Greengram Cultivation]

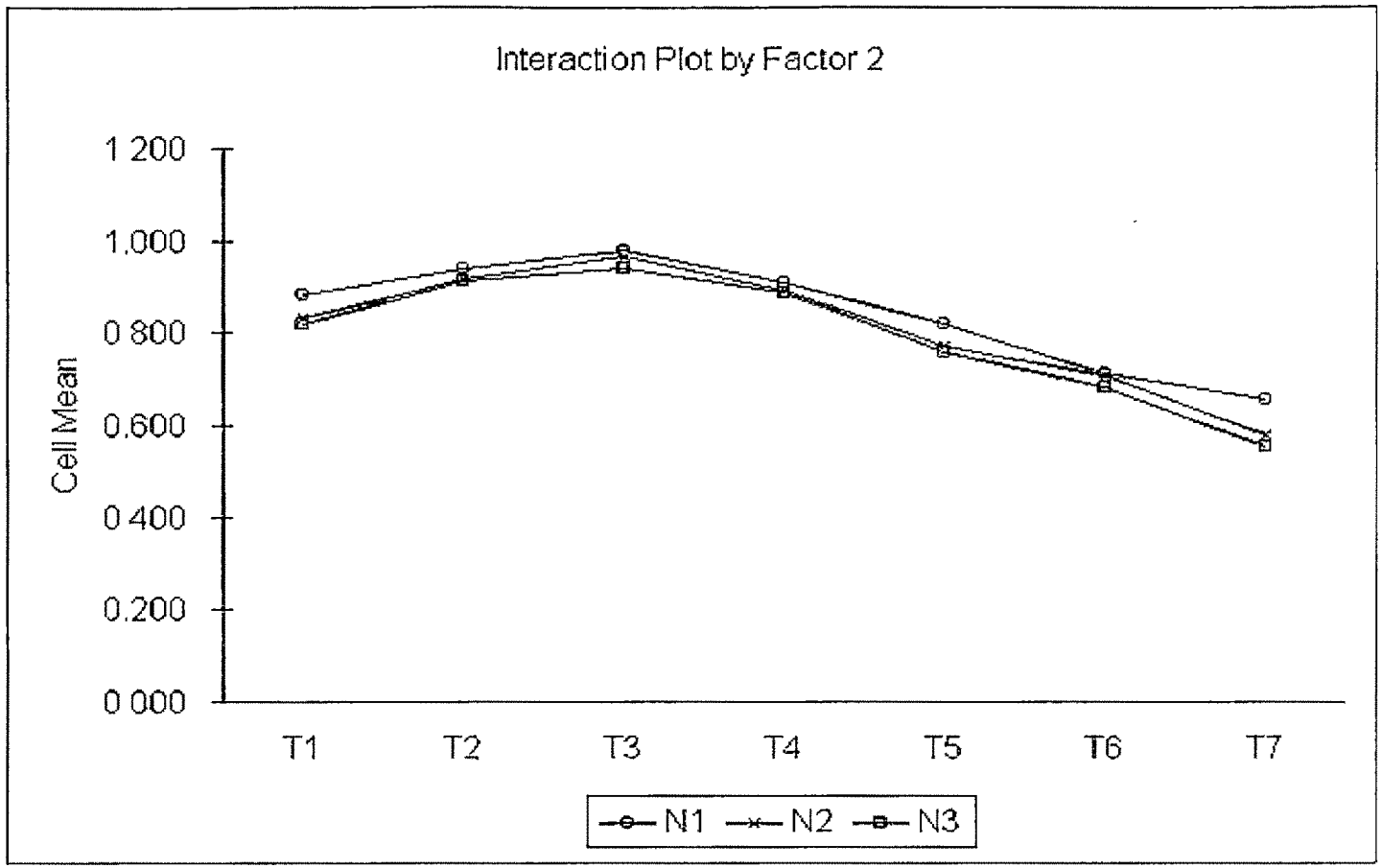


Fig 5.84 Interaction Plot by Factor 2 [EC Level (mmhos/cm)in Soil under Greengram Cultivation]

5.7.2 Heavy Metal Accumulation

5.7.2.1 Lead (Pb) Level

Table 5.119, Table 5.120 and Table 5.121 represent analysis of lead (Pb) level in soil under greengram cultivation during three successive replications. Fig. 5.85 shows Pb level under various treatments for each replication.

Table 5.119 Analysis of Pb Level (ppm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.45	10.01	10.49	6.5	9.47	9.88	8.1
N2	8.21	8.96	10.26	5.45	10.23	9.45	7.02
N3	9.56	8.75	8.65	7.26	9.12	10.18	6.33

Table 5.120 Analysis of Pb Level (ppm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	10.03	8.98	6.84	8.26	7.21	7.03	6.47
N2	10.01	8.71	6.32	7.96	7.12	6.89	7.07
N3	9.37	8.09	7.03	6.88	7.76	6.78	7.25

Table 5.121 Analysis of Pb Level (ppm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	10.19	9.45	7.15	8.32	8.33	7.12	6.68
N2	10.32	8.75	7.85	8.11	7.41	7.52	7.11
N3	9.57	8.56	8.74	7.14	7.81	6.85	7.36

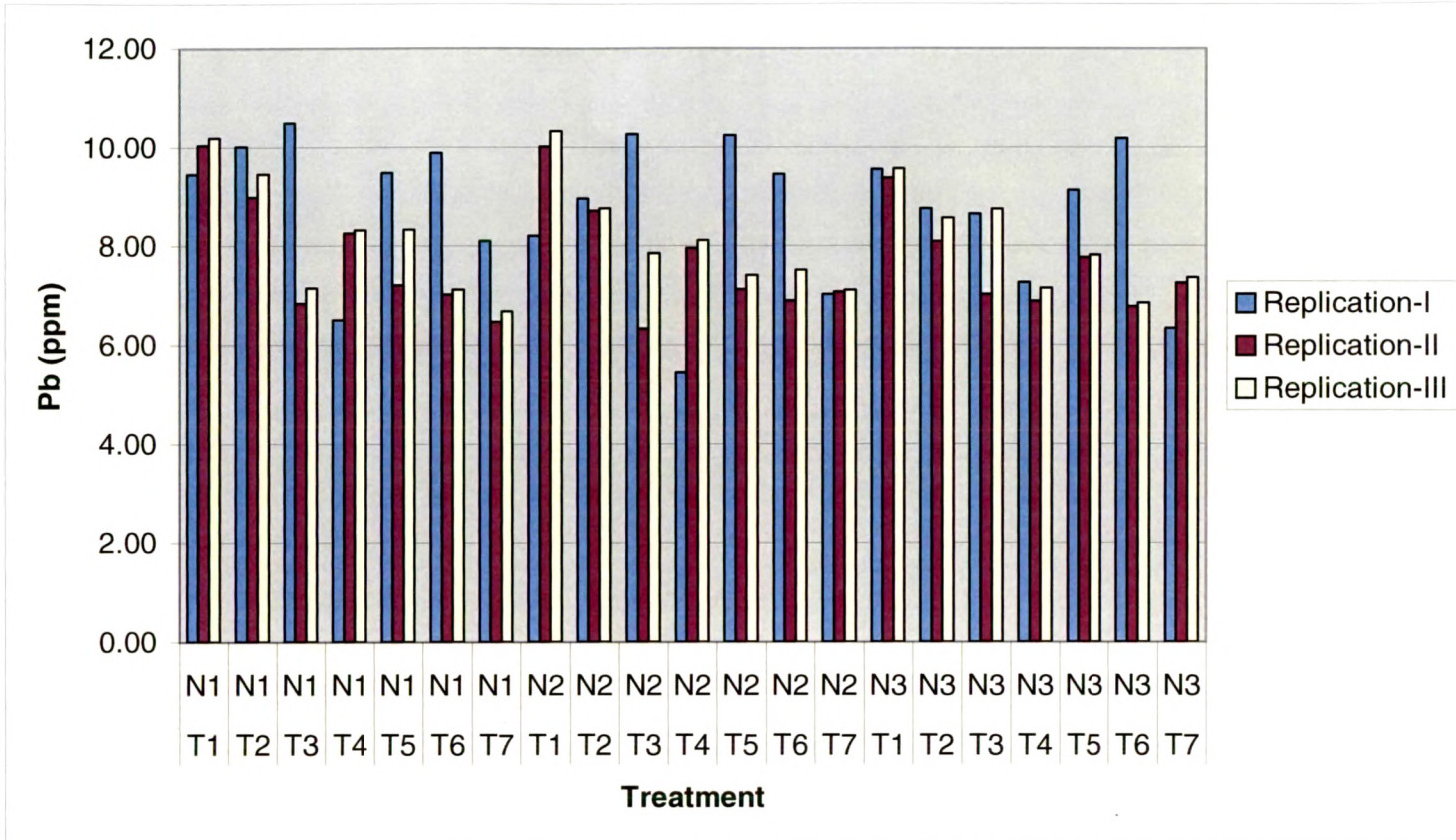
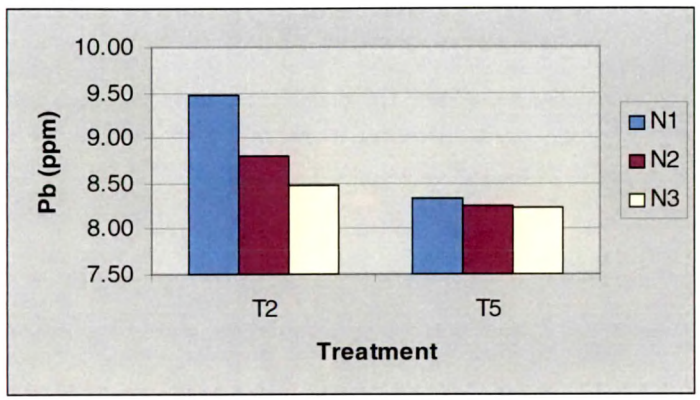


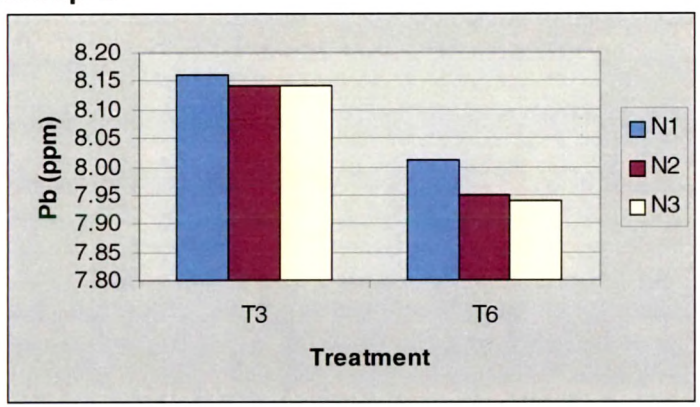
Fig. 5.85 Pb Level in soil under Greengram Cultivation

Fig. 5.86 shows comparison of Pb Level in soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

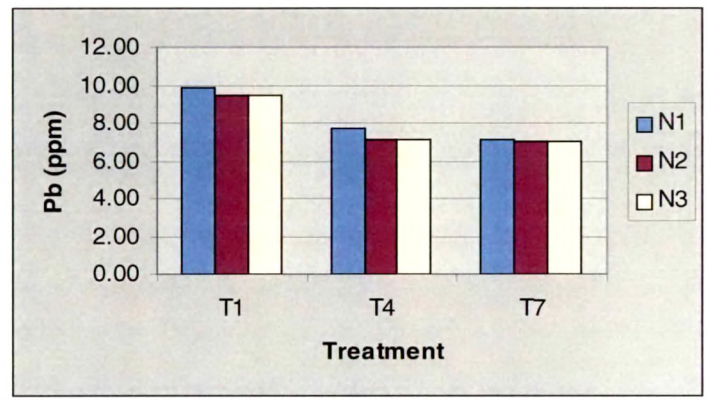


Fig. 5.86 Comparison of Pb Level in soil under Greengram Cultivation among Group-A, B and C

Table 5.122 and Table 5.123 represent two factor ANOVA and ANOVA Table for Pb level in soil under greengram Cultivation respectively. Post hoc analysis for Factor 2 (irrigation treatments) is given in Table 5.124. Table 5.125 shows p-values for pairwise t-tests. Fig.5.87 and Fig.5.88 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.122 Two factor ANOVA (Pb Level in Soil under Greengram Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	9.89	9.48	8.16	7.69	8.34	8.01	7.08	8.38
	N2	9.51	8.81	8.14	7.17	8.25	7.95	7.07	8.13
	N3	9.50	8.47	8.14	7.09	8.23	7.94	6.98	8.05
		9.63	8.92	8.15	7.32	8.27	7.97	7.04	8.19

Table 5.123 ANOVA Table (Pb Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	1.24	2.00	0.62	0.46	0.63
Factor 2	42.72	6.00	7.12	5.29	0.00
Interaction	1.33	12.00	0.11	0.08	1.00
Error	56.56	42.00	1.35		
Total	101.85	62.00			

Table 5.124 Post hoc analysis for Factor 2 (Pb Level in Soil under Greengram Cultivation)

Post hoc analysis for Factor 2

Tukey simultaneous comparison t-values (d.f. = 42)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	7.04	7.32	7.97	8.15	8.27	8.92	9.63
T7	7.04							
T4	7.32	0.51						
T6	7.97	1.69	1.18					
T3	8.15	2.02	1.51	0.33				
T5	8.27	2.25	1.74	0.56	0.23			
T2	8.92	3.43	2.92	1.74	1.41	1.18		
T1	9.63	4.74	4.23	3.05	2.72	2.49	1.31	

critical values for experimentwise error rate:

0.05	3.10
0.01	3.72

Table 5.125 p-values for pairwise t-tests (Pb Level in Soil under Greengram Cultivation)

		T7	T4	T6	T3	T5	T2	T1
	(ppm)	7.04	7.32	7.97	8.15	8.27	8.92	9.63
T7	7.04							
T4	7.32	0.62						
T6	7.97	0.10	0.24					
T3	8.15	0.05	0.14	0.74				
T5	8.27	0.03	0.09	0.58	0.82			
T2	8.92	0.00	0.01	0.09	0.17	0.25		
T1	9.63	0.00	0.00	0.00	0.01	0.02	0.20	

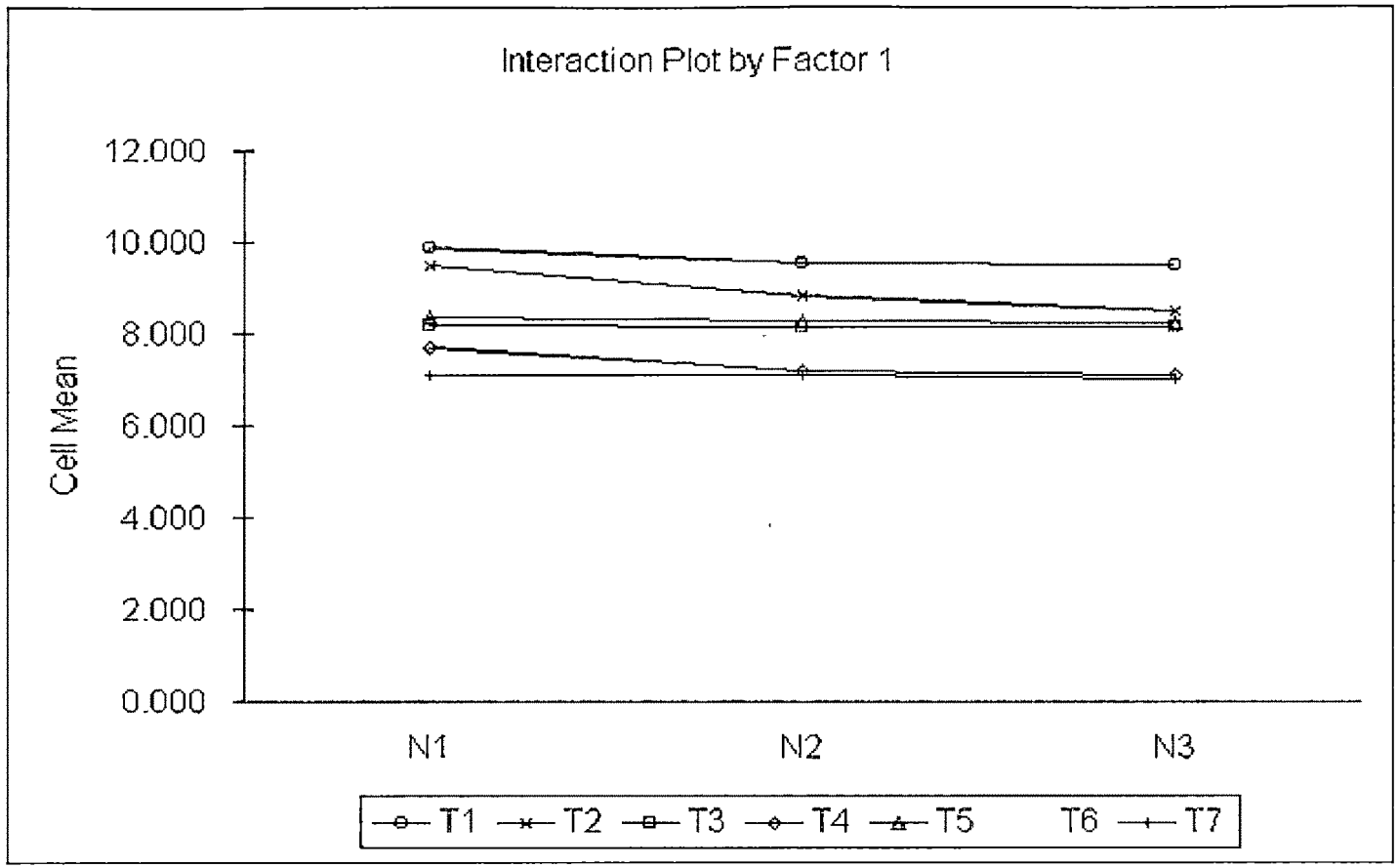


Fig 5.87 Interaction Plot by Factor 1 [Pb Level (ppm) in Soil under Greengram Cultivation]

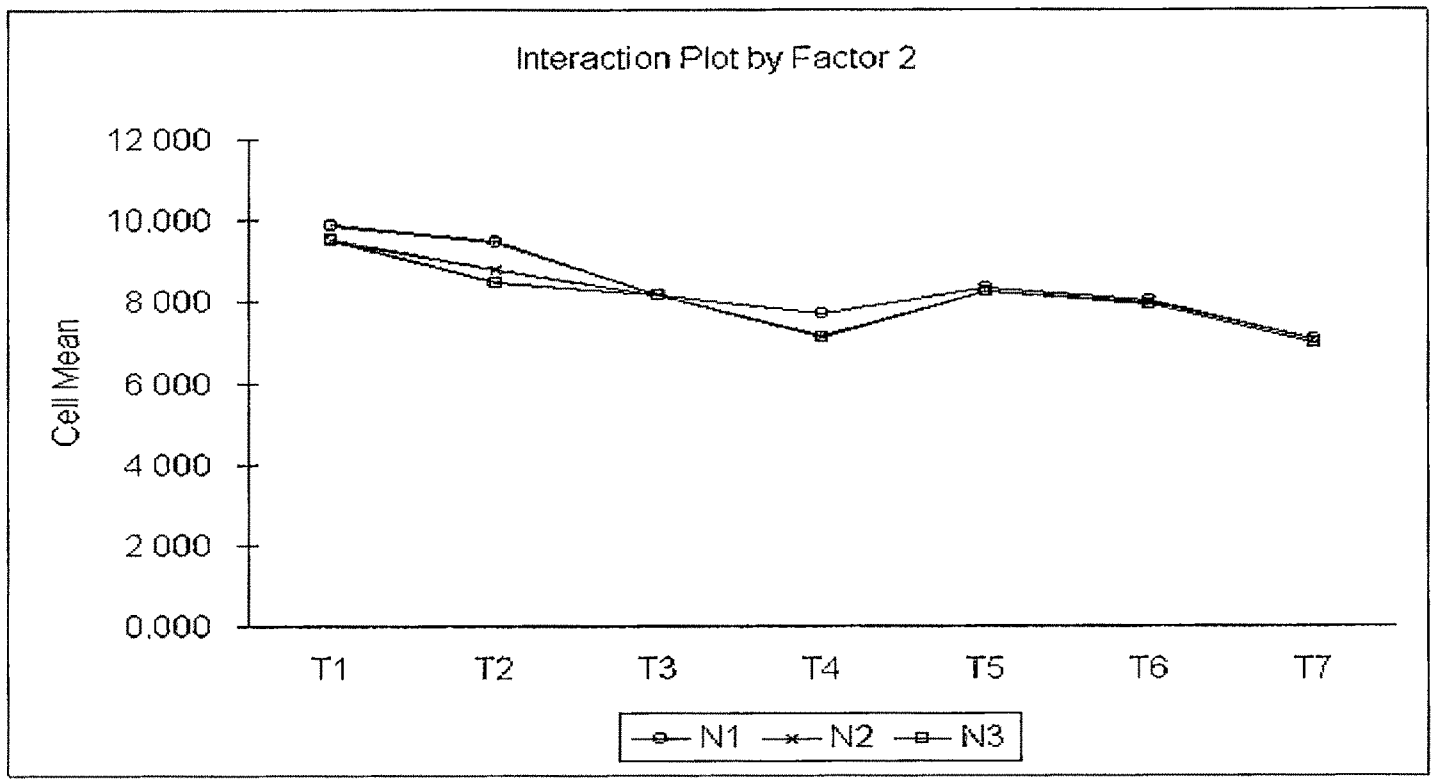


Fig 5.88 Interaction Plot by Factor 2 [Pb Level (ppm) in Soil under Greengram Cultivation]

5.7.2.2 Copper (Cu) Level

Table 5.126, Table 5.127 and Table 5.128 represent analysis of copper (Cu) level in soil under greengram cultivation during three successive replications. Fig. 5.89 shows Cu level under various treatments for each replication.

Table 5.126 Analysis of Cu Level (ppm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.02	1.11	1.14	0.8	1.02	0.8	0.76
N2	0.92	1.26	0.88	0.62	0.86	1.02	0.72
N3	0.88	1.16	0.94	1.16	0.9	1.02	0.86

Table 5.127 Analysis of Cu Level (ppm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.98	1.78	1.42	1.45	1.56	1.61	1.25
N2	1.99	1.7	1.64	1.52	1.54	1.24	*1.14*
N3	1.92	1.68	1.56	1.11	1.68	1.38	1.12

Table 5.128 Analysis of Cu Level (ppm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	2.05	1.88	1.76	1.55	1.94	1.64	1.33
N2	2.05	1.73	1.73	1.61	1.96	1.68	1.35
N3	1.99	1.74	1.72	1.14	1.75	1.44	1.22

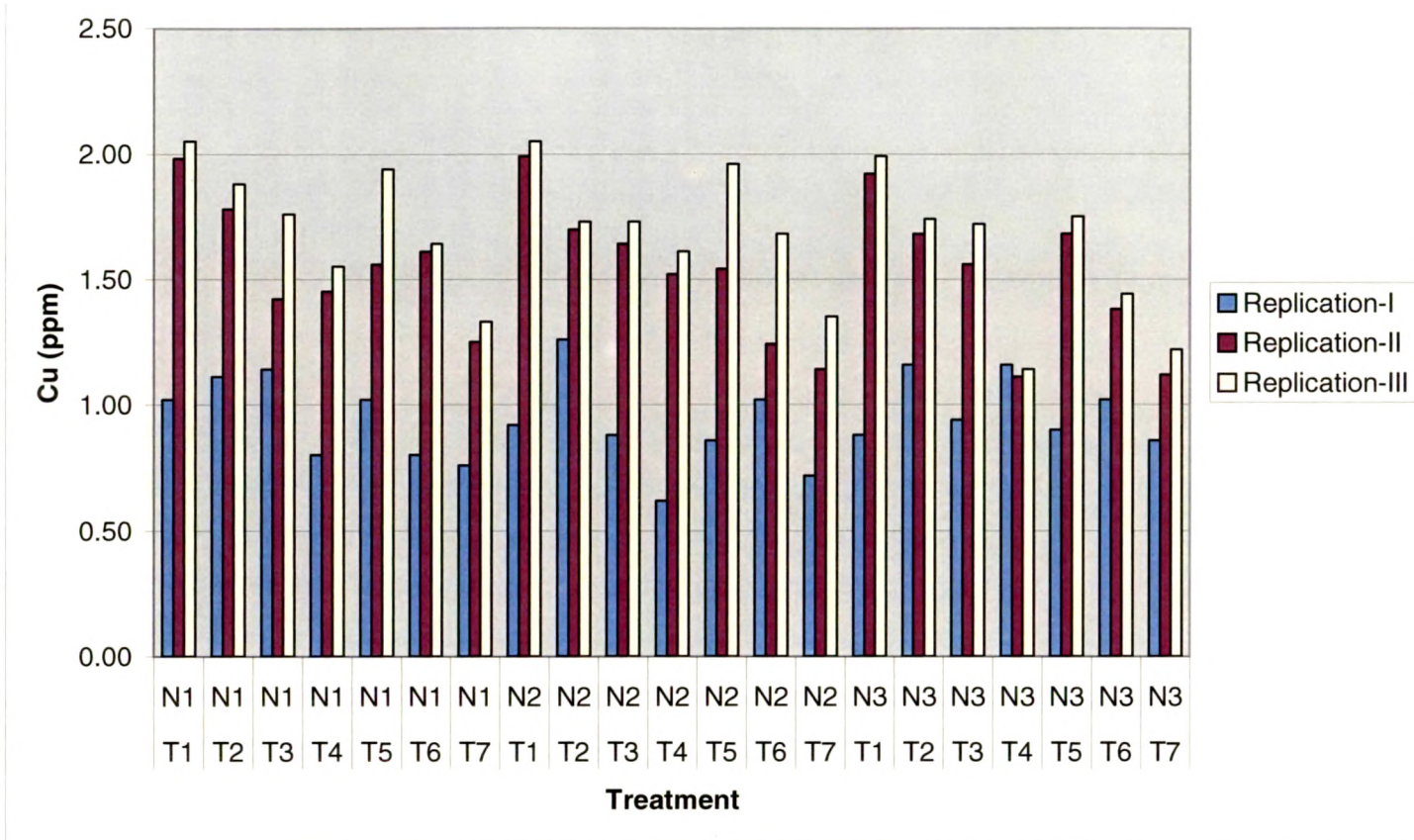
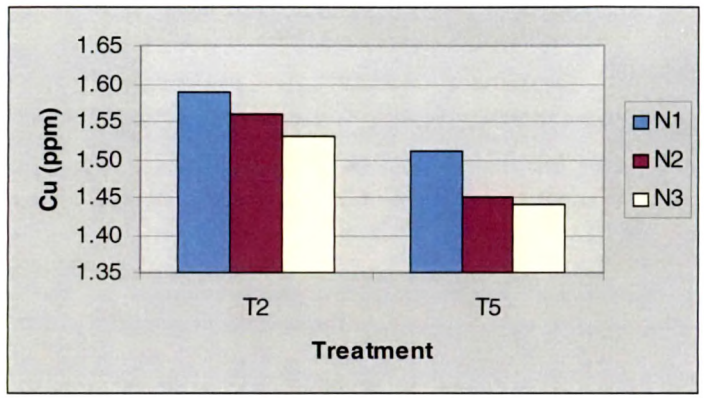


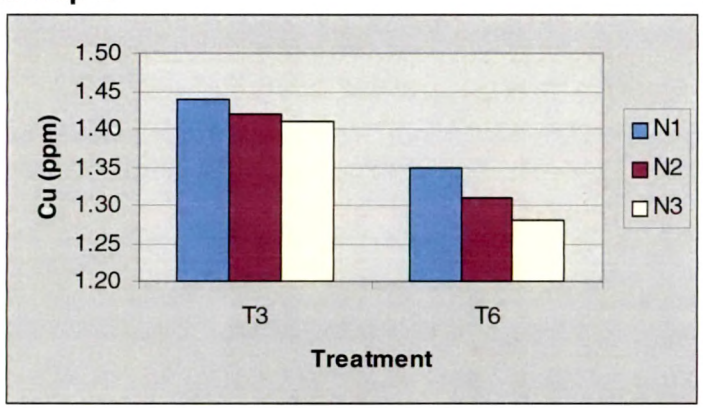
Fig. 5.89 Cu Level in soil under Greengram Cultivation

Fig. 5.90 shows comparison of Cu Level in soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

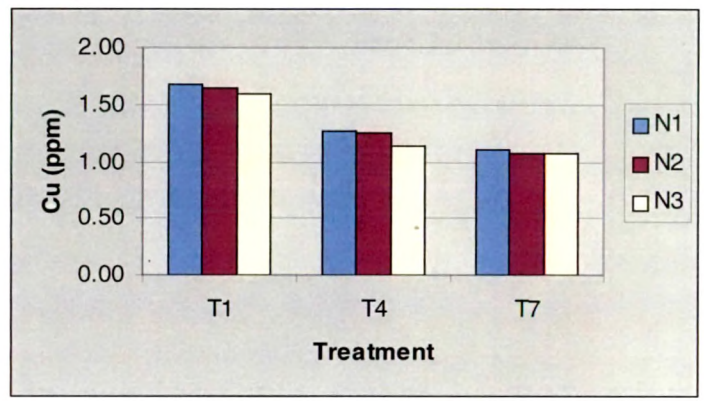


Fig. 5.90 Comparison of Cu Level in soil under Greengram Cultivation among Group-A, B and C

Table 5.129 and Table 5.130 represent two factor ANOVA and ANOVA Table for Cu level in soil under greengram Cultivation respectively. Fig.5.91 and Fig.5.92 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.129 Two factor ANOVA (Cu Level in Soil under Greengram Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	1.68	1.59	1.44	1.27	1.51	1.35	1.11	1.42
	N2	1.65	1.56	1.42	1.25	1.45	1.31	1.07	1.39
	N3	1.60	1.53	1.41	1.14	1.44	1.28	1.07	1.35
		1.64	1.56	1.42	1.22	1.47	1.31	1.08	1.39

Table 5.130 ANOVA Table (Cu Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.05	2.00	0.03	0.14	0.87
Factor 2	2.07	6.00	0.35	1.91	0.10
Interaction	0.02	12.00	0.00	0.01	1.00
Error	7.57	42.00	0.18		
Total	9.71	62.00			

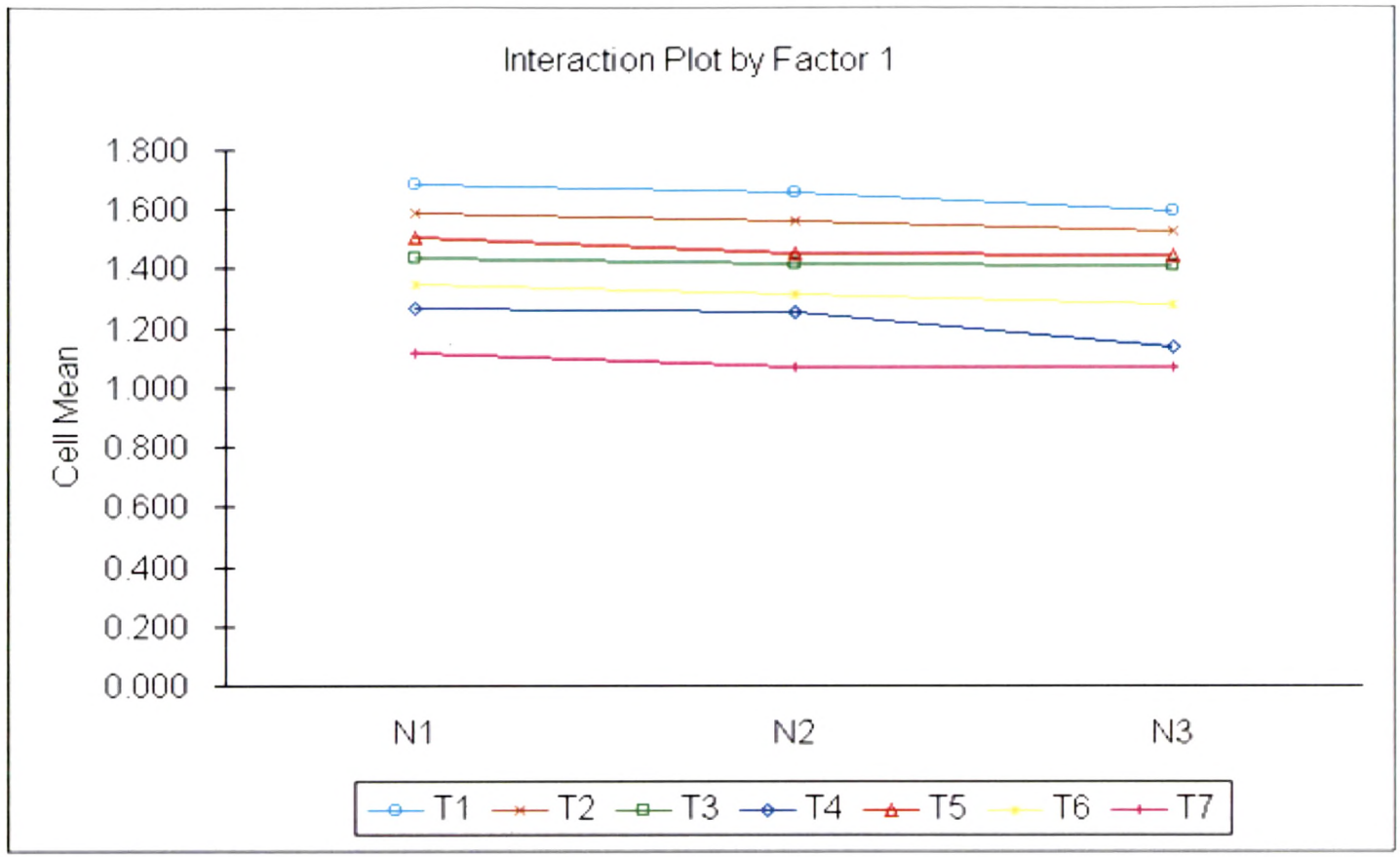


Fig 5.91 Interaction Plot by Factor 1 [Cu Level (ppm) in Soil under Greengram Cultivation]

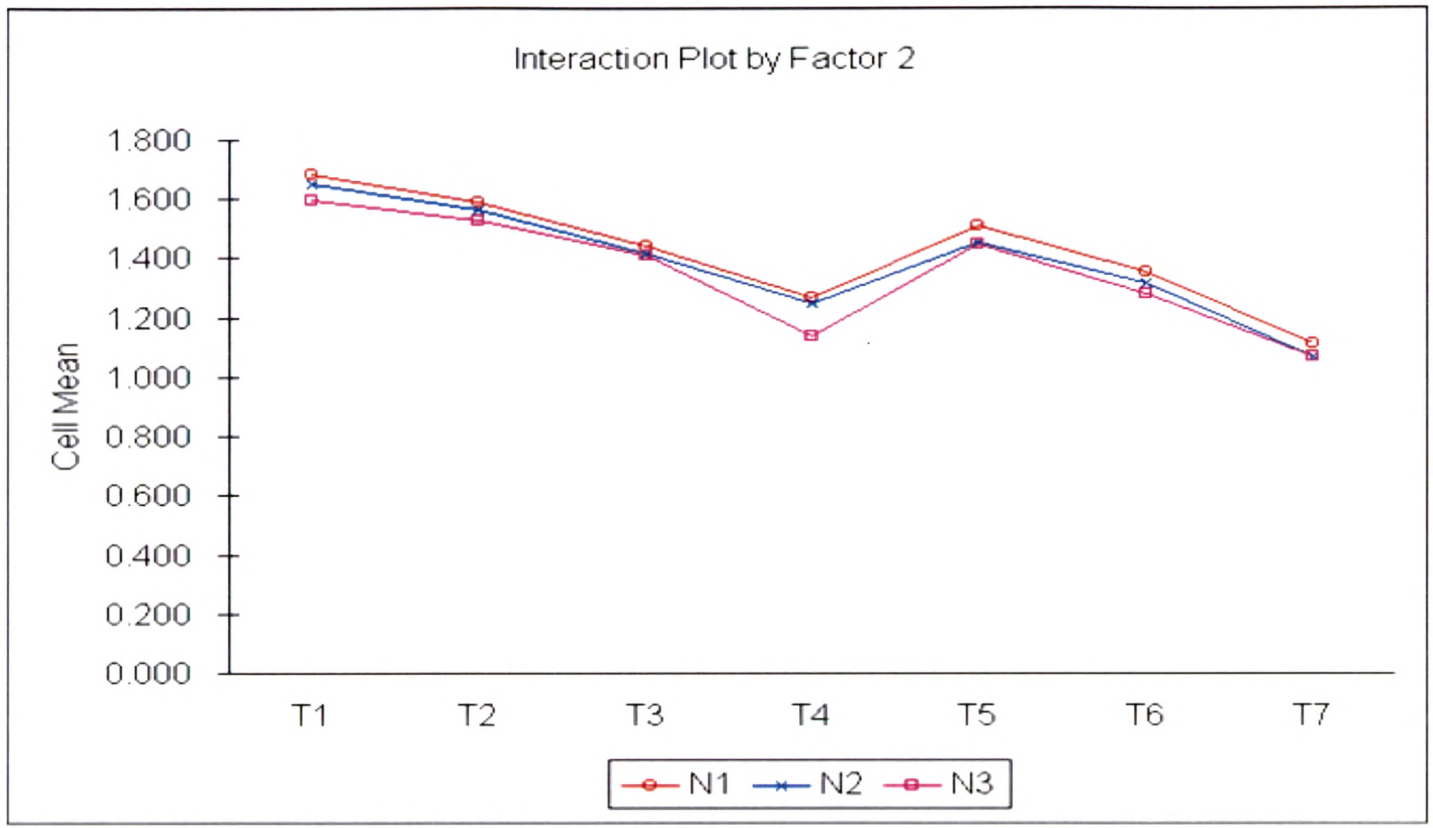


Fig 5.92 Interaction Plot by Factor 2 [Cu Level (ppm) in Soil under Greengram Cultivation]

5.7.2.3 Zinc (Zn) Level

Table 5.131, Table 5.132 and Table 5.133 represent analysis of zinc (Zn) level in soil under greengram cultivation during three successive replications. Fig. 5.93 shows Zn level under various treatments for each replication.

Table 5.131 Analysis of Zn Level (ppm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	0.62	0.55	0.52	0.54	0.66	0.88	0.28
N2	0.46	0.84	0.44	0.4	1.14	0.46	0.38
N3	0.54	0.38	0.54	0.7	0.52	0.4	0.48

Table 5.132 Analysis of Zn Level (ppm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.85	1.84	1.67	1.48	1.7	1.24	1.32
N2	1.85	1.62	1.51	1.35	1.41	1.66	1.25
N3	1.84	1.85	1.42	1.11	1.68	1.41	1.14

Table 5.133 Analysis of Zn Level (ppm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	1.92	1.87	1.79	1.12	1.75	1.33	1.42
N2	1.99	1.78	1.68	1.37	1.52	1.28	1.28
N3	1.88	1.89	1.52	1.26	1.84	1.42	1.25

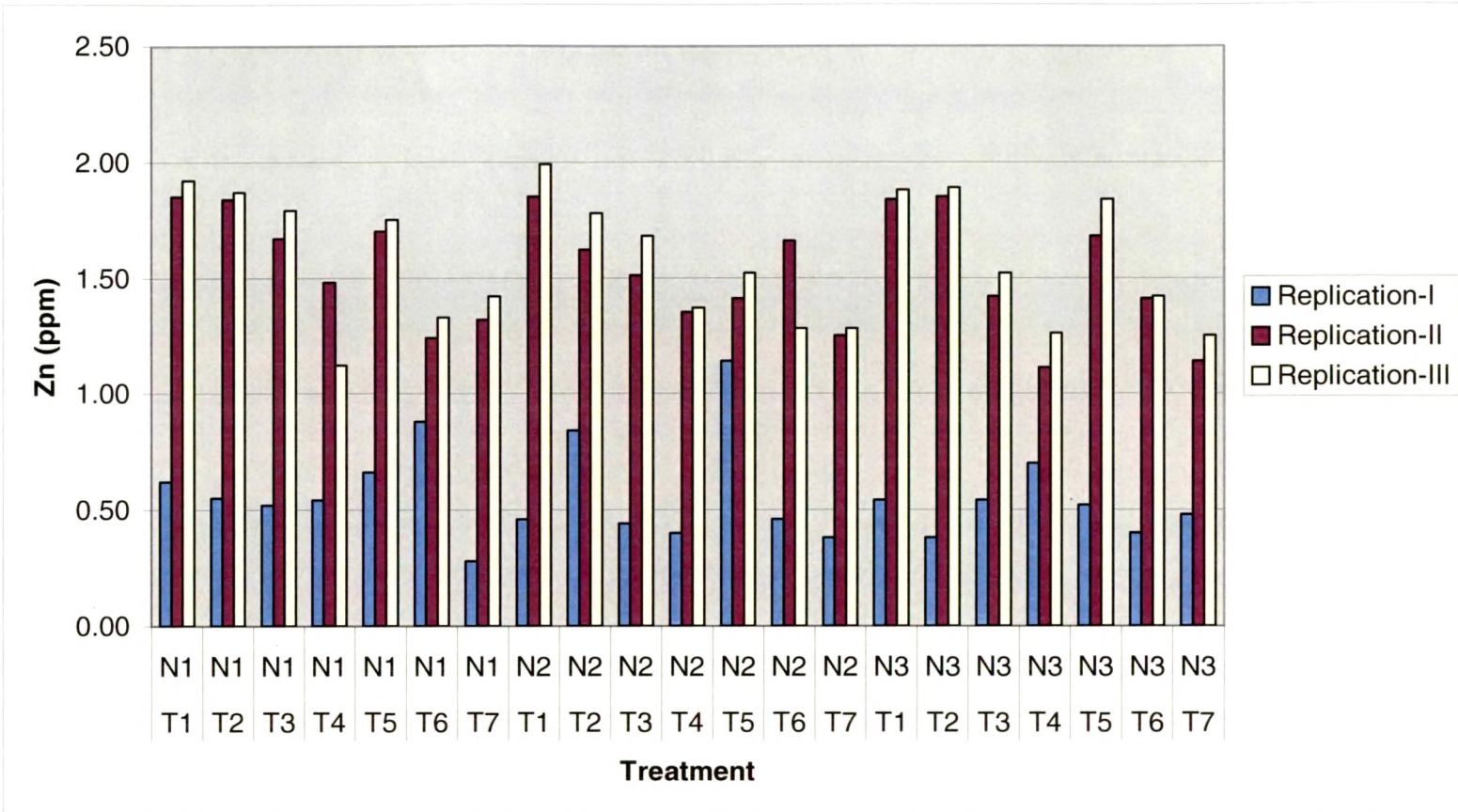
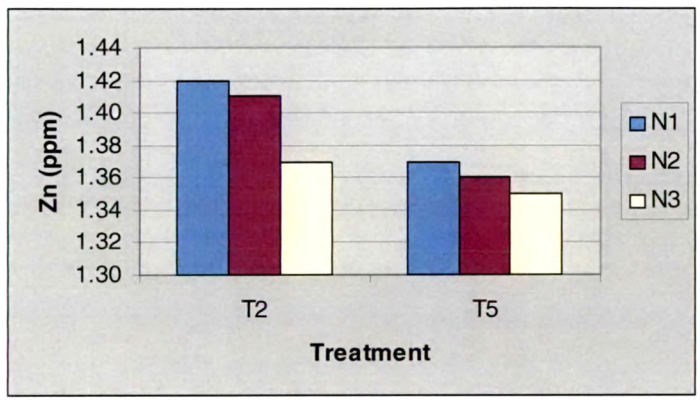


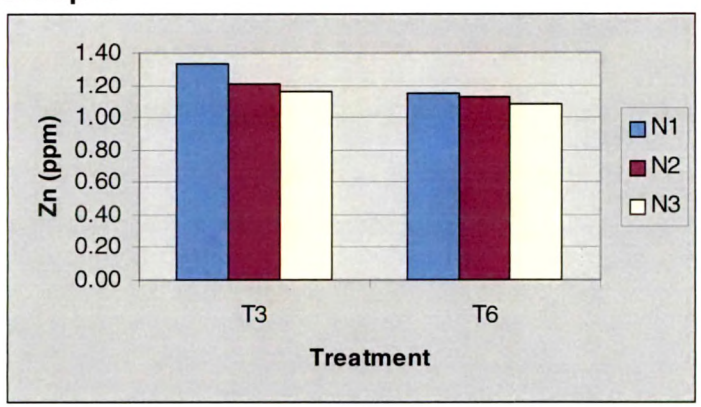
Fig. 5.93 Zn Level in Soil under Greengram Cultivation

Fig. 5.94 shows comparison of Zn Level in Soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

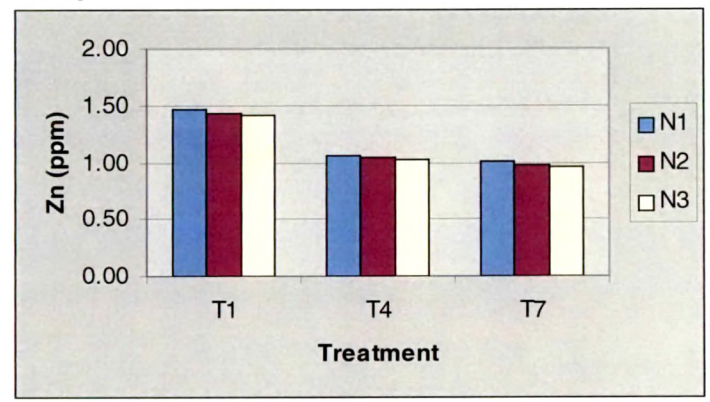


Fig. 5.94 Comparison of Zn Level in Soil under Greengram Cultivation among Group-A, B and C

Table 5.134 and Table 5.135 represent two factor ANOVA and ANOVA Table for Zn level in soil under greengram Cultivation respectively. Fig.5.95 and Fig.5.96 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.134 Two factor ANOVA (Zn Level in Soil under Greengram Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	1.46	1.42	1.33	1.05	1.37	1.15	1.01	1.25
	N2	1.43	1.41	1.21	1.04	1.36	1.13	0.97	1.22
	N3	1.42	1.37	1.16	1.02	1.35	1.08	0.96	1.19
		1.44	1.40	1.23	1.04	1.36	1.12	0.98	1.22

Table 5.135 ANOVA Table (Zn Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	0.04	2.00	0.02	0.05	0.95
Factor 2	1.82	6 00	0.30	0.82	0.56
Interaction	0.03	12.00	0.00	0.01	1.00
Error	15.58	42.00	0.37		
Total	17.46	62.00			

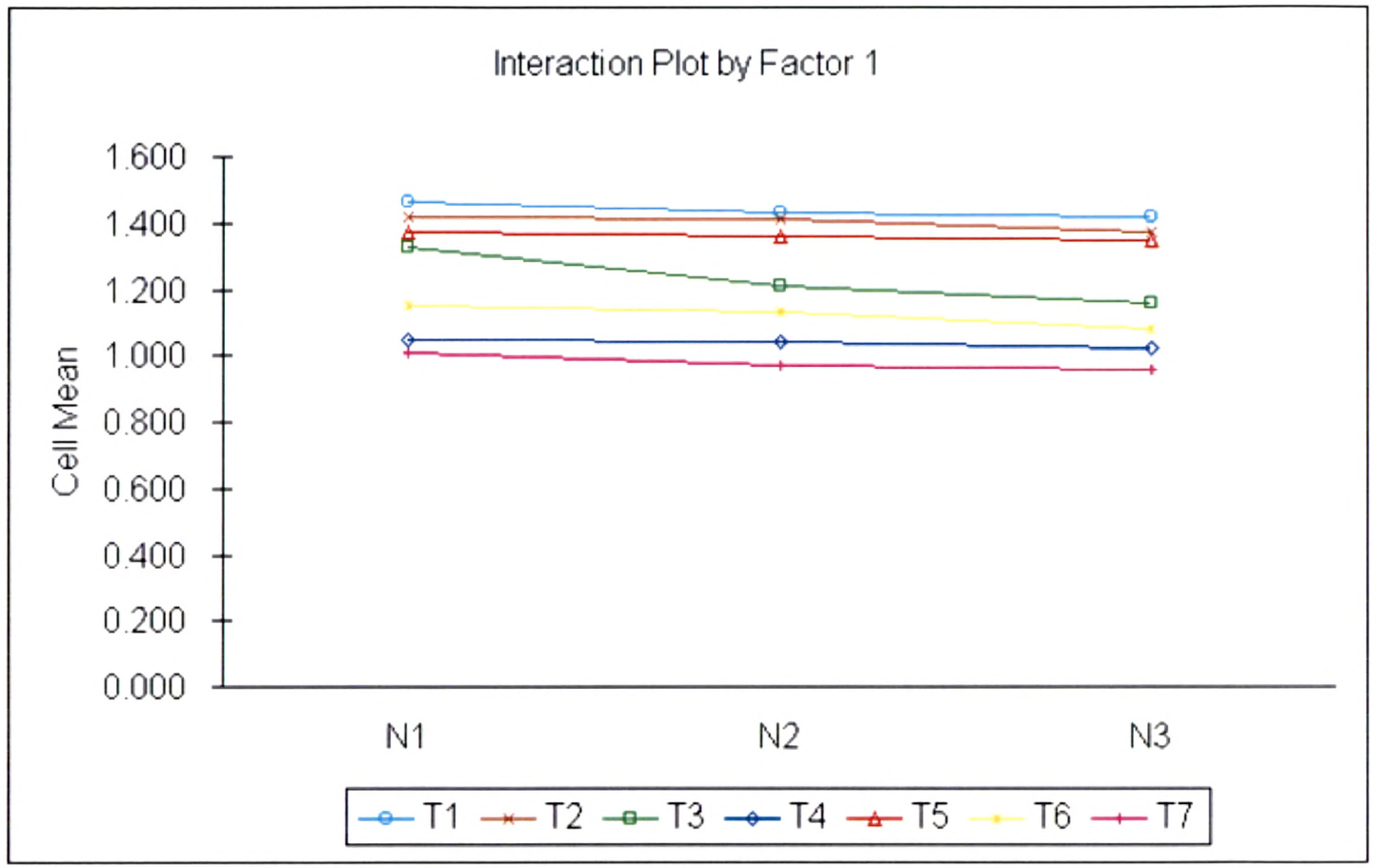


Fig 5.95 Interaction Plot by Factor 1 [Zn Level (ppm) in Soil under Greengram Cultivation]

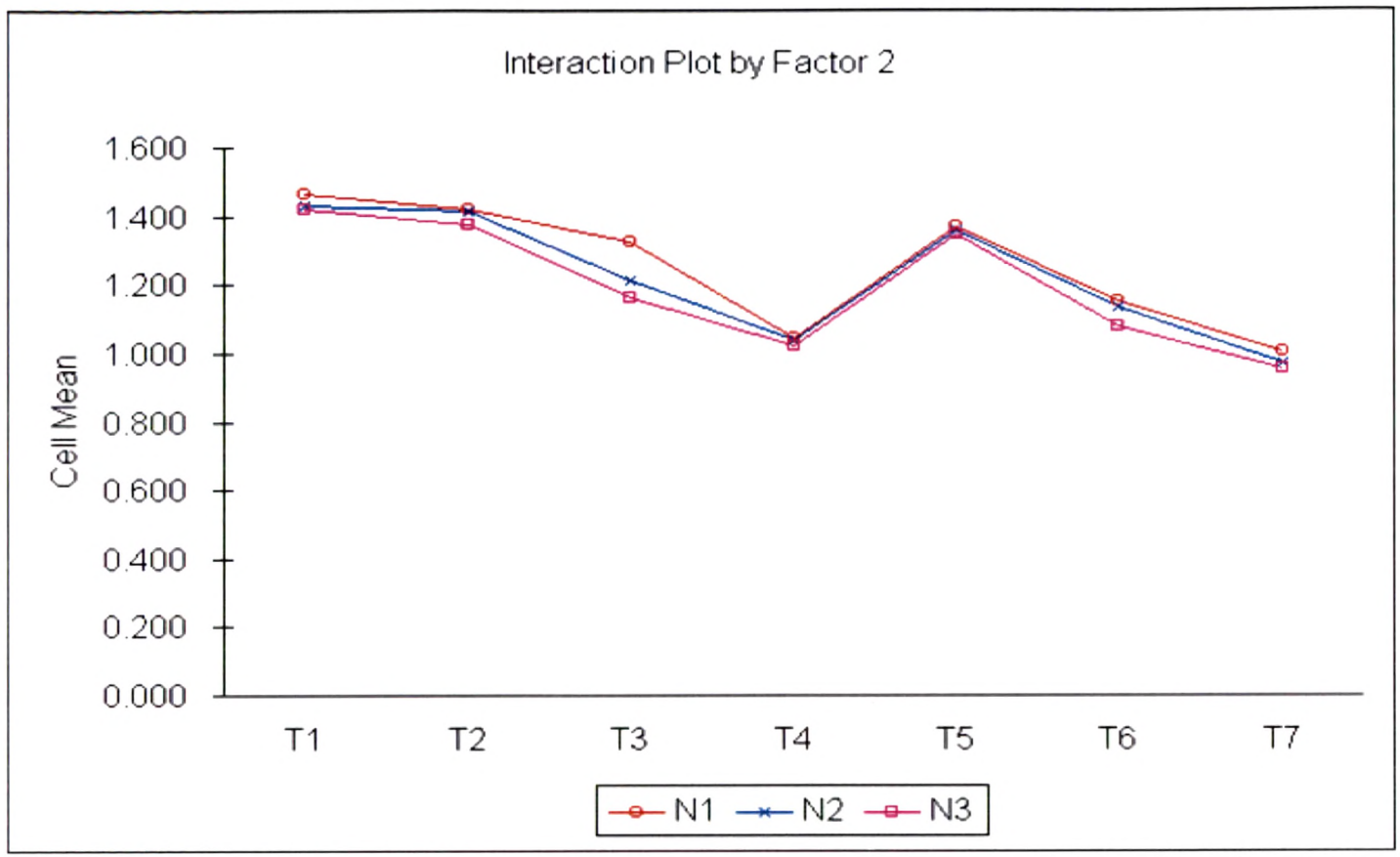


Fig 5.96 Interaction Plot by Factor 2 [Zn Level (ppm) in Soil under Greengram Cultivation]

5.7.2.4 Manganese (Mn) Level

Table 5.136, Table 5.137 and Table 5.138 represent analysis of Mn level in soil under greengram cultivation during three successive replications. Fig. 5.97 shows Mn level under various treatments for each replication.

Table 5.136 Analysis of Mn Level (ppm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	4.8	4.08	3.28	3.34	3.9	2.96	4.32
N2	4.26	5.18	3.04	2.78	6.2	4.62	2.98
N3	4.82	5.98	2.42	3.44	2.94	4.06	2.84

Table 5.137 Analysis of Mn Level (ppm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.52	8.9	8.12	7.46	8.65	7.8	6.87
N2	9.12	8.1	7.89	7.59	6.68	7.11	7.16
N3	8.87	6.16	8.45	7.25	8.86	6.78	6.65

Table 5.138 Analysis of Mn Level (ppm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	9.63	8.4	8.53	7.58	8.82	8.19	6.95
N2	8.47	8.16	7.95	7.89	8.12	7.15	7.25
N3	8.14	9.25	8.25	7.48	8.52	7.55	6.32

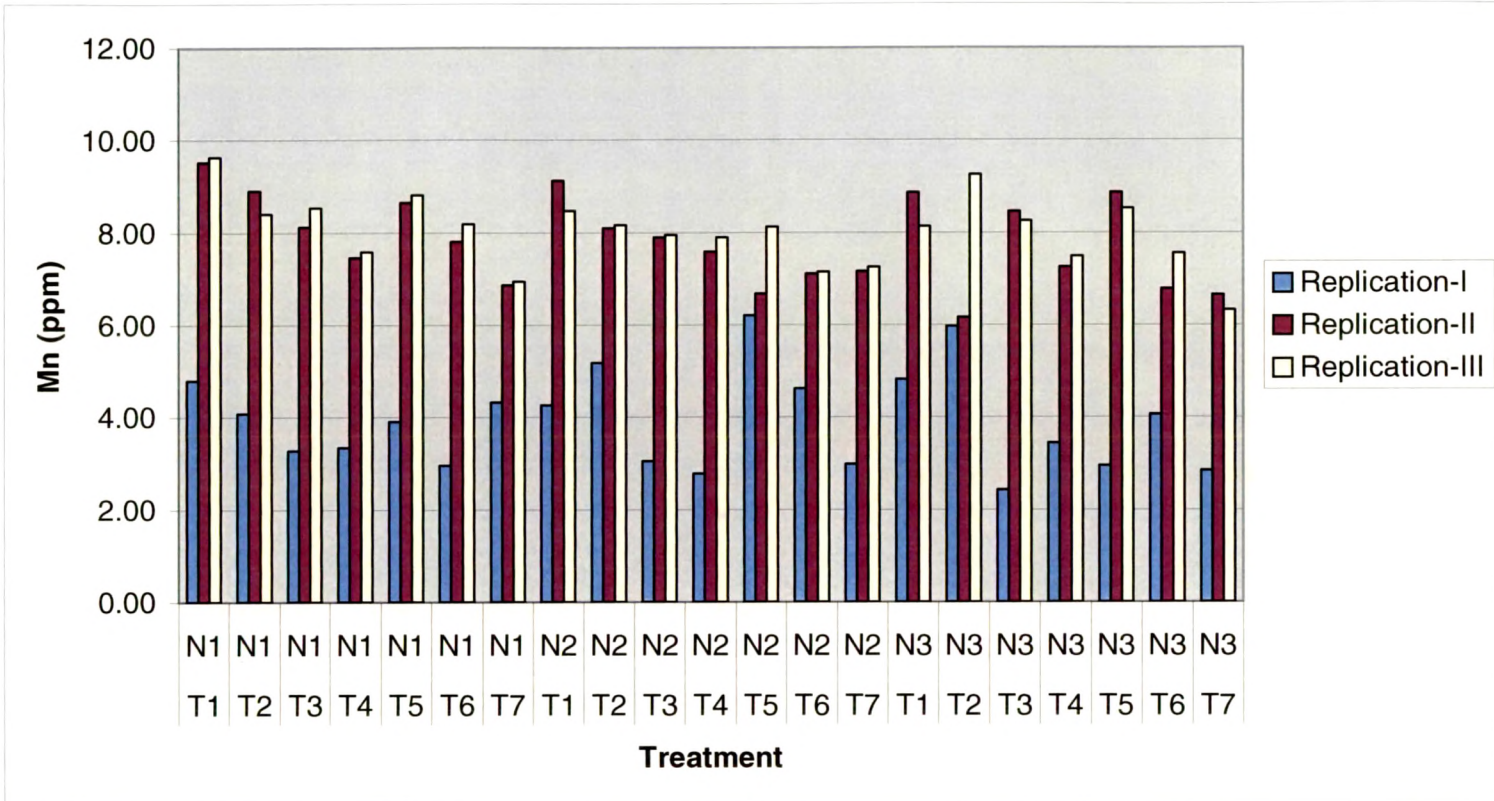
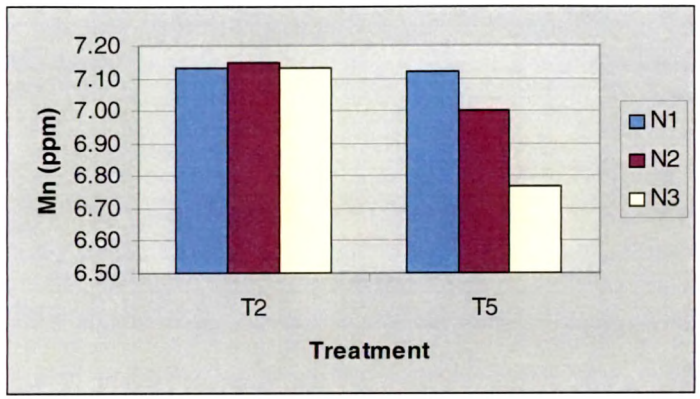


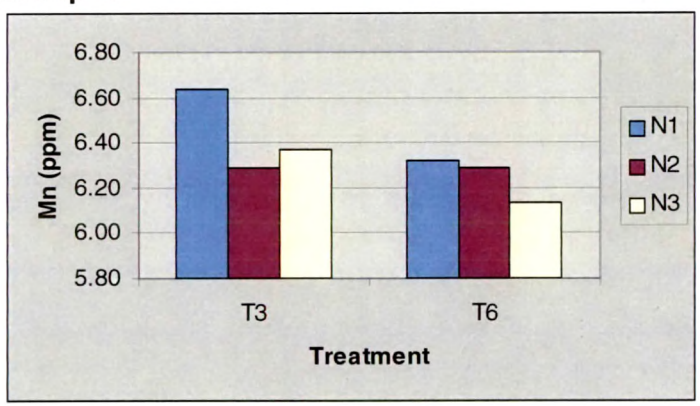
Fig. 5.97 Mn Level in soil under Greengram Cultivation

Fig. 5.98 shows comparison of Mn Level in soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

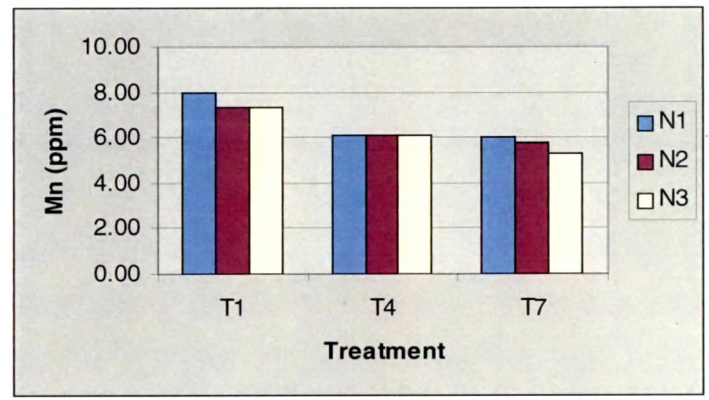


Fig. 5.98 Comparison of Mn Level in soil under Greengram Cultivation among Group-A, B and C

Table 5.139 and Table 5.140 represent two factor ANOVA and ANOVA Table for Mn level in soil under greengram Cultivation respectively. Fig.5.99 and Fig.5.100 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.139 Two factor ANOVA (Mn Level in Soil under Greengram Cultivation)

		Factor 2							
	Means:								
	(ppm)	T1	T2	T3	T4	T5	T6	T7	
	N1	7.98	7.13	6.64	6.13	7.12	6.32	6.05	6.77
Factor 1	N2	7.28	7.15	6.29	6.09	7.00	6.29	5.80	6.56
	N3	7.28	7.13	6.37	6.06	6.77	6.13	5.27	6.43
		7.51	7.13	6.44	6.09	6.97	6.25	5.70	6.58

Table 5.140 ANOVA Table (Mn Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	1.21	2.00	0.61	0.10	0.90
Factor 2	22.21	6.00	3.70	0.62	0.72
Interaction	1.18	12.00	0.10	0.02	1.00
Error	252.74	42.00	6.02		
Total	277.34	62.00			

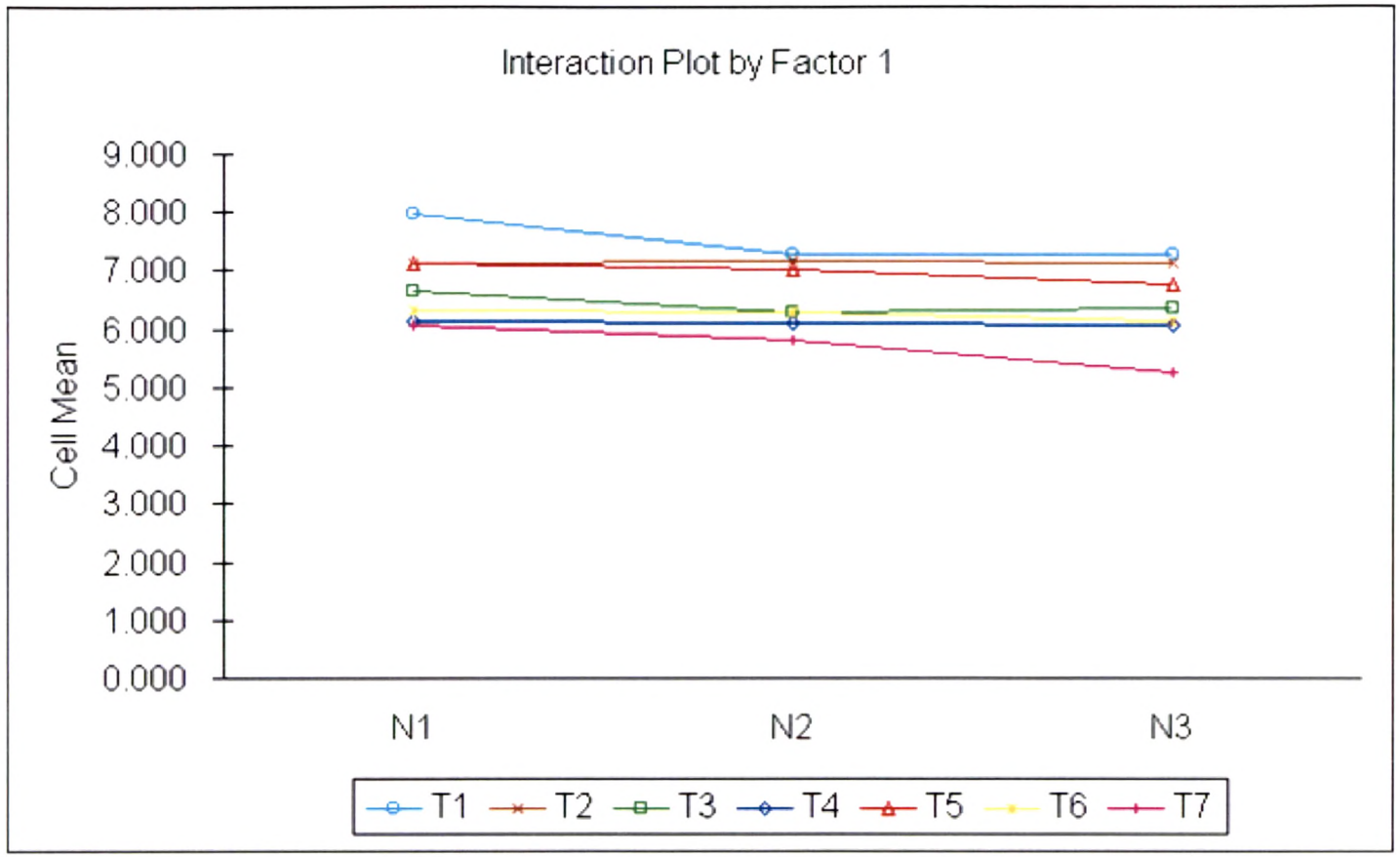


Fig 5.99 Interaction Plot by Factor 1 [Mn Level (ppm) in Soil under Greengram cultivation]

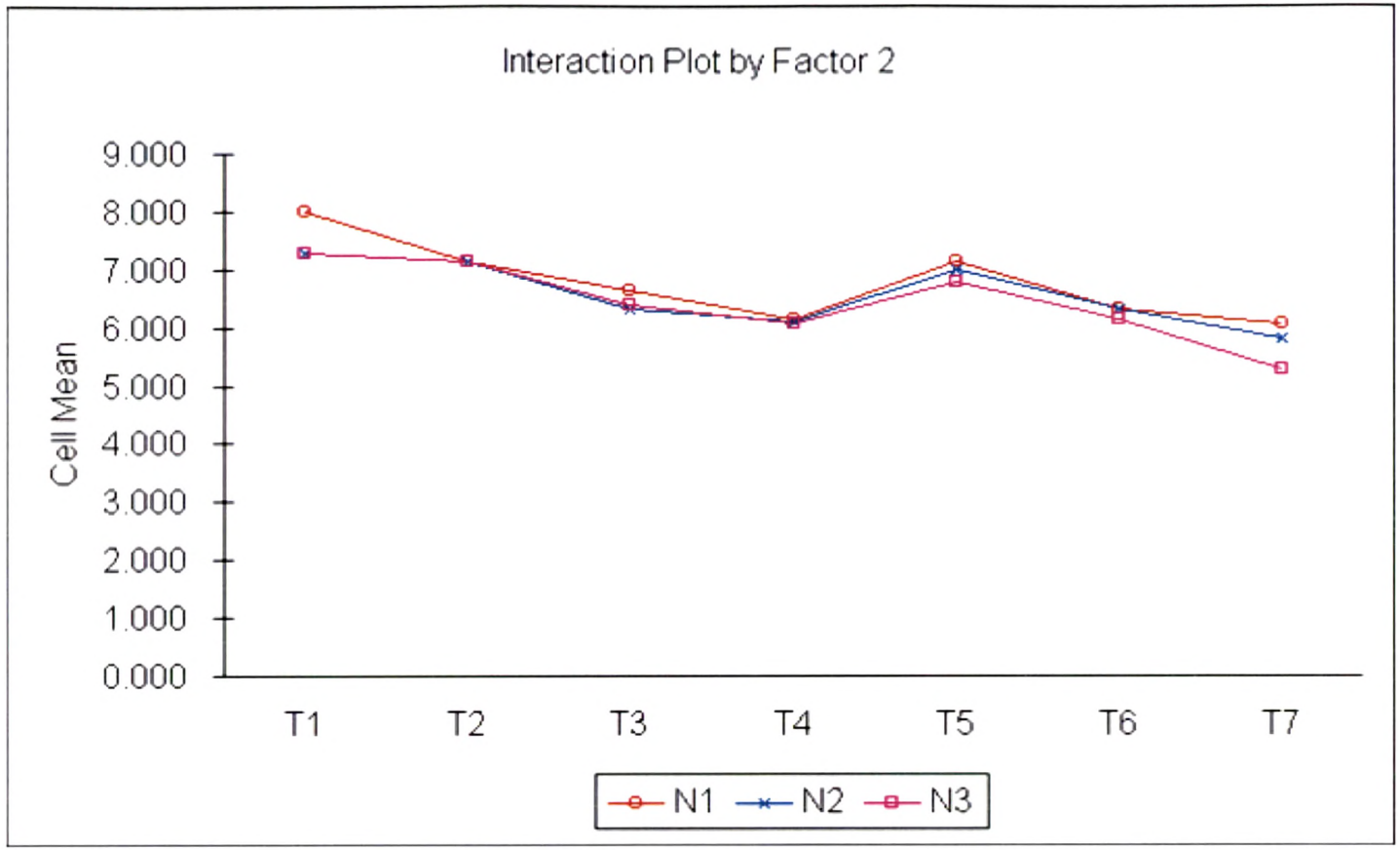


Fig 5.100 Interaction Plot by Factor 2 [Mn Level (ppm) in Soil under Greengram cultivation]

5.7.2.5 Iron (Fe) Level

Table 5.141, Table 5.142 and Table 5.143 represent analysis of iron (Fe) level in soil under greengram cultivation during three successive replications. Fig. 5.101 shows Fe level under various treatments for each replication.

Table 5.141 Analysis of Fe Level (ppm) in Soil under Greengram Cultivation (Replication-I)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	7.52	12.14	14.62	17.24	7.26	*8.04*	4.58
N2	6.98	15.6	18.54	6.74	6.18	19.66	14.4
N3	9.14	12.94	12.34	22.08	10.5	11.82	10.24

Table 5.142 Analysis of Fe Level (ppm) in Soil under Greengram Cultivation (Replication-II)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	18.84	12.58	10.25	7.45	14.1	12.32	11.85
N2	17.7	10.98	8.21	12.45	14.68	6.59	6.54
N3	15.23	11.46	10.75	5.06	12.36	9.95	8.06

Table 5.143 Analysis of Fe Level (ppm) in Soil under Greengram Cultivation (Replication-III)

Treatment	T1	T2	T3	T4	T5	T6	T7
N1	18.96	13.84	10.62	7.81	14.52	12.57	11.98
N2	18.24	11.2	8.26	13.08	14.95	6.62	7.22
N3	15.83	12.21	10.88	5.11	12.66	10.91	8.12

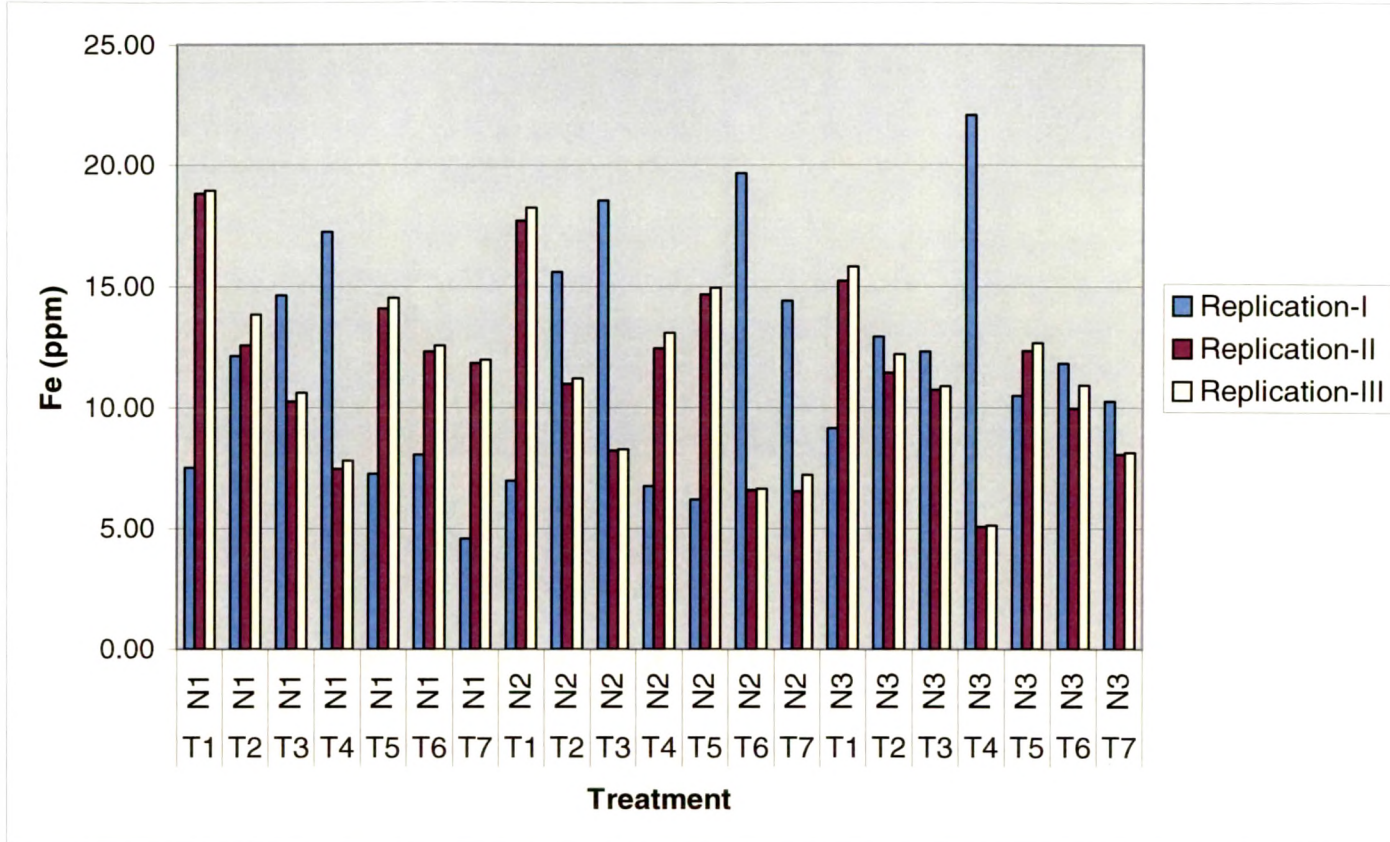
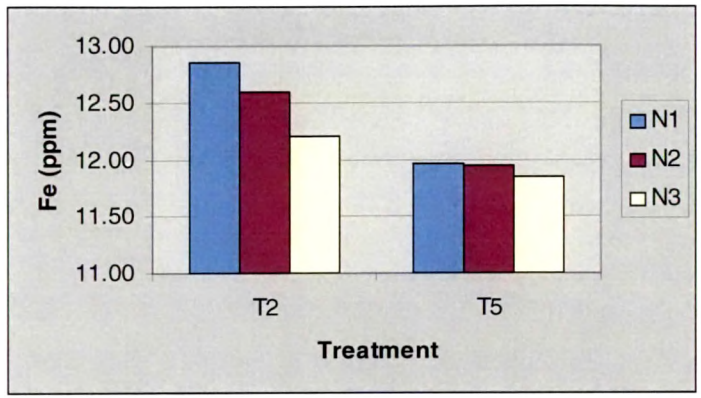


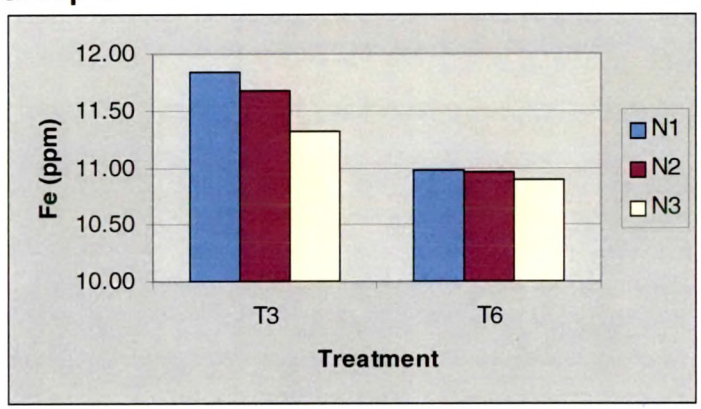
Fig. 5.101 Fe Level in Soil under Greengram Cultivation

Fig. 5.102 shows comparison of Fe Level in Soil under Greengram Cultivation among three Groups namely Group-A consisting of treatment T2 & T5, Group-B consisting of treatment T3 & T6 and Group-C consisting of treatment T1, T4 & T7.

Group-A



Group-B



Group-C

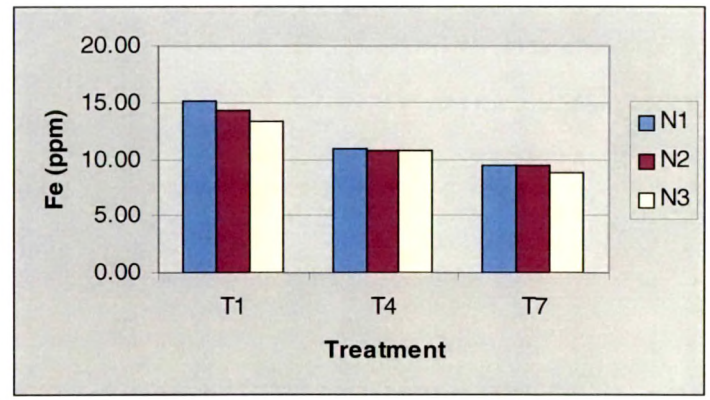


Fig. 5.102 Comparison of Fe Level in Soil under Greengram Cultivation among Group-A, B and C

Table 5.144 and Table 5.145 represent two factor ANOVA and ANOVA Table for Fe level in soil under greengram Cultivation respectively. Fig.5.103 and Fig.5.104 represent interaction plot by factor 1 (fertilizer treatments) and factor 2 (irrigation treatments) respectively.

Table 5.144 Two factor ANOVA (Fe Level in Soil under Greengram Cultivation)

Means (ppm):

		Factor 2							
		T1	T2	T3	T4	T5	T6	T7	
Factor 1	N1	15.11	12.85	11.83	10.83	11.96	10.98	9.47	11.86
	N2	14.31	12.59	11.67	10.76	11.94	10.96	9.39	11.66
	N3	13.40	12.20	11.32	10.75	11.84	10.89	8.81	11.32
		14.27	12.55	11.61	10.78	11.91	10.94	9.22	11.61

Table 5.145 ANOVA Table (Fe Level in Soil under Greengram Cultivation)

Source	*SS*	*df*	*MS*	*F*	*p-value*
Factor 1	3.18	2.00	1.59	0.08	0.93
Factor 2	134.08	6.00	22.35	1.09	0.39
Interaction	3.07	12.00	0.26	0.01	1.00
Error	864.27	42.00	20.58		
Total	1004.60	62.00			

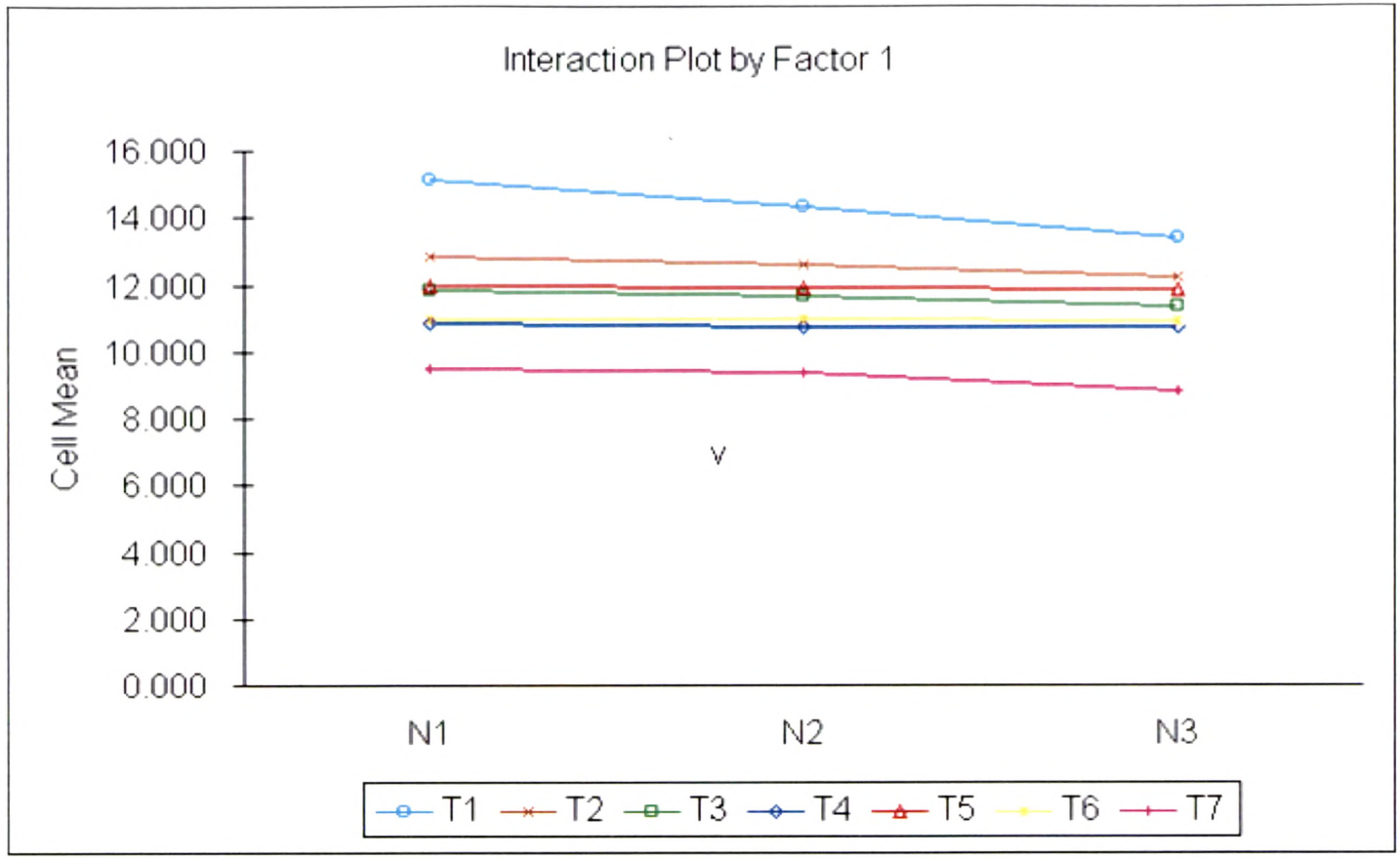


Fig 5.103 Interaction Plot by Factor 1 [Fe Level (ppm) in Soil under Greengram Cultivation]

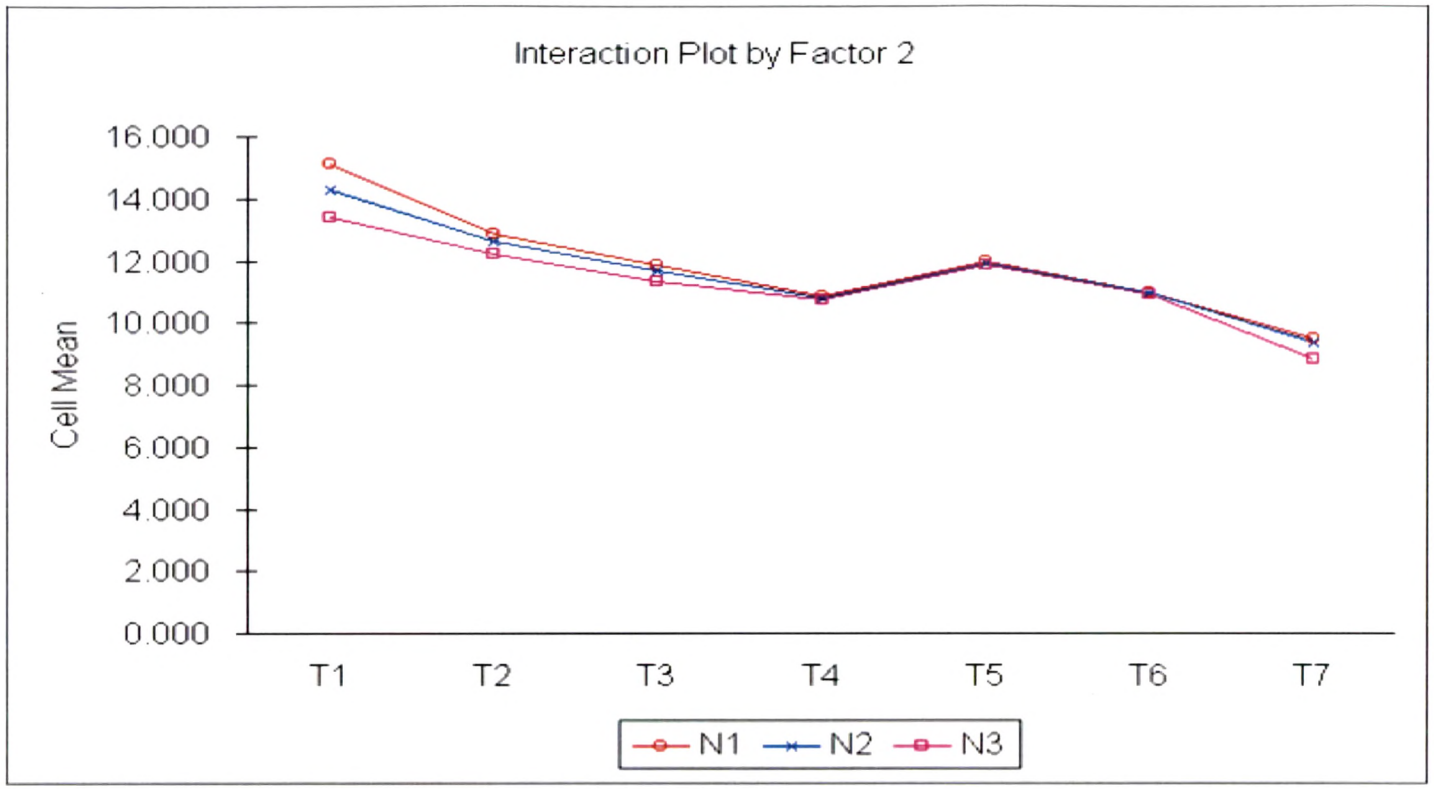


Fig 5.104 Interaction Plot by Factor 2 [Fe Level (ppm) in Soil under Greengram Cultivation]

5.8 Impacts on Ground Water Quality

5.8.1 Ground Water Quality after experiment on Wheat

The ground water quality is examined after each three experiments on Wheat and the accumulation of contaminating heavy metals in the same in Table 5.146. Table 5.147 shows accumulation of nitrate and other contaminating substances in ground Water.

Tab 5.146 Accumulation of Contaminating Heavy Metals in Ground Water

Parameters governing contamination	Year		
	2003	2004	2005
Fe	BDL	BDL	BDL
Zn	BDL	BDL	BDL
Mn	BDL	BDL	BDL
Pb	BDL	BDL	BDL
Cu	BDL	BDL	BDL

Tab. 5.147 Accumulation of Nitrate and other Contaminating Substances in Ground Water

Parameters governing contamination	Year		
	2003	2004	2005
NO_3	7.85	7.92	8.03
F	1.10	1.02	1.06
Phenolic compound	BDL	BDL	BDL
Oil & Grease	BDL	BDL	BDL
Detergents	BDL	BDL	BDL

Note: BDL - Below Detectable Limit

5.8.2 Ground Water Quality after experiment on Green gram

The ground water quality is examined after each three experiments on green gram and the accumulation of contaminating heavy metals in the same in Table 5.148. Table 5.149 shows accumulation of nitrate and other contaminating substances in ground Water.

Tab 5.148 Accumulation of Contaminating Heavy Metals in Ground Water

Parameters governing contamination	Year		
	2003	2004	2005
Fe	BDL	BDL	BDL
Zn	BDL	BDL	BDL
Mn	BDL	BDL	BDL
Pb	BDL	BDL	BDL
Cu	BDL	BDL	BDL

Tab. 5.149 Accumulation of Nitrate and other Contaminating Substances in Ground Water

Parameters governing contamination	Year		
	2003	2004	2005
NO_3	7.95	7.98	8.21
F	1.05	1.12	1.01
Phenolic compound	BDL	BDL	BDL
Oil & Grease	BDL	BDL	BDL
Detergents	BDL	BDL	BDL

Note: BDL - Below Detectable Limit

5.9 Impacts on health of workers associated with Sewage water irrigation for Wheat & Green gram Cultivation

The heath conditions of two workers associated with sewage water irrigation for wheat and green gram cultivation were examined by conducting various tests as shown in Table 5.150 and Table 5.151.

The significance of the parameters for evaluating the health conditions is as follows.

(A) Lead Estimation

Lead is mainly absorbed directly into blood where it is circulated and distributed in soft tissues-kidneys, brain and muscle and bone. It's ingestion destroys brain tissue and nerve cells by increasing cellular membrane permeability. This allows for the leakage of nutrients out of the cells. It inhibits enzyme production and causes excessive free radical production. This test is performed to screen people at risk for lead poisoning.

(B) Biochemical Investigations

Biochemical Investigations mainly include determination of Bilirubin i.e. Total, Conjugated & unConjugated and S.G.P.T. i.e. Serum Glutamic Pyruvic Transaminase (Refer to 5.1).

(C) Differential Leucocyte Count

This is required to determine qualitative and quantitative variations in white cell numbers & morphology and morphology of red cells. It helps in evaluation of anemia, leukemia, infections, inflammatory states and inherited disorders of red cells. Diseases causing decreased production of white blood cells include blood diseases and infections (virus diseases, tuberculosis, typhoid).

(D) Platelet Count

It is a test to measure the number of platelets in blood. Platelets play a key role in normal blood clotting. During the clotting process, platelets release phospholipids in order to clump together to plug small holes in damaged blood vessels for stopping bleeding. If the numbers of platelets are not in normal range, then it may cause leukemia, thrombocytosis, anemia, etc.

Table 5.150 Examination of Health Conditions of Worker-I

(A) Lead Estimation by Atomic Absorption

Test	Result	Normal Range
Lead level	0.00 mg/dl	0-20 mg/dl

(B) Biochemical Investigations on Cobas Integra 400 (Roche)

Test	Result	Normal Range
Bilirubin Total	0.50 mg/dl	0.00-1.30 mg/dl
Bilirubin Conjugated	0.10 mg/dl	0.00-0.30 mg/dl
Bilirubin Unconjugated	0.40 mg/dl	0.00-1.00 mg/dl
S.G.P.T.	17.10 U/L	0.00-40.00 U/L

(C) Differential Leucocyte Count

Test	Result	Normal Range (%)
Polymorphs	45 %	40-70
Lymphocyte	42 %	20-45
Eosinophil	5 %	1-6
Monocytes	8 %	2-10
Basophil	0 %	0-1.5

(D) Platelet Count

Test	Result	Normal Range (per cmm)
Platelet	355000 / cmm	150000-500000

Table 5.151 Examination of Health Conditions of Worker-II

(A) Lead Estimation by Atomic Absorption

Test	Result	Normal Range
Lead level	0.00 mg/dl	0-20 mg/dl

(B) Biochemical Investigations on Cobas Integra 400 (Roche)

Test	Result	Normal Range
Bilirubin Total	0.40 mg/dl	0.00-1.30 mg/dl
Bilirubin Conjugated	0.20 mg/dl	0.00-0.30 mg/dl
Bilirubin Unconjugated	0.20 mg/dl	0.00-1.00 mg/dl
S.G.P.T.	31.90 U/L	0.00-40.00 U/L

(C) Differential Leucocyte Count

Test	Result	Normal Range (%)
Polymorphs	40 %	40-70
Lymphocyte	41 %	20-45
Eosinophil	8 %	1-6
Monocytes	10 %	2-10
Basophil	1 %	0-1.5

(D) Platelet Count

Test	Result	Normal Range (per cmm)
Platelet	273000 / cmm	150000-500000

5.10 Socio Economic Impacts

The socio economic conditions in terms of distribution of beneficiaries* and non beneficiaries** according to their education level, land holdings, Paddy production, Cropping intensity, Herd Milk Production and attack of sickness are analysed and shown in Table 5.152 to 5.157 respectively.

Table 5.152 Distribution of Beneficiaries and Non beneficiaries according to their Education Level

Sr. No.	Education	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	Illiterate	07	23.33	07	23.33
2	1 to 7 std.	13	43.33	11	36.67
3	8 to 12 std.	06	20.00	07	23.33
4	Above 12 std.	04	13.33	05	16.67
	Total	**30.00**	**100.00**	**30.00**	**100.00**

* Beneficiaries were the farmers who were getting treated wastewater for irrigating their fields under cultivation in area adjoining to sewage treatment plant, Jaspur, Gandhinagar.

** Non beneficiaries were the farmers who were not getting treated wastewater for irrigating their fields under cultivation in area adjoining to sewage treatment plant, Jaspur, Gandhinagar.

Table 5.153 Distribution of Beneficiaries and Non beneficiaries according to their Land Holdings

Sr. No.	Land holdings	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	<0.4 ha	07	23.33	05	16.67
2	0.4 to 1 ha	14	46.67	13	43.33
3	1 to 2 ha	06	20.00	08	26.67
4	> 2 ha	03	10.00	04	13.33
	Total	**30.00**	**100.00**	**30.00**	**100.00**

Table 5.154 Distribution of Beneficiaries and Non beneficiaries according to their Paddy Production

Sr. No.	Paddy Production	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	< 2000 kg/ha	00	00.00	12	40.00
2	2001 to 3000 kg/ha	04	13.33	17	56.67
3	3001 to 4000 kg/ha	10	33.33	01	03.33
4	>4000 kg/ha	16	53.33	00	00.00
	Total	**30.00**	**100.00**	**30.00**	**100.00**

Table 5.155 Distribution of Beneficiaries and Non beneficiaries according to their Cropping Intensity

Sr. No.	Cropping intensity	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	<100%	00	00.00	18	60.00
2	101 to 150%	00	00.00	07	23.33
3	151 to 200%	02	06.67	04	13.33
4	201 to 250%	03	10.00	01	03.33
5	>250%	25	83.33	00	00.00
	Total	**30.00**	**100.00**	**30.00**	**100.00**

Table 5.156 Distribution of Beneficiaries and Non beneficiaries according to their Herd Milk Production

Sr. No.	Milk production per buffalo (averaged over nos. of buffaloes owned)	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	<4 lit/day	02	06.66	11	36.37
2	4 to 7 lit/day	04	13.33	13	43.33
3	7 to 10 lit/day	09	30.00	04	13.33
4	>10 lit/day	15	50.00	02	06.67
	Total	**30.00**	**100.00**	**30.00**	**100.00**

Table 5.157 Distribution of Beneficiaries and Non beneficiaries according to Attacks of Sickness to them

Sr. No.	Attacks of sickness/month	Category of respondents			
		Beneficiaries		Non Beneficiaries	
		Frequency	%	Frequency	%
1	< 2	12	40.00	13	43.33
2	2 to 4	11	36.67	08	26.67
3	5 to 6	04	13.33	05	16.67
4	>6	03	10.00	04	13.33
	Total	**30.00**	**100.00**	**30.00**	**100.00**

5.11 Scores under Priority wise Conditional Impacts

5.11.1 Allocation of weightage and maximum scores to the parameters governing environmental impacts

Different weightage and maximum scores were allotted to the relevant parameters according to priority wise conditional environmental impacts as shown in Table 5.158.

Table 5.158 Allocation of Weightage and Maximum Scores

Parameters governing impacts	Weightage	Break up of weightage		Maximum Score
Heavy Metals in Grains	60%	Pb	50 %	30
		Cu	20 %	12
		Zn	15 %	09
		Mn	10 %	06
		Fe	05 %	03
Heavy Metals in Soil	20 %	Pb	50 %	10
		Cu	20 %	04
		Zn	15 %	03
		Mn	10 %	02
		Fe	05 %	01
Electrical Conductivity of Soil	10 %	-	-	10
Protein Content in Grains	05 %	-	-	05
Crop Yield	05 %	-	-	05
Total	**100 %**	**-**	**-**	**100**

With the available data on heavy metals in grains & soil, electrical conductivity of Soil, protein content in grains and crop yield, weightages are assigned to different parameters governing impact on a priority basis in order to arrive at

proper conclusion regarding appropriate treatment, elements having maximum harmful impact are given 60% weightage to be on the safer side. While parameter having minimum harmful impact is assigned minimum weightage. Focus is laid more on quality rather than on quantity of agricultural produce.

Considering weightage and maximum scores to relevant parameters as mentioned in Table 5.158, the scores were worked out for various treatments of irrigation and fertilizer application as shown in Table 5.159 to Table 5.162 for wheat and Table 5.163 to Table 5.166 for green gram.

5.11.2 Conditions for working out scores under each treatment

The following conditions were taken into account for working out scores under each treatment for both wheat and green gram crop cultivation.

5.11.2.1 Heavy metals in grains

Maximum score and minimum score were given to treatment which was having lowest and highest concentration of heavy metal in grains respectively. In other words, full score is awarded to treatment which consists of least toxicity, while zero score is awarded to treatment which consists of highest toxicity

5.11.2.2 Heavy metals in soil

Maximum score and minimum score were given to treatment which was having lowest and highest concentration of heavy metal in soil respectively.

5.11.2.3 Electrical conductivity of soil

Maximum score and minimum score were given to treatment which was having lowest and highest level of EC in soil respectively.

5.11.2.4 Protein content in grains

Maximum score and minimum score were given to treatment which was having highest and lowest level of EC in soil respectively.

5.11.2.5 Crop yield

Maximum score and minimum score were given to treatment which was having highest and lowest yield level of crop respectively.

Table 5.159 Scores of Treatments (Governing Parameter: Heavy Metals in Wheat Grains)

Treatment		Pb		Cu		Zn		Mn		Fe		Total Score (60)
		Mean Value (ppm)	Score (30)	Mean Value (ppm)	Score (12)	Mean Value (ppm)	Score (09)	Mean Value (ppm)	Score (06)	Mean Value (ppm)	Score (03)	
T1	N1	0.74	0.00	0.90	0.00	9.03	0.00	24.97	0.00	3.67	0.00	**0.00**
T2	N1	0.70	3.53	0.76	5.25	8.74	1.32	24.67	1.20	3.57	0.27	**11.57**
T3	N1	0.68	5.29	0.71	7.13	8.10	4.25	24.32	2.60	3.04	1.67	**20.94**
T4	N1	0.47	23.82	0.68	8.25	7.70	6.08	24.03	3.76	2.84	2.20	**44.11**
T5	N1	0.69	4.41	0.74	6.00	8.27	3.47	24.48	1.96	3.47	0.53	**16.37**
T6	N1	0.64	8.82	0.70	7.50	7.95	4.93	24.17	3.20	2.90	2.04	**26.50**
T7	N1	0.43	27.35	0.59	11.63	7.29	7.95	23.86	4.44	2.70	2.58	**53.94**
T1	N2	0.72	1.76	0.85	1 88	8.97	0 27	24.94	0.12	3.63	0.11	**4.14**
T2	N2	0.69	4.41	0.75	5.63	8.72	1.42	24.57	1.60	3.53	0.37	**13.42**
T3	N2	0.68	5.29	0.71	7.13	8.03	4.57	24.23	2.96	2.98	1.83	**21.78**
T4	N2	0.45	25.59	0.61	10.88	7.67	6.21	24.01	3.84	2.76	2.42	**48.93**
T5	N2	0.68	5.29	0.73	6.38	8.23	3.65	24.41	2.24	3.37	0.80	**18.36**
T6	N2	0.63	9.71	0.70	7.50	7.91	5 12	24 11	3.44	2.90	2.04	**27.81**
T7	N2	0.42	28.24	0.59	11.63	7.23	8.22	23.50	5.88	2.59	2.87	**56.83**
T1	N3	0 71	2.65	0.76	5.25	8.90	0.59	24.74	0.92	3.60	0.19	**9.60**
T2	N3	0.69	4.41	0.75	5.63	8.67	1.64	24.54	1.72	3.50	0.45	**13.85**
T3	N3	0.67	6.18	0.70	7.50	8.00	4.71	24.20	3.08	2.97	1.86	**23.32**
T4	N3	0.44	26.47	0.61	10.88	7.30	7.90	23.93	4.16	2.73	2.50	**51.90**
T5	N3	0.68	5.29	0.72	6.75	8.23	3.65	24.37	2.40	3.10	1.51	**19.61**
T6	N3	0.63	9.71	0.69	7.88	7.87	5.30	24 07	3.60	2.87	2.12	**28.60**
T7	N3	0.40	30.00	0.58	12.00	7.06	9.00	23.47	6.00	2.54	3.00	**60.00**

Table 5.160 Scores of Treatments (Governing parameter: Heavy Metals in Soil under Wheat Cultivation)

Treatment		Pb		Cu		Zn		Mn		Fe		Total Score (20)
		Mean Value (ppm)	Score (10)	Mean Value (ppm)	Score (04)	Mean Value (ppm)	Score (03)	Mean Value (ppm)	Score (02)	Mean Value (ppm)	Score (01)	
T1	N1	8.21	0.00	1.3	0.00	2.63	0.00	14.9	0.00	14.25	0.00	**0.00**
T2	N1	8.01	0.70	1.23	0.65	2.57	0.35	14.34	0.27	13.65	0.14	**2.11**
T3	N1	7.78	1.51	1.11	1.77	2.42	1.21	12.69	1.05	12.76	0.35	**5.89**
T4	N1	6.84	4.81	0.96	3.16	2.3	1.90	11.52	1.61	11.37	0.68	**12.16**
T5	N1	7.97	0.84	1.13	1.58	2.43	1.15	13.43	0.70	12.84	0.33	**4.61**
T6	N1	7.63	2.04	1.03	2.51	2.36	1.56	11.98	1.39	12.52	0.41	**7.90**
T7	N1	5.69	8.84	0.89	3.81	2.16	2.71	10.89	1.90	11.16	0.73	**18.00**
T1	N2	8.1	0.39	1.29	0.09	2.63	0.00	14.81	0.04	14.22	0.01	**0.53**
T2	N2	8	0.74	1.23	0.65	2.54	0.52	14	0.43	13.38	0.20	**2.54**
T3	N2	7.71	1.75	1.1	1.86	2.41	1.27	12.24	1.26	12.71	0.36	**6.51**
T4	N2	6.84	4.81	0.92	3.53	2.22	2.37	11.2	1.76	11.35	0.68	**13.15**
T5	N2	7.96	0.88	1.12	1.67	2.43	1.15	13.41	0.71	12.8	0.34	**4.75**
T6	N2	7.9	1.09	1	2.79	2.36	1.56	11.8	1.47	12.15	0.49	**7.40**
T7	N2	5.62	9.09	0.89	3.81	2.12	2.94	10.88	1.91	10.15	0.96	**18.72**
T1	N3	8.08	0.46	1.24	0.56	2.58	0.29	14.76	0.07	14.09	0.04	**1.41**
T2	N3	7.98	0.81	1.22	0.74	2.44	1.10	13.52	0.66	13.37	0.21	**3.51**
T3	N3	7.7	1.79	1.04	2.42	2.36	1.56	12.05	1.35	12.59	0.39	**7.51**
T4	N3	6.82	4.88	0.89	3.81	2.17	2.65	10.92	1.89	11.19	0.72	**13.96**
T5	N3	7.86	1.23	1.12	1.67	2.42	1.21	12.71	1.04	12.77	0.35	**5.50**
T6	N3	7.13	3.79	1	2.79	2.35	1.62	11.53	1.60	12.08	0.51	**10.31**
T7	N3	5.36	10.00	0.87	4.00	2.11	3.00	10.69	2.00	10	1.00	**20.00**

Table 5.161 Scores of Treatments (Governing parameter: EC, Protein content and Yield - Wheat)

Treatment		Mean EC Level		Mean Protein content		Mean Yield	
		(mmhos/cm)	Score (10)	(%)	Score (05)	(kg/ha)	Score (05)
T1	N1	0.59	2 92	14.43	5.00	5206.99	5.00
T2	N1	0.63	1.25	14.33	4.48	4547.81	1.53
T3	N1	0.66	0.00	14.07	3.13	4421.13	0.86
T4	N1	0.6	2.50	13.8	1.72	4312.89	0.29
T5	N1	0.5	6.67	14.2	3.80	4916.97	3.47
T6	N1	0.47	7.92	13.83	1 88	4490.04	1.22
T7	N1	0.42	10.00	13 5	0.16	4399.59	0.75
T1	N2	0.55	4.58	14.4	4.84	5140.02	4.65
T2	N2	0.62	1.67	14.3	4.32	4581.84	1.71
T3	N2	0 65	0.42	14	2.76	4422.67	0.87
T4	N2	0.59	2.92	13.77	1 56	4302.78	0.24
T5	N2	0.48	7.50	14.13	3.44	4755.5	2.62
T6	N2	0.44	9.17	13.83	1.88	4468.89	1.11
T7	N2	0.42	10.00	13.53	0.31	4353.75	0.50
T1	N3	0.51	6.25	14.37	4 69	5010.88	3.97
T2	N3	0.61	2 08	14.27	4.17	4504.06	1.30
T3	N3	0.64	0.83	14	2.76	4403.8	0.77
T4	N3	0 59	2.92	13.57	0.52	4258.1	0 00
T5	N3	0.47	7.92	14.07	3.13	4668.47	2.16
T6	N3	0.43	9.58	13.83	1.88	4450.38	1.01
T7	N3	0.42	10.00	13.47	0.00	4323.03	0.34

Table 5.162 Treatment wise Scores under Priority wise Conditional Environmental Impacts (Wheat)

Treatment		Heavy metals in grains (60)	Heavy metals in soil (20)	EC level in soil (10)	Protein content in grain (05)	Yield Level (05)	Total Score (100)
T1	N1	**0.00**	**0.00**	2.92	5 00	5.00	12.92
T2	N1	**11.57**	**2.11**	1 25	4.48	1.53	20.94
T3	N1	**20.94**	**5.89**	0.00	3.13	0.86	30.82
T4	N1	**44.11**	**12.16**	2.50	1.72	0.29	60.78
T5	N1	**16.37**	**4.61**	6.67	3.80	3.47	34.92
T6	N1	**26.50**	**7.90**	7.92	1.88	1.22	45.42
T7	N1	**53.94**	**18.00**	10.00	0.16	0.75	82.85
T1	N2	**4.14**	**0.53**	4.58	4.84	4.65	18.74
T2	N2	**13.42**	**2.54**	1.67	4.32	1 71	23.66
T3	N2	**21.78**	**6.51**	0.42	2.76	0.87	32.34
T4	N2	**48.93**	**13.15**	2.92	1.56	0.24	66.8
T5	N2	**18.36**	**4.75**	7.50	3.44	2.62	36.67
T6	N2	**27.81**	**7.40**	9.17	1.88	1.11	47.37
T7	N2	**56.83**	**18.72**	10.00	0.31	0 50	86.36
T1	N3	**9.60**	**1.41**	6.25	4.69	3.97	25.92
T2	N3	**13.85**	**3.51**	2.08	4.17	1.30	24.91
T3	N3	**23.32**	**7.51**	0.83	2.76	0.77	35.19
T4	N3	**51.90**	**13.96**	2.92	0.52	0.00	69.3
T5	N3	**19.61**	**5.50**	7.92	3.13	2.16	38.32
T6	N3	**28.60**	**10.31**	9.58	1.88	1 01	51.38
T7	N3	**60.00**	**20.00**	10.00	0.00	0.34	90.34

Table 5.163 Scores of Treatments (Governing Parameter: Heavy Metals in Greengram Grains)

Treatment		Pb		Cu		Zn		Mn		Fe		Total Score (60)
		Mean Value (ppm)	Score (30)	Mean Value (ppm)	Score (12)	Mean Value (ppm)	Score (09)	Mean Value (ppm)	Score (06)	Mean Value (ppm)	Score (03)	
T1	N1	0.9167	0.00	0.6600	0.00	4.6700	0.00	4.1700	0.00	3.7267	0.00	**0.00**
T2	N1	0.7400	13.47	0.6300	0.90	4.3967	2.38	3.9433	1.34	3.5133	0.82	**18.91**
T3	N1	0.6600	19.58	0.5733	2.60	4.0967	4.99	3.6933	2.82	3.3567	1.42	**31.41**
T4	N1	0.5800	25.68	0.5300	3.90	4.0233	5.63	3.3867	4.64	3.1633	2.16	**42.00**
T5	N1	0.6933	17.03	0.6133	1.40	4.2967	3.25	3.8400	1.95	3.4767	0.96	**24.60**
T6	N1	0.6400	21.10	0.5533	3.20	4.0467	5.43	3.4933	4.01	3.2433	1.85	**35.59**
T7	N1	0.5467	28.22	0.3267	10.00	3.8767	6.91	3.2933	5.19	3.0833	2.46	**52.78**
T1	N2	0.7700	11.19	0.6467	0.40	4.4133	2.24	4.1300	0.24	3.6233	0.40	**14.46**
T2	N2	0.7333	13.98	0.6200	1.20	4.3333	2.93	3.9767	1.14	3.5067	0.84	**20.10**
T3	N2	0 6567	19.83	0.5700	2.70	4.0933	5.02	3.6300	3.20	3.3333	1.51	**32.26**
T4	N2	0.5733	26.18	0.5167	4.30	3.9567	6.21	3.3467	4.88	3.1400	2.25	**43.82**
T5	N2	0.6767	18.30	0.6000	1.80	4.2600	3.57	3.7433	2.53	3.4667	1.00	**27.20**
T6	N2	0.6233	22.37	0.5500	3.30	4.0400	5.49	3.4600	4.20	3.2067	1.99	**37.35**
T7	N2	0.5333	29.23	0.3033	10.70	3.6833	8.59	3.2800	5.27	3.0767	2.49	**56.29**
T1	N3	0.7533	12.46	0.6467	0.40	4.4067	2.29	4.1000	0.41	3.6000	0.49	**16.05**
T2	N3	0.6967	16.78	0.6167	1.30	4.3167	3.08	3.8400	1.95	3.4900	0.91	**24.02**
T3	N3	0.6500	20.34	0 5667	2.80	4.0700	5.23	3.6200	3.26	3.2800	1.71	**33.33**
T4	N3	0.5567	27.46	0.4900	5.10	3.8967	6.74	3.3400	4.91	3.1300	2.29	**46.49**
T5	N3	0.6700	18.81	0.5800	2.40	4.1600	4.44	3.7433	2.53	3.4067	1.23	**29.41**
T6	N3	0.6200	22.63	0.5433	3.50	4.0367	5.52	3.4033	4.54	3.1700	2.13	**38.31**
T7	N3	0.5233	30.00	0.2600	12.00	3.6367	9.00	3.1567	6.00	2.9433	3.00	**60.00**

Table 5.164 Scores of Treatments (Governing parameter: Heavy Metals in Soil under Greengram Cultivation)

Treatment		Pb		Cu		Zn		Mn		Fe		Total Score (20)
		Mean Value (ppm)	Score (10)	Mean Value (ppm)	Score (04)	Mean Value (ppm)	Score (03)	Mean Value (ppm)	Score (02)	Mean Value (ppm)	Score (01)	
T1	N1	9.89	0.00	1.68	0.00	1.46	0.00	7.98	0.00	15.11	0.00	**0.00**
T2	N1	9.48	1.41	1.59	0.61	1.42	0.26	7.13	0.63	12.85	0.36	**3.26**
T3	N1	8.16	5.95	1.44	1.58	1.33	0.81	6.64	0.99	11.83	0.52	**9.84**
T4	N1	7.69	7.55	1.27	2.70	1.05	2.47	6.13	1.37	10.83	0.68	**14.77**
T5	N1	8.34	5.34	1.51	1.15	1.37	0.55	7.12	0.63	11.96	0.50	**8.17**
T6	N1	8.01	6.46	1.35	2.16	1.15	1.86	6.32	1.23	10.98	0.66	**12.36**
T7	N1	7.08	9.64	1.11	3.70	1.01	2.70	6.05	1.43	9.47	0.89	**18.37**
T1	N2	9.51	1.29	1.65	0.19	1.43	0.18	7.28	0.52	14.31	0.13	**2.31**
T2	N2	8.81	3.72	1.56	0.78	1.41	0.30	7.15	0.62	12.59	0.40	**5.81**
T3	N2	8.14	6.00	1.42	1.73	1.21	1.50	6.29	1.25	11.67	0.55	**11.02**
T4	N2	7.17	9.34	1.25	2.81	1.04	2.51	6.09	1.40	10.76	0.69	**16.74**
T5	N2	8.25	5.62	1.45	1.49	1.36	0.63	7.00	0.72	11.94	0.50	**8.98**
T6	N2	7.95	6.66	1.31	2.40	1.13	1.95	6.29	1.25	10.96	0.66	**12.91**
T7	N2	7.07	9.70	1.07	3.98	0.97	2.92	5.80	1.61	9.39	0.91	**19.12**
T1	N3	9.50	1.34	1.60	0.56	1.42	0.26	7.28	0.52	13.40	0.27	**2.95**
T2	N3	8.47	4.89	1.53	1.02	1.37	0.53	7.13	0.63	12.20	0.46	**7.53**
T3	N3	8.14	6.01	1.41	1.79	1.16	1.80	6.37	1.19	11.32	0.60	**11.39**
T4	N3	7.09	9.61	1.14	3.55	1.02	2.61	6.06	1.42	10.75	0.69	**17.87**
T5	N3	8.23	5.70	1.44	1.56	1.35	0.69	6.77	0.89	11.84	0.52	**9.36**
T6	N3	7.94	6.71	1.28	2.62	1.08	2.29	6.13	1.37	10.89	0.67	**13.65**
T7	N3	6.98	10.00	1.07	4.00	0.96	3.00	5.27	2.00	8.81	1.00	**20.00**

Table 5.165 Scores of Treatments (Governing parameter: EC, Protein content and Yield - Greengram)

Treatment		Mean EC Level		Mean Protein content		Mean Yield	
		(mmhos/cm)	Score (10)	(%)	Score (05)	(kg/ha)	Score (05)
T1	N1	0.88	2.21	23.83	5.00	735.81	**0.64**
T2	N1	0.94	0.95	23.67	4.59	1115.16	**4.41**
T3	N1	0.98	0.00	23.13	3.28	757.62	**0.86**
T4	N1	0.91	1.58	22.90	2.70	704 36	**0.33**
T5	N1	0.82	3.78	23 23	3 52	1033.62	**3.60**
T6	N1	0.71	6.30	23.00	2.95	919 89	**2.47**
T7	N1	0.66	7.56	22.03	0.57	734.26	**0.63**
T1	N2	0.83	3.46	23.73	4.75	736.65	**0.65**
T2	N2	0.92	1.42	23.63	4 51	1174.13	**5.00**
T3	N2	0.96	0.32	23.10	3.20	755.03	**0.83**
T4	N2	0.89	1 97	22 60	1.97	684.38	**0.13**
T5	N2	0.77	4.88	23.17	3.36	1099 65	**4.26**
T6	N2	0.71	6.38	22 97	2.87	831.47	**1.59**
T7	N2	0.58	9.37	21.93	0.33	727.63	**0.56**
T1	N3	0.82	3.78	23.70	4.67	739.86	**0.68**
T2	N3	0 91	1 50	23.60	4.43	1106.00	**4.32**
T3	N3	0.94	0.87	23.13	3.28	744.92	**0.73**
T4	N3	0.89	2.13	22.07	0.66	671.07	**0.00**
T5	N3	0.76	5.20	23.17	3.36	1029.97	**3.57**
T6	N3	0.68	7.01	22.90	2.70	774.50	**1.03**
T7	N3	0 55	10.00	21.80	0.00	715.62	**0.44**

Table 5.166 Treatment wise Scores under Priority wise Conditional Environmental Impacts (Greengram)

Treatment		Heavy metals in grains (60)	Heavy metals in soil (20)	EC level in soil (10)	Protein content in grain (05)	Yield Level (05)	Total Score (100)
T1	N1	0.00	0.00	2.21	5.00	0.64	7.85
T2	N1	18.91	3.26	0.95	4.59	4.41	32.12
T3	N1	31.41	9.84	0.00	3.28	0.86	45.39
T4	N1	42.00	14.77	1.58	2.70	0.33	61.38
T5	N1	24.60	8.17	3.78	3.52	3.60	43.67
T6	N1	35.59	12.36	6.30	2.95	2.47	59.67
T7	N1	52.78	18.37	7.56	0.57	0.63	79.91
T1	N2	14.46	2 31	3.46	4.75	0.65	25 64
T2	N2	20.10	5.81	1.42	4.51	5.00	36.84
T3	N2	32.26	11.02	0.32	3.20	0.83	47.63
T4	N2	43.82	16.74	1.97	1.97	0.13	64 63
T5	N2	27.20	8.98	4.88	3.36	4 26	48.68
T6	N2	37.35	12.91	6.38	2.87	1.59	61.11
T7	N2	56.29	19.12	9.37	0.33	0 56	85.67
T1	N3	16.05	2 95	3.78	4.67	0.68	28.14
T2	N3	24.02	7.53	1.50	4.43	4.32	41.79
T3	N3	33.33	11.39	0.87	3.28	0.73	49.60
T4	N3	46.49	17.87	2.13	0.66	0.00	67.15
T5	N3	29.41	9.36	5.20	3.36	3.57	50.89
T6	N3	38.31	13.65	7.01	2.70	1.03	62.71
T7	N3	60.00	20.00	10.00	0.00	0 44	90.44