Studies on the effect of integrated nutrient management on soil health of tea (*Camellia* sp.)

Abstracts

A field trial was conducted at Parry Agro Industries Ltd., Valparai, Coimbatore district in two varieties of tea *viz.*, Assam jat and ATK clone. Totally eighteen treatments with different combinations of 100, 75, 62.5 and 50 per cent of the recommended doses of fertilizers along with DCC and biofertilizers. The DCC at the rate of three and six tonnes ha^{-1} and biofertilizers *viz.*, VAM, *Azospirillum* and Phosphobacteria each @ 50 kg ha^{-1} were given annually. The soil physical properties viz., bulk density, particle density, porosity and water holding capacity, chemical properties viz., pH, EC, CEC, organic matter, soil N, P, K, Zn, Cu, Fe and Mn and biological properties viz., VAM infection, population of Azospirillum, Phosphobacteria, bacteria, actinomycetes and fungi were greatly improved by the treatments consisting DCC 6 tonnes and biofertilizers along with full or reduced level of recommended dose of the estate practice.

Introduction

Physical and chemical properties of the tea soil in south India have become poor besides its microbial activities are substantially reduced due to the continuous application of inorganic sources of fertilizers for the last one century to supply the required nutrients to get high productivity. Swaminathan (1992) stressed the importance of integrated nutrient management in tea to increase the soil health and thus the productivity. Coirpith as an industrial waste from coir industries, which is available in plenty in the plains of South India, may be well exploited as a source of organic manure for tea. VA mycorrhiza (VAM), a symbiotic fungi, is known to improve growth and development of mycorrhizal plants due to increased nutrient uptake (Mukerji *et al*., 1991), *Azospirillum*, a diazotrophic bacterium, in addition to its nitrogen fixation ability, has been demonstrated to improve the growth and development of many perennial horticultural crops like coffee (Merina Premkumari and Balasubramanian, 1993). Similarly, phosphobacteria (phosphate solubilizing bacteria) has the capacity to solubilize insoluble inorganic phosphates; helping the plants to absorb and translocate more soluble phosphates (Azcon *et al*., 1976). With this background, the present study of nutrient management through the use of organic manures in the form of Digested Coirpith Compost (DCC) and biofertilizers like *Azospirillum brasilense*, Vesicular Arbuscular Mycorrhizae (VAM) and phosphobacteria has been taken up during one complete pruning cycle to assess their influence on the physical, chemical and biological properties of tea soil

Key words: INM, DCC, Biofertilizers Soil health, Assam jat and ATK clone

Materials and Method

The field trial was conducted during 1997-2002 at Parry Agro Industries Ltd., Valparai, Coimbatore district in two varieties of tea *viz*., Assam jat and ATK clone immediately after pruning. Totally eighteen treatments (Table 1) with different combinations of 100, 75, 62.5 and 50 per cent of the recommended doses of fertilizers along with DCC and biofertilizers constituted the study. The experiment has laid out RBD with 3 replications. Each treatment units consisted of 100 bushes. The DCC at the rate of three and six tonnes ha^{-1} and biofertilizers *viz.*, VAM, *Azospirillum* and Phosphobacteria each @ 40 kg ha^{-1} were given annually. The soil sampling was done one before the initiation of the experiment (October, 1997) and the other during December 2001 ie. after four years after start of the experiment and at two depths (0-22.5 and 22.5 – 45.0 cm). Bulk density, porosity, the particle density and the maximum water holding capacity were estimated as per the procedure described by Piper (1966). The pH, EC, and CEC were measured as per the procedure described by Jackson (1973). Organic matter (Walkley and Black (1934), the available nitrogen (Subbiah and Asija, 1956), the available phosphorus (Chandrasekaran and Verma, 1993), the available potassium (Stanford and English, 1949) and micronutrients (Lindsay and Norvell, 1978) werw also estimated. Microbial populations (bacteria, actinomycetes and fungi) of soils were determined by dilution plate method (Allen, 1957). The VAM infection in terms of mycelia colonization in tea roots was examined as per the methods standardized by Phillips and Hayman (1970). Population of *Azospirillum sp.* was estimated by most probable number (MPN) method (Cochran, 1950) with semi solid medium (Dobereiner, 1980). Phosphobacteria was estimated with Sperbers hydroxy apatite medium (Sperber, 1957).

Table 1. Treatment details.

Treatments	Details
T_1	Recommended dose of inorganic fertilizers (Estate practice or control)
T_2	T_1 + Digested Coirpith Compost (DCC) alone @ 3 t/ha
T_3	T_1 + Digested Coirpith Compost (DCC) alone @ 6 t/ha
T_4	T_2 + Biofertilizers
T_5	T_3 + Biofertilizers
T_6	75% of T_1
T_7	75% of T_1 + DCC @ 3 t/ha + Biofertilizers
T_8	75% of T_1 + DCC @ 6 t/ha + Biofertilizers
T_9	75% of T_1 + Biofertilizers alone
T_{10}	62.5% of T_1
T_{11}	62.5% of T_1 + Biofertilizers
T_{12}	62.5% of T_1 + DCC @ 6 t/ha + Biofertilizers
T_{13}	62.5% of T_1 + Biofertilizers alone
T_{14}	50% of T_1
T_{15}	50% of T_1 + DCC @ 3 t/ha + Biofertilizers
T_{16}	50% of T_1 + DCC @ 6 t/ha + Biofertilizers
T_{17}	50% of T_1 + Biofertilizers alone
T_{18}	T_1 + Biofertilizers alone
Biofertilizers - VAM, *Azospirillum* and Phosphobacteria each @ 40 kg/ha	

Results and Discussion

Physical properties

The bulk density and particle density are interrelated and the lesser their values, the better is the aeration, porosity, reduced compactness and increased aggregate size, etc. In the present study, treatments involving application of DCC either alone (T2 and T3) or in combination with biofertilizers reduced bulk density and particle density and increased porosity and water holding capacity when compared to estate practice and initial value recorded before start of the experiment (Table 2a and 2b). Savithri and Hameed Khan (1994) reported that bulk density of the soil would be generally altered by DCC application. The decreased bulk density and particle density might be due to higher application and advanced decomposition of organic matter and formation of better stable aggregates (Mathan and Thilagavathi, 1997) or due to the inherent low bulk density nature of the DCC. Increased pore space and water holding capacity in the plots added with DCC at 6t ha^{-1} might be attributed due to physical and chemical properties of DCC itself. The coirpith is fibrous in nature and this property improves the physical properties of even the heaviest clay soil and allows free drainage when incorporated into the soil. Because of its sponge like structure, it helps to contain water and improve aeration (Savithri and Hameed Khan, 1994). Besides, high carbonaceous material in DCC might have contributed for enhancing the water holding capacity / power of the soil (Selvi Ranganathan and Augustine Selvaseelan, 1997).

Chemical properties

In the present investigation over the period of 4 years, there was slight reduction in the pH in all the treatments except estate practice treated plots and biofertilizers alone applied plots (Table 3a and 3b). Among the various treatments, T_5 (100% estate practice + DCC 6 t ha-1 and biofertilizers) lowered the initial pH from 4.6 to 4.4 at the end of the experiment. In certain cases, application of biofertilizers either alone or in combination with DCC had registered relatively lower soil pH. The decrease in soil pH after organic matter addition i.e. DCC in the later years was probably caused by the production of CO_2 and organic acids during decomposition of organic materials (Nambiar *et al.*, 1978; Tate, 1987 and Soedarjo Habte, 1993).The treatment T_8 reduced the initial EC from 0.14 to 0.10, whereas, estate practice slightly increased the EC to 0.15. Generally, application of DCC alone or in combination with biofertilizers reduced the EC. On the other hand, the EC was not on the lower side in any of the treatments (0.05 to 0.20), which is a favourable range for plant growth. This indicated that soil reaction was not much affected by the application of DCC. The possible reason may be that the increased leaching of salts in the DCC plots could have been caused by increased pore space.

The organic matter content analyzed initially at the start of experiment and end of one pruning cycle at both layers in both the varieties revealed that in the DCC with or without biofertilizers treated plots, it progressively increased with years (Table 3a and 3b). It is also very interesting to know that the higher level of DCC applied plots generally had higher organic matter content than estate practiced plot i.e. more than 5.5 per cent at the end of the experiment. Similarly in the present study, CEC of the soil was increased by the treatment T_5 from 8.00 to 9.82, whereas, the estate practice did not increase the CEC of the soil.

Microbial population

The treatments containing higher level of DCC alongwith biofertilizers increased the initial VAM colonization from 13.32 to about 34.00 per cent at the end of the experiment. The population dynamics of microbes viz., *Azospirillum*, phosphobacteria, bacteria, actinomycetes and fungi were also significantly increased. Inoculation of biofertilizers alone also had higher microbial population than estate practice. Generally, application of DCC along with biofertilizers resulted in more infection of roots by VAM than application of DCC alone in the present investigation (Table 4a and 4b). Applied VAM might have utilized the carbon sources and other nutrients from DCC in a better way to colonize more (Manivel *et al.*, 1994 and Rajagopal and Ramarethinam, 1997). Application of biofertilizers alone also increased the colonization of VAM when compared with estate practice. This may be due to the fact that applied mycorrhizae were more efficient than native mycorrhizae in infecting the roots (Merina Premkumari, 1991; Merina Premkumari and Balasubramanian, 1993 and Kumaran, 1994).

On the whole, it could be concluded that application of DCC in combination with biofertilizers is beneficial in enhancing the soil health by way of improving the physical, chemical and biological properties of tea soil.

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Table 2a. Effect of digested coirpith compost and biofertilizers on physical properties in tea cv. ATK

Treatments	**Bulk density**		**Particle density**		**Pore space (%)**		**Water holding capacity**	
	0-22.5 cm	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**
I.V	**1.17**	**1.21**	**2.08**	**2.12**	**37.92**	**37.22**	**51.96**	**50.72**
T_1	1.20	1.21	2.07	2.10	41.03	41.38	53.16	50.89
T_2	1.15	1.17	2.05	2.06	43.90	43.20	57.15	55.21
T_3	1.12	1.16	2.02	2.07	44.55	43.96	57.33	55.63
T_4	1.16	1.18	2.04	2.07	43.14	43.00	57.28	54.58
T_5	1.10	1.15	2.03	2.05	45.81	43.90	57.66	55.48
T_6	1.19	1.23	2.08	2.11	42.79	41.71	53.26	50.93
T_7	1.15	1.18	2.03	2.06	43.35	42.72	57.51	55.81
T_8	1.11	1.16	2.02	2.08	45.05	44.23	58.12	56.13
T_9	1.18	1.20	2.06	2.10	42.72	42.86	54.58	51.25
T_{10}	1.21	1.22	2.09	2.10	42.11	41.90	53.35	50.99
T_{11}	1.14	1.16	2.03	2.06	43.84	43.69	57.17	54.83
T_{12}	1.13	1.16	2.02	2.08	44.06	44.23	57.28	55.98
T_{13}	1.19	1.19	2.06	2.07	42.23	42.51	54.42	51.85
T_{14}	1.19	1.20	2.08	2.08	42.79	42.31	53.21	50.82
T_{15}	1.15	1.16	2.04	2.07	43.63	43.96	57.35	53.85
T_{16}	1.14	1.15	2.03	2.06	43.84	44.17	57.48	54.13
T_{17}	1.18	1.19	2.06	2.08	42.72	42.79	54.35	50.73
T_{18}	1.19	1.19	2.05	2.07	41.95	42.51	54.74	50.81

S.Ed	0.026	0.063	0.025	0.100	0.796	2.413	1.325	1.794
CD (P=0.05)	0.054	NS	0.052	NS	1.617	NS	2.693	3.645

Note: I.V. – Initial value recorded at the start of experiment (1997)
T_1-T_{18} – Values recorded at the closure of experiment (2002)

Table 2b. Effect of digested coirpith compost and biofertilizers on physical properties in tea cv. Assam jat.

Treatments	Bulk density		Particle density		Pore space (%)		Water holding capacity	
	0-22.5 cm	22.5-45.0 cm	0-22.5 cm	22.5-45.0 cm	0-22.5 cm	22.5-45.0 cm	0-22.5 cm	22.5-45.0 cm
I.V	**1.19**	**1.20**	**2.07**	**2.10**	**38.57**	**36.22**	**51.20**	**50.16**
T_1	1.21	1.22	2.06	2.09	41.26	41.63	53.85	51.25
T_2	1.14	1.18	2.02	2.06	43.56	42.72	57.35	54.18
T_3	1.12	1.16	2.00	2.04	44.00	43.14	59.63	55.86
T_4	1.13	1.18	2.04	2.05	44.61	42.44	57.85	54.28
T_5	1.10	1.14	2.02	2.05	45.54	44.39	59.12	55.96
T_6	1.20	1.20	2.07	2.07	42.03	42.03	53.92	51.28
T_7	1.11	1.16	2.04	2.05	45.59	43.41	58.36	56.28
T_8	1.09	1.15	2.02	2.04	46.04	43.63	59.25	56.34
T_9	1.18	1.19	2.06	2.06	42.72	42.23	54.45	51.39
T_{10}	1.21	1.20	2.08	2.07	41.83	42.03	53.67	51.33
T_{11}	1.12	1.16	2.02	2.07	44.55	43.96	57.38	55.47
T_{12}	1.10	1.14	2.00	2.06	45.00	44.66	58.63	55.63
T_{13}	1.17	1.19	2.05	2.08	42.93	42.79	54.28	51.83
T_{14}	1.22	1.21	2.09	2.10	41.63	42.38	53.86	51.21
T_{15}	1.12	1.16	2.03	2.05	44.83	43.41	57.25	55.83
T_{16}	1.11	1.15	2.01	2.04	44.78	43.63	58.72	56.85
T_{17}	1.19	1.19	2.06	2.06	42.23	42.23	53.98	51.42
T_{18}	1.18	1.20	2.06	2.06	42.72	41.75	54.15	51.48

S.Ed	0.028	0.067	0.025	0.099	0.811	2.405	1.268	1.809
CD (P=0.05)	0.058	NS	0.050	NS	1.648	NS	2.577	3.676

Note: I.V. – Initial value recorded at the start of experiment (1997)

T_1-T_{18} – Values recorded at the closure of experiment (2002)

Table 3a. Effect of digested coirpith compost and biofertilizers on chemical properties in tea cv. ATK

Treatments	**pH**		**EC**		**CEC**		**Organic matter content (%)**	
	0-22.5 cm	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**
I.V	**4.60**	**4.50**	**0.15**	**0.16**	**8.00**	**7.92**	**4.12**	**3.08**
T_1	4.7	4.7	0.15	0.16	8.22	7.98	4.36	3.24
T_2	4.6	4.6	0.13	0.10	9.62	8.94	5.76	4.58
T_3	4.5	4.5	0.12	0.12	9.78	9.05	5.96	4.76
T_4	4.4	4.4	0.13	0.13	9.63	9.07	5.84	4.78
T_5	4.4	4.3	0.12	0.12	9.82	9.24	5.90	4.90
T_6	4.6	4.7	0.17	0.16	8.28	8.08	4.38	3.43
T_7	4.4	4.5	0.12	0.10	9.62	9.18	5.81	4.70
T_8	4.5	4.6	0.10	0.12	9.75	9.32	5.96	4.40
T_9	4.5	4.6	0.14	0.14	8.46	8.26	4.34	3.28
T_{10}	4.7	4.7	0.16	0.13	8.32	7.96	4.29	3.18
T_{11}	4.5	4.6	0.13	0.10	9.42	9.04	5.76	4.50
T_{12}	4.5	4.5	0.11	0.12	9.58	9.38	5.92	4.82
T_{13}	4.7	4.8	0.15	0.15	8.58	8.26	4.32	3.42
T_{14}	4.8	4.6	0.18	0.15	8.16	7.96	4.36	3.24
T_{15}	4.4	4.4	0.13	0.13	9.48	8.94	5.86	4.84
T_{16}	4.5	4.5	0.12	0.10	9.53	9.35	5.92	4.88
T_{17}	4.6	4.5	0.16	0.14	8.63	8.16	4.34	3.24

T_{18}	4.6	4.4	0.15	0.13	8.42	8.04	4.36	3.28
S.Ed	0.097	0.280	0.011	0.014	0.226	0.223	0.105	0.093
CD (P=0.05)	0.197	NS	0.022	0.028	0.460	0.453	0.213	0.189

Note: I.V. – Initial value recorded at the start of experiment (1997)
T_1-T_{18} – Values recorded at the closure of experiment (2002)

Table 3b. Effect of digested coirpith compost and biofertilizers on chemical properties in tea cv. Assam jat.

Treatments	**pH**		**EC**		**CEC**		**Organic matter content (%)**	
	0-22.5 cm	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**
I.V	**4.7**	**4.6**	**0.11**	**0.14**	**7.82**	**7.68**	**4.02**	**3.10**
T_1	4.7	4.8	0.15	0.13	8.45	7.98	4.18	3.14
T_2	4.5	4.6	0.13	0.10	9.58	9.04	5.68	4.56
T_3	4.4	4.4	0.12	0.12	9.76	9.16	5.82	4.48
T_4	4.4	4.3	0.12	0.11	9.65	9.06	5.66	4.52
T_5	4.5	4.4	0.10	0.11	9.82	9.08	5.84	4.69
T_6	4.9	4.8	0.14	0.14	8.34	8.04	4.22	3.08
T_7	4.5	4.6	0.12	0.11	9.62	8.98	5.64	5.72
T_8	4.4	4.5	0.11	0.10	9.85	9.26	5.86	4.72
T_9	4.7	4.7	0.14	0.14	8.53	8.04	4.26	3.12
T_{10}	4.8	4.8	0.15	0.13	8.28	8.10	4.28	3.18
T_{11}	4.6	4.4	0.13	0.11	9.63	9.06	5.68	4.46
T_{12}	4.4	4.4	0.11	0.10	9.84	9.28	5.86	4.72
T_{13}	4.6	4.6	0.15	0.14	8.46	7.92	4.25	4.24
T_{14}	4.8	4.8	0.16	0.15	8.16	8.02	4.32	3.21
T_{15}	4.4	4.4	0.12	0.12	9.55	9.08	5.68	4.11
T_{16}	4.4	4.5	0.11	0.10	9.64	9.45	5.88	4.52
T_{17}	4.6	4.6	0.14	0.13	8.46	8.14	4.22	3.12

T_{18}	4.7	4.8	0.13	0.13	8.55	8.23	4.28	3.18
S.Ed	0.096	0.310	0.016	0.016	0.180	0.174	0.112	0.112
CD (P=0.05)	0.195	NS	0.032	0.033	0.366	0.353	0.227	0.228

Note: I.V. – Initial value recorded at the start of experiment (1997)

T_1-T_{18} – Values recorded at the closure of experiment (2002)

Table 4a. Effect of digested coirpith compost and biofertilizers on biological properties in tea cv. ATK

Treatments	**VAM**		**Azospirillum**		**Phosphobacteria**		**Bacteria**		**Actinomycetes**		**Fungi**	
	0-22.5 cm	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**
I.V	**13**	**8**	**1.20**	**0.21**	**2.3**	**1.7**	**7.7**	**2.3**	**2.3**	**2.3**	**8.3**	**6.3**
T_1	13	9	0.45	0.18	2.2	1.5	3.8	2.2	1.2	1.2	7.5	4.2
T_2	13	12	0.40	0.20	2.5	1.7	4.5	2.5	2.3	1.3	7.3	5.0
T_3	18	11	0.42	0.19	2.8	1.9	4.9	2.6	2.8	1.8	12.5	5.2
T_4	30	18	0.92	0.25	6.2	3.2	5.2	2.8	2.6	1.2	12.8	4.9
T_5	38	22	1.40	0.33	7.5	3.8	5.9	2.7	4.5	1.8	13.6	4.9
T_6	15	8	0.48	0.12	2.5	1.9	3.4	2.0	1.4	1.4	7.3	4.5
T_7	18	12	0.98	0.42	6.5	3.0	5.2	2.4	2.8	2.0	11.4	4.9
T_8	22	13	1.46	0.48	7.2	3.1	5.2	2.6	4.3	2.5	12.3	5.3
T_9	24	11	0.68	0.29	5.5	2.5	4.2	2.2	2.8	1.4	9.2	4.5
T_{10}	15	9	0.42	0.16	2.0	1.5	3.6	2.0	1.2	1.7	7.8	4.1
T_{11}	30	17	1.06	0.42	6.8	3.0	4.8	2.3	3.0	2.1	10.6	4.3

T_{12}	37	15	1.42	0.46	7.8	3.6	5.6	2.7	4.9	2.0	11.9	4.7
T_{13}	25	13	0.56	0.32	5.9	2.5	4.0	2.4	2.6	1.4	10.3	4.5
T_{14}	14	11	0.41	0.15	2.2	1.6	3.8	2.3	1.2	1.9	7.6	4.3
T_{15}	32	18	0.86	0.39	6.6	2.9	4.6	2.7	3.2	1.5	10.5	5.1
T_{16}	36	20	1.34	0.46	7.3	3.5	5.5	3.0	4.8	2.1	12.5	5.5
T_{17}	26	17	0.85	0.28	5.9	2.7	4.2	2.4	2.7	1.9	9.8	5.0
T_{18}	27	19	0.53	0.23	6.0	2.3	4.5	2.4	2.8	1.3	10.2	5.4
S.Ed	1.248	0.991	--	--	0.418	0.201	0.214	0.448	0.177	0.120	0.573	0.253
CD (P=0.05)	2.536	2.013	--	--	0.849	0.409	0.435	0.911	0.360	0.243	1.164	0.514

Note: I.V. – Initial value recorded at the start of experiment (1997)
T_1-T_{18} – Values recorded at the closure of experiment (2002)

Table 4b. Effect of digested coirpith compost and biofertilizers on biological properties in tea cv. Assam jat

Treatments	**VAM**		**Azospirillum**		**Phosphobacteria**		**Bacteria**		**Actinomycetes**		**Fungi**	
	0-22.5 cm	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**	**0-22.5 cm**	**22.5-45.0 cm**
I.V	**5**	**4**	**1.00**	**0.26**	**1.7**	**2.0**	**8.0**	**2.0**	**2.0**	**1.7**	**8.7**	**5.7**
T_1	9	5	0.33	0.15	2.8	2.5	4.5	2.4	1.5	1.2	7.5	3.0
T_2	10	9	0.39	0.18	3.5	3.5	4.9	2.9	2.4	1.7	7.9	4.9
T_3	12	13	0.36	0.27	3.7	3.5	4.9	2.7	3.2	2.2	10.9	3.5
T_4	25	16	0.82	0.33	4.8	5.3	6.1	2.6	2.7	1.5	11.6	4.7
T_5	32	17	1.38	0.39	4.9	7.5	6.3	2.9	3.2	1.7	12.9	5.4

T_6	8	6	0.36	0.13	2.8	2.2	4.2	2.5	1.7	1.3	7.8	4.6
T_7	26	16	0.93	0.36	4.5	5.8	5.4	2.7	2.5	1.9	11.3	5.2
T_8	34	19	1.46	0.42	4.9	8.2	6.2	3.0	3.6	2.6	11.5	5.7
T_9	25	15	0.78	0.30	4.2	5.7	4.9	3.2	2.5	1.9	9.6	4.9
T_{10}	10	7	0.33	0.15	3.3	2.1	4.5	2.9	2.0	1.5	7.4	4.5
T_{11}	28	19	0.90	0.39	4.2	6.5	5.6	3.0	3.2	1.3	10.8	5.5
T_{12}	34	21	1.45	0.45	5.1	7.7	6.2	3.0	3.5	2.2	11.9	5.9
T_{13}	21	15	0.81	0.30	4.6	5.8	4.8	2.5	3.3	2.4	9.8	4.7
T_{14}	11	5	0.31	0.18	3.2	2.5	4.6	2.3	1.5	1.5	7.2	3.5
T_{15}	30	18	0.78	0.33	4.5	6.8	5.2	2.5	2.6	1.6	11.8	5.0
T_{16}	34	20	0.68	0.42	4.6	7.2	6.6	2.7	3.6	2.5	12.5	5.8
T_{17}	25	14	0.75	0.18	4.2	6.3	5.0	2.5	2.4	1.5	9.2	5.0
T_{18}	28	16	0.78	0.26	40	6.0	5.4	2.4	2.3	1.7	9.6	4.9
S.Ed	1.249	0.905	--	--	0.245	0.225	0.255	0.520	0.093	0.112	0.602	0.268
CD (P=0.05)	2.537	1.839	--	--	0.498	0.457	0.517	NS	0.190	0.227	1.223	0.545

Note: I.V. – Initial value recorded at the start of experiment (1997)

T_1-T_{18} – Values recorded at the closure of experiment (2002)