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EFFECT OF DIFFERENT SOURCES OF ORGANIC AND INORGANIC FERTILIZERS ON A BIOCHEMICAL PARAMETER OF SUNFLOWER (HELIANTHUS ANNUUS.L.)

Agricultural Science

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ABSTRACT

The waste product obtained from vegetable market, sugarcane and coconut goes as waste. In order to convert these waste into organic compost it is processed and utilized as an economical input in agriculture. Processed three types of compost is used as an excellent soil amendment because of its favourable physical properties in maintaining soil health. In addition to this, it find its importance in increase in nutrient in Protein, amino acid, fatty acid, carbohydrate and also in Chlorophyll pigments. In a Comparing the organic compost and inorganic fertilizer with NPK organic compost showed significant result. In organic comparison coconut waste gave best result which as special characteristic of water holding capacity.it deserves to gain he attention of the researcher studied on its usefulness and its potential in food production.

KEYWORDS

Sunflower, Organic Compost Fertilizer, Biochemical parameters, coconut coir compost.

INTRODUCTION

Organic farming and food processing practices are wide-ranging and necessitate the development of socially, ecologically, and economically sustainable food production system [25]. Sunflower (*Helianthus annuus* L.) is one of the four most important annual crops in the world grown for oil along with soybean, rapseed and groundnut. It is an important additional to the list of edible oilseed crops in India in the last four decades [26]. Organically grown Sunflower plants and its oils have become one of the best choices for both consumers and farmers [28].

Compost applied as a soil amendment can improve soil organic matter content, nutrient retention in soils susceptible to leaching, and stabilize soil pH [27]. Production of composted fertilizer from lignocellulosic residues of by-products of sugar industries maintains the health of plant and soil properties and protects the plant from soil borne diseases [16, 20]. Vegetable waste is the non-edible parts of vegetables that are discarded during collection, handling, transportation and processing [6]. Coir pith has many beneficial characteristics, making it a productive resource for use in agriculture if used after proper composting [17].

Therefore, the present work was designed to investigate the effect of different compost on biochemical parameters of sunflower (*Helianthus annuus* L.; family Compositae), one of the most important oilseed plants.

MATERIALS AND METHODOLOGY

The Sunflower variety CO2 was obtained from Tamilnadu Agriculture University Seed Bank, Coimbatore. The Seeds were sown in the field treated with different organic compost and combination of composts, Inorganic fertilizer. The sunflower growth was analyzed during the 7th, 15th and 30th, Days After Sowing (DAS), that is described in our previous article. [10]. Further, the biochemical parameters for the sunflower plants was determined and statistically analyzed for the better yield.

Biochemical Parameters

The biochemical analysis was done by determining total chlorophyll and total carbohydrate content by standard methods [3, 8] while crude protein and amino acids were determined by Moore and Stein, [15] and Lowry et al., [13]. The Fatty acid of sunflower leaves were analysed by the method of Frankel, [9].

RESULTS

Biochemical Parameters of germinated seedling

Besides morphological parameters, some biochemical constituents such as leaves chlorophyll, carbohydrate, amino acids, protein, fatty acids, ash content were analysed and recorded at 7th, 15th and 30th, Days After Sowing (DAS).

Estimation of Chlorophyll

Sunflower leaves of all the treated and untreated varieties were harvested during 7th day, 15th day and 30th day were freshly grounded and acetone treated sample were were incubated and quantified by 630 and 670 nm in a UV- Spectrophotometer for estimation of Chlorophyll A and B by Arnon's method.

I. Chlorophyll A

In 30th day observation, the maximum Chlorophyll A contents were found in T3 treatment in Trail 1 (0.49 mg/ml) and Trail 2 (0.48 mg/ml) periods, respectively and minimum in T1 treatment (0.18 mg/ml). The results were tabulated in Table 1.

Among the Sunflower growing stages, the Chlorophyll A content was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum Chlorophyll A content. The mean for each DAS observation was statistically significant (p value ≤ 0.05).

Table 1: Chlorophyll A estimation in Sunflower CO2 variety plants

		Trail 1 - Amino acids				Trail 2 - Amino acids			
		I	II	III	Mean and SD	I	II	III	Mean and SD
Amino acids	Control	0.116	0.116	0.116	0.12 ± 0.00	0.13	0.1123	0.1045	0.12 ± 0.01
	T1	0.141	0.146	0.147	0.14 ± 0.00	0.122	0.1248	0.1356	0.13 ± 0.01
	T2	0.138	0.138	0.139	0.14 ± 0.00	0.124	0.1158	0.1196	0.12 ± 0.00
	T3	0.307	0.310	0.324	0.32 ± 0.00	0.309	0.286	0.35	0.32 ± 0.04
	T4	0.270	0.270	0.260	0.27 ± 0.01	0.2236	0.2491	0.2136	0.23 ± 0.02
	T5	0.186	0.184	0.185	0.19 ± 0.00	0.1752	0.1752	0.1646	0.17 ± 0.01
	T6	0.155	0.155	0.155	0.15 ± 0.00	0.1338	0.1352	0.1423	0.14 ± 0.00
	T7	0.166	0.165	0.165	0.17 ± 0.00	0.1459	0.1499	0.15	0.15 ± 0.00
	T8	0.151	0.151	0.151	0.15 ± 0.00	0.1288	0.1296	0.1366	0.13 ± 0.00
Carbohydrates	Control	0.4443	0.4471	0.4465	0.45 ± 0.00	0.511	0.4811	0.48	0.49 ± 0.02
	T1	0.3707	0.3727	0.3717	0.37 ± 0.00	0.3665	0.3578	0.3675	0.36 ± 0.01

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	T2	0.4757	0.4904	0.490	0.49 ± 0.01	0.4957	0.4991	0.500	0.50 ± 0.00
	T3	0.6462	0.6475	0.649	0.65 ± 0.00	0.655	0.6589	0.547	0.62 ± 0.06
	T4	0.5647	0.5666	0.5650	0.57 ± 0.00	0.787	0.5785	0.5890	0.65 ± 0.12
	T5	0.6209	0.6221	0.6217	0.62 ± 0.00	0.6425	0.6575	0.655	0.65 ± 0.01
	T6	0.4127	0.4131	0.421	0.42 ± 0.00	0.4001	0.4331	0.45	0.43 ± 0.03
	T7	0.5955	0.5965	0.5961	0.60 ± 0.00	0.5777	0.5772	0.589	0.58 ± 0.01
	T8	0.4222	0.4238	0.4301	0.43 ± 0.00	0.4353	0.4117	0.4265	0.42 ± 0.01
Fatty acids	Control	0.15	0.1	0.1	0.1 ± 0.03	0.1	0.11	0.10	0.1 ± 0.02
	T1	0.2	0.3	0.2	0.23 ± 0.06	0.1	0.19	0.17	0.15 ± 0.05
	T2	0.5	0.5	0.45	0.48 ± 0.03	0.45	0.54	0.39	0.46 ± 0.08
	T3	0.3	0.3	0.4	0.33 ± 0.06	0.35	0.3	0.42	0.36 ± 0.06
	T4	0.3	0.3	0.2	0.27 ± 0.06	0.39	0.12	0.23	0.25 ± 0.14
	T5	0.4	0.4	0.5	0.43 ± 0.06	0.5	0.37	0.65	0.51 ± 0.14
	T6	0.2	0.3	0.2	0.23 ± 0.06	0.19	0.13	0.12	0.15 ± 0.04
	T7	0.4	0.4	0.3	0.37 ± 0.06	0.55	0.51	0.12	0.39 ± 0.24
	T8	0.3	0.2	0.3	0.27 ± 0.06	0.25	0.11	0.39	0.25 ± 0.14
Proteins	Control	0.1776	0.1773	0.1775	0.18 ± 0.00	0.167	0.096	0.154	0.14 ± 0.04
	T1	0.1808	0.1805	0.182	0.18 ± 0.00	0.150	0.099	0.099	0.12 ± 0.03
	T2	0.1909	0.1906	0.1905	0.19 ± 0.00	0.171	0.152	0.014	0.11 ± 0.09
	T3	0.2374	0.2374	0.2375	0.24 ± 0.00	0.217	0.139	0.382	0.25 ± 0.12
	T4	0.1336	0.1347	0.135	0.13 ± 0.00	0.103	0.100	0.085	0.10 ± 0.01
	T5	0.1491	0.149	0.148	0.15 ± 0.00	0.129	0.011	0.074	0.07 ± 0.06
	T6	0.2118	0.2114	0.221	0.21 ± 0.01	0.177	0.177	0.156	0.17 ± 0.01
	T7	0.1947	0.1948	0.1954	0.19 ± 0.00	0.094	0.079	0.150	0.11 ± 0.04
	T8	0.2066	0.2071	0.2081	0.21 ± 0.00	0.197	0.176	0.190	0.19 ± 0.01

* **T1** - Vegetable waste compost, **T2** - Sugarcane waste compost, **T3** - Coconut coir waste compost, **T4** - Combination of T1 + T2 + T3, **T5** - 25 % NPK fertilizer, **T6** - 50 % NPK fertilizer, **T7** - 75 % NPK fertilizer, **T8** - 100 % NPK Fertilizer * **I, II, III** - Triplicates sown in the field

ii. Chlorophyll B

In 30th day observation, the maximum Chlorophyll B contents were found in T3 treatment in Trail 1 (0.77 mg/ml) and Trail 2 (0.72 mg/ml) periods, respectively and minimum in T1 treatment (0.27 mg/ml). The results were tabulated in Table 1.

Among the Sunflower growing stages, the Chlorophyll Bcontent was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum Chlorophyll B content. The mean for each DAS observation was statistically significant (p value ≤ 0.05).

Amino acid Estimation in Sunflower CO2 variety

Sunflower leaves of all the treated and untreated varieties were harvested during 7th day, 15th day and 30th day were freshly grounded and filtrate sample were added with Ninhydrin reagent and quantified by spectrophotometer for estimation of amino acids by Ninhydrin method. In 30th day observation, the maximum amino acid contents were found in T3 treatment in Trail 1 (0.32 mg/ml) and Trail 2 (0.32 mg/ml) periods, respectively and minimum in control (0.12 mg/ml). The results were tabulated in Table 2.

Among the Sunflower growing stages, the amino acid content was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum amino acid content. (Figure 1). The mean for each DAS observation was statistically significant (p value ≤ 0.05).

Table 2: Biochemical estimation in Sunflower CO2 variety plants – 30th day Observation

		Trail 1 - Amino acids				Trail 2 - Amino acids			
		I	II	III	Mean and SD	I	II	III	Mean and SD
Amino acids	Control	0.116	0.116	0.116	0.12 ± 0.00	0.13	0.1123	0.1045	0.12 ± 0.01
	T1	0.141	0.146	0.147	0.14 ± 0.00	0.122	0.1248	0.1356	0.13 ± 0.01
	T2	0.138	0.138	0.139	0.14 ± 0.00	0.124	0.1158	0.1196	0.12 ± 0.00
	T3	0.307	0.310	0.324	0.32 ± 0.00	0.309	0.286	0.35	0.32 ± 0.04
	T4	0.270	0.270	0.260	0.27 ± 0.01	0.2236	0.2491	0.2136	0.23 ± 0.02
	T5	0.186	0.184	0.185	0.19 ± 0.00	0.1752	0.1752	0.1646	0.17 ± 0.01
	T6	0.155	0.155	0.155	0.15 ± 0.00	0.1338	0.1352	0.1423	0.14 ± 0.00
	T7	0.166	0.165	0.165	0.17 ± 0.00	0.1459	0.1499	0.15	0.15 ± 0.00
	T8	0.151	0.151	0.151	0.15 ± 0.00	0.1288	0.1296	0.1366	0.13 ± 0.00
Carbohydrates	Control	0.4443	0.4471	0.4465	0.45 ± 0.00	0.511	0.4811	0.48	0.49 ± 0.02
	T1	0.3707	0.3727	0.3717	0.37 ± 0.00	0.3665	0.3578	0.3675	0.36 ± 0.01
	T2	0.4757	0.4904	0.490	0.49 ± 0.01	0.4957	0.4991	0.500	0.50 ± 0.00
	T3	0.6462	0.6475	0.649	0.65 ± 0.00	0.655	0.6589	0.547	0.62 ± 0.06
	T4	0.5647	0.5666	0.5650	0.57 ± 0.00	0.787	0.5785	0.5890	0.65 ± 0.12
	T5	0.6209	0.6221	0.6217	0.62 ± 0.00	0.6425	0.6575	0.655	0.65 ± 0.01
	T6	0.4127	0.4131	0.421	0.42 ± 0.00	0.4001	0.4331	0.45	0.43 ± 0.03
	T7	0.5955	0.5965	0.5961	0.60 ± 0.00	0.5777	0.5772	0.589	0.58 ± 0.01
	T8	0.4222	0.4238	0.4301	0.43 ± 0.00	0.4353	0.4117	0.4265	0.42 ± 0.01
Fatty acids	Control	0.15	0.1	0.1	0.1 ± 0.03	0.1	0.11	0.10	0.1 ± 0.02
	T1	0.2	0.3	0.2	0.23 ± 0.06	0.1	0.19	0.17	0.15 ± 0.05
	T2	0.5	0.5	0.45	0.48 ± 0.03	0.45	0.54	0.39	0.46 ± 0.08
	T3	0.3	0.3	0.4	0.33 ± 0.06	0.35	0.3	0.42	0.36 ± 0.06
	T4	0.3	0.3	0.2	0.27 ± 0.06	0.39	0.12	0.23	0.25 ± 0.14
	T5	0.4	0.4	0.5	0.43 ± 0.06	0.5	0.37	0.65	0.51 ± 0.14
	T6	0.2	0.3	0.2	0.23 ± 0.06	0.19	0.13	0.12	0.15 ± 0.04
	T7	0.4	0.4	0.3	0.37 ± 0.06	0.55	0.51	0.12	0.39 ± 0.24
	T8	0.3	0.2	0.3	0.27 ± 0.06	0.25	0.11	0.39	0.25 ± 0.14
Proteins	Control	0.1776	0.1773	0.1775	0.18 ± 0.00	0.167	0.096	0.154	0.14 ± 0.04
	T1	0.1808	0.1805	0.182	0.18 ± 0.00	0.150	0.099	0.099	0.12 ± 0.03
	T2	0.1909	0.1906	0.1905	0.19 ± 0.00	0.171	0.152	0.014	0.11 ± 0.09

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	T3	0.2374	0.2374	0.2375	0.24 ± 0.00	0.217	0.139	0.382	0.25 ± 0.12
	T4	0.1336	0.1347	0.135	0.13 ± 0.00	0.103	0.100	0.085	0.10 ± 0.01
	T5	0.1491	0.149	0.148	0.15 ± 0.00	0.129	0.011	0.074	0.07 ± 0.06
	T6	0.2118	0.2114	0.221	0.21 ± 0.01	0.177	0.177	0.156	0.17 ± 0.01
	T7	0.1947	0.1948	0.1954	0.19 ± 0.00	0.094	0.079	0.150	0.11 ± 0.04
	T8	0.2066	0.2071	0.2081	0.21 ± 0.00	0.197	0.176	0.190	0.19 ± 0.01

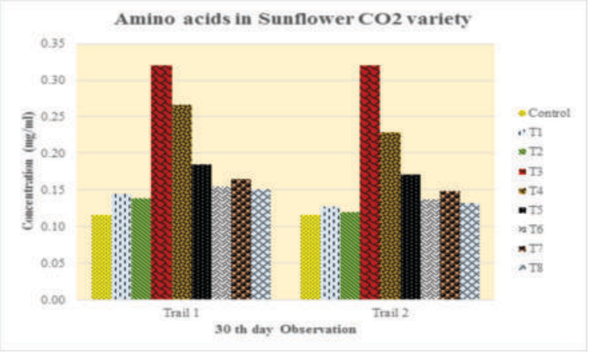

Figure 1: Amino acid estimation in Sunflower CO2 variety plants – 30th day Growth

Carbohydrates

Sunflower leaves of all the treated and untreated varieties were harvested during 7th day, 15th day and 30th day were freshly grounded and filtrate sample were added with Anthrone reagent and quantified by spectrophotometer for estimation of carbohydrate by Anthrone method.

In 30th day observation, the maximum carbohydrate contents were found in T3 treatment in Trail 1 (0.65 mg/ml) and Trail 2 (0.62 mg/ml) periods, respectively and minimum in T1 treatment (0.36 mg/ml).

Among the Sunflower growing stages, the carbohydrate content was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum carbohydrate content. (Figure 2). The mean for each DAS observation was statistically significant (p value ≤ 0.05).

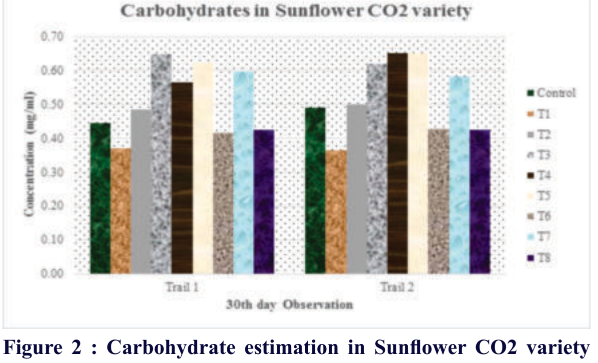

Figure 2 : Carbohydrate estimation in Sunflower CO2 variety plants – 30th day Growth

Fatty acid Estimation in Sunflower CO2 variety

Sunflower leaves of all the treated and untreated varieties were harvested during 7th day, 15th day and 30th day were freshly grounded and titrated with KOH solution and Phenolphthalein indicator.

In 30th day observation, the maximum fatty acid contents were found in T3 treatment in Trail 1 (0.33 mg/ml) and Trail 2 (0.36 mg/ml) periods, respectively and minimum in control (0.10 mg/ml).

Among the Sunflower growing stages, the fatty acid content was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum fatty acid content. (Figure 3). The mean for each DAS observation was statistically significant (p value ≤ 0.05).

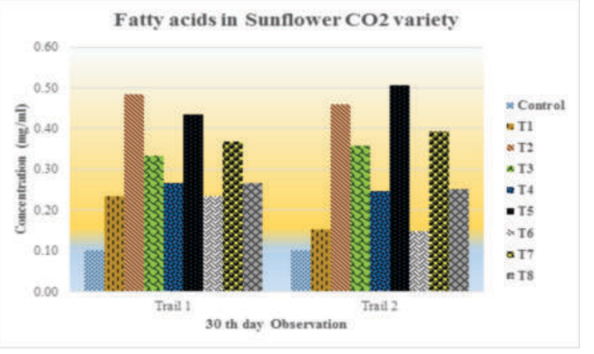

Figure 3: Fatty acid estimation in Sunflower CO2 variety plants – 30th day Growth

Proteins

Sunflower leaves of all the treated and untreated varieties were harvested during 7th day, 15th day and 30th day were freshly grounded and alkaline copper treated sample were added with folinciocalteau phenol reagent were incubated and quantified by calorimeter for estimation of Protein by Lowry's method.

In 30th day observation, the maximum protein contents were found in T3 treatment in Trail 1 (0.24 mg/ml) and Trail 2 (0.25 mg/ml) periods, respectively and minimum in T4 treatment (0.10 mg/ml).

Among the Sunflower growing stages, the protein content was found to be highest in 15th day growth when compared to 7th and 30th day observation. The treatment coconut coir waste compost T3 was found to be efficient among all the compost treatments and yields the maximum protein content. (Figure 4). The mean for each DAS observation was statistically significant (p value ≤ 0.05).

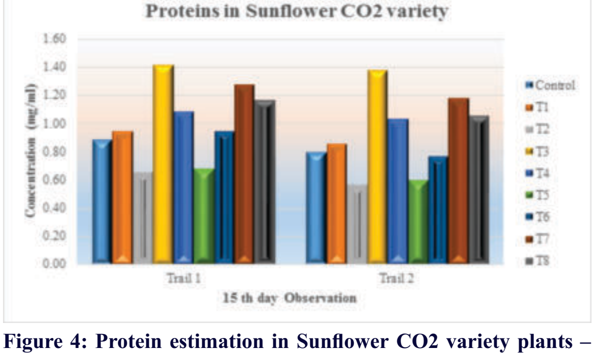

Figure 4: Protein estimation in Sunflower CO2 variety plants – 30th day Growth

DISCUSSION

Leaf chlorophyll content was significantly higher when coconut coir compost treatment compared with using organic manure alone or combined with inorganic fertilizers. These results agreed with the previous findings obtained on other vegetable crops [2,1]. A promotion effect of organic and inorganic fertilizers on chlorophyll contents might be attributed to the fact that nitrogen is a constituent of chlorophyll molecule. Moreover, nitrogen is the main constituent of all amino acids in proteins and lipids that acting as a structural compounds of the chloroplast [5,2].

The composting of agronomic wastes with the support of nominated bacteriological treatments enhanced its total carbohydrate and crude protein contents which might work as good source of carbon and nitrogen and may facilitate to restore or increase the fertility of degraded soil [4]. Triadimefon increased the amino acids content in *Phaseolus uulgari's* [14], penconazole increased amino acid content in higher plants [18] and LAB — 150978 treated sunflower and mungbean [19]. Triazole treatments increased the amino acid content in carrot [11]. The biochemical parameters such as reducing sugar, non-reducing sugar, total sugar, amino acid, starch etc., were analyzed in sunflower leaves to evaluate the effect of different treatments of organic and inorganic fertilizers. Results revealed that application of different organic and inorganic fertilizer treatments showed a significant effect on the biochemical contents when compared to control. This could be due to the presence of micro and macronutrients in the optimized concentration in organic manure, which can be easily assimilated by plants.

Xu *et al*., [24] found that concentration of sugar and vitamin C contents were highest in tomato fruit treated with chicken manure and the lowest in chemical fertigation. Verma *et al*., [23] reported that fruit quality was improved in terms of lycopene content, antioxidant activity and defense enzyme activity in tomatoes in effective microorganisms compost as compared to the application of recommended dose of fertilizers. All the organic waste compost increased vegetable growth and yield of sunflower more than chemical fertilizer, although the use of sustainable organic materials can increase the fertility without negative effects on human health and environment.

In this study, reducing sugar, non—reducing sugar and total sugar was found to be increased significantly in sunflower. The increase in reducing sugar may be due to the presence of magnesium which could have triggered chlorophyll synthesis and there by subsequently increasing the photosynthetic rate in the plants.

CONCLUSION

The significant difference in available nutrients due to application of different organic sources are mainly due to varying nutrient composition of crop residues and organic manures [7]. The availability of nitrogen, phosphorous and potassium was higher in compost treatment, which might be attributed to the faster rate of decomposition and mineralisation in compost than inorganic fertilizer as reported by several workers, Suriyanarayanan [21], Udayasooriyan *et al*.,[21], Hundakar *et al*.,[22].

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