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# Utilization of Biodynamic Farming to Improve Quality Attributes of Soybean (*Glycine max* L. var. Co. Soy)

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## Abstract

Organics must form an indispensable component of the manurial schedule for any crop. The present study was designed to study the effect of biodynamic (BD) compost on biochemical parameters of soya bean plants on 30th, 45th, 60th and 75th day after sowing. The protein content was more in $T_1$ treatment (3.5 kg of BD compost) on 30th, 45th, 60th and 75th day. The total carbohydrate was found to be maximum in $T_1$ (3.5 kg of BD compost) on 30th, 45th, 60th and 75th day. The chlorophyll 'a', 'b' and 'total' chlorophyll were highest in $T_1$ (3.5 kg of BD compost) on 30th, 45th, 60th and 75th day. The ascorbic acid and protein content of the harvested seeds were significantly increased in $T_1$ treatment on 75th day. The biodynamic compost helps in improvement of crop quality and reduces environmental pollution. The study shows that utilization of biodynamic compost is beneficial for legumes to improve the quality of the products obtained from the plants.

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## INTRODUCTION

The organic manures help to improve soil fertility. Adequate and timely application of organic manure is most essential for proper growth of the crop. Higher uptake of nutrients in organic amendments applied pots might also be due to greater availability of nutrients contributed by the organic amendments. The organic manure apart from supplying major nutrients also supplies secondary and micro nutrients. It also produces alkaloids, gums and resins which bind the soil particles and improve the aggregation. The organic farming improves plant growth and resistance under unfavorable condition. Different organic resources like panchagavya, humic acid and micro herbal fertilizer are found beneficial in improving the yield of legume (Vijayakumari *et al*., 2012).The organic farming also improves the physical, chemical and biological properties of soil which has a direct influence on crop (Vijayakumari and Hiranmai, 2012).

Biodynamic farmers use 'preparations' to improve soil and crop quality, including fermented herbs to inoculate manure and compost, and field sprays that are either made from cow manure and silica fermented in cow horns, or from special mixture of cow manure with concentrated applications of herbs (Compound preparations) (Koepf *et al*., 1989). Application of Biodynamic sprays 500, 501, and 508 was correlated with higher yield of Lentil per unit plant biomass, lower C and crude protein, higher $NO^-_3$ content in soft white spring wheat, and greater $NH_4^+$ concentration in soil (Carpenter-Boggs *et al*., 2000a).

In companion studies biodynamic preparation use in compost increased compost temperature and affected its microbial community structure. In companion studies, Carpenter-Boggs, (2000b) found that BD preparation 502 to 507 altered the microbial community, phospholipids, fatty acid makeup of compost and raised the temperature of composting dairy manure and bedding by an average of 3.4°C during an 8-wk development period. BD compost preparation are used to treat compost piles, enhancing the breakdown, fermentation, and decomposition of raw compost materials, and help the rebuilding of refuse into stable humus, full of life. BD increase plant growth. BD 500 increases health fertility and life of soils by stimulating humus formation, increasing microbial life, earth warm activity; and promoting root growth (Lioyd Nelson, 2005).

Lytton *et al*. (2007) observed that bio-dynamic soil improved marginal root growth (7%) than conventionally managed soil (2%). The more favorable physical and chemical properties in the biodynamic, soil may be attributed to less grazing pressure. Ansari and Ismail (2008) revealed that application of BD 500 was significantly better in physical, chemical and biological properties of soil. The main objective of the present study was to assess the impact of biodynamic compost on the biochemical parameters of soya bean.

## MATERIALS AND METHODS

The research work was carried out at the Department of Botany, Avinashilingam University for Women, Coimbatore, Tamil Nadu, India.

### Treatment Details

**$T_0$ :** Control - Red loamy soil (7 kg)

**$T_1$ :** 3.5 kg Red loamy soil + 3.5 kg BD compost

**$T_2$ :** 4.0 kg Red loamy soil + 3.0 kg BD compost

**$T_3$ :** 4.5 kg Red loamy soil + 2.5 kg BD compost

**$T_4$ :** 5.0 kg Red loamy soil + 2.0 kg BD compost

**$T_5$ :** 5.5 kg Red loamy soil + 1.5 kg BD compost

**$T_6$ :** 6.0 kg Red loamy soil + 1.0 kg BD compost

### Collection of Plant Samples on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ Days after Sowing

The plant samples were collected on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ day after treatment and analyzed for total protein, carbohydrates, reducing sugar and chlorophylls content. The total protein was estimated by the method of Lowry *et al*. (1951), total carbohydrates by Hedge and Hofreiter (1962), Reducing sugar by Miller (1972) and Chlorophylls by the method of Arnon (1949).

### Statistical Analysis

The study was in completely randomized design with three replications. The data obtained from various biochemical parameters were statistically analyzed by one way ANOVA method. Based on the results inferences were drawn. For the significant treatment differences critical differences were worked out.

## RESULTS AND DISCUSSION

The different biochemical parameters were observed in plant leaves of appropriate stage of analysis and the values obtained are presented in Tables 1, 2 and 3.

### Total Protein

The protein content of crop was improved in $T_1$ on $30^{th}$ (0.0977 mg/g), $45^{th}$ (0.1070 mg/g), $60^{th}$ (0.1170 mg/g) and $75^{th}$ (0.1257 mg/g) day. The control plants showed reduced protein content of 0.0413 mg/g ($30^{th}$ day), 0.0513 mg/g ($45^{th}$ day), 0.0630 mg/g ($60^{th}$ day) and 0.0657 mg/g ($75^{th}$ day). Significantly more protein content was recorded in mulberry plants grown in the presence of earthworms and cow dung. Ravignanam and Gunathilagaraju (1996) showed the higher nutritional levels of mulberry are attributed to the increased root growth resulting in greater uptake of nutrients from soil due to the earthworm activity. Sankar *et al*. (2000) observed significantly higher crude protein content in mulberry leaves by application of FYM. Javed and Aruna Panwar (2013) also reported that increased protein content in *Glycine max* by vermin compost application.

### Total Carbohydrates

The increase in carbohydrates content of soya bean plants was observed in 3.5 kg biodynamic compost applied crop ($T_1$) on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ day (0.2650, 0.0290, 0.0367 and 0.0447 mg/g respectively). The decreased carbohydrate content was observed in $T_0$, control on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ day (0.1507, 0.0151, 0.0237 and 0.0273 mg/g respectively) after treatment. Improved carbohydrate content due to application of composted and vermin composted Parthenium is reported by Vijayakumari *et al*. (2009). Similarly Javed and Aruna Panwar (2013) reported improved carbohydrate content in *Vigna mungo* by application of biofertilisers and vermin compost.

### Reducing Sugar

The plants treated with 3.5 kg ($T_1$) showed a higher reducing sugar content of 0.0267, 0.0360, 0.0443 and 0.0480 mg/g on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ day after treatment respectively, when compared to the lowest value of 0.0163, 0.0250, 0.0317 and 0.0330 mg/g on $30^{th}$, $45^{th}$, $60^{th}$ and $75^{th}$ day after treatment in control group (Table 2). Farm yard manure application to maize resulted in an increased reducing sugar, crude protein, starch, carbohydrates and phenol (Kamalakumari and Singaram, 1996). Application of vermin composted Parthenium was found to improve the reducing sugar content of chilly (Hiranmai Yadav and Vijayakumari, 2004).

**Table 1:** Impact of biodynamic compost on protein and carbohydrates reducing sugar of soybean on 30th, 45th, 60th and 75th day after treatment.

| Treatments | Protein (mg/g) | | | | Carbohydrate (mg/g) | | | |
|---|---|---|---|---|---|---|---|---|
| | 30th Day | 45th Day | 60th Day | 75th Day | 30th Day | 45th Day | 60th Day | 75th Day |
| $T_0$ | 0.0413 | 0.0513 | 0.0630 | 0.0657 | 0.0151 | 0.0237 | 0.0273 | 0.0290 |
| $T_1$ | 0.0977 | 0.1070 | 0.1170 | 0.1257 | 0.0290 | 0.0367 | 0.0447 | 0.0467 |
| $T_2$ | 0.0967 | 0.1020 | 0.1127 | 0.1203 | 0.0293 | 0.0393 | 0.0423 | 0.0457 |
| $T_3$ | 0.0947 | 0.0953 | 0.1097 | 0.1117 | 0.0310 | 0.0353 | 0.0423 | 0.0443 |
| $T_4$ | 0.0793 | 0.0783 | 0.0943 | 0.1103 | 0.0260 | 0.0340 | 0.0393 | 0.0413 |
| $T_5$ | 0.8030 | 0.0843 | 0.0886 | 0.0930 | 0.0230 | 0.0277 | 0.0323 | 0.0363 |
| $T_6$ | 0.0687 | 0.0767 | 0.0750 | 0.0840 | 0.0230 | 0.0283 | 0.0300 | 0.0343 |
| **SEd** | **0.0031** | | | | **0.0010** | | | |
| **CD (0.05)** | **0.0066**** | | | | **0.0021**** | | | |

**Table 2:** Impact of biodynamic compost on reducing sugar of soybean.

| Treatments | Reducing sugar (mg/g) | | | |
|---|---|---|---|---|
| | 30th Day | 45th Day | 60th Day | 75th Day |
| $T_0$ | 0.0163 | 0.0250 | 0.0317 | 0.0330 |
| $T_1$ | 0.0267 | 0.0360 | 0.0443 | 0.0480 |
| $T_2$ | 0.0253 | 0.0327 | 0.0427 | 0.0450 |
| $T_3$ | 0.0243 | 0.0290 | 0.0427 | 0.0447 |
| $T_4$ | 0.0230 | 0.0277 | 0.0393 | 0.0417 |
| $T_5$ | 0.0187 | 0.0263 | 0.0367 | 0.0393 |
| $T_6$ | 0.0177 | 0.0253 | 0.0343 | 0.0357 |
| **SEd** | **0.0006** | | | |
| **CD (0.05)** | **0.0012**** | | | |

**Table 3:** Impact of biodynamic compost on chlorophyll 'a', 'b' and total chlorophyll of soybean.

| Treatments | Chlorophyll 'a' (mg/g) | | | | Chlorophyll 'b' (mg/g) | | | | Total chlorophyll (mg/g) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30th day | 45th day | 60th day | 75th day | 30th day | 45th day | 60th day | 75th day | 30th day | 45th day | 60th day | 75th day |
| $T_0$ | 0.0002 | 0.0004 | 0.0006 | 0.0007 | 0.0004 | 0.0008 | 0.0010 | 0.0011 | 0.0006 | 0.0012 | 0.0016 | 0.0018 |
| $T_1$ | 0.0004 | 0.0010 | 0.0013 | 0.0015 | 0.0007 | 0.0017 | 0.0024 | 0.0027 | 0.0012 | 0.0027 | 0.0037 | 0.0042 |
| $T_2$ | 0.0004 | 0.0009 | 0.0013 | 0.0014 | 0.0006 | 0.0015 | 0.0024 | 0.0025 | 0.0011 | 0.0024 | 0.0037 | 0.0039 |
| $T_3$ | 0.0004 | 0.0008 | 0.0013 | 0.0014 | 0.0006 | 0.0015 | 0.0022 | 0.0024 | 0.0010 | 0.0023 | 0.0035 | 0.0038 |
| $T_4$ | 0.0004 | 0.0008 | 0.0012 | 0.0013 | 0.0006 | 0.0014 | 0.0022 | 0.0022 | 0.0010 | 0.0022 | 0.0034 | 0.0035 |
| $T_5$ | 0.0003 | 0.0008 | 0.0012 | 0.0013 | 0.0006 | 0.0013 | 0.0022 | 0.0022 | 0.0009 | 0.0022 | 0.0034 | 0.0035 |
| $T_6$ | 0.0003 | 0.0007 | 0.0011 | 0.0012 | 0.0004 | 0.0012 | 0.0019 | 0.0020 | 0.0009 | 0.0019 | 0.0030 | 0.0032 |
| **SEd** | **0.0001** | | | | **0.0001** | | | | **0.0002** | | | |
| **CD (0.05)** | **0.0001**** | | | | **0.003**** | | | | **0.0004**** | | | |

## Chlorophylls

Chlorophylls 'a', 'b' and total chlorophylls are depicted in Table 3. Chlorophyll 'a', 'b' and total chlorophylls contents were highest in $T_1$ (3.5 kg BD compost) on 30th day (0.0004 mg/g, 0.0007 mg/g, 0.0012 mg/g respectively), on 45th day (0.0010 mg/g, 0.0017 mg/g, 0.0027 mg/g respectively) on 60th day (0.0013 mg/g, 0.0024 mg/g, 0.0037 mg/g respectively) on 75th day (0.0015 mg/g, 0.0027 mg/g, 0.0042 mg/g respectively) after treatment. The least chlorophyll was obtained in $T_0$ on 30th day (0.0002 mg/g, 0.0004 mg/g, 0.0006 mg/g respectively), on 45th day (0.0004 mg/g, 0.0008 mg/g, 0.0012 mg/g respectively) on 60th day (0.0006 mg/g, 0.0010 mg/g, 0.0016 mg/g respectively) 75th day (0.0007 mg/g, 0.0011 mg/g, 0.0018 mg/g respectively). The present findings are in accordance with the work of Ingale *et al*. (2007) who revealed that six per cent cow urine + 50 per cent NAA significantly increased the leaf chlorophyll content in black gram. Organic manures auxins and essential amino acids increase the chlorophyll content of leaf which in turn enhances metabolite synthesis resulting in crop productivity (Ghosh and Das, 1998). Vermicompost treatment improved the chlorophyll content in gerbera (Rodriguez *et al*., 2000) and in papaya (Shivaputra *et al*., 2004).

## CONCLUSIONS

The protein, total carbohydrates reducing sugar and chlorophyll 'a', 'b' and total chlorophyll were highest in 3.5 kg of BD compost on 30$^{th}$, 45$^{th}$, 60$^{th}$ and 75$^{th}$ day after treatment. From the above study it can be inferred that bio-dynamic compost could be ideal and suitable organic mixture for better production of Soya bean. Furthermore organic substances are constantly undergoing changes in the tropical soils, which must be replenished. The sources of organic matter for incorporation in to the soil are becoming scarce. Hence the alternate sources have to be found out as substitute for organic sources.

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