Effect of Different Bio-fertilizers on the Chlorophyll, Nitrogen and Vitamin E Content in *Arachis hypogeae* L. and *Sesamum indicum* L.

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ABSTRACT

The peanut or ground nut (*Arachis hypogeae* L.) is a species in the legume or bean family (Fabaceae). Sesame (*Sesamum indicum* L.) is a flowering plant belonging to the family Pedaliaceae. The present study was carried out to study the effect of different bio-fertilizers on the chlorophyll, nitrogen content on the 30^{th} day of growth of the plants and Vitamin E content in the seeds after harvest of the two test crops. The bio-fertilizers used were *Azospirillum*, panchagavya, VAM fungi and a mixture of these three fertilizers. Control plant was maintained without any fertilizer application. The chlorophyll and nitrogen content seemed to be more in the plants treated with mixture of organic fertilizers in both the plants. The Vitamin E content were found to be higher in seeds obtained from *Azospirillum* treated plants in groundnut and VAM fungus treated plants in sesame.

Key words: *Arachis*, Bio-fertilizer, Chlorophyll, Nitrogen, *Sesamum*, Vitamin E.

INTRODUCTION

The natural oils such as mustard, peanut and sesame are stable, non-drying or semi-drying oils with a low tendency to oxidize in the light. In their natural form, they contain antioxidants which prevent rancidity and reversion (development of 'off' odors). In contrast, soybean and safflower oil are drying oils while sunflower oil is semidrying oil. Thus, due to a higher percentage of PUFAs, they are prone to oxidation in the presence of light, temperature and air and metal (Sharma and Sharma, 2017). Nuts and seeds are a rich source of Vitamin E compared to vegetables and fruits (Bauernfiend, 1980; Murphy *et al*., 1990). Edible oil seeds play a vital role in human nutrition by providing calories and aiding in digestion of several fat soluble vitamins for example vitamin A, D, E, K (Sharma and Sharma, 2017). Seeds store TAG (Triacylglycerols), as a food reserve for germinative growth of the seedlings. They are present in small, discrete intercellular organelles called oil bodies (Stymne and Stobart, 1987; Huang, 1992). Traditional oils like sesame, coconut, mustard and groundnut oils are being used in India from long time, which may be used in cooking vegetables, deep frying and for storage purposes as pickles. Therefore, the fact is that mostly oil is treated at high temperature or stored for long period. Literature survey reveals that rancidity and reversion are found to be the major problems in the use of vegetable oils, which are caused due to tendency of unsaturated fatty acids to oxidize during thermal treatment and storage (Sharma and Sharma, 2017).

Vitamin E is essential for normal growth and development, and deficiency leads to clinical abnormalities. Vitamin E prevents cell damage by preventing *in vivo* peroxidation and is thought to be a preventive factor for inflammation, cardiovascular disease, cancer, various neurodegenerative diseases-including Alzheimer's disease and other disease states involving oxidative stress (Manton *et al*., 1997; Sayre *et al*., 1997).

Leaf chlorophyll content, a good indicator of photosynthetic activity, mutations, stress, and nutritional state has important potential implications on crop stress and chlorosis detection, agricultural field management, and especially for precision agriculture practices in which the healthy plants have higher range of chlorophyll content when compared to the unhealthy ones (Zarco-Tejada *et al*., 2004). It is critical in photosynthesis as it allows plants to absorb energy from light (Anthony *et al*., 2003). Chlorophyll molecules are specifically arranged in and around photosystems that are embedded in the thylakoid membranes of chloroplasts (Chen *et al*., 2010). Chlorophyll content can be an indicator of the plant's condition.

Nitrogen is an essential nutrient for plant growth, development and reproduction. Despite nitrogen being one

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of the most abundant elements on earth, nitrogen deficiency is probably the most common nutritional problem affecting plants worldwide. Nitrogen from the atmosphere and earth's crust is not directly available to plants. Healthy plants often contain 3 to 4 percent nitrogen in their above-ground tissues. This is a much higher concentration compared to other nutrients. The main objective of the present study is to calculate the Vitamin E content in the two test crops and also to analyze the chlorophyll and nitrogen content present in the plants under different biofertilizer treatments.

MATERIALS AND METHODS

The plants taken for the present study were *Arachis hypogeae* L. belonging to the family Fabaceae and *Sesamum indicum* L. belonging to the family Pedaliaceae. Estimation of chlorophyll, nitrogen and Vitamin E content was carried out under different treatments of bio-fertilizers namely Vesicular Arbuscular Mycorrhiza, Panchagavya and *Azospirillum.*

Collection of the seeds

Seeds of *Arachis hypogeae L*. and *Sesamum indicum* L. were obtained from Tamil Nadu, Agricultural University, Coimbatore.

Collection of biofertilizers

The bio-fertilizers such as VAM, Panchagavya and *Azospirillum* were collected from TNAU, Coimbatore. The different treatments given were

T_0 – Control
T_1– VAM
T_2–Panchagavya
T_3–*Azospirillum*
T_4– VAM + Panchagavya + *Azospirillum*

Plant Nutrient Analyzer

Description

Plant nutrient analyzer (PX- 152) shows three parameters namely chlorophyll, nitrogen content and leaf temperature at the same time. These parameters are important for a plant. They are important basis for plant fertilization and irrigation. It is mostly used to analyze the effectiveness of the fertilizers to the plant.

Procedure

The fresh plant sample was taken on the 30th day of growth and the leaves were washed. The plant nutrient analyzer was clipped to the center of the leaf. The upper part of the nutrient analyzer was pressed for few seconds. Then the level of chlorophyll and nitrogen was calculated. Three readings were taken for statistical analysis.

Statistical analysis

The data obtained were subjected to statistical analysis as per the procedure of Panse and Sukhatme (1978).

Vitamin E

Vitamin E is an essential constituent in our daily diet. In plants vitamin E contribute a major role in maintaining stress. Vitamin E analysis was carried out based on the method of Devries and Silvera (2002). Vitamin E was estimated after harvesting the seeds of groundnut and sesame.

RESULTS AND DISCUSSION

The study conducted in the two oil-seed crops namely *Arachis hypogeae* L. and *Sesamum indicum* L. showed the following results.

Chlorophyll and nitrogen content of *Arachis hypogeae* L. and *Sesamum indicum* L.

The chlorophyll content and nitrogen content was measured at random on the 30th day in the leaves of control plants and plants treated with bio-fertilizers using Plant Nutrient Analyzer and tabulated (Table 1 and Table 2). The chlorophyll content seemed to be more in the plants treated with mixture of organic fertilizers in both the plants. The values observed were 45.53 ± 4.82 (SPAD) for *Arachis* and 55.90 ± 10.81 (SPAD) for *Sesamum*. Similarly, the nitrogen content was also more in plants treated with VAM + Panchagavya + *Azospirillum* and the values observed were 17.03 ± 1.53 mg/g for *Arachis* and 20.37 ± 3.42 mg/g for *Sesamum*. *Sesamum* seemed to contain more chlorophyll and nitrogen content.

Vitamin E in seeds

The groundnut as well as sesame seeds contain Vitamin E in it. So, an attempt was made to estimate the Vitamin E content in the seeds obtained from control plant and plants treated with various bio-fertilizers and tabulated (Table 3). In the seeds of control plant of groundnut, the Vitamin E content was more (4.0 mg/dl). Among the various treatments, the Vitamin E content was found to be more in seeds obtained from groundnut plants treated with *Azospirillum* (3.6 mg/dl). In case of the sesame seeds, more Vitamin E content

Table 1: Chlorophyll (SPAD) content of *Arachis hypogeae* L. and *Sesamum indicum* L. on the 30th day.

Treatments	*Arachis hypogeae* L.	*Sesamum indicum* L.
T_0 (Control)	35.53 ± 0.85	44.73±9.55
T_1 (VAM)	44.27 ±5.34	53.13±5.60
T_2 (Panchagavya)	45.17 ± 5.73	46.10±2.65
T_3 (*Azospirillum*)	43.50 ± 2.42	49.50±4.77
T_4 (VAM+Panchagavya+Azospirillum)	45.53 ± 4.82	55.90±10.81
SEdCD(P<0.05)	3.48707.7695	5.992613.3525

Values are given as mean ± SD from 3 samples in each group.

Table 2: Nitrogen (mg/g) content of *Arachis hypogeae* L. and *Sesamum indicum* L. on the 30thday.

Treatments	*Arachis hypogeae* L.	*Sesamum indicum* L.
T_0 (Control)	13.90 ±0.30	11.83±9.11
T_1 (VAM)	16.67 ±1.70	19.47±1.82
T_2 (Panchagavya)	16.97 ±1.83	17.23±0.85
T_3 (*Azospirillum*)	16.43 ±0.76	18.33±1.50
T_4 (VAM+Panchagavya+Azospirillum)	**17.03 ±1.53**	**20.37±3.42**
SEdCD(P<0.05)	1.11262.4789	3.66968.1765

Values are given as mean ± SD from 3 samples in each group.

Table 3: Vitamin E content (mg/dl) in the seeds of *Arachis hypogeae* L. and *Sesamum indicum* L.

Treatments	*Arachis hypogeae* L. (mg/dl)	*Sesamum indicum* L. (mg/dl)
T_0 (Control)	**4.0**	1.5
T_1 (VAM)	3.0	**1.8**
T_2 (Panchagavya)	3.1	1.0
T_3 (*Azospirillum*)	**3.6**	1.2
T_4 (VAM+Panchagavya+Azospirillum)	3.3	**1.7**

was observed in the plants treated with VAM fungus (1.8 mg/dl). Second higher reading was observed in T4 (1.7 mg/dl).

Studies by Gharib *et al*. (2008) on the effect of compost and bio-fertilizers on the growth, yield and essential oil of sweet Marjoram plant have shown an increase in oil percentage and yield per plant as a result of aqueous extract of compost at low level + Bio-fertilizers. Naturally occurring Vitamin E are synthesized by photosynthetic organisms and functions as antioxidants (Hunter and Cahoon, 2007). The tocopherols (Vitamin E) are lipophilic antioxidants synthesized by all the plants and are particularly abundant in seeds (Satler *et al.,* 2004). Now-a-days, bio-fertilizers have emerged as a highly potent alternative to chemical fertilizers due to their eco-friendly, easy to apply, non-toxic and cost effective nature (Mazid and Khan, 2014).

Groundnut seeds are a rich source of protein, sugars and oil. Earlier studies by Shad *et al*. (2009) have proved its higher calorific score as compared to most of the other legumes. On the basis of the results obtained and the discussion made so far, it may be concluded that application of the organic fertilizer or bio-fertilizer is the most effective way to increase the chlorophyll, nitrogen content and Vitamin E in both the test crops studied. Hence, the use of and management of natural resource in sustainable agriculture, the microbial fertilizers hold vast potential for future. The conclusion is based on only pot culture experiments. Further studies in the field are required to strongly support the current investigation.

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