ISSN : 0974 - 7435 Volume 5 Issue 4

Trade Science Inc.

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 5(4), 2011 [262-265]

Study on the level of antioxidases at various time intervals of selected medicinal plants

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Received: 21st May, 2011 ; Accepted: 21st June, 2011

ABSTRACT

Antioxidases play an important role in prevention of oxidative stress. Oxidative stress is a state of imbalance between generation of Reactive Oxygen Species like hydroxyl and superoxide radical, and the level of antioxidant defense system. Antioxidases prevent damage of biopolymers including nucleic acids, proteins, polyunsaturated fatty acids and carbohydrates caused by ROS. Further, antioxidants are believed to be important in the prevention of many diseases such as cardiovascular disease, diabetes, liver diseases and cancer. In 1960's Green revolution in India has witnessed a jump in agricultural production with the introduction of high yielding varieties of various crops and by following intensive cultivation practices with the use of fertilizers, pesticides and other inputs. The intensive use of inputs has not only polluted the soil, water and the environment causing their slow degradation but also affected the human beings due to the presence of insecticide and pesticide residues in food produce. The use of organic manures like farmyard manure and vermicompost improves physical, chemical and biological properties of the soil. It also sustains biological production, provides safe and nutritious food and phytochemicals from food crops and medicinal plants respectively. Therefore, the present investigation was aimed to study the effect of farmyard manure and vermicompost and the comparison with inorganic fertilizer on the level of antioxidases namely peroxidase and catalase of two selected medicinal plants namely *Cinnamomum verum* and *Acorus calamus.* The manural potential of three manures: inorganic fertilizers, farmyard manure and vermicompost on enzyme activity was evaluated at different time intervals (25, 50 and 75 days after planting). Our results revealed that the level ($p<0.05$) of peroxidase and catalase were found to be significantly higher in vermicompost applied plants when compared to control and other treatments.

KEY-WORDS

Vermicompost;
Farmyard manure;
Inorganic fertilizer;
Medicinal plants.

INTRODUCTION

Traditional medicine based on the plants has played a key role in the health care system of our country. Medicinal plants play an important role in the development of potent therapeutic agents. Herbal drugs form the backbone of the invaluable traditional medical practices. Recently interest in medicinal plant research has increased all over the world. It has been reported that medicinal plants used in various traditional systems have immune potential against various diseases.

Oxidative damage is one of the major causes of many diseases. A free radical is a molecule with an unpaired electron. The molecule, which losses an electron, becomes free radicals giving rise to a self- perpetuating chain system[1]. The majority of free radicals initiates the chain reaction and damages the cells and its components. Preventing oxidative damage is the simple and effective way of preventing any disease. Antioxidants are able to give free radicals an electron, which becomes a companion to their unpaired electron, thus eliminating the threat of leading to diseases.

Antioxidants are any substances that delays or inhibits oxidative damage to a target molecule. The antioxidants protect the cells against ROS toxicity by preventing ROS formation, interception of ROS attack by scavenging the reactive metabolites, converting them to less reactive molecules, by enhancing the resistivity of sensitive biological targets to ROS attack, facilitating the repair of damage caused by ROS and finally by providing a favorable environment for the effective functioning of other antioxidants. Many chemotherapeutics agents are used in the treatment of various diseases but are facing problems of side effects and therapy is quite costly. Ethnobotanical search reveals use of many traditional herbs in treatment of diseases which are usually free from or having minimum side effects[2].

The modern inorganic farming system with the input of synthetic fertilizer has resulted in the rapid destruction of soil structure, fall of fertilizer response on continuous usage, loss of beneficial microorganism with subsequent microbial nutrient recycling system and above all the human health hazardous substance as pesticide and insecticide residue in the food produce. Inorder to overcome these problems faced, organic farming is adopted now- a- days which avoids or largely excludes the use of compound chemicals such as chemical fertilizers/pesticides and herbicides, instead natural sources such as organic manures are used[3]. Organic farming is a system of natural farming which fulfills the food, nutrition and pharmaceutical needs of society without depleting essential natural resources of agriculture, water, soil fertility and diverse biological reserves. Vermitechnology is an important aspect of biotechnology involving the use of earthworms for processing of various types of organic wastes into valuable resources[4]. Vermicomposting refers to composting biodegradable organic matter with earthworms. Vermicomposting helps to process wastes simultaneously giving biofertilizers and proteins. Thus vermitechnology could be successfully used both to clean the environment as it uses waste as raw materials and to change polluted, costly chemical farming to sustainable agriculture simultaneously[5]. Selection of earthworm species is very important factor because only few species are able to survive and adjust to a particular type of environment[6].

Since medicinal plants play a vital role in maintaining health, to control and to cure certain diseases, an attempt was made to study the effect of inorganic fertilizer, farmyard manure and vermicompost on the enzymatic levels of peroxidase and catalase at different time intervals in the two selected medicinal plants namely *Cinnamomum verum* and *Acorus calamus*. Both of these plants are used widely for the treatment of cough, bronchitis and other respiratory diseases.

MATERIALS AND METHODS

The stem cuttings of *Adhatoda vasica* and *Solanum trilobatum* were collected from Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamilnadu, India. The selected medicinal plants were cultivated during late winter and early summer (i.e during the months of January and February) to attain the optimum growth. The stem cuttings of *Adhatoda vasica* and *Solanum trilobatum* were planted in eight different pots as follows.

T_1 - Control (without any manure)
T_2 - Inorganic Manure (NPK 1:1:1 ratio)
T_3 - Farmyard Manure
T_4 - Vermicompost

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For *Adhatoda vasica* and *Solanum trilobatum* four stem cuttings of each were planted in eight different pots containing various manures and watered regularly. The activity of peroxidase and catalase were assayed on the 30th, 60th and 90th day after planting according to the procedure described[7,8].

STATISTICAL ANALYSIS

For the purpose of statistical analysis, Duncan's multiple range test was applied for comparing treatments.

RESULTS AND DISCUSSION

The efficiency of inorganic fertilizer, farmyard manure and vermicompost on the levels of peroxidase and catalase which involved in the detoxication of reactive oxygen species in the two selected medicinal plants at different time intervals were quantified and are depicted in TABLE 1.

Based on the data presented in TABLE 1, it is evident that the level of peroxidase and catalase were less in inorganic fertilizer applied medicinal plants when compared to farmyard manure and vermicompost applied plants. The inorganic fertilizer contains mainly macronutrients namely nitrogen, phosphorus and potassium. Besides the macronutrients, micronutrients are also required in minute quantities for the proper synthesis of the enzymes. Since inorganic fertilizer lacks micronutrients, the plant has to uptake the micronutrients from the soil for the synthesis of the enzymes and continuous uptake of micronutrients from the soil leads to decline in soil fertility thus resulting in reduced production of the enzymes peroxidase and catalase.

TABLE 1 : Level of peroxidase and catalase at different time intervals of selected medicinal plants as influenced by manures

	Treatment	*Adhatoda vasica*			*Solanum trilobatum*		
		30 days	60 days	90 days	30 days	60 days	90 days
Peroxidase	Control	0.547c	0.529a	0.407a	0.540b	0.520a	0.410bc
	Inorganic fertilizer (NPK)	0.690ab	0.562a	0.420a	0.599b	0.485a	0.440c
	Farmyard Manure	0.612bc	0.592a	0.444a	0.629ab	0.592a	0.499c
	Vermicompost	0.755a	0.700d	0.629b	0.726c	0.628c	0.590a
Catalase	Control	0.628c	0.512d	0.510d	0.710d	0.692d	0.599d
	Inorganic fertilizer (NPK)	0.715d	0.612b	0.592b	0.806b	0.790b	0.628b
	Farmyard Manure	0.805b	0.716c	0.678c	0.896c	0.804c	0.710c
	Vermicompost	0.923a	0.809a	0.710a	0.962a	0.912a	0.810a

Values are means of four replicates

In a column means followed by a common letter are not significantly different at the 5% level by two way anova of DMRT.

Units

Peroxidase - μMoles/min/mg protein

Catalase - Decompostion of μmoles H_2o_2 /min/mg protein

Farmyard manure is the most commonly used organic manure. Unlike inorganic fertilizer, it contains various essential micronutrients in addition to macronutrients. That's why we observed higher levels of peroxidase and catalase in farmyard manure treated plants than inorganic fertilizer treated plants. But low levels of peroxidase and catalase were found in farmyard manure applied plants because farmers generally rely on animal dung for manure making (farmyard manure) by dumping in a pit or a heap near the dwellings on the roadside without proper attention and maintenance. Since the process of composting is not controlled, a poor quality farmyard might be formed with lower benefits in macro and micronutrients.

Vermicompost is a potential organic manure rich in plant nutrients compared to farmyard manure and inorganic fertilizers in respect to supply of macro and micronutrients, which have stimulatory effect on the enzymatic activity of peroxidase and catalase and thus resulting in higher levels of peroxidase and catalase in vermicompost applied plants. Increased levels of enzymatic activity enhanced the level of biochemical contents that not only result in better and quick growth of the plant, but also enhance the medicinal property[9].

CONCLUSION

Vermicompost, a heterogeneous mixture with worm cast and many useful immobilized microbes, is considered as a highly efficient cost effective, ecologically sound, nutrient rich input for the growth of plants. Vermicompost not only helps to stimulate plant growth by improving the soil quality and fertility but also enhance the nutritive and pharmaceutical value by synthesizing higher antioxidases.

REFERENCES

[1] R.E.Shackelford, W.K.Kaufamann, R.S.Paules; Free Radical Biol.and Med., **28**, 1387 **(2000)**.

[2] N.H.Indurwade, K.R.Biyani, S.B.Kosalge, V.V.Redasani, R.Khade; Drug Lines, **7**, 13-14 **(2005)**.

[3] A.S.Dhawan, M.S.Deshmukh; Kisan World, **32**, 27-28 **(2005)**.

[4] O.P.Lal, Y.N.Srivastava, S.R.Sinha, Vermicomposting; Indian Farming, **52**, 6-8 **(2003)**.

[5] M.L.Prabha, I.A.Jayaraaj, R.Jeyaraaj, S.D.Rao; Eco Friendly Solid Waste Management Through Vermitechnology, In: Proceedings of National Level Seminar on Challenges for Green Environment, Begum, M.Sivraj, R.Kalyani, Vadivel, (Eds); 36 **(2006)**.

[6] M.S.Priya, M.L.Priya; Advanced Biotech., **10**, 21-24 **(2011)**.

[7] J.Putter; In: Methods of Enzymatic Analysis, Bergmeyer, (Ed); Academic Press, New York, 685 **(1974)**.

[8] A.K.Sinha; Analytical Biochem., **11**, 469 **(1972)**.

[9] S.Sharma, K.Pradhan, S.Satya, P.Vasudevan; The Journal of American Science, **1**, 4-16 **(2005)**.