Original Research Paper

Volume-9 | Issue-1 | January-2019 | PRINT ISSN - 2249-555X

Agricultural Science

STUDY THE COMPARATIVE IMPACT OF VERMICOMPOST AND CHEMICAL FERTILIZERS ON THE ANTIOXIDANT PROPERTIES OF *ABELMOSCHUS ESCULENTUS* L.

Chandni Mishra Department of Chemistry, Govt. Gitanjali Girls P.G. College, Bhopal, India

H C Katariya* Department of Chemistry, Govt. Gitanjali Girls P.G. College, Bhopal, India
*Corresponding Author

ABSTRACT The aim of the present study was to investigate the impact of vermicompost and chemical fertilizers on accumulation of essential secondary metabolites and their antioxidant activity. Three different treatments with combination of chemical fertilizers and vermicompost were prepared in this study. DPPH and nitric oxide scavenging assay were performed for antioxidant activity. The results of the study revealed that the use of vermicompost resulted in higher production of secondary metabolites and increased antioxidant activity compared to the use of chemical fertilizers. Okra plants supplemented with vermicompost were found to exhibit better antioxidant activity.

KEYWORDS : Abelmoschus esculentus, Vermicompost, DPPH, nitric oxide scavenging activity, antioxidant assay.

INTRODUCTION

As India is one of the major agriculture based country in the world. Heavy use of agrochemicals since the "green revolution" of the 1960s boosted food productivity at the cost of environment & society. It has badly ruined the soil, food and water quality. Therefore farmers are in search of alternative of these agrochemicals which can replenish the damage caused by them.

For this reason a revolution is unfolding in vermiculture studies for vermicomposting of diverse organic wastes by waste eater earthworms into a nutritive "organic fertilizer" and using them for production of chemical free safe food in both quantity & quality without recourse to agrochemicals [1].

Vermicomposts are products of a nonthermophilic bio-degradation of organic materials through interactions between earthworms and microorganisms. They provide many benefits to agricultural soil, including increased ability to retain moisture, better nutrient-holding capacity, better soil structure and higher levels of microbial activity. The process of vermicomposting tends to result in higher levels of plant availability of most nutrients than does the conventional composting process [2].

Unlike compost, vermicompost is produced under mesophilic conditions, and although microorganisms degrade the organic matter biochemically, earthworms are the crucial drivers of the process, as they aerate, condition and fragment the substrate, thus drastically altering the microbial activity. Earthworms act as mechanical blenders, and by fragmenting the organic matter they modify its physical and chemical status by gradually reducing the ratio of C:N and increasing the surface area exposed to microorganisms - thus making it much more favourable for microbial activity and further decomposition [3].

Abelmoschus esculentus L. (Moench) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world.The crop is from West African origin, annual or perennial up to 0.5m-4m tall, heat and drought tolerant.In India, Abelmoschus esculentus L. (Moench) popularly known as Bhindi is an important warm season vegetable crop cultivated [4].

It is an oligo purpose crop, but it is usually consumed for its green tender fruits as a vegetable in a variety of ways. Adaptability to a wide range of soil and climatic conditions, suitability for year round cultivation has made bhindi a popular vegetable. It is well for its antioxidants and provides an important source of vitamins, calcium, potassium and other minerals. The mature okra seed is a good source of oil and protein has been known to have superior nutritional quality [5,6].

An antioxidant is a molecule stable enough to donate an electron to a rampaging free radical and neutralize it, thus reducing its capacity to damage. These antioxidants delay or inhibit cellular damage mainly through their free radical scavenging property [7]. Antioxidants significantly delay or prevent oxidation of oxidizable substrates when present at lower concentrations than the substrate [8]. Free radicals are chemical species possessing an unpaired electron that can be considered as fragments of molecules and which are generally very reactive. They are produced continuously in cells either as accidental by-products of metabolism or deliberately during, for example, phagocytosis [9].

Soil treated with vermicompost enhanced the soil quality in comparison to chemical fertilizers. Hence, the present study was conducted to analyze the effect of vermicompost on the growth pattern of lady finger and its antioxidants.

The aim of the study was to determine the effect of vermicompost and chemical fertilizers on the antioxidant properties of *Abelmoschus esculentus* L.

MATERIAL AND METHOD

To study the effect of vermicompost and chemical fertilizer on *Abelmoschus esculentus* L, certified and healthy seeds were collected from the local market of Bhopal. Three treatments with three replicates were prepared (T1- Control soil without compost, T2- Soil with Vermicompost in 1:1 and T3- Soil with chemical fertilizers (Urea @ 5% and DAP @20%). After seedlings of *Abelmoschus esculentus* L were transplanted into pots of equal size 20 cm in height and 6 cm in dm. The pots were provided with water facilities. The pots were maintained in the open shade at the temperature of 27°C - 30°C. After one month of growth some plants were removed from all samples and studied for the quality and quantity of phytochemical [10].

PREPARATION OF PLANT MATERIAL

The fresh fruits *Abelmoschus esculentus* L plant was washed under running tap water to remove dust. The plant samples were then air dried and crushed into powder for extraction. The fruit powder was taken in a Jar and extracted with distilled water. The solution, then filtered with the help of muslin cloth used for further phytochemical analysis [11].

NITRIC OXIDE FREE RADICAL SCAVENGING ACTIVITY

Nitric oxide scavenging assay was performed with the method of Singh et al., 2012 [12]. Plant extract was dissolved in distilled water for this quantification. Sodium Nitroprusside (5mM) in standard phosphate buffer saline (0.025m, pH 7.4) was incubated with different concentration (100-400µg/ml) of methanol extract and tubes were incubated at 29oC for 3 hours. Control experiment without the test compounds but with equivalent amount of buffer was conducted in an identical manner. After 3 hours incubated samples were diluted with 1 ml of Griess reagents. The absorbance of the colour developed during diazotization of Nitrite with sulphanilamide and its subsequent coupling with Napthylethylenediaminehydro-chloride was observed at 550nm on spectrophotometer. Same procedure was done with ascorbic acid which was standard in comparison to methanol extract. Calculated the % inhibition by formula and plot graph in compared to standard. The antioxidant capacity was estimated using following formula:

Antioxidant effect (%) = [(control absorbance - sample absorbance)/ (control absorbance)]x100

DPPH RADICAL SCAVENGING ASSAY

The 2,2-diphenylpicrylhydrazyl (DPPH) assay is widely used in plant biochemistry to evaluate the properties of plant constituents for scavenging free radicals. The method is based on the spectrophotometric measurement of the DPPH concentration change resulting from the reaction with an antioxidant [13].

Different conc. (200, 400, 600, 800, 1000 µl) of each of the ethanol extract of seeds and leaves, as well as ascorbic acid were taken in separate test tubes and the volume was uniformly made up to 1000 µl with distilled water. To each tube 1ml of DPPH (0.004% in ethanol) was added. Then reactions were incubated at room temperature for 30 min, and the absorbance was measured at 520nm. The similar procedure was repeated with water as blank which served as control. Ascorbic acid was used as standard (1mg/ml).

RESULTS AND DISCUSSION

The results of the present study showed highly significant differences in nitric oxide scavenging properties of okra due to the effect of vermicompost and chemical fertilizers (Figure 2). L- ascorbic acid was used as positive standard (Figure 1) for NO scavenging. Three different treatments with combination of vermicompost and chemical fertilizers selected for comparative study. The results show the positive effect of vermicompost on the antioxidant properties of *Abelmoschus esculentus* L as compare to chemical fertilizers. The results is agreement with previous studies done on the effect of different fertilizers on phytochemicals and antioxidant activities. Similar work done by Ligoriya Mary and Nithi, 2015 [14]. They reported the effect of organic and inorganic fertilizer on growth, phenolic compounds and antioxidant activity of *Solanum nigrum L.* Their study has shown that organic fertilizer produced a higher effect on *Solanum nigrum* leaf when compared with inorganic fertilizer. Yusof et al., 2018 [15] studied the comparative effect of chemical fertilizer and vermicompost on improvement and stability of bioactive components of *Clinacanthus nutans*. The extract from plants treated with vermicompost showed better stability compared with chemical fertilizer and control.

Vermicompost produced a higher effect on accumulation of plant secondary metabolites like phenol, flavonoids and alkaloids which is responsible for antioxidant activity [16]. The significant variation in DPPH activity is summarized in Figure 4. Our findings indicate the highest percentage of scavenging activity in vermicompost treated okra plants. Similarly, Ibrahim et al., 2013 [17] reported the impact of organic and inorganic fertilizers on extract of *Labisia pumila* Benth by DPPH and FRAP activities. They used chicken manure as organic compost and recorded enhancement in secondary metabolites and antioxidant activity. Vermicompost have similar or even better qualities than farmyard manure and that they can contribute to the improvement of nutritional values of vegetable [18].

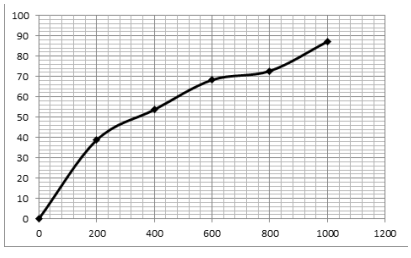

FIGURE 1 STANDARD GRAPH OF L- ASCORBIC ACID FOR NITRIC OXIDE SCAVENGING ASSAY

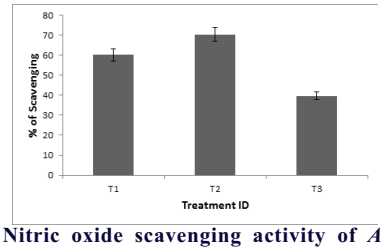

Figure 2 Nitric oxide scavenging activity of *Abelmoschus esculentus* L grows under T1, T2 and T3 treatment conditions

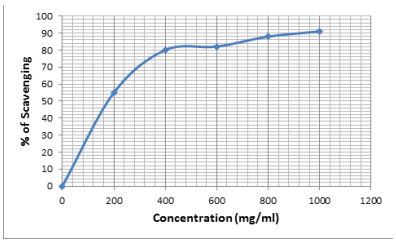

FIGURE 3 STANDARD GRAPH OF L- ASCORBIC ACID FOR DPPH SCAVENGING ASSAY

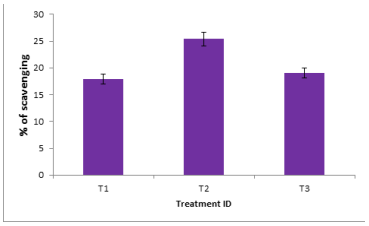

Figure 4 DPPH scavenging activity of Abelmoschus esculentus L grows under T1, T2 and T3 treatment conditions

CONCLUSION

In the present study, it was observed that the use of vermicompost resulted in higher production of secondary metabolites and increased antioxidant activity compared to the use of chemical fertilizers. Okra plants supplemented with vermicompost were found to exhibit better antioxidant activity. Thus, the idea that organic manures have the potential to support the development of plant species is strengthened when are used as part of the growing media. The study also supports, the better human health.

REFERENCES

[1]. Adhikary S. Agricultural Sciences, 2012, vol.3, no.7, 905-917.
[2]. Sallaku G, Babaj I, Kaciu S and Balliu A. Journal Of Food, Agriculture & Environment, 2009, vol.7 (3&4) : 869 - 872 .
[3]. Dominguez J, Aira M and BrandOn G. Vermicomposting: earthworms enhance the work of microbes. In: h. Insam, i. Franke-whittle and m. Goberna, (eds.), microbes at work: from wastes to resources (pp. 93-114), 2010. Springer, berlin heidelberg.
[4]. Sundari S and Gandhi A. International Journal Of Recent Scientific Research, 2013, vol. 4, issue, 5, pp. 568 - 571.
[5]. Kumar S, Tony E, Kumar P, KumarA, Rao BS, Nadendla R. Int. Res j pharm. App sci; 2013, 3(4):129-132.
[6]. Rekha B and Mahavishnan K,. Agric. Rev., 2008, 29 (4): 298 – 305.
[7]. Lobo V, Patil A, Phatak A, and Chandra N. Pharmacogn Rev, 2010, 4(8): 118–126.
[8]. Kasote DM, Katyare SS, Hegde MV, and Bae H. Int J Biol Sci., 2015, 11(8): 982–991.
[9]. Cheeseman KH, Slater TF. Br Med Bull., 1993, 49(3):481-93.
[10]. Mishra C and Katatiya HC. European Journal of Pharmaceutical and medical research, 2018, 5(5), 540-543.
[11]. Ofosu-Anim J, Blay ET, and Frempong ME, Journal of Applied Horticulture, 2006, 8(2): 155-158,
[12]. Singh D, Mishra M, Gupta M, Singh P, Gupta A, Nema R. International Journal of Pharmacy and Pharmaceutical Science Research, 2012, 2(3) 42-44.
[13]. Pyrzynska K and Pękal A, Application of free radical diphenylpicrylhydrazyl (DPPH) to estimate the antioxidant capacity of food samples. Analytical Methods, 2013.
[14]. Ligoriya Mary AJ and Nithiya T, World Journal Of Pharmacy And Pharmaceutical Sciences, 2015, Volume 4, Issue 05, 808-822.
[15]. Yusof Z, Ramasamy S, Mahmood NZ, ID and Yaacob ZS. Molecules 2018, 23, 1345; 1-13.
[16]. Moreno-Resendez A, Parcero-Solano R, Reyes-Carrillo JL, Salas-Perez L, Food and Nutrition Sciences, 2016, 7, 1401-1413.
[17]. Ibrahim MH, Jaafar H, Karimi E and Ghasemzadeh A, Molecules, 2013, 18, 10973-10988.
[18]. Bimova P, Pokluda R. Hort. Sci. (Prague), 2009, 36, (1): 21–25.