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Effect of vermicompost extract on seed germination and seedling growth of some leafy vegetables

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Abstract: - Green leafy vegetables are rich in macronutrients and micronutrients available at low cost throughout the year. The influence of vermicompost extract on the germination and seedling growth of three different leafy vegetables such as Amaranthus dubius, Amaranthus cruentus and Trigonella foenum – graecum were studied. The result showed that germination rate, shoot height, root length; fresh and dry weight increased considerably after the seeds were soaked at 50% concentrations of vermicompost extract. Maximum germination rate (98%), highest shoot (6.85cm) and longest root length (3.4cm) were recorded for the seeds of Trigonella foenum – graecum. Similarly, 50% concentration of vermicompost extract increased fresh and dry weights of all the seedlings. The present study revealed that application of vermicompost extract improves the germination rate and seedling growth of leafy vegetables.

Keywords : **Leafy vegetables, vermicompost extract, germination, seedling growth**

INTRODUCTION

Modernization of agricultural practices such as using of pesticides, fertilizers, growth promoters etc has led to improved production of crops. But prolonged application of these chemicals in the soil has led to depletion of soil nutrients and increased pollution making these kinds of method non-preferable in the long run. Sustainable agricultural production, especially in organic agriculture, requires new means of fertilisation and plant protection. The use of variety of fertilizers and other products derived from organic waste is extremely promising in light of renewable resource utilisation.

Kale, 1998, reported the vermiwash contains enzymes and secretions of earthworms and would stimulate the growth and yield of crops. Another interesting and possible nutrient is the humic acid which is now looked upon as a plant growth supplement. It is known to improve soil fertility, increase the water holding capacity thereby affect the plant growth and yield. It also helps the plants to resist droughts and stimulates seed germination (Salman et al., 2005).

Among the various organic fertilizers, vermicompost has been regarded as a safe, clear and efficient soil fertilizer. Vermicompost is derived from agricultural wastes such crop straw, cow dung, leftover food and so on (Arancon et al., 2005). Its application to plants is believed to be highly beneficial for plant growth (Rakesh et al.,2015).

Vermicomposts are products derived from the accelerated biological degradation of organic wastes by earthworms and microorganisms. Earthworms consume and fragment the organic wastes into finer particles by passing them through a grinding gizzard and derive their nourishment from microorganisms that grow upon them. The process accelerates the rates of decomposition of the organic matter, alter the physical and chemical properties of the material, leading to a humification effect in which the unstable organic matter is fully oxidized and stabilized (Albanell et al., 1988; Orozco et al., 1996).

Vermicompost contains a lot of mineral nutrients, active soil enzymes and microbes (Dominguez, 2004). Vermicomposts improve seed germination, seedling vigor, and plant productivity more than what would have been possible from inorganic mineral nutrient sources, while using as little as 10–40 % of the total plant rooting volume (Subler et al.1998; Gopalakrishnan et al., 2012; Alsina et al., 2013).

To scientifically define vermicompost fertiliser as an alternative type of organic fertiliser, more studies related to its favourable effects on plant growth, crop yield, and quality are needed, although there are already a considerable number of studies on the effects of compost fertilisers on plant growth and soil (Vivas et al., 2009; Lazcano et al., 2008; Lazcano and Domínguez, 2011).

Application of aqueous extract of vermicompost (vermicompost tea) has shown to improve plant health, crop

yield, and nutritive quality (Gamaley et al., 2001; Pant et al., 2009). Effects of vermicompost treatment tried to be determined on some morphological and physiological seedlings quality characteristic of one year Scot pines (Atik and Yilmaz ,2014)

Green Leafy Vegetables are rich in macro nutrients and micronutrients, available at low cost or no cost throughout the year and are the cheapest of all the vegetables within the reach of poor man, being richest in their nutritional value and also the medicinal values of greens are good for health, increase the blood level, clear vision, to cure sore in the stomach and mouth, prevent the jaundice, cure the heart diseases, release the knees pain, sugar disorder and the greens are good food for children and give essential nutrient for pregnant women (Rao et al., 1980 and Saxena, 1999). Amaranthus dubius is a stimulant and an aphrodisiac, rejuvenator, strengthens the tissues of the body, cure fever, cough and rheumatism.

Red Amaranth is the richest source of protein, Vitamin A, B6, K and C and also good source of folate and minerals. It boost up the immune system and have many more health benefits.

Many vegetable crops particularly the leafy vegetables are mainly consumed for their nutritional values without much consideration for their medicinal importance. In view of the advantages posed by vermicompost exract as growth supplements for plants, the present study is undertaken to study the effect of this extract on seed germination and seedling growth of the leafy vegetables.

MATERIAL AND METHODS

Study plants

Amaranthus dubius Marx. ex Thell.

It is an annual herb, Wild and cultivated Leafy vegetable Inflorescence spike like or paniculate, glomerules more or less isolated at base of inflorescence and clustered towards apex; leaves broadly triangular blade down; female flowers 5 tepals; Fruit an ovoid-urceolate capsule, dehiscing circularly, blackish seeds. It belongs to family Amaranthaceae.

Amaranthus cruentus L. An erect herb, 30-60 cm in high; branchlets grooved. Leaves simple, alternate, ovate, lanceolate or oblong, entire, glabrous above, main nerves numerous. Flowers small, sessile, in axillary spikes. It belongs to family Amaranthaceae.

Trigonella foenum - graecum (Linn.) Fenugreek is a aromatic, 30-60 cm tall, annual herb, belongs to the family Papilionaceae. A nearly smooth erect annual. Stipulets not toothed. Leaflets 2-2.5 cm long, oblanceolate-oblong, toothed. Flowers 1-2, axillary, sessile. Calyx-teeth linear. Corolla much exserted. Pod 5-7.5 cm long, with a long persistent beak, often falcate, 10-29 seeded, without transverse reticulations.

Seeds of above said leafy vegetables were soaked for 17 hrs in different concentrations of vermicompost extracts (25%, 50%, 75% and in water (0%). Treated seeds were sown in pots containing garden soil. Media were sprayed once at the time of sowing with the respective concentration of vermicompost extract that was used for soaking the seeds. Plants were allowed to grow in the greenhouse. Seed germination rate was recorded after 3 days. Seedlings were harvested after 7days of planting. Ten seedlings of different leafy vegetables in each treatment were randomly selected for the measurement of root and shoot length on the 7th day of germination and expressed in cm.

RESULTS AND DISCUSSION

The results showed that soaking of seeds in aqueous extract of vermicompost at lower concentration (50%) had significant effect on the germination and seedling growth of leafy vegetables. Table 1 shows an effect of vermicompost extract on seed germination rate.

Maximum germination rate was recorded for the seeds growing in 50% concentration of vermicompost extract. Among the studied leafy vegetables, seeds of Trigonella foenum – graecum showed highest

S.No	Plant samples	% of Seed germination			
		Control	25%	50%	75%
1.	*Amaranthus dubius*	56%	61%	74%	52%
2.	*Amaranthus cruentus*	76%	80%	92%	70%
3.	*Trigonella foenum–graecum*	84%	90%	98%	84%

Table-1.Effect of different concentrations of vermicompost extract on Seed germination

germination rate (98%) at 50% concentration. Seeds soaked at higher (75%) concentration showed decreased germination rate. Lowest germination rate (52%) was recorded for the seeds of Amaranthus dubius at higher concentration.

Vermicompost is reported to have bioactive principles which are considered to beneficial for root growth and this has been hypothesised to result in greater root initiation, higher germination, increased biomass, enhanced growth and development(Bachman and Metzger, 2008).

Highest shoot height (6.85cm) and longest root length (3.4cm) were recorded for the seeds of Trigonella foenum – graecum soaked at 50% concentration of vermicompost extract (Table-2).Vadiraj, 1992 noticed a significant increase in number of roots per plant, root length, plant height, number of leaves, fresh and dry weight of cardamom seedlings when vermicompost was used as potting mixture.

The results showed that lower concentrations (25% and 50%) improved the seed germination and seedling growth; whereas higher concentration (75%) of vermicompost extract had also shown inhibitory effect on seed germination and seedling growth, as compared to control.
Savalgi and Savalgi (1991) have also shown difference in number of roots, root length, shoot length and plant biomass in different doses of vermicompost on sorghum seed germination compared to control.

Similarly, 50% concentration of vermicompost extract increased fresh and dry weights

(Table-3) of all the seedlings. Application of aqueous extract of vermicompost (vermicompost tea) has shown to improve plant health, crop yield, and nutritive quality (Gamaley et al., 2001; Pant et al., 2009).

Germination rate and seedling growth decreased for the seeds soaked in 75% vermicompost extract. Greater proportions of vermicomposts in the plant growth medium have not always improved plant growth (Subler et al., 1998; Karmegam and Daniel, 2010).

Vermicompost preparations are increasingly used agricultural practice. There is a possibility of the crop plants are sensitive to negative effect of vermicompost at early stages of development.

Levinsh, 2011 found that vermicompost extract as watering solution showed positive effect on growth of bean and pea seedlings. And also reported that Germination response of vermicompost extract-imbibed seeds was clearly crop-species dependent. Hypocotyl growth of was stimulated by low and moderate vermicompost extract concentrations.

It is stated that both solid vermicompost and vermicompost extract contain number of both phenolic and humic nature, each with own dose and genotype dependent effect of seed germination and early stages of seedling development.

CONCLUSION

The present study showed that, compared with the control group, germination rate, shoot height and root length and fresh and dry weight of seedlings increased considerably after the seeds were soaked in vermicompost extract. From the study, it is concluded that soaking of seeds in vermicompost extract with optimum concentration resulted in maximum germination and better seedling growth of leafy vegetables. An application of vermicomposts in the field enhances the quality of soils by increasing microbial activity and microbial biomass which are key components in nutrient cycling, production of plant growth regulators and protecting plants from soil-borne disease and arthropod pest attacks. Our results confirmed that soaking of seeds in vermicompost extract is an effective practice to improve the germination percentage, germination rate, seedling growth and to get better crop yield.

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