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# Vermicompostng as Advocacy for Climate Change Due to Crop Production - A Review

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**Abstract**
In sub- Saharan Africa including Ethiopia, vermicompost is painstaking a valuable or organic fertilizer in many tropical areas, but has hardly been used. Organic litters after completion of decomposition returned to the soil can preserve, improves eminence, fertility and productivity through promising effect on soil physical, chemical and biological characteristics and other processes. Vermicomposting technology for composting of organic wastes is unusually effective for reduction in the processing time of decomposition and produce good quality compost in terms of nutritional contents. Vermicomposting serves as a significant factor of integrated plant nutrient supply system for balanced fertilization along with maintaining health to sustain the productivity of soils. Organic wastes returned to soil as vermicompost contribute to reduce the fertilizer requirement of the crop. Vermicomposting increase crop yield by many fold, these increased yield directly helps in minimization of cultivable land for the objective of crop production, so this can directly help for ecological conservation. More beneficial effects vermicomposting on yield and quality of crop are also highlighted in the review.

## INTRODUCTION

Current, alarming situation of soil degradation and declining crop yields, sustainability in agriculture with respect to maintenance of soil fertility and stabilized crop production year after year is the main concern.

Vermicomposting is a process that involves chemical, physical, and biological transformations of solid organic materials (agricultural residues of plant and animal origin) through the use of worms and microorganisms (Garg and Gupta, 2009). And it is an alternative to decreasing the amount of chemical fertilizers used by farmers. It is a simple and ecofriendly compounds based on the quick conversion of organic leftover into high quality compost "vermicompost" by earthworms "*Eisenia foetida* and *Eisenia andrei*" and other worms. Vermicompost recovers soil fertility and decreases using inorganic/chemical fertilizer. It also rises the rate of organic matter in the soil while strengthening the capacity of carbon sequestration by the soil.

Recycling of organic wastes is not only ecological necessity but in a country like Ethiopia, it is also an economical compulsion.

Composting is producing a biomass that is able to improve the structural properties of soil, increase its water capacity, increase its nutrients, support living soil organisms, and finally help organic materials return to the soil (Shilev *et al.,* 2006). Temperature, pH, carbon/nitrogen (C/N) ratio, oxygen, and moisture content are the important conditions to optimize biological activity (Roupas *et al.,* 2007). Vermicast (also called worm castings, worm humus, worm manure, or worm feces) is the end-product of the breakdown of organic matter by earthworms (Nagavallemma *et al.,* 2004)

In the past 30 years, the overuse of chemical fertilizers - along with a dependence on mono-cropping and inorganic pesticides - has reduced soil fertility. Furthermore, the production of chemical fertilizers requires high inputs of fossil fuels, and the application of chemical fertilizers accounts for up to 80% of human-related emissions of nitrous oxide, without benefiting from carbon sequestration in soils where it is applied. Community-level vermicomposting, on the other hand, only requires the use of fossil fuels when transported long distances. While vermicompost, like any organic fertilizer, does release trace amounts of nitrous oxide, its application leads to decades of increased carbon sequestration, water retention and soil fertility.

Climate change could be accelerated by dangerous feedbacks: melting of ice/snow on tundra’s reflect less light and absorb more heat, releasing more methane, which in turn increases global warming and melts more tundra; warming ocean water releases methane hydrates from the seabed to the air, warming the atmosphere and melting more ice, which further warms the water to release more methane hydrates; the use of methane hydrates or otherwise disturbing deeper sea beds releases more methane to the atmosphere and accelerates global warming; Antarctic melting reflects less light, absorbs more heat, and increases melting; and the Greenland ice sheet (with 20% of the world’s ice) could eventually slide into the ocean.

Without a global strategy to address climate change, the environmental movement may turn on the fossil fuel industries. The legal foundations are being laid to charge for damages caused by greenhouse gases. Climate change adaptation and mitigation policies should be integrated into an overall sustainable development strategy. Without sustainable growth, billions more people will be condemned to poverty, and much of civilization probably collapse, which is unnecessary since we know enough techniques and tactic to tackle climate change while increasing economic growth.

 

## IMPACT OF VERMICOMPOST ON CLIMATE CHANGE

Climate change poses a huge threat especially to dry land areas. Climate change causes prolonged droughts and erratic rainfall that is what our world is facing currently, which in turn leads to, a reduced water retention capacity of the soil, increased erosion and biodiversity loss. According to the UN Intergovernmental Panel on Climate Change (IPCC), large areas of Africa could be stricken by yield decreases of over 50% by the year 2020 as a result of an increasingly hotter and drier climate. This ultimately threatens food security and resilience of the inhabitants of the dry lands. Therefore, means have to be found to adapt to climate change. Now a day scientists are studying how to create sunshades in space, build towers to suck $CO_2$ from the air, sequester $CO_2$ underground and reuse carbon at power plants to produce cement and grow algae for biofuels.

Large-scale geoengineering, such as spraying aerosols into the atmosphere to reduce sunlight, could have unintended and irreversible side effects. Others have suggested new taxes, such as on carbon, international financial transactions, urban overcrowding, international travel, and environmental footprints. Such taxes could support international public/private funding mechanisms for high-impact technologies (Global futures studies & research, 2010)

The Clean Development Mechanism, the Reducing Emissions from Deforestation and Forest Degradation program, and the voluntary offset program are not fully utilized.

Africa's total ecological footprint is set to double by 2040 and needs about $675 billion by 2030 to achieve low-carbon sustainable growth; the current carbon market for mitigation is not sufficient to address then the regional focus will be on adaptation to climate change rather than mitigation.

For successful adaptation and to overcome the situation what we are going to face, optimal use of the scarce water resources and improvement of the conditions of the soil are a pre-requisite. Organic agricultural practices used in this case contribute to increase water efficiency and the building up of healthy soils, thereby increasing the elasticity of the people and the environment.

Compost that is incorporated into the soil will become part of the soil's long term carbon pool (sequestration). In addition, there are a number of indirect effects, such as, increased soil moisture holding capacity and a reduction in the need for fertilizers, pesticide.

The use of compost improve numerous greenhouse gas benefits, both directly through carbon sequestration and indirectly through improved soil health, reduced soil loss, increased water infiltration and storage, and reduction in other inputs. (Sharma and Campbell, 2003).

Since good composting practices minimize greenhouse gas emission. Therefore, the most important benefit of vermicomposting is avoiding the production of methane gas to the atmosphere.

## IMPORTANT WORMS FOR COMPOSTING

The supreme communal worms used in composting systems, redworms (*Eisenia foetida, Eisenia andrei,* and redworms (*Lumbricus rubellus*) feed most rapidly at temperatures of 15–25 °C (59-77 °F). They can survive at 10 °C (50 °F). Temperatures above 30 °C (86 °F) may harm them *(Appelhof and Mary, 2007)* this temperature range means that indoor vermicomposting with redworms is possible in all but tropical climates. (https://www.*vermicomposters.com*)

Other worms like Perionyx excavatus are suitable for warmer climates (*Selden et al; 2005)* If a worm bin is kept outside, it should be placed in a sheltered position away from direct sunlight and insulated against frost in winter.

These two species make great worms for the compost bin because they prefer a compost environment to plain soil, and they are very easy to keep. Worms that feed on vegetable waste, compost, and organic bedding produce richer casting than those feed on plain soil. (https://www.gardeningknowhow.com)

## EFFECT OF VERMICOMPOST ON SOIL

Earthworms play an important role in the process of soil formation and soil aggregation, mainly through the production of casts. Edwards and Bohlen (1996) reported that earthworm cast contains more water stable aggregate than the surrounding soil. Utilization of vermicompost (VC) in agricultural and environmental activities is related to the ability of this material to improve the chemical, physical, and biological soil conditions and to directly and indirectly improve the biological and agricultural plant yield. Therefore, vermicomposting has been used to remediate contaminated soils, to promote plant regulation, and to stimulate plant growth (García *et al.,* 2013b)

With respect to the use of vermicompost in soil remediation, it has been shown that its use, when based on olive cake compost, may promote a rapid decrease in the concentration of atrazine herbicides in the soil. This reduction occurs because vermicompost may stimulate microbial activity related to the degradation of these substances. The same results were not obtained when using only olive cake that was not previously composted, which indicates that atrazine degradation depends on the type of organic matter applied to the soil, and humic organic matter is more favorable to the degradation of this contaminant (Delgado-Moreno and Peña., 2009).

Vermicompost is richer in essential plant nutrients such as nitrogen, phosphorous and potassium than traditional compost. It also contains microbes that help plants growth. (www.gardeningknowhow.com)

Vermicompost contains an average of 1.5% - 2.2% N, 1.8% - 2.2% P and 1.0% - 1.5% K. The organic carbon is ranging from 9.15 to 17.98 and contains micronutrients like Sodium (Na), Calcium (Ca), Zinc (Zn), Sulphur (S), Magnesium (Mg) and Iron (Fe).

The production of potato (*Solanum tuberosum*) by application of vermicompost in a reclaimed sodic soil in India was studied and observed that with good potato growth the Sodicity of the soil was also reduced from initial 96.74 kg/ha to 73.68 kg/ha in just about 12 weeks. The average available nitrogen (N) content of the soil increased from initial 336.00 kg/ha to 829.33 kg/ha (Ansari, A.A., 2008). Vermicompost contains enzymes like amylase, lipase, cellulose and chitinase, which can break down the organic matter in the soil to release the nutrients and make it available to the plant roots (Chaoui *et al.,* 2003).

From various studies it is also, evident that vermincompost provides all nutrients in readily available form and enhances uptake of nutrients by plants. Soil available nitrogen increased significantly with increasing levels of vermicompost and highest nitrogen uptake was obtained at 50% of the recommended fertilizer rate. Uptake of nitrogen (N), phosphorus (P), potassium (K) and magnesium (Mg) by rice (*Oryza sativa*) plant was highest when fertilizer was applied in combination with vermicompost (Jadhav *et al.,* 1997)

## YIELD INCREASE DUE TO VERMICOMPOST ON SOME CROP

**Table: Yield Change due to Application of Vermicomposting Over Chemical Fertilizer**

| **Types of Crop** | Yield change due to Vermicomposting over inorganic fertilizer | |
|---|---|---|
| | Increased change in % | **Sources** |
| Wheat | 47 | Baker *et al.,* 2006 |
| Soybean | 51 | Baker *et al.,* 2006 |
| Pea (*Pisum sativum*) | 24.8 - 91 | (Meena *et al.,*2007) |
| Tomato | 22.8 | (Xin-Xin Wang *et al.,*2017) |
| Vines | 23 | **(**Buckerfield *et al.,*1998) |
| Potato | 59.5 | (Ansari,A.A;2008) |

## CONCLUSION

Since crop production is the major activities to sustain most of leaving organisms in these glob. However, crop production activities has negative impact in the ecosystem horizontal expansion of the cultivable land leads the loss of biodiversity, utilization of pesticide and chemical fertilizer to maximize the produce these decrease the quality of the environment. Now a day it is not the alternative way to produce crop through organically. Therefore, these review indicates that as the yield were increased in many fold with the application of compost and this increase is due to the modification capacity of organic compost. It is known that walking many kilometers start with single feet. Then if we increase the crop yield forever increasing population of the world through increasing the productivities of the specific land. Such activities directly helps for the life existing in the world.

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