

## Natural and Processed Organic Fertilizer

Hayat Ullah<sup>1\*</sup>, Maliha Sarfraz<sup>2\*</sup>, Arinah Muteen<sup>3</sup>, Ali Umar<sup>3</sup>, Misbah Ullah Khan<sup>4</sup>, Huma Nawaz<sup>3</sup>, Maria Bashir<sup>1</sup>, Ammara Sohail<sup>1</sup>, Muhammad Luqman<sup>3</sup>, Asad Rasheed<sup>3</sup>, Zeeshan Ulfat<sup>3</sup>, Aman Ullah<sup>3</sup> and Muhammad Saleem Khan<sup>3</sup>

<sup>1</sup>Department of Chemistry, University of Okara, Okara-56130, Punjab, Pakistan

<sup>2</sup>Department of Zoology, Wildlife and Fisheries, Sub-Campus Toba Tek Singh, University of Agriculture Faisalabad, Faisalabad-36050, Pakistan

<sup>3</sup>Department of Zoology, Faculty of Life Sciences, University of Okara, Okara-56130, Punjab, Pakistan

<sup>4</sup>Center for Nanoscience, University of Okara, Okara-56130, Pakistan

**\*Corresponding author:** Hayat Ullah, Department of Chemistry, University of Okara, Okara-56130, Punjab, Pakistan

Maliha Sarfraz, Department of Zoology, Wildlife and Fisheries, Sub-Campus Toba Tek Singh, University of Agriculture Faisalabad, Faisalabad-36050, Pakistan

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### ABSTRACT

There are many natural and processed organic fertilizers that are used in agriculture and this chapter aims to review their impact in a multi-disciplinary scheme. Organic fertilizers are mineral sources that are readily available in nature and contain enough essential plant nutrients. Slurry and manure are examples of natural fertilizers are organic in nature, while blood meal, bone meal, fish emulsion and compost are examples of processed organic fertilizers. When it comes to organic fertilizers, they are considered delayed release fertilizers since they release nutrients in smaller amounts over a longer period. A balanced amount of raw nitrogen is included in most organic fertilizers, making them suitable as a slow-release fertilizer. The use of organic fertilizers reduces groundwater contamination, eutrophication, and over-fertilization risks by virtue of their composition.

**Keywords:** Organic Fertilizer; Increase Soil Nutrients; Soil Fertility and Decrease Environmental Damage

### Fertilizer

There are two types of fertilizer used in the United States: natural and synthetic. Other soil additives, such as liming materials, may not be considered fertilizers. Naturally occurring and industrially manufactured fertilizers are both available. Potassium (K), Phosphorus (P) and Nitrogen (N), these three fundamental macronutrients that are very helpful in most current agricultural methods with micronutrient adjunct such as dirt rock being put on occasion. A variety of methods by which agronomist make use of apply these fertilizers such as liquid approaches dry, pelletized, hand-tool methods and heavy

agricultural equipment. The traditional methods of fertilizing included animal dung, compost, mined minerals, excrement, crop rotations or residue of industrial human-nature (i.e., blood meal from animal slaughter or fish processing waste). With advances in plant nutrition in the late 1800s, a synthetic fertilizer business sprang up. These changes enabled large-scale industrial agriculture with great yields. N-fixing chemical processes established during World War II, such as the Haber process, caused a surge in the industry. This has been a significant component is known as «Green Revolution» in the second half of 20th century, with usage of nitrogen fertilizer that

increasing by 800 percent between 1961 and 2019 [1]. In agriculture, synthetic fertilizer use has far-reaching environmental implications. Global warming is a direct result of land use practices or fertilizers that accompany them, on Climate Change and Land, IPCC Special has been reported [2]. So, fungicides, for example can destroy soil microbiomes and lead to toxin buildup in ecosystems. For example, natural gas fracking that is used in Haber process has an indirect impact on synthetic fertilizers. Large-scale industrial agriculture methods have been linked to habitat degradation and biodiversity pressure. Sustainable Development Goal basis on establishing a sustainable food production system or favorable climate on a global scale [3]. To address these problems, the majority of legislative and regulatory actions aim to move practices on agricultural toward regenerative or sustainable agricultural systems which utilize better soil management (such as no-till farming), fewer synthetic fertilizers, and better water management (i.e., no-till farming).

### Organic fertilizer

A natural fertilizer so called organic fertilizers contains carbon and is derived from natural resources. Plants and soil can benefit from fertilizers, which are substances that offer nutrients and promote development. All animal waste, plant-based fertilizers like compost, mineral sources including meat processing waste, slurry, guano, manure and biosolids these are big examples of common organic fertilizers [4]. Many non-chemical fertilizer options or abiotic are correspond to Organic Agriculture Principles are available. Animal wastes, peat, agricultural plant wastes and processed sewage sludge are examples [5,6].

### Natural Organic Fertilizers

Manures and other natural organic fertilizers are used by almost all farmers [7]. Horse, poultry, peanut husk and calf dung were frequently employed, either alone or in combination. Fish excrement is also used by some farmers for specific crops. Before planting, manure is usually applied. Most farmers have little experience with organic manure processing [8]. The type of crop, variety and season all influence the manure selection. It also depends on the soil chemistry and the farmers' previous observations and experience [9]. Many researches have been carried out with the goal of determining the agronomic potential of organic manure on various crop systems. Increased agricultural productivity will help farmers earn more money [10-13].

### Organic Manure

Animal excrement is the main source of organic manures (excluding green manure). In animal manures large quantities of nutrients are depending on species. As a result, in agriculture fields they are one of the most important organic fertilizer sources. Soil fertility are enhancing due to manure by providing nutrients like as

nitrogen that can be taken by soil microbes. Manure increases the water holding capacity or soil structure when applied to it. Depending on the soil chemistry, observation, farmer's previous experience, season, crop type, manures and organic fertilizers are almost always utilized in farming [9].

### Fish Manure

When compared to other types of ground or dried fish and manure is a good fertilizer with extensive ranges of applications. Plants are more resistant to bollworms and nematodes as a result, and fruits are better (rate of dry matter or coloration). Crops like lettuce and onions can benefit from fish excrement. During the wet season, fish feces cause sickness and have a terrible stench. A study was conducted using fresh dung samples from 12 commercial rainbow trout farms in Canada, Ontario to determine the chemical composition of fish feces. Fisherman's dung, on the other hand, has higher levels of Mn and Cd than lower levels of As, Se, Co, and Ni or many other livestock manures, but. Fresh fish excrement, according to this research, is chemically similar to other livestock manures and might be used as a fertilizer [14].

### Peanut Hulls Manure

If you want to avoid weed growth, you can use peanut shells as mulch (a covering such as straw, compost etc.) around your plants to stop enrich the soil. N, P or K and over-evaporation as well as erosion are abundant in them. For the most part they are employed in the production of livestock feed and they have been shown to boost crop production as well as soil fertility. In comparison to the control, another factor that has a greater effect on growth indices such as height, stem, and leaf dry weight is peanut shells fertilizer [15].

### Horse Dung Manure

It is a excellent origin of nutrients that is widely used as a fertilizer in many backyard plants. Equine dung manure is highly prized in the agricultural industry since it boosts soil fertility, regenerates the earth's surface, and produces high quality harvests. Fertilizer for plants can be made from it at a reasonable cost. A young plant's growth can be accelerated with the use of horse dung, which provides critical nutrients for continued growth. Equine dung composting is simple and does not require any additional equipment. A shovel or pitchfork is all that is required to compost it. Soil water retention is improved, and detrimental impacts of salinity are avoided. Because it boosts the crop output and has a long-lasting presence in the soil, this type of manure is suggested for tomato, lettuce and mint crops [16].

### Poultry Manure

Poultry litter is one of the best organic fertilizers or valuable resource. It improved to soil fertility as well as plant vigor. Plants are less susceptible to illnesses and pest infestations because of using

it. It is not suggested to utilize poultry manure during the warm months since it mineralizes quickly in soil and generates a lot of heat. Implementation of the best management techniques can reduce the negative effects of poultry manure application to the soil (BMPs). It was determined that varying quantities of chicken manure (PM) had distinct effects on the yield and growth of *Citrullus lanatus*. Application of chicken manure considerably improved the growth metrics according to study's findings vigour and number of fruits during the two seasons [17].

### **Cattle Manure**

It is excretory waste produced by bovines such as domestic cattle, buffalo, bison, and yaks. There are two types of cow dung: digested and undigested plant debris from the animal's digestive tract. In urban agriculture, the resulting fecal matter is employed because it is mineral-rich. Fertilizer made from composted cow manure is a wider source for plants. In soil or as a compost for plants and vegetables these fertilizers have a good source of nutrients. As they mineralize slowly, they are often utilized as beginning materials. Animal dung has been indicated that it enhances the pH of acidic soils. Unfertilized soil shows very low acidity or fertilized soil had a pH level that was substantially higher [18].

### **Peat**

Toboggan is a partially decomposed plant substance. As a source of organic matter, it's a good option. In addition to improving soil aeration and drainage, increased amounts of organic matter also support soil microbial health [19,20]. As a result, it sometimes mentioned as the most frequently used natural organic fertilizer.

### **Processed Organic Fertilizers**

Processed organic fertilizers include seaweed and wood ash, in addition to bone meal, fish emulsion and cottonseed meal. Fertility can also be obtained through degrade agricultural residue (green manure) from last years. Even while fertilizer does not provide many nutrients to plants, it assists to build the soil stability by adding organic matter.

### **Blood Meal**

Blood meal is an inert or dry powder that made from blood which is used as an organic nitrogen fertilizer or as feeding of animal with a high protein content. It has N content of 13.25 percent, P content of 1.0 percent and K content of 0.6 percent. This is the one of most abundant natural sources of nitrogen. As a by-product of the slaughterhouse, it mainly comes from cattle or hogs. An iron-containing prosthetic group characterizes hemoglobin as the fertilizer's primary component (Fe). Before being utilized as blood meal, the blood must be dried and put on gardens to dissuade pest animals like rabbits. The stench of blood repels these creatures. Inert blood meal powder can be made utilizing a variety of drying methods, including solar drying,

drum drying, spray drying, or oven drying flash. The organic matter content of blood meal was measured using sophisticated techniques such as isoelectric focusing and humification parameters after it was allowed to sit in a soil for a year. Fe availability increased throughout incubation as a result of prosthetic group breakdown or from humic compounds subsequent form the chelation of Fe [21]. Blood meal differs from bone meal in that it includes more nitrogen than bone meal, and bone meal has more phosphorus. Feather meal and alfalfa meal are two alternatives to blood meal. Composting activators such as blood meal have been employed in the past [22].

### **Fish Emulsion**

As its name suggests, fish oil and meal are extracted from fish fluids to create this fertilizer emulsion. Starting with entire fish or fish carcass items such as bones, scales and skin after a fish has been processed is the first step in the creation of fish emulsions. It is then crushed into slurry. Slurry that has been stripped of its oils and fish meal is now referred to as «Fish Emulsion». Following the straining, most emulsions are acidified with sulfuric acid to prevent the growth of bacteria. The fact that fish emulsion is a naturally generated product makes it suitable for organic agriculture. An additional benefit of fish emulsion is that it contains micronutrients in addition to the normal 5-2-2 N-P-K analysis. To increase the color of roses, fish emulsion is used as a liquid fertilizer.

### **Seaweed**

An all-purpose fertilizer, it contains valuable trace metals and plant-growth-stimulating hormones that promote plant growth. Seaweed breaks down quickly due to its low cellulose content, and it is abundant in carbohydrates, which are essential building blocks for plant growth. Although seaweed fertilizer is more expensive than fish emulsion, its key advantage is that it does not cause an unpleasant odor like fish emulsion does. When put to the soil as mulch, it acts as a good activator. Seaweed has a less major potential concern in that it raises salt concentration, which can alter the salt balance in soil. Soil or rainwater can be used to desalinate seaweed that has been hosed down to lower the salt level. Seaweed liquid fertilizers (SLF) *Caulerpa chemnitzia* or *Sargassum wightii* were tested on biochemical or developmental contents of *Vigna sinensis*, and their results were promising. Seaweed extract-soaked seedlings germinated at 100%, compared to water-soaked controls [23].

### **Cottonseed Meal**

This quality meal is a by-product that manufacturing of cotton seed oil. Acid-loving plants like azaleas, blueberries and rhododendrons are the most common recipients. As a result of the numerous processes used to extract cottonseed oil, different varieties of cottonseed meal with varying levels of oil, fiber and protein are produced. Cotton seed meal are natural fertilizers that used prior to sowing for increasing pH of soil and replenish deficient trace elements. The ratio of N to K

in this fertilizer is 6 to 4. You can use it to fertilize your garden with nitrogen because of its high nutritional value. From agri-food business using the various organic wastes, potential for extend greenhouse tomato (*Lycopersicon esculentum* Mill. «Vision») transplants was tested. Cottonseed fertilizer and other organic elements were carefully mixed into the soil before transplantation. In comparison to non-fertilized plants, cottonseed fertilizer dramatically increased the shoot dry weight by 57% e83 percent [24].

### Wood Ash

Bonfire wood ash has long been recognized as a possible source of lime or potash for agricultural utilization. Since it contains various trace components that plants need to survive, ash generally improves the nutritional value of crops. It's recommended to use wood ash fertilizer sparingly, or to compost it along with other organic waste before using it, because it will form salt or lye if it became moisten. When used high quantities, salt or lye can burn plants. Salt or lye can be moved from wood ash composting. Nutritional makeup of wood ash varies based on the type of wood. Compared to soft wood, ash generated from burning hardwoods such as oak and maple contains more nutrients and minerals. To destroy pests like snails and other soft-bodied invertebrates that can cause damage to your plants' roots, just sprinkle wood ash salt around the base of the plants' roots [25].

### Bone Meal

Bone meal is made from of finely and coarsely powdered animal bones as well as waste products from slaughterhouses. Because it is high in phosphate and calcium, Plants use it as an organic fertilizer, while animals use it as a nutritional supplement. Firstly, Bone meal is utilized as origin of protein or phosphate that is slow-release fertilizer. Bone meal is very helpful as a dietary/mineral supplement for animals, along with a range of other meals, including meat meal [26]. Traditional mineral nutrient production, such as P or N fertilizers, is univariable due to its dependency on fossil fuels for N and finite mineral resource stocks for P. Organic waste-based fertilizers, also referred to as alternative or supplemental fertilizers are gaining popularity. It takes a long time for bone meal to breakdown and release the phosphorus. As a food source for bioremediation, cod bone meal was studied [27]. Biodegradation of petroleum hydrocarbons by microorganisms in contaminated cold area soils is generally limited due to a shortage of accessible nutrients, especially nitrogen. However, excessive levels of nitrogen might hinder biodegradation by depleting soil water potential. These inorganic fertilizers quickly partition into the soil's water, raising salinity and imposing an «osmotic potential.» Because of this, controlled- release fertilizers are the best way to avoid microbial inhibition. At 20°C having pH 6.5 and p 7.5 resulted at a large nitrogen oxidized into mineral from bone meal than room temperature. As a result, animal byproducts (ABP) are nutrient and energy-rich foods. Animal bone meal (ABM) is rich in minerals and its high organic fertilizer for agricultural crops according to the USDA.

ABM was differentiated to typical mineral like NPK fertilizers in spring barley observation. Because MBM and mineral fertilization had the same test weight, protein content, grain weight or protein yield, there was no change in grain output supported by MBM for cereal species. [28] According to the study, utilizing MBM as fertilizer has less of an impact on the environment than using chemical fertilizers. According to the findings of the study, nutrient recovery and chemical fertilizer substitution lowered greenhouse gas emissions and acidity [29]. Bone meal was once widely used as a calcium supplement for humans. Many bone meal formulations were found to be tainted with lead and other harmful elements during research in the 1980s; as a result, bone meal is no longer recommended as a calcium source [30].

### Compost

Composting is an aerobic process of digesting organic solid waste (requiring the presence of air) [31]. As a result, it has the potential to play a role in recycle organic waste. Decaying of organic matter as compost, a material looks alike humus that is a valuable nutrient for plants, is the process [31]. Compost is composed of many materials that improve soil and are used as fertilizer. The composition of compost is by decomposing the plants and recycling the organic materials, food waste and beneficial animals such as worms and fungal mycelium and resulting in a rich blend of plant nutrients. Compost is also very beneficial in landscaping, urban agriculture, gardening, horticulture, and organic farming to promote soil fertility. Compost has numerous benefits, including some major nutrients like as acting as a soil conditioner, fertilizer for the crop, humid acid content of the soil, increasing the humus and introducing beneficial microbial colonies in soil that aid to disease reduction. Compost can help with stream wetland development, land reclamation, and landfill cover [31]. When ratio of carbon or nitrogen is around 25:1, enrich is most efficient [32]. Carbon and nitrogen are found in almost all dead animals or plant components, but the amounts vary greatly. Hot container composting basis on contrast heat that speed up the decaying process and produce many kinds of fertilizer. Containing a C/N ratio of 30 or below promotes rapid to process of composting [33]. Cold composting is a more time-consuming procedure that take place up to many years [34]. These occurs because of little piles, such as receiving modest amounts of kitchen and garden waste or many households compost piles at very long time period [35]. Composting can eliminate viruses and unwanted seeds that would otherwise be killed by temperatures above 50 degrees Celsius (122 degrees Fahrenheit) [36]. In pathogen, the length of the temperature (which can scope from seconds to weeks), and pH all influences the range of temperature at which pathogen depart this life [37]. To raise tilth and give humus and nutrients, compost can be put to matrices or other soil such as peat and coir [38]. Compost can help plants become more resistant to diseases and pests [39].

## Conclusion

Components of inorganic and organic fertilizers that are free of hazardous compounds or metals can be utilized together or separately. Agronomists fertilize organic fields with animal waste, plant leftovers and other biological resources to boost yields. Other organic fertilizers include leftovers of organic waste, such as bone meal, wood ash, cottonseed meal or fish emulsion. Organic fertilizers, like inorganic fertilizers are available in both natural and synthetic varieties. Carbon or more precisely, bond of carbon-hydrogen in fertilizers that are organic in nature, which inhibits the emission of nutrient ions, is what separates two. With inorganic fertilizers, nutrient release is faster, enhancing soil physical properties, nutrient availability for longer periods of time, root burn or soil aeration protection. Plant development of soil structure is both improved by using organic fertilizers as a source of energy. As a result of their release of nitrogen as well as potash and phosphate, plants can quickly absorb these nutrients. As an alternative to organic or inorganic fertilizers offer a lifelong protection for fertilized area against soil deterioration and contamination.

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## Conflict of Interest

All authors have no conflict of interest.

## References

- Dickson OO (2020) The Effects of Fertilizers on Tomato Plant and Caterpillar Interaction: Western Illinois University.
- Chen H, Yang ZK, Yip D, Morris RH, Lebreux SJ, et al. (2019) One-time nitrogen fertilization shifts switchgrass soil microbiomes within a context of larger spatial and temporal variation. *Plos one* 14(6): e0211310.
- MacFeely S (2020) Measuring the sustainable development goal indicators: An unprecedented statistical challenge. *Journal of official statistics* 36(2): 361-378.
- Guertel E, Green B (2012) Evaluation of organic fertilizer sources for south-eastern (USA) turfgrass maintenance. *Acta Agriculturae Scandinavica, Section B-Soil & Plant Science* 62(sup1): 130-138.
- Dittmar H, Drach M, Vosskamp R, Trenkel ME, Gutser R, et al. (2000) Fertilizers, 2. types. *Ullmann's Encyclopedia of Industrial Chemistry*.
- Penhallegon R (2003) Nitrogen-phosphorus-potassium values of organic fertilizers. Oregon State University, Extension Service.
- Kannan P, Saravanan A, Krishnakumar S, Natarajan S (2001) Biological properties of soil as influenced by different organic manures. *Research Journal of Agriculture and Biological Sciences* 1(2): 181-183.
- Guene O (2002) editor Integrated Traditional Composting within Domestic Solid Waste Management. Proceedings of International Symposium on Environmental Pollution Control and Waste Management Tunisia.
- Niassy S, Diarra K, Niang Y, Niang S, Pfeifer HR (2010) Effect of organic fertilizers on the susceptibility of tomato *Lycopersicon esculentum*: Solanaceae to *Helicoverpa armigera* Lepidoptera: Noctuidae in the Niayes area Senegal. *Research Journal of Agriculture and Biological Sciences* 6(6): 708-712.
- Ayeni L, Adetunji M (2010) Integrated application of poultry manure and mineral fertilizer on soil chemical properties, nutrient uptake, yield and growth components of maize. *Nature and science* 8(1): 60-87.
- Boateng SA, Zickermann J, Kornahrens M (2006) Poultry manure effect on growth and yield of maize. *West African Journal of Applied Ecology* 9(1).
- Ramadan MA, Adam SM (2007) The effect of chicken manure and mineral fertilizers on distribution of heavy metals in soil and tomato organs. *Australian Journal of Basic and Applied Sciences* 1(3): 226-231.
- Zake J, Tenywa J, Kabi F (2005) eds. Enhancement of manure utilisation in smallholder cattle management systems for crop production in Central Uganda. African Crop Science Conference Proceedings.
- Naylor SJ, Moccia RD, Durant GM (1999) The chemical composition of settleable solid fish waste (manure) from commercial rainbow trout farms in Ontario, Canada. *North American Journal of Aquaculture* 61(1): 21-26.
- Mahboub Khomami A (2015) The possibility using the composted peanut shells in the growth of marigold and Viola tricolor plants. *Journal of Ornamental Plants* 5(1): 61-66.
- Stephan Z (1995) The efficacy of nematicides and horse manure in controlling root-knot nematodes on tomato and eggplant. *Nematologia Mediterranea* (Italy).
- Dauda S, Ajayi F, Ndor E (2008) Growth and yield of water melon (*Citrullus lanatus*) as affected by poultry manure application. *J Agric Soc Sci* 4(3): 121-124.
- Whalen JK, Chang C, Clayton GW, Carefoot JP (2006) Cattle manure amendments can increase the pH of acid soils. *Soil Science Society of America Journal* 64(3): 962-966.
- Barker AV (2012) Plant growth in response to phosphorus fertilizers in acidic soil amended with limestone or organic matter. *Communications in soil science and plant analysis* 43(13): 1800-1810.
- Hillel D (2008) Soil fertility and plant nutrition. *Soil in the Environment* 18: 151-162.
- Ciavatta C, Govi M, Sitti L, Gessa C (1997) Influence of blood meal organic fertilizer on soil organic matter: A laboratory study. *Journal of plant nutrition* 20(11): 1573-1591.
- Bradley FM, Ellis BW (2006) Rodale's all-new encyclopedia of organic gardening: the indispensable resource for every gardener. 1992.
- Sivasankari S, Venkatesalu V, Anantharaj M, Chandrasekaran M (2006) Effect of seaweed extracts on the growth and biochemical constituents of *Vigna sinensis*. *Bioresource technology* 97(14): 1745-1751.
- Gagnon B, Berrouard S (1994) Effects of several organic fertilizers on growth of greenhouse tomato transplants. *Canadian journal of plant science* 74(1): 167-168.
- Vessey JK (2003) Plant growth promoting rhizobacteria as biofertilizers. *Plant and soil* 255: 571-586.
- ADAMU H (2021) COMPARATIVE EFFECT OF COMMERCIAL FEED AND FORMULATED DIETS ON THE GROWTH AND BIOCHEMICAL PARAMETERS OF HETEROBRANCHUS BIDORSALIS (CATFISH) FINGERLINGS.
- Walworth J, Woolard C, Harris K (2003) Nutrient amendments for contaminated peri-glacial soils: use of cod bone meal as a controlled release nutrient source. *Cold regions science and technology* 37(2): 81-88.

28. Chen L, Kivelä J, Helenius J, Kangas A (2011) Meat bone meal as fertiliser for barley and oat. *Agricultural and Food Science* 20(3): 235-244.
29. Spångberg J, Hansson P-A, Tidåker P, Jönsson H (2011) Environmental impact of meat meal fertilizer vs. chemical fertilizer. *Resources, conservation and recycling* 55(11): 1078-1086.
30. Whiting D (2011) Making compost. Department of Horticulture and Landscape Architecture, Colorado State University.
31. Masters GM (1997) Introduction to environmental science and engineering: Upper Saddle River, NJ: Prentice-Hall.
32. Tilley E, Ulrich L, Lüthi C, Reymond P, Zurbrügg C (2014) Compendium of sanitation systems and technologies.
33. Rodríguez Medina AJ (2017) Propuesta para la producción de un abono orgánico partiendo de los lodos residuales de la planta de tratamiento de aguas residuales del Colegio Rochester: Fundación Universidad de América.
34. Harmon AH, Gerald BL (2007) Position of the American Dietetic Association: food and nutrition professionals can implement practices to conserve natural resources and support ecological sustainability. *Journal of the American Dietetic Association* 107(6): 1033-1043.
35. Zaman AU, Lehmann S (2011) Urban growth and waste management optimization towards 'zero waste city'. *City, Culture and Society* 2(4): 177-187.
36. van Haaren R, Themelis NJ, Barlaz M (2010) LCA comparison of windrow composting of yard wastes with use as alternative daily cover (ADC). *Waste management* 30(12): 2649-2656.
37. Mehl J, Kaiser J, Hurtado D, Gibson DA, Izurieta R, et al. (2011) Pathogen destruction and solids decomposition in composting latrines: study of fundamental mechanisms and user operation in rural Panama. *Journal of water and health* 9(1): 187-199.
38. Morel P, Guillemain G (2004) Assessment of the possible phytotoxicity of a substrate using an easy and representative biotest. *Acta Horticulturae* pp. 417-424.
39. Bahramisharif A, Rose LE (2019) Efficacy of biological agents and compost on growth and resistance of tomatoes to late blight. *Planta* 249: 799-813.

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Hayat Ullah and Maliha Sarfraz. *Biomed J Sci & Tech Res*

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