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# Organic sources are traditionally important inputs for crop production and soil health: A review

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**Abstract**
Crop residues, cow dung, and human excreta are each thought to be available in the nation in large quantities as organic sources. Of these, about one-third of crop wastes, half of the manure from livestock, and 80% of the excreta from people can be used for agriculture. Increasing the use of these resources in agriculture can improved the soil fertility and long-term high productivity. These organic sources will probably become more widely available in the future. According to estimates, every million tonnes more of food grain produced will result in an additional 1.2–1.5 million tonnes of crop residue, and every million more cattle will create an additional 1.2 million tonnes of dry dung annually. Therefore, it is anticipated that all wastes, including crop residues, will provide 5.0, 6.25, and 10.25 million tonnes of NPK in 1991, 2011, and 2030, respectively. The above-mentioned organics were used for vegetable crop production and other grain production to support life on the earth ecosystem.

**Keywords:** Farmyard manure, municipal solid waste composting, bagasse, rice husk and crop residues etc.

## Introduction

Organic agriculture practices rely upon recycling of crop residues, animal manure, farm organic residues and wastes etc. (Choudhary *et al*., 2002; Stockdale *et al*., 2001 and Bhuma, 2001) [9, 51, 5]. In view of higher cost of synthetic fertilizers and their contribution to poor health of soil and water it becomes imperative to go for alternative and cheaper sources like organic manures and industrial byproducts. Even modern agriculture is heavily dependent on chemicals, which have caused problems related to environmental degradation and human health. In intensive cropping system with vegetables, a number of crops are grown in each year on the same piece of land and accordingly the nutrient supply of each crop is to be balanced by the use of organic manures and fertilizers. There must be an optimum nutrient balance for sustainable vegetable production. Recently organic farming is gaining momentum as a means of sustainable agriculture production. Organic farming completely keeps away the use of synthetic chemical fertilizers and other plant protection chemicals, depending only on naturally available materials for the supply of plant nutrients and for the control of pests and diseases. Though nature farming and organic farming concepts are fast gathering momentum, they are also beset with problems like low yield and poor returns to investment made. In addition, it also requires large quantities of good quality organic manures.

## Organic Inputs for crop production and soil health

Organic sources are traditionally important inputs for maintaining soil fertility and ensuring yield stability. These organic sources supply macronutrients and improve the physical and chemical properties of soil. There is a need for utilizing manures / wastes for supplementing the chemical fertilizer.

## Effect of municipal solid waste compost on growth and yield of vegetable crops

Francesco Montemuro *et al.* (2007) [13] reported that organic fertilization with municipal solid waste compost is compatible with partially substituted mineral N fertilization, registered higher sugar beet yield. Wenliangu Lu *et al.* (2008) [61] stated that yield of okra increased up to 33% due to treatment of 50 t ha$^{-1}$ municipal solid waste compost. Olfati *et al.* (2009) [34] reported that the greatest yield of lettuce was obtained by plants treated with 100 t ha$^{-1}$ municipal solid compost.

Warman *et al.* (2009) [58] concluded that fruit of berry recorded higher yield in municipal solid waste compost treated plots @ 59 t ha $^{-1}$. The yield of lettuce was significantly higher in municipal solid waste compost treated plot @ 40 t ha $^{-1}$ in all crop seasons (Castro *et al*. 2009) [6]. Ghaly and Alkoaik (2010) [16] showed that NPK+ Municipal solid waste compost @ 25 t ha $^{-1}$ gave the best plant growth and yield of potato.

Yield of Brussels were higher due to application of municipal solid waste compost @ 16 t ha $^{-1}$ (Andrew Rachin and Philip Warman, 2011) [2]. Hadi Shabani *et al.* (2011) [18] reported that application of municipal solid waste compost, @ 50 t ha $^{-1}$ had significant effect on plant height and no. of primary branches per plant $^{-1}$.

Olfati et al. (2012) [33] observed that plants treated with municipal solid compost @100 t ha $^{-1}$ had the highest yield in French dwarf bean. Topcuoflu and Kubilayonal (2012) [55] observed that the highest potato yield was found at 40 t ha $^{-1}$ of municipal solid waste compost application.

**Effect of FYM on growth and yield of vegetable crops.**

Ghosh *et al.* (2005) [17] stated that conjunctive use of inorganics and organics (FYM) recorded higher seed and stover yield of soybean grown on Vertisols during kharif overuse of inorganics alone. Application of inorganics in combination with organics (FYM, poultry manure and compost) recorded highest pod and haulm yield of groundnut grown on sandy clay loam over use of chemical fertilizers alone (Reddy *et al.*, 2005) [45]. Varalakshmi *et al.* (2005) [57] observed that application of RDF (25:50:25 kg NPK ha $^{-1}$) showed highest yield (4.03 t ha $^{-1}$) of groundnut on sandy clay loam soil during kharif over application of 100 per cent RDN through FYM (2.55 t ha $^{-1}$) or combined application of 50 per cent RDN + 50 per cent through FYM (2.72 t ha $^{-1}$). Premsekhar and Rajashree (2009) [40] studied that application of FYM @ 20 t ha $^{-1}$ performed better than other treatments through improved plant characters viz., plant height (57.6cm), number of fruits plant $^{-1}$ (19.3) and yield (10.39 t ha $^{-1}$) okra.

Kausale *et al.* (2009) [25] revealed that application of 100 per cent RDF (25:50:0 kg ha $^{-1}$) recorded higher pod and haulm yield (22.06 and 43.58 q ha $^{-1}$) of groundnut in clayey soil during summer season over application of FYM @ 10 t ha $^{-1}$ (21.1 and 41.9 q ha $^{-1}$). Sharma and Sharma (2011) [49] the reported that application of FYM @ 15 t ha $^{-1}$ along with 150:60:75 kg ha $^{-1}$ of N, P and K recorded the maximum yield of 25.18t ha $^{-1}$.

Sruti Karmakar *et al.* (2013) [50] reported that application of 100 % organic through FYM increased the rice yield 30-56 % over control. Ajaz Lone *et al.* (2013) [1] observed that the addition of 6 t ha $^{-1}$ of FYM resulted in manifold increments in the overall yield of raw baby corn.

Zelalem Bekeko (2013) [64] indicated that FYM@ 10t ha $^{-1}$ + N @ 100 kg ha $^{-1}$ + P @ 100 kg ha $^{-1}$ increased the maize grain yield. Hisham Aziz Amran *et al.* (2014) [20]. observed that application of 100 kg N, 60 kg $P_2O_5$ and 50 kg $k_2O$ ha $^{-1}$, along with FYM 25 t ha $^{-1}$ registered maximum plant height (127.6cm), number of leaves (49.35), number of branches (2.8), number of fruit plant $^{-1}$ (23.15), fresh weight of plant $^{-1}$ (12.43g), fruit yield plant $^{-1}$ (287.61g), average yield (16.25t ha $^{-1}$) in okra. Sandeep Kumar *et al.* (2014) [48] reported that application of FYM + Vermicompost 75% + 25% resulted in improvement of plant height (21.9 cm), number of leaves (13.22), length of leaves (16.56 cm), total plant weight (268.31g), root weight (161.47 g), root length (16.81cm), leaf dry weight (3.22g) in radish. The highest grain yield (42.6q ha $^{-1}$) was recorded by application of 75% general recommended dose of fertilizer + 60t Fly ash ha $^{-1}$ + 5t FYM ha $^{-1}$ in rice (Bharat *et al.* 2014) [4].

The maximum plant height (66.02cm), number of leaves per plant $^{-1}$ (13.47 cm), width of leaves (12.98 cm), fresh weight of root (193.039), maximum yield (5.06 kg pot $^{-1}$) was recorded with the application of NPK (80:60:60 kg ha $^{-1}$) + FYM @ 10 t ha $^{-1}$ in radish. Babbu Singh Brar *et al.* (2015) [3] observed that highest maize yield (6.5 t ha $^{-1}$) and wheat yield (5.13 t ha $^{-1}$) were in treatment having 100 % NPK + FYM. Priyanka Kumari Jat *et al.* (2017) [41] indicated that application of FYM@ 15t ha $^{-1}$ and 50% RDF significantly increased the fresh weight of root and yield of radish over RDF.

**Effect of Rice husk ash in yield of vegetable crops**

Paul Okon *et al.* (2005) [39] reported that yield of okra increased with the rate if rice husk ash and reached a maximum at 20 t ha $^{-1}$.

**Effect of Municipal solid waste compost on nutrient uptake in other crops**

Application of municipal solid waste compost with recommended N fertilizer increased N uptake in maize (Richard Wolkowski, 2003) [46]. The highest uptake of and straw yield were observed with application of 5 t ha $^{-1}$ municipal solid waste compost in combination with 25 per cent N through inorganic fertilizer (Kavitha and Subramani, 2007) [26]. Youssef Ouni *et al.* (2014) [63] suggested that overall root and shoot dry weights increased with the municipal solid waste compost additions for Hordeum sp. The uptake of showed a broad optimum in the plants amended with 100 t ha $^{-1}$ of municipal solid waste compost. They also revealed that application of municipal solid waste compost @ 100 t ha $^{-1}$ used as saline soil amendment, improved plant biomass production and enhanced mineral contents.

**Effect of Bagasse ash on growth and yield of crops**

Muhammad Jamil Khan and Muhammad Qasim (2008) [32]. revealed that maximum grain yield of 5.22 g plant $^{-1}$ was obtained from the treatment receiving 50 t ha $^{-1}$ boiler ash. Jamil Qasim *et al.* (2004) [21] reported that maximum plant height, spike length, number of productive tillers m $^{-2}$, number of grains spike $^{-1}$ and grain yield were obtained in wheat crop where bagasse ash was applied @ 2 % along with a basal dose of NPK @ 120, 90 and 60 kg ha $^{-1}$ respectively before sowing of the crop. Charles Webber *et al.* (2016) [7] indicated that squash plant stalk and total plant fresh weight (stalk leaves, tops roots, and total plant), overall responded best at the 75% sugarcane Bagasse ash in potting media. The concentration of bagasse ash with clay soil (prepared by mixing bagasse ash 20% with 80% clay) was found to be the optimal dose for recording important yield parameters such as the root and shoot length plant $^{-1}$, shoot and root dry weight plant $^{-1}$, number of leaves, flowers and pods weight and yield of *Brassica juncea* crop in pot culture. (Sabanoor *et al.* 2016) [47].

**Effect of Bagasse Ash on soil properties**

Dee *et al.* (2002) [10] reported that application of bagasse ash@ 10 t ha $^{-1}$ resulted improvement in fertility by the addition of basic cations. Valerio pita *et al.* (2012) [56] reported that bagasse ash application led to significant by increased the soil extractable P and K content.

**Effect of FYM on quality attributes**

Sushma *et al*. (2012) [53] reported that in helicona grown with treatments of 25: 20: 20g NPK + 2kg FYM/ $m^2$ registered highest chlorophyll content of 1.2 mg $g^{-1}$. Sunanda *et al*. (2014) observed that highest chlorophyll content (21.44 mg /100 mg) and crude protein content (13.31%) was recorded due to application of 75% N + recommended dose of PK + FYM@ 7.5t $ha^{-1}$ in Kasuri Methi. Garhwal *et al*. (2014) [14] revealed that the application of 80kg FYM per plant resulted in significantly increase in total sugar (6.63%) in kinnow mandarin. Application of FYM@ 15 t $ha^{-1}$ registered highest (10.59 mg/100 g) ascorbic acid content in radish (Priyanka Kumari Jat *et al*. 2017) [41].

**Effect of farmyard manure on nutrient uptake in crops**

Panwar and Munda (2007) [36] noticed that nitrogen, phosphorus and potassium uptake by groundnut in the treatment received FYM@ 10 t $ha^{-1}$ + 75 per cent recommended dose of inorganic fertilizer was significantly higher than that of 100 per cent recommended dose of inorganic fertilizer. Reddy *et al.* (2007) [44]. reported that application of 100 per cent RDN through inorganics showed higher uptake of N, P and K by soybean on sandy clay loam soil over integrated application of FYM along with inorganics.

Chikkaramappa *et al.* (2011) [8] revealed that significant increase in N, P, K, Ca, Mg and S content and uptake of groundnut haulm and kernel in FYM 5 t $ha^{-1}$ + 100 % recommended dose of NPK + *Azospirillum* treated plots. Pathak *et al.* (2007) [38] stated that NPK @ 30:60:60 kg $ha^{-1}$ gave the highest uptake values of NPK in groundnut during the first year and FYM (6.0 t $ha^{-1}$) during the second year.

Jatav *et al*. (2010) [22] indicated that dry matter yield and radish in tops (1.89 and 0.85t ha $^{1}$) was higher in 75% PK from inorganic fertilizer and remaining 25% from FYM. Sharma and Sharma (2011) [49] reported that application of 50: 22: 25 kg of NPK along with FYM @ 15 t $ha^{-1}$ to crop registered higher NPK uptake of 172.4, 15.7, 159.5 kg $ha^{-1}$ respectively was found in potato – radish rotation. Ramesh *et al.* (2013) [43] observed that application of FYM @ 5 t $ha^{-1}$ recorded significantly the highest uptake of N (65.1 kg $ha^{-1}$), P (10.63 kg $ha^{-1}$) and K (33.2 kg $ha^{-1}$) compared to NPK alone (50.2, 7.73 and 22.8 kg NPK $ha^{-1}$) respectively in castor. Babbu Singh Brar *et al.* (2015) [3] revealed that maximum uptake for N (186.5 kg $ha^{-1}$) P (23.5 kg $ha^{-1}$) and K (119.3 kg $ha^{-1}$) in maize and N (150.8 kg $ha^{-1}$) P (18.5 kg $ha^{-1}$) and K (92.4 kg $ha^{-1}$) in wheat crops were recorded.

**Effect of FYM on dry matter production and nutrient uptake in crops**

Dhirendra kumar and Kumar Nikhil (2016) [11] recorded that a maximum of root dry biomass was achieved during 65 days of vetiver grass i.e., 2.1g and whereas in shoot dry biomass attained by vetiver grass was found maximum of 2.59g in Algae bio fertilizer and FYM@ 10 t $ha^{-1}$

**Effect of rice husk ash on nutrient uptake in vegetable crop**

Thind *et al.* (2012) [54] carried out a study in wheat crop that phosphorus uptake wheat in was significantly higher in all treatments receiving rice husk ash @ 10 t ha $^{1}$.

**Effect of municipal solid waste compost on soil properties**

Municipal solid waste compost is increasingly used in agriculture as a soil conditioner as well as a fertilizer. Large amounts of municipal solid waste compost are used in agriculture to meet nut crop N requirements and for addition of organic matter. Mkhabela and Warman (2006) [30] reported that application of municipal solid waste compost increased the N availability and supply enough for potato in sandy loam soil. They found that a mixed application of municipal solid waste compost and NPK fertilizer was responsible for a decrease in P fixation in a sandy loam soil.

Francesco Montemurro *et al.* (2005) [13] showed that the application of municipal solid waste compost at the end of experiment modified the soil chemical properties. In particular, it significantly improved available P, maintained almost same level of exchangeable K and significantly enhanced total soil organic matter. Application rates of 30 and 60 t $ha^{-1}$ of municipal solid waste compost increased the aggregates stability of soil through the formation of cationic bridge thereby improving the soil structure. Municipal solid waste compost increased the EC value in soils. It increased soil N content; effectively supply P to soil and total K availability in soil (Hargreaves *et al*. 2007) [19].

Kavitha and Subramanian (2007) [26] found that increased soil ammonium nitrogen, nitrate nitrogen, highest P concentration, maximum level of potassium content was obtained in the treatment where municipal solid waste compost of 7 t $ha^{-1}$ was applied. Webber *et al.* (2007) [60] observed that application of municipal solid waste compost resulted in an appreciable increase of organic carbon, total nitrogen, and soil physical properties.

The increase in available macro nutrients were pronounced in case of fertilization with municipal solid waste compost compared to rice straw compost (Edi *et al.* 2008) [12]. At the highest rate of application of 400 kg N $ha^{-1}$ as municipal solid waste compost significantly increased the levels of P, K and Ca in soil (Warman, 2009) [59]. The continuous use of municipal solid waste compost for 10 years increased the soil content of most nutrients including P, K, Ca, Mg, Mn and Zn, organic matter and cation exchange capacity (Monica Ozores-Hampton *et al.* 2011) [31].

Rahimi Alashty *et al.* (2011) [42] observed that application of municipal solid waste compost increased the amount of organic material and electrical conductivity of soil significantly, in such a way that applying 40 t $ha^{-1}$ municipal solid waste compost for 3 years had been more in all treatments, but it had also decreased pH of soil. Orenella Lopedota *et al.* (2013) [35] reported that use of composted municipal solid waste significantly increased organic carbon in the soil. Municipal solid waste treatments increased the soil EC, CEC and organic carbon and organic matter content but little decrease in soil pH was observed.

**Effect of FYM on soil properties**

Parmar *et al.* (2006) [37] studied the effect of organic manure in combination with synthetic fertilizer on cauliflower in kullu soils of Himachal Pradesh and reported that application of FYM @ 20 t $ha^{-1}$ along with 100 per cent recommended NPK fertilizer increased soil organic carbon, available N, P and K content in soil. Mann *et al.* (2006) indicated that application of FYM@ 10 t $ha^{-1}$ along with 100 per cent NPK fertilizers increased the organic carbon (0.8%) and availability of NPK in *Typic ustochrept.*

Laxminarayana (2006) [28] reported that application of 100 per cent NPK + FYM @ 15 $ha^{-1}$ recorded highest organic carbon (8.2 g $kg^{-1}$) along with recommended dose of NPK resulted in a progressive improvement in organic matter content of the soil over the initial content. Highest available P and K content in the soil was observed with combined application of 100 per cent NPK + poultry manure followed by NPK + green manure and NPK + FYM was reported by (Laxminarayana and Patiram 2006) [28].

A combined application of FYM and fertilizer in a study apparently provided supply of nutrients in balanced proportion which was reflected in terms of increase in amount of microbial biomass N and other alternate amendments, *viz.*, $ZnSO_4$ and S fertilizers produced similar effect on microbial biomass N as did the optimal NPK reported by Gayatriverma and Mathur (2009) [15]. These results are in the line with findings of Singh *et al.* (2009) who observed that available nitrogen content in soil increased significantly with the use of recommended dose of fertilizer in combination with manure. Further, by increasing the application rate of nutrients, the amount of available nutrients also increased significantly.

Katkar *et al.* (2012) [24] have also reported higher buildup of soil available N under integrated nutrient supply system. Application of 100% RDF with 5 t $ha^{-1}$ FYM significantly improved the soil organic carbon (0.38%) and resulted in a positive balance of 42, 12.4 and 80 kg $ha^{-1}$ of available N, P and K respectively (Ramesh *et al.*, 2013) [43].

### Effect of rice husk ash on soil properties

Yankaraddi *et al.* (1990) [62] stated that application of rice husk ash @ 2 t $ha^{-1}$ + 100 per cent recommended dose of fertilizer for rice crop, the available nitrogen, phosphorus and potassium in post-harvest soil were maximum. Karmakar *et al*. (2009) [23] studied the effect of application of ash, rice husk ash, and paper factory sludge on the growth and yield of rice in the acid lateritic soil of India. They showed that the application of these industrial wastes improved the soil properties by decreasing soil bulk density and increasing soil pH, organic carbon, available nutrients, and rice yield.

### Conclusion

The organics and biologically derived products from plants and animal waste are effectively utilized for vegetable crop production and grain production without harming the ecosystem. Recycling of plant and animal waste as an organic inputs for agricultural and horticultural crop production and improving soil health for sustainable crop production.

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