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Recycling of organic wastes as an organic fertilizers for boosting the growth of Bengal Gram

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Abstract
The present research work is carried out in net house, Department of Botany, Jinnah University for women as lab trial of BS 3rd year students. The influence of different organic wastes and NPK on growth and development of Bengal gram had been studied. In the present study, we examined the effects of peanut shell, tea waste, bottom ash, sawdust, coconut coir, rice husks (1% w/w) and NPK (0.2%) beside control on physical and biochemical parameters of experimental plants. Results showed that the increase in physical and biochemical parameters of Bengal gram plants under the different organic fertilizers compared to the control treatment. Most of the treatments significantly enhanced the growth of Bengal gram plants. Thus, these indicated that organic wastes should be recommended to increase soil fertility and plants growth.

Keywords: Organic wastes, Organic fertilizers, Soil fertility, Bengal Gram

1. Introduction
Bengal gram is a main pulse of Pakistan [1]. The agronomical position of Bengal gram is recognized on its amazing protein content (approx. 19.3–25.4%) for the human and animal diet, being used supplementary as an alternate protein source [2]. Furthermore, it is too extensively used as forage and green manure [3].
Continuous consumption of chemical fertilizers decreases vital soil nutrients and minerals that are naturally set up in fertile soil [4]. The consumption of organic fertilizers will make available an environmentally friendly, naturally sustainable, nontoxic and reasonable means for sustaining soil fertility and increasing crop production [5]. Organic materials grasp excessive promise as a source of multiple nutrients and capacity to develop soil characteristics [6]. Soil organic matter increases the physical and biological properties of the soil which expand the crop productivity and yield [7].
Organic manuring can show a dynamic part in sustaining soil fertility and crop production. It is a fact that consumption of inorganic fertilizers for the crops is not so decent for soil condition because of residual effect while organic fertilizer does not generate such problem. Besides, it rises the productivity of soil as well as crop quality and yield [8]. The farmers use chemical fertilizers as a readily supplemental source of nutrients but they do not put on in balanced amount [9]. It is as well a fact that organic fertilizers rise yields of crops significantly over inorganic fertilizers [10].
The environment friendly choices include the use of growth-promoting (PGP) microbes, animal wastes, botanicals and crop residues works as an alternative to chemical fertilizers [11]. Therefore, the present study described the outcome of organic and inorganic fertilizers on growth of Bengal gram plants.

Material and methods
Experimental procedures: Eight experimental treatments were used for present study as shown in table 1. Three replicate were used for each treatment. Complete randomized design was applied for experimental purpose. After 21 days plants from each treatment were plugged out and analyzed their physical (root & shoot length, fresh & dry plants weight) and biochemical analysis. Following biochemical processes were used for study.

Bio-chemical parameters of experimental plants: An Arnon method [12] was used to determine photosynthetic pigments (mg/g fresh wt.) and by Barton's reagent [13] total phosphorus was estimated.

Table 1: List of Treatments.

S.no.	Treatments
1	Control
2	NPK (0.2%)
3	Peanut shell (1%)
4	Tea waste (1%)
5	Bottom ash (1%)
6	Sawdust (1%)
7	Coconut Coir (1%)
8	Rice husk (1%)

Statistical Analysis: Outcomes of current pot experiments are expressed as mean ± standard deviation (SD). The records was evaluated by means of *One-way* ANOVA followed by LSD test through SPSS 16 (version 4). The differences were considered significant at $p<0.05$ when treatments' mean compared with control.

Results & discussions

Soil organic matter is a fundamental supplier to soil due to its ability to affect plant growth indirectly and directly. Stumpy soil fertility is one of the key factors liable for low yield of crops. Soil fertility can be probably improved by organic and inorganic fertilizers application. However, the use of any form of fertilizer depends on numerous features such as soil type, nature of crop and socio-economic conditions of the area [14, 15]. Organic fertilizers are environmentally friendly and rise soil health, water-holding capacity, high cation exchange capacity and stumpy bulk density and they are substitute numerous residents of helpful soil microbes [16].

All treatments increased the both, physical and biochemical parameters of experimental plants after 21 days of growth. All organic amendments including peanut shell, tea waste, bottom ash, sawdust, coconut coir and rice husks significantly increased root lengths of Bengal gram plants (table, 2).Maximum elongation observed with the treatment of peanut shells. These results are similar to the findings of the Badar *et al*., 2015[6] which also exhibited progressive influence of organic manures on plants' growth. Khomami in 2015[17] also defined that the consumption of peanut shells composts rises growth of the marigold and *Viola tricolor* plants. Chala and Gurmu [10] point out that the use of organic fertilizer have prepared the soil more porous and powdered, to permit enhanced root growth and development, so bring about in more root cation exchange ability.

Treatments with peanut shell, tea waste, bottom ash, sawdust and coconut coir (1% w/w) significantly elongate shoot lengths of experimental plants as compare to control (table, 2). Badar *et al*., [18] also described the advantageous effects of organic fertilizers on growth of cowpea plants. Minimum Shoot elongation was recorded in the plants grown without fertilizer application (table,2).Organic fertilizers might have upgraded the soil porosity, structure, water holding capacity and provided plant growth stimulating materials and therefore significantly augmented plant growth. Related result was stated by Reza *et al* [8].

Table 2: Effects of NPK and different organic wastes on root & shoot lengths of Bengal Gram

S.no	Treatmets	Root length (cm)	Shoot length (cm)
1	Control	9.78±3.14	21.50±3.99
2	NPK (0.2%)	11.41±2.05	24.30±4.62
3	Peanut shell (1%)	20.83^{a}±3.59	33.10^{a}±1.45
4	Tea waste (1%)	15.55^{c}±1.41	28.38^{d}±2.87
5	Bottom aash (1%)	15.86^{c}±0.77	28.30^{d}±3.45
6	Sawdust (1%)	13.73^{d}±0.90	29.26^{c}±3.13
7	Coconut Coir (1%)	17.16^{a}±0.76	29.73^{c}±3.10
8	Rice husk (1%)	16.50^{b}±1.60	25.06±0.90

Each value is the mean ± SD (standard deviation) of 4 replicates. Any two means not sharing a superscript in common are significantly different at $p<0.05$ (LSD).

Treatments with peanut shell, tea waste, bottom ash and coconut coir significantly enhanced fresh weights of plants after 21 days of growth (table, 3).Tea waste improved maximum fresh weight of experimental plants. Tea waste and bottom ash as organic fertilizers boosted significantly dry weights of plants (table, 2).These outcomes are in accordance with Badar *et al*. [3] and Badar *et al*. [7]. These results are also comparable to the outcomes of the Wang *et al*., in 2006 [19]indicated that bottom ash used generally as an amendment to rise the physical and chemical properties of soil, as a basis of liming material to improve soil acidity and as a nutrient source to supply calcium and sulphur.

Table 3: Effects of NPK and different organic wastes on fresh & dry weights of Bengal Gram

S.no	Treatmets	Fresh biomass (g)	Dry biomass (g)
1	Control	1.07±0.21	0.19±.07
2	NPK (0.2%)	1.66±0.50	0.23±.01
3	Peanut shell (1%)	2.03^{d}±0.32	.26±.00
4	Tea waste (1%)	3.31a±1.36	.57c±.26
5	Bottom aash (1%)	2.32d±0.16	.44d±.28
6	Sawdust (1%)	1.34±0.10	.32±.05
7	Coconut Coir (1%)	2.52c±0.32	.34±.06
8	Rice husk (1%)	1.24±0.12	.24±.04

Each value is the mean ± SD (standard deviation) of 3replicates. Any two means not sharing a superscript in common are significantly different at $p<0.05$ (LSD).

Organic soil administration can significantly develop soil structure [20], support maintain C in the surface soil, and rise crop yields [21]. The enhancement of soil physicochemical properties by accumulative soil organic carbon (SOC) has been suggested for increasing crop yields [22]. Exogenous uses of organic materials be able to decrease the amounts of

chemical fertilizers used and pay off for soil C losses make happen by land-use modifications [23].

The biochemical contents of experimental plant also improved by organic amendments. Treatments with sawdust and rice husk increased chl-a content significantly while remaining treatments promoted chl-a content non significantly (fig.1).

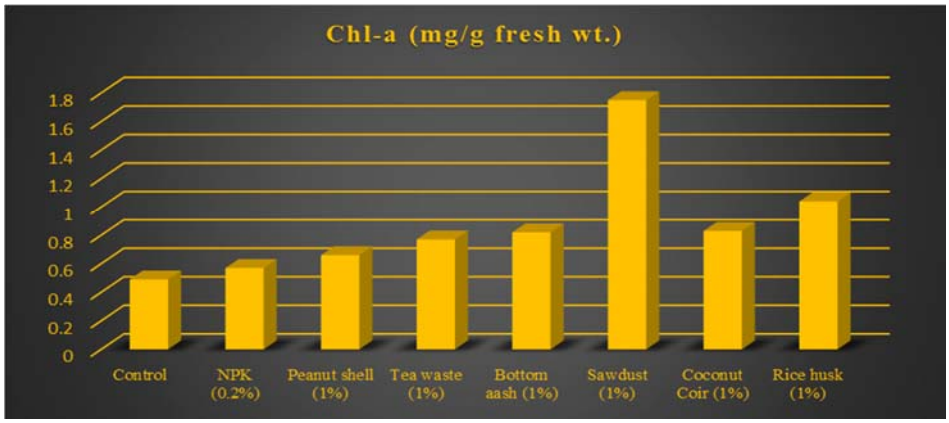

Fig 1: Effects of NPK and different organic wastes on Chl-a of Bengal gram. Columns bearingsuperscript are statistically significant (p<0.05 LSD) with respective control. a = p<0.0001, b = p<0.001, c = p<0.01 andd = p<0.05.

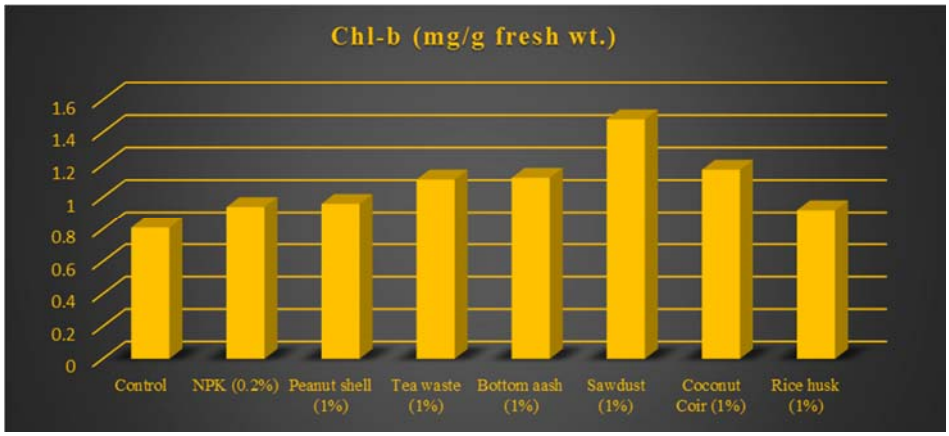

Fig 2: Effects of NPK and different organic wastes on Chl-b of Bengal gram. Columns bearing superscript are statistically significant (p<0.05 LSD) with respective control. a = p<0.0001, b = p<0.001, c = p<0.01 andd = p<0.05.

All treatments non significantly increased chl-b contents of Bengal gram plants (fig.2). All organic amendments except treatment with peanut shells significantly stimulated total chl. contents of plants as compared to control and NPK (fig.3). Jan *et al.*, described in (2014) [24] that utilization of organic fertilizers encouraged chlorophyll content and the capacity of wheat plant to stand stress. Badar *et al.* [6] reported such increase in chlorophyll content of cowpea plants due to application of organic materials. These results are also in accordance with the work of Zeid *et al.* [25] who found an rise in Chlorophyll 'a', 'b' and total chlorophyll with the use of organic materials as fertilizers on radish plants.

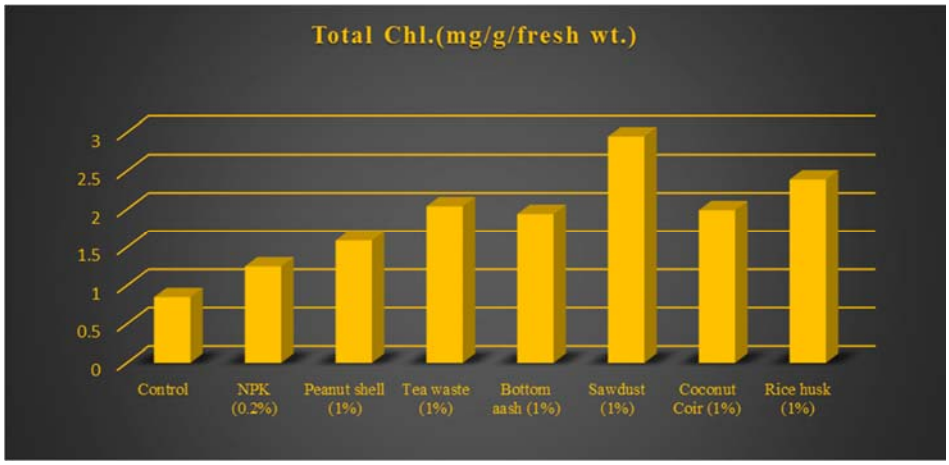

Fig 3: Effects of NPK and different organic wastes on total chl. of Bengal gram. Columns bearing superscript are statistically significant (p<0.05 LSD) with respective control. a = p<0.0001, b = p<0.001, c = p<0.01 andd = p<0.05.

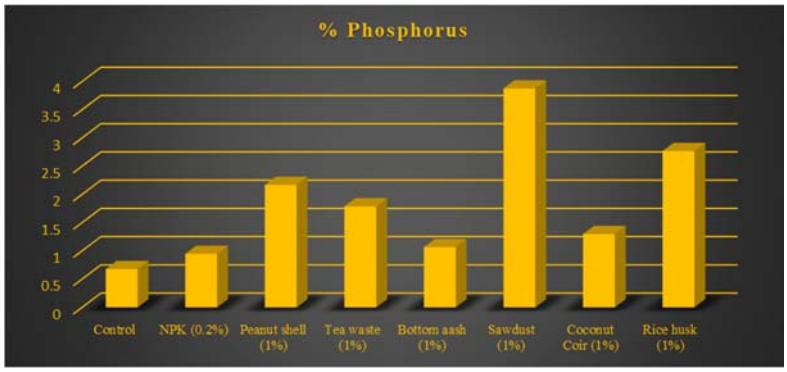

Fig 4: Effects of NPK and different organic wastes on% Phosphorus of Bengal gram. Columns bearing superscript are statistically significant (p<0.05 LSD) with respective control. a = p<0.0001, b = p<0.001, c = p<0.01 andd = p<0.05.

Application of peanut shells, sawdust and rice husks significantly augmented phosphorus contents of plants. Treatment with sawdust promoted maximum phosphorus contents of plants (fig.4). Phosphorus (P) is a vital macronutrient for plant growth and it is restrict crop production in various areas of the world. The availability of soil P for plants is associated to a number of plant characters, as well as the rhizosphere pH, morphological traits such as length and surface area of roots, root architecture, root hairs and specific structures such as root clusters [26]. Phosphorus is a part of the complex nucleic acid structure of plants, which controls protein production. Phosphorus is significant in cell division and development of new tissue. It is also related with complex energy transformations in the plant. The outcomes exhibited that the application of organic fertilizers increased phosphorous uptake in experimental plants [8].

Conclusion

Organic wastes as an organic fertilizers positively affect soil structure and nutrient availability and can be less expensive than synthetic fertilizers. The consumption of organic wastes can increase fertility without deleterious effects on environment. It is therefore most essential to decrease the dependence on chemical inputs in agriculture

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