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Stimulus of Panchgavya Bio-Manure (PGBM) on developmental growth as well as harvest of *Pisum sativum*

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Abstract
A field experiment was conducted during six months (2019) to study the effect of bio-fertilizers in conjunction with inorganic fertilizers on growth and yield of pea at Shri Ram College Muzaffarnagar, U.P. The experiment was laid out in split plot design with three replications in sandy loam soil. The experiment comprised 9 treatment combinations of four levels of fertility (Control, PGBM and Urea). Results indicated that the comparative effect of Panchgavya bio- manure (PGBM) on the growth and yield of pea (*Pisum sativum)* was showed that the plant enrichment with respect to biomass components such as mean number of leaf size, leaf length, arial part, root length, root hair, root width, no. of leaf, full plant size and fresh weight of plant were expressively influenced by used PGBM. Similar trend was noticed with respect to leaf length, Fresh weight and plant height which were found to be significantly higher 45 cm, 136.26 gm/plant and 60 cm/plant respectively. Bio-organic formulation PBGM has increasing level of growth than other treatments. So, it can be concluded that PBGM can be best substitute for chemical fertilizer, which has proven positive effects on various crops with environmental sustainability.

Keywords: PBGM, Pea, environmental sustainability

1. Introduction
In order to meet the nutritional demands of the increasing population efforts are being made at national and international level to increase per hectare production. Fertilizers being vital agriculture input to increase the population but the main weaknesses by the use and manufacture of inorganic chemical because energy crisis and unavailability of native effects of chemical fertilizers on our health and environment. The bio-fertilizers are safe, low cost and easy in application. Bio-fertilizer application have shown good results in case of leguminous crop, especially exclusive results have been obtained in case of vegetable pea. In view of the above facts, the present investigation was carried out to ascertain the effect of bio-fertilizers and their interaction on growth and yield of crop. Pulse crops have a specific importance for the vegetarian population of our country because pulses are the major source of protein. However, due to population blast and low productivity of pulse crops, per head availability of pulses is consistently decreasing. Per unit of population availability of pulses per day is only 47g as against the minimum requirement of 104 g as recommended by nutritional experts of World Health Organization/Food and Agriculture Organization (K. Hariprasanna *et al.,* 2017) [4].

Pea (*Pisum sativum* L.) is a cold season legume crop that is produced on over 25 million acres worldwide. It is commonly used throughout the world in human diets and has high levels of amino acid, lysine and tryptophan, which are relatively low in cereal grains and contains approximately 21-25% protein. Presence a leguminous family and has the essential ability to obtain much of its nitrogen requirement from the nature by forming a symbiosis with Rhizobium bacteria in the soil (Hukam Singh Kothyari *et al.,* 2017) [9]. The favorable effect of Azotobacter and mineral nitrogen fertilizer on growth, chemical composition of leaves, and yield was reported on pea indicated that both inoculation with Azotobacter and application of N increased seed yield. A minor qantity of Biofertilizer is ample to produce desirable effects because each gram of carrier of biofertilizers contains at least 10 million viable cells of a specific strain (Ben-Zeíev, N. and D. Zohary. 1973) [3]. Among the various fertilizers, biofertilizers are important sources of nutrients. Biofertilizers are natural fertilizers containing micro-organism which help in enhancing the productivity by Biological nitrogen fixation or solubilisation of insoluble phosphate or producing hormones, vitamins and other growth regulators required for plant growth. PGBM increased the root nodulation through better root development and more nutrient availability, resulting in vigorous plant growth and dry matter production which resulted in better flowering, pod formation and ultimately there was beneficial effect on seed yield (Slanc *et al*. 2009) [18].

The main objectives of the project are to demonstrate the production and use of a fertilizer characterized by reduced salinity. This innovative product based organic biofertilizer residues will allow the substitution of chemical and mineral fertilizer. The large amount of organic matter will increase the quantity of humus in the soil and will have positive effects on the development of soil microflora, which in turn will make nitrogen and phosphorus more available for the plants. Screening, selection and collection of materials for Panchgavya Bio-manure (PGBM), production and analysis of PGBM and to estimate the effect of PGBM on *Pisum sativum.* In future this study should be performed on other vegetable crop to get the maximum output by maintaining soil health. PGBM can also be a noble growth booster in flowering plants as well as in fruit yield oriented vegetative crops. In future PGBM can be a better substitute for organic production and commercialization of medicinal plants and species for manufacturing of drug development.

2. Material Method

Firstly, we buy the seed of pea from Prakash chowk Muzaffarnagar marketplace. Pea is the one of the largest selling in all over India. It is widely used in vegetables.

2.1 Preparation of seed healer

We take a plastic container of 6 kg with air tight close lid. Weight 1kg Cow dung, 1kg Cow urine, 20gm calcium hydroxide $[Ca\ (OH)_2]$ and 4 litre water, put in the container. Mix all the material in container with a rod. Closed the lid and mixed the material daily with a rod. Let it fermented for 24 hours after 24 hours your seed healer was ready to use for seed treatment

2.2 Measurement of germinated seeds

Pore some drop of water daily in Petri plates. Germination can be seen in petri plates after one day from the sowing. After seven days seeds are fully germinate. After the germination was completed it is seen that the seeds with treatment seeds are better than the control seeds.

2.3 Preparation of PGBM

PGBM is plant growth promoting agent, is formulated by mixing Base solution with cow dung, cow urine, curd, cow ghee, jaggery, ripened banana, milk (Table 1). We take a plastic container 10 kg with air tight close lid. The cow dung and urine are thoroughly mixed in the morning and evening, and kept for 3 days.

Table 1: Material for PGBM preparation

Material	Kg / litre
Plastic container	8 kg
Cow dung	1.25 kg
Water	500ml
Cow urine	0.75 ml
Curd	500 gm
Jaggery	500 gm
Ripened banana	4 nos.
Cow ghee	125 gm
Milk	500 ml
Tender coconut water	1 nos.

Sowing the seed 3-3 control seeds of pea in 3 pots and into another 6 pots sow the seed from the 2-2 treatment seeds of pea seed for the germination. Pour water in all pots. Now then pour water after 7 days in control pea pots and into treatment pea pots

2.4 Analysis of germinated seeds

Green leaves of germinated seeds After 1 month of sowing the seed are germinated and 4-5 small leaves are there After 1 month of sowing the seed are germinated and 10-12 cm in length are there Height and number of leaves increased and also the size of leaves increased. Seeds are grown in each pot but germinated 1-1 seed in each pot.

3. Result

3.1 Effect of different treatment-based PGBM the growth of pea plant

Effect of different treatment-based PGBM on the growth of pea plant doses of respectively different treatment based bio-manure. Show the effect of different doses of different waste on the growth of pea plant. Different doses show different results with pea plants the effect was studied in the following forms.

Fig 1: Treatment of pea plant with DAP, Control, and PBGM after 30, 45 and 60 days from sowing

3.2 Observation of plant growth with different treatment

Observation of plant growth with different treatment tabulation of plant growth parameters on treatment with PGBM and DAP.

Table 2: Final means of observation after sowing working days

Treatment	Control	PGBM	Urea (DAP)
Plant length (cm)	19.24	26.45	11.76
No. of leaf	7.99	7.99	3.83
No. of sown seeds	2.25	2.58	2.08
No. of germinated seeds	1.00	1.24	1.33

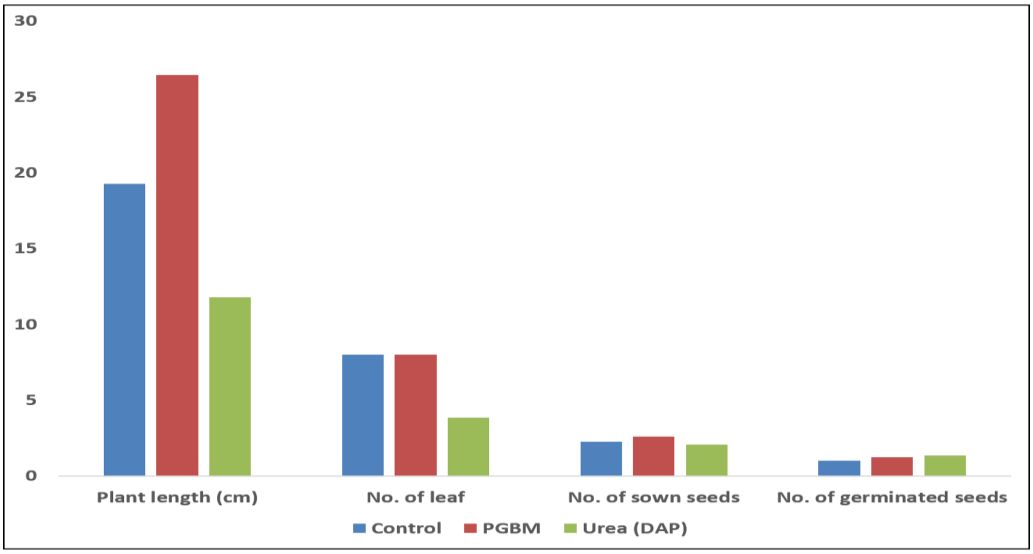

Fig 2: Graph of final means of observation after sowing working days

Mean number of leaves is better in high concentration of PGBM (26.45) other treatments urea and control. Dry shoot weight output is better in PGBM (2.57) than other treatments urea and control. Fresh shoot weight is also increasing by applying PGBM (7.99) other treatments urea and control. Root length is better in PBGM (26.45) other treatments urea and control. Number of fruits output is better in PGBM than other treatments urea and control. Dry root weight is also increasing by applying PGBM (2.58) other treatments urea and control. Fresh root weight is also increasing by applying PGBM (7.99) other treatments urea and control. Plant height is better in PBGM (26.45) other treatments urea and control.

Table 3: Effect of various treatment of bio-organic formulation on Biomass of pea

Treatments	Leaf Size	Leaf Length	Arial Part	Root Length	Root Hair	Root Width	No. Of Leaf	Full Plant Size	Fresh Weight	Stem Weight	Arial Part Weight	Root Weight	Leaf Weight
Control	6	25	9	15	2	6	9	40	14.48	0.86	0.8	1.18	1.63
PGBM	16	45	25	13	12	1.5	13	60	136.26	8.7	9.1	10.34	17.74
DAP	2.5	13	5	3	16	0.4	6	18	1.21	0.15	0.2	0.04	0.36

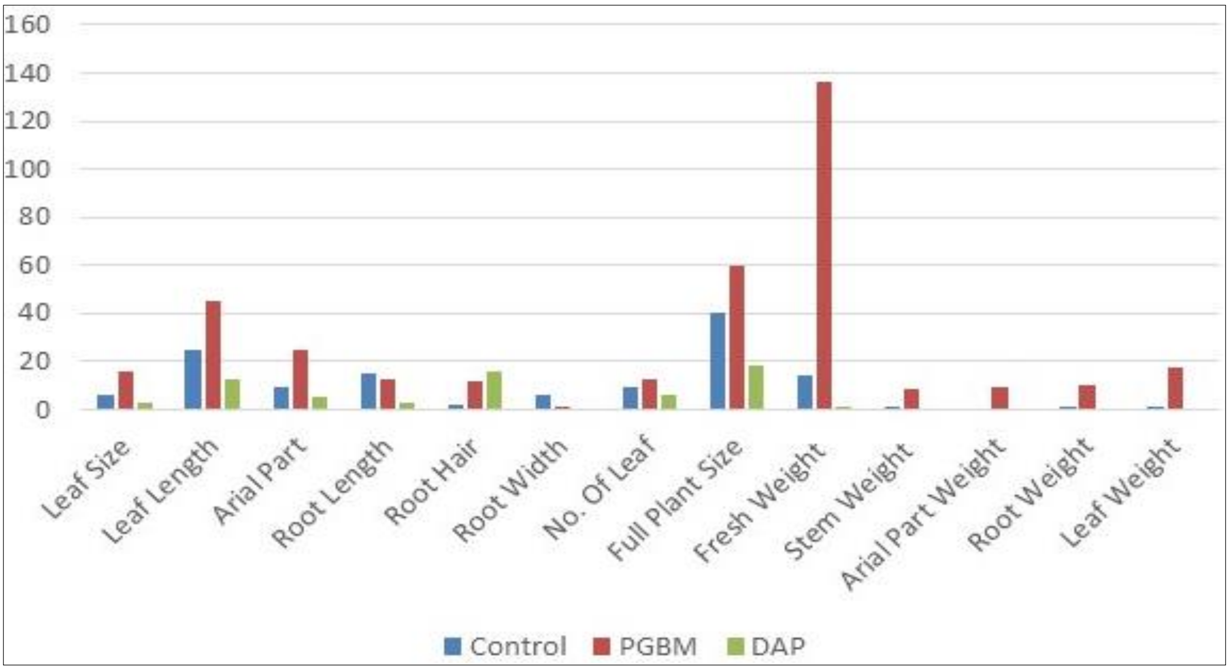

Fig 3: Reproductive growth in pea (control vs Treated) after 60 days of sowing. Further, to depict the accuracy and significance of data, observations were statistically tested using independent t-test on mean values of different phenotypic characters.

Table 4: Independent t-test on dosages of PGBM on Biomass of PEA to calculate the significance level of observations.

Treatments	Control	PGBM		DAP	
Biomass Parameter	Mean	Mean	p-value	Mean	p-value
Leaf size(cm)	06	16	0.005*	2.5	0.003*
Leaf length(cm)	25	45	0.004*	13	0.002*
Arial part(cm)	09	25	0.001**	05	0.002*
Root length(cm)	15	13	0.113	03	0.332
Root hair(cm)	02	12	0.044*	16	0.187
Root width(cm)	06	1.5	0.032	0.4	0.311
No. of leaf	09	13	0.00**	06	0.421
Full plant size(cm)	40	60	0.002**	18	0.003
Dry weight(g)	2.9	62.2	0.003**	0.12	0.089
Stem weight(g)	0.02	3.9	0.012*	0.01	0.076
Arial part weight(g)	10.1	1.5	0.011*	0	0.045
Root weight(g)	0.2	3.2	0.224	0.01	0.002
Leaf weight(g)	10.3	5.6	0.045*	0.02	0.011

Test applied: Independent t test (Testing of means), *Statistically Significant at 5% level of Significance (p<0.05). ** Highly significant at 5% level of Significance (p< 0.005).

4. Discussion

It is well recognized that the leaves use of fresh Drumstick leaf and twigs juice along with Panchagavya, Humic acid, and oiled seed cake can positively influence the plant biomass parameters (Balakumbahan and Rajamani, 2010; Emmanuel 2011a & b) [6, 7]. It has been reported that 30 times diluted Moringa leaf extract significantly increased seed and seedling vigour in wheat (Afzal *et al*., 2008) [1], Maize (Basra *et al*., 2011) and many grass species including Cenchrus ciliaris, Panicum antidotala and Echinochola crusgalli (Nouman *et al*., 2012a) [2]. Moringa leaf extract spray increased the yield in crops like peanut (5319 kg/hec), onion (4194 kg /hec) and black bean (1194 kg / hec) compared to their respective control (Foidl *et al*., 2001) [8]. Several experiments were sustained that the increased growth and yield parameters by foliar uses of Moringa leaf extracts at different percentage and combined with Panchagavya and Humic acid. The mixture of all different organic substances are economically viable for producing higher dry herbage yield in sacred basil - *Ocimum sanctum* L., (Prabhu *et al*., 2010) [13]. The same impacts of higher value of growth and yield were recorded in Senna crop Cassia angustifolia var.KKM.1 (Balakumbahan and Rajamani, 2010) [2]. The field investigation established the fact that application of M. oleifera de-oils seed cake without pre-decomposition as an organic fertilizer on a maize farm achieved significant improvement on soil nutrient as well as the plant yield, as compared to the control (Emmanuel *et al*., 2011a & b) [6, 7]. Remaining to the reported potential performance of panchagavya on vegetable cropes (Rajamani *et al*., 2014), the present study was carried out in an attempt to explain its effect on vegetative and reproductive growth of pot cultured tomato plant.

The field investigation established the fact that application of M. oleifera de-oils seed cake without pre-decomposition as an organic fertilizer on a maize farm achieved significant conducted an experiment in split plot design with three replications in sandy loam soil (Mishra *et al*. 2010) [11]. The experiment comprised 32 treatment combinations of four levels of fertility (Control, 50, 75 and 100% RDF) and eight bio-fertilizer treatments (Control, Rhizobium, PSB, PGPR, Rhizobium+PSB, Rhizobium+PGPR, PSB+PGPR and Rhizobium +PSB+PGPR). Results indicated that the combined application of 100% RDF and seed inoculation with Rhizobium+PSB+PGPR improved all the growth; yield attributes and yields of field pea. Grain yield of field pea up to 31.00 q ha-1 with the application of 100% DRF and seed inoculation of Rhizobium + PSB + PGPR, yield was 10.96 and 11.93% higher over co-inoculation of Rhizobium + PSB + PGPR (27.60 q ha-1) and 100% RDF (27.30 q ha-1) application. El Shaikh *et al*. (2010) conducted a field experiment aimed to investigate the efficiency of VA-mycorrhizal inoculants as an effective alternative for phosphorus chemical fertilizer on the productivity of some garden pea cultivars (Master B, Early perfection and progress no.9). They reported that early perfection cultivar gave the highest total green pods yield (5.270 and 5.520 ton/bed) as compared to other cultivars with application of phosphorus and inoculation with VA-mycorrhiza. The most interesting result was found with interaction among VA-mycorrhizal inoculants with early perfection cultivar (Jaipaul *et al*. 2011). were conducted Field experiments in 2006–08 to study the effect of different organic manures in comparison to inorganic inputs on growth, yield, and quality attributes of garden pea (*Pisum sativum* L.). Poultry manure + biofertilizer resulted in yield of garden pea at par with integrated nutrient management. In summery the yield attributing characters as well as the yield of pea was significantly increased with inoculation of biofertilizers than the control. This increase in yield appear due to proper establishment and greater infection of Rhizobium strain, more number of nodules and their weight, which resulted in supply of N on larger quantity to plants. So a judicial combination of inorganics and biofertilizers will give the best result on yield attributes and yield.

The present study was conducted to the Influence of biofertilizers on plant growth and seed yield of Pea (Pisum sativum L.). Based on the mean performance the Treatment- 8 (100% RDF + Rhizobium 200 gm/ kg) was found best treatment for plant growth and seed yield. This obtained high in plant height (50.65cm), Number of branches per plant (13.75), Number of leaves per plant (33.10), days to 50% flowering (49.33), Number of pods per plant (16.00), days to maturity (81.00), Pod length (8.10cm), Number of seed per pod (6.45), 100 seed weight (seed index) (17.45gm), seed yield per plant (17.35gm), Nodules per plant (21.95). Thus, it indicates that the process of seed treatment by biofertilizers may be better option for seed growers to achieve higher seed yield and yield attributes in pea. Biofertilizers are one of the most important tools in Agriculture for highest plant growth and seed production. Biofertilizers are prepared from live cells of different microorganisms and applied to soil, seed to the availability of nutrients and to improve fertility status of soil. Biofertilizers were found to be superior with regards to plant growth, and yield characters over control (Hukam Singh Kothyari *et al.,* 2017) [9].

Despite the existence of a considerable knowledge on effects of specific taxa of biofertilizers, a comprehensive quantitative assessment of the performance of biofertilizers with different traits such as phosphorus solubilization and N fixation applied to various crops at a global scale is missing. We conducted a meta-analysis to quantify benefits of biofertilizers in terms of yield increase, nitrogen and phosphorus use efficiency, based on 171 peer reviewed publications that met eligibility criteria. Major findings are: (i) the superiority of biofertilizer performance in dry climates over other climatic regions (yield response: dry climate +20.0 ± 1.7%, tropical climate +14.9 ± 1.2%, oceanic climate +10.0 ± 3.7%, continental climate +8.5 ± 2.4%); (ii) meta-regression analyses revealed that yield response due to biofertilizer application was generally small at low soil P levels; efficacy increased along higher soil P levels in the order arbuscular mycorrhizal fungi (AMF), P solubilizers, and N fixers; (iii) meta-regressions showed that the success of inoculation with AMF was greater at low organic matter content and at neutral pH. Our comprehensive analysis provides a basis and guidance for proper choice and application of biofertilizers (Lukas Schütz *et al.*, 2018) [11]. A bio-fertilizer is a modernized form of organic fertilizer into which beneficial microorganisms have been incorporated. This review mainly focus on components, mechanisms, market availability on Biofertilizer. Nitrogen fixers, potassium solubilizers, phosphorus solubilizer and phosphorus mobilizers that are applied exclusively or in combination with fungi are the components of Biofertilizer. Various types of microbial cultures and inoculants are available on the market today and these have rapidly increased because of the advances in technology. There is a success to improve mineral uptake, release minerals from soil and organic matter, enhance plant hormone production, induce systematic resistance mechanisms, and induced root systems under greenhouse and field condition (Daniel Yimer *et al.*, 2019) [5]. Biofertilizers increases the soil fertility naturally and does not effect the soil like chemical fertilizers. Hence to increase the producity of the soil the use of biofertilizer is a must. The comparative effect of biofertilizer Rhizobium on the growth and yield of Mungbean vigna radiata (*L. Wilczek*) was studied. The seeds of mungbean were treated with biofertilizer and their result was recorded after 45 days. The proves that plants treated with Rhizobium japonicum showed excellent results in the morphological as well as biochemical parameters result as compared to controlled plants (Satish Bhalerao 2015) [17]. Continuous application of expensive chemical fertilizers causes reduction of organic matter content in soil and also microbial activity drasticaly. Biofertilizers are organic, bio-degradable. They contain micro-organisms, provide nutrients *viz*., N, P, K and other nutrients, antibiotics, hormones like auxins, cytokinins, vitamins which enrich root rhi-zosphere. The present article highlights biofertilizer mediated crop functional such as plant growth and productivity, nutrition, plant protection and there by crop improvement. The knowledge gained from the literature appraised here in will help us to understand the physiological bases of biofertilizers towards sustainable agriculture in reducing problems associated with the use of chemicals fertilizers (Kamlesh Kumar Yadav *et al.*, 2018) [10].

5. Conclusion

From the above enumeration, it can be concluded that PGBM could be a potent source to improve soil fertility, crop productivity and quality. This can also be a potential alternative for fertigation which is becoming common in most of the crops. However, care should be taken that bio enhancers which are used in limited quantities cannot meet the entire nutrient requirement of the crops. These simply catalyze quick decomposition of organic wastes in to humus, hence incorporation of enough bio mass preferably combination of plant and animal product, which is prerequisite for improving soil fertility and crop productivity. Combined with manures and frequent use of bio enhancers can address many challenges of agriculture and will be surface way for sustainable agriculture through organic resources. These simply catalyze quick decomposition of organic wastes in to humus, hence incorporation of enough bio mass preferably combination of plant and animal product, which is prerequisite for improving soil fertility and crop productivity. Combined with manures and frequent use of bio enhancers can address many challenges of agriculture and will be surface way for sustainable agriculture through organic resources. Bio-organic formulation PGBM has increasing level of growth than other treatments. Mean number of leaves is better in high concentration of PGBM (45 cm) other treatments. Fresh weight is also increasing by applying PGBM (136.26g) other treatments urea and control. Plant height is better in PGBM (60cm) in comparison to other treatments.

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