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RESEARCH ARTICLES

Performance of garden pea (*Pisum sativum* var. *hortense*) under different organic liquid manure applications in Eastern Plateau and Hill zone of India

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Abstract

A field study was executed at the farm of Divyayan Krishi Vigyan Kendra, Ramakrishna Mission Ashrama, Ranchi, Jharkhand, India during the winter season of 2021 in a randomised block design using 6 treatments (Panchagavya @10%, Sasyagavya @10%, Kunapajala @10%, Paudh Sanjeevani @10%, Veeja Sanjeevani @5% and control/water), replicated thrice to find out the influence of organic liquid manures on garden pea growth, yield, quality and profitability. Results depicted that spraying of Panchagavya @10% at 30 and 60 days after sowing registered maximum growth attributes, green pods/plant (18.4), seeds/pod (6.8), pod length (8.85 cm), 100 seed weight (22.9 g) and girth (4.97 cm), total green pod yield (107.5 q/ha), total sugar (12.19%), protein (19.1%) and vitamin-C (217.2 mg/100 g) of garden pea. Consequently, it ensured the highest gross return (₹5,37,660/ha), net return (₹4,54,558/ha) and B:C (6.47). Spraying of Paudh Sanjeevani @10% was also statistically equally effective in registering growth, green pods/plant, seeds/pod, green pod yield, quality, gross return, net return, and B:C of garden pea. Therefore, garden pea growers of Eastern Plateau and Hill zone of India can be benefitted through uses of Panchagavya or Paudh Sanjeevani @10% at 30 and 60 days after sowing.

Keywords Garden pea · Green pod yield · Growth · Organic liquid manure · Profitability · Quality

Introduction

Garden pea is an important winter vegetable legume having high protein (21–25%) including high amino acids, especially lysine and tryptophan (Bhat et al 2013). India ranks second in global garden pea production (32.09 mt) after China with 497.00 thousand of hectares area (FAO 2016). Jharkhand is a significant producer of garden pea (362.84 thousand tonnes) in India with a productivity of 14.88 t/ha (HSD, DAC and FW 2016). To increase the supply to meet its demand as well as to reduce its high market price, garden pea productivity should be increased at this hour especially in the context of agricultural land shrinkage and climate change scenario.

Modern day crop cultivation relies on of the use of chemical fertilizers. Over time, increased fertilizer use in conventional farming results in a number of detrimental environmental effects, including eutrophication of water bodies, soil degradation, and climate change and global warming (Verhulst et al 2013; Patel et al 2023).

On the other hand, excessive tillage damages soil fertility by reducing microbial diversity and activity, exposing soil organic matter to rapid oxidation, and interfering with the soil's natural nutrient cycle processes (Page et al 2020; Singh et al 2021; Ghosh et al 2023). Continuous and excessive use of chemical fertilizers not only leads to depletion of soil health, loss of soil productivity and environmental pollution, but also causes serious health issues of the growers, consumers and other living organisms in the ecosystem. Use of chemicals is beneficial for short term and detrimental for long term sustainable agricultural production (Biswas 2020). On the other hand, organic farming practices as alternative, sustainable approaches can solve these issues and help

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the crop to realize good growth and yield. In organic farming, the application of nutrients from organic sources is done instead of chemical fertilizers which ensures crop productivity and quality in an eco-friendly, sustainable way.

Among the different alternatives of chemical fertilizers, various organic liquid manures like Panchagavya, Sasyagavya, Kunapajala, Sanjeevani etc. are emerging as highly effective for many crops (Solanki et al 2015). They contain various beneficial micro-organisms, macro and micro-nutrients, plant growth promoters, antioxidant, and plant protection properties etc. (Anandan et al 2016). These liquid manures are prepared from on-farm/local raw materials or products like cow dung, cow urine, cow ghee, cow milk, cow curd, crop field and livestock waste and some other low-cost materials through fermentation and/or decomposition. They act as bio stimulants and rejuvenate degraded soil health leading to good crop growth and high crop yield and quality (Ram et al 2018). Researchers working in various agro-ecological circumstances have acknowledged the benefits of these liquid formulations not only on soil health but also on crop quality and productivity (Aulakh et al 2013; Mahto and Dutta 2018; Mukherjee et al 2023). Earlier, Dutta et al (2018) studied garden pea cultivation using Panchagavya and the biodynamic formulation BD-501 and obtained positive results. It is therefore, hypothesized that the application of these organic liquid manures can enhance garden pea growth and productivity. However, there has been limited research done on the impact of these liquid formulations on crop performance in the acidic, low-fertile soils of the eastern Indian plateau. Considering all these facts, the following study was planned and executed to confirm the efficacy of manures and screen out the most effective organic liquid manure for organic garden pea cultivation in Jharkhand, India.

Materials and methods

Experimental site

The field experiment was conducted at the farm of Divyayan Krishi Vigyan Kendra, Ramakrishna Mission Ashrama, Morabadi, Ranchi Jharkhand (23.23°N latitude, 85.23°E longitude and 628 m above the mean sea level) during the winter season of 2021–22 to study the response of garden peas to the application of various organic liquid manures. The experimental soil was clay loam textured, red and lateritic in nature having 6.70 of pH, 1.20% organic carbon, 393.11 kg/ha of available N, 140.0 kg/ha of available P_2O_5 and 228.0 kg/ha available K_2O. The experiment was conducted at Divyayan Krishi Vigyan Kendra, where organic farming has been performed for the past 15 years.

Treatment details

The experiment followed randomized block design having 5 organic liquid manures and water application as control (T_1: Panchagavya@10%, T_2: Sasyagavya@10%, T_3: Kunapajala@10%, T_4: Poudh sanjeevani@10%, T_5: Veeja Sanjeevani@5% and T_6: Control/water), replicated thrice. Preparation processes of the organic liquid manures are mentioned in Table 1. After obtaining each of the mother solution, it was taken 50 L and mixed with 450 L of water for single spraying @10% in one hectare crop field.

Experiment details

Garden pea was sown on 22nd November, 2021 at a spacing of 30 × 15 cm. 5 times plucking of garden peas (var. GS 10) were taken on February 15, 20, 25, March 2 and 6, 2022. The individual plot size was 4 × 3 m. FYM @ 10t/ha was applied as basal and organic liquid manures (except Veeja Sanjeevani) were sprayed 2 times at 30 and

Table 1 Preparation of various organic liquid manures

Organic liquid manure	Preparation
Panchagavya	Five cow-based ingredients i.e. cow dung, cow urine, milk, curd and ghee were mixed in 5:3:2:2:1 ratio and incubated for 7–9 days in an earthen pot or wide mouth plastic container. Stirring with a stick was done every day two times during morning and evening, clockwise and anti-clockwise.
Sasyagavya	Initially, vegetable waste/crop residues were chopped. Then, fresh cow dung, cow urine, chopped organic waste and water were mixed at 1:1:1:2 ratio properly and allowed to ferment for 10–12 days aerobically (stirring twice a day).
Sanjeevani	Cow dung, cow urine and water were mixed in the ratio of 1:1:2 in an earthen pot and left aerobically (stirring twice daily) for 7–9 days. Stirring with a stick was done every day two times during morning and evening, clockwise and anti-clockwise.
Kunapajala	It contains mainly cow dung, cow urine, water and any animal flesh like part of fishes, poultry birds or animals. Fresh cow dung, cow urine, animal waste (flesh of fishes, poultry birds etc.) and water were taken in a bucket at 1:1:1:2 ratio and mixed properly. Then, the mixture was fermented in a shady place for 25–30 days aerobically (stirring twice a day).

60 days after sowing (DAS) through knapsack sprayer. Veeja Sanjeevani was used for seed treatment. Apart from one pre-sowing irrigation, three irrigations were given at 30 DAS, at first flowering and pod development. Three hand weedings at 15, 30 and 45 DAS were carried out to reduce crop-weed competition. Neem oil @ 5% was sprayed twice at 60 and 75 DAS. The crop was harvested on 6th March, 2022.

Observations taken

Observations on plant height and numbers of leaves/plant were taken at 25, 50 and 75 DAS, while plant population/m^2, pod length, pod girth and 100 seed weight were taken at maturity. Numbers of green pods/plant, numbers of seeds/pod and green pod yield were recorded at 5 times of plucking as and when the pods became marketable in size (February 15, 20, 25, March 2 and 6, 2022). For this, ten plants from a net plot (excluding borders) were randomly chosen and tagged. Plant height was taken using measuring tape from the base to the tip portion of the plant, while the number of leaves was manually counted from these tagged plants and an average was made. At different plucking also, pods of these ten plants per plot were separated, counted and the mean was chalked out. Numbers of seeds/pod was manually counted from 10 randomly selected pods per plot at each plucking and average was made. At each plucking pod the length and girth of 10 randomly selected pods per plot were measured using a measuring scale and an average was made. From these pod lengths and girths obtained in each plucking, a mean was made to represent the pod length and girth of the garden pea in this study. Similar process was also done in the case of counting and weighing 100 seeds after threshing and cleaning.

The quantity of harvested green pods at each plucking from the net area per plot was weighed and expressed in q/ha. Finally, the green pod yield at each plucking was summed up to obtain total green pod yield of garden pea. Thereafter, quality parameters (total sugar, protein and vitamin- C) were estimated at the laboratory of Horticulture, Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI), Ranchi based on the protocols suggested by Dubois et al (1956), Gupta et al (1972) and Seth and Khandelwal (2008), respectively. Finally, production economics i.e. cost of cultivation, gross return, net return and benefit–cost ratio (B:C) was determined based on the following ways:

Cost of cultivation (₹/ha) = Cost involved in the purchase or use of inputs and practices.

Gross return (₹/ha) = Garden pea yield × Market price.

Net return (₹/ha) = Gross return – Cost of cultivation.

B:C = Gross return/ Cost of cultivation.

Statistical analysis

All the data obtained from the field, laboratory and computation were subjected to statistical analysis using the ANOVA method as stated by Panse and Sukhatme (1985) and comparison of treatment means for field and laboratory data was made through Tukey's HSD (honestly significant difference) test using Statistical Product and Service Solutions (SPSS) software (version 25.0). Influence of organic liquid manures on the production economics of garden pea was compared through critical difference at 5% level of significance (Gomez and Gomez 1984).

Results

Growth attributes

The result expressed that organic liquid manures exhibited a statistically significant ($p < 0.05$) and positive influence on plant height and numbers of leaves/plant at 50 and 75 DAS over control (Figs. 1 and 2). At 25 DAS, those growth attributes did not vary among the organic liquid manures and the plant height and leaves/plant among the treatments ranged 25.8–27.5 cm and 13.2–14.5, respectively. It was further explored that the plant height and number of leaves/plant of garden pea were gradually increased throughout the crop growth period with a declining rate after 50 DAS. Among different organic liquid manures, application of Panchagavya@10% (T_1) attained maximum plant height (33.8% and 40.5% taller than control/water at 50 and 75

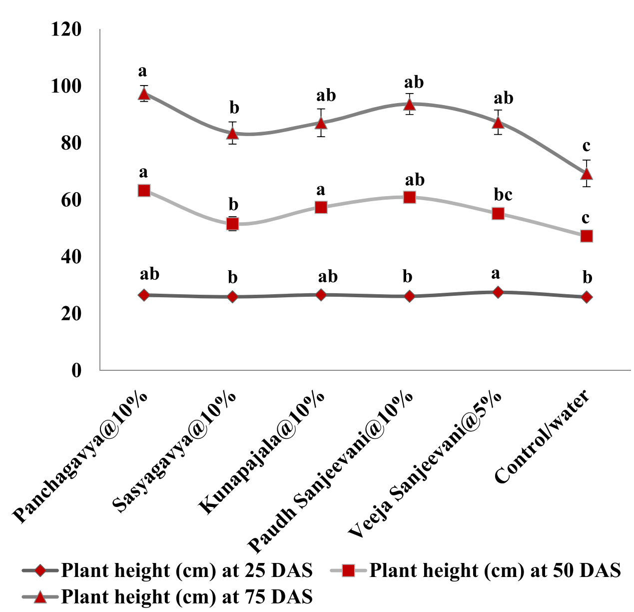

Fig. 1 Impact of organic liquid manures on plant height of garden pea

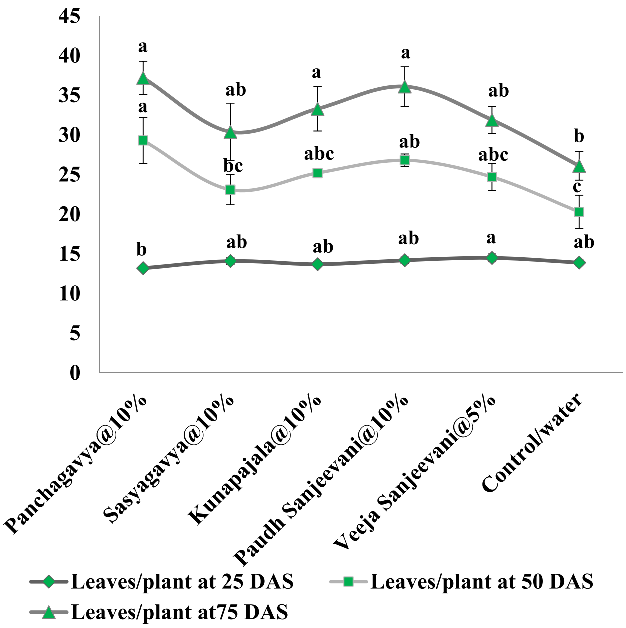

Fig. 2 Impact of organic liquid manures on no. of leaves/plant of garden pea

DAS, respectively) and leaves/plant (44.3% and 42.5% higher than control/water at 50 and 75 DAS, respectively), closely followed by spraying of Paudh Sanjeevani@10% (T_4) (Plant height: 28.8% and 35.2% taller; leaves/plant: 32.0% and 38.3% higher than control/water at 50 and 75 DAS, respectively) and Kunapajala@10% (T_3) (Plant height: 21.4% and 25.7% taller; leaves/plant: 24.1% and 27.6% higher than control/water at 50 and 75 DAS, respectively). Both the Paudh Sanjeevani and Panchagavya applications remained statistically similar to each other in attaining these growth attributes. The plant population/m^2 was taken at maturity, and it did not vary significantly among the treatments (Fig. 3). The garden pea plant population/m^2 ranged between 21.3 and 22.0.

Yield attributes

Yield attributes except 100 seed weight showed statistically significant variations among different organic liquid manures and control (Figs. 4, 5 and 6). 100 seed weight did not vary among treatments probably because they were genetically governed. Organic liquid manures registered higher yield attributes over control, irrespective of plucking dates. Results explored that spraying of Panchagavya@10% (T_1) exhibited 34.5%, 31.3%, 30.0%, 47.8% and 66.7% higher numbers of pods/plant as well as 20.4%, 33.9%, 39.7%, 32.7% and 27.3% higher numbers of seeds/pod than the control/water at 1st, 2nd, 3rd, 4th and 5th pluckings, respectively. Further, application of Panchagavya@10% (T_1) ensured the highest pod length

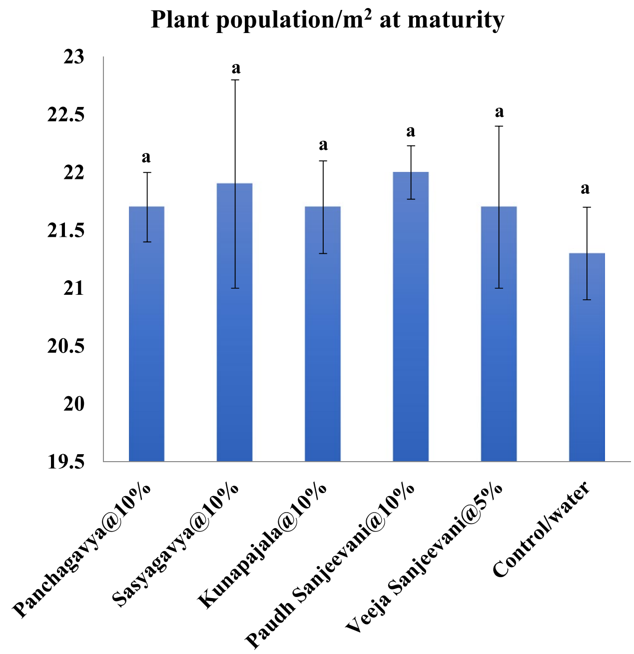

Fig. 3 Impact of organic liquid manures on plant population of garden pea/m.^{2}

(8.85 cm), pod girth (4.97 cm) and 100 seed weight (22.9 g) of garden pea, which were respectively 20.1%, 20.3% and 13.9% higher than the control/water. It was next followed by spraying of Paudh Sanjeevani@10% (T_4) (pods/plant: 24.1%, 31.3%, 26.7%, 34.8% and 55.6%

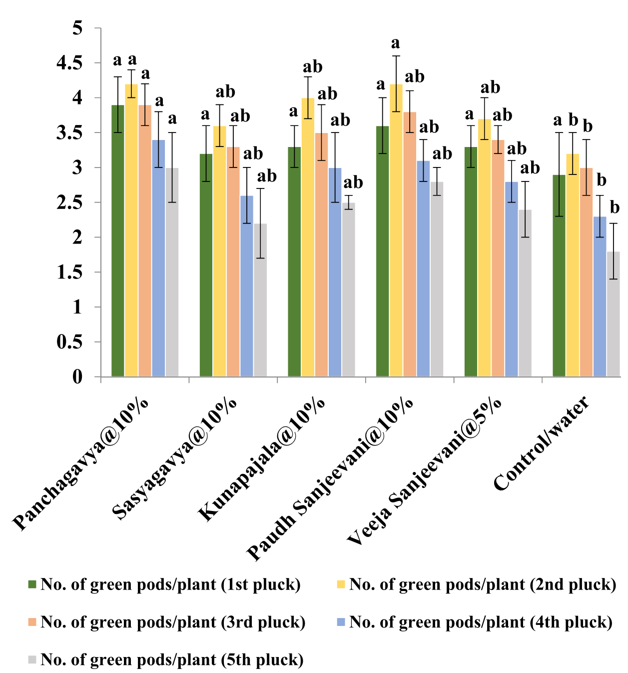

Fig. 4 Impact of organic liquid manures on no. of green pods/plant of garden pea

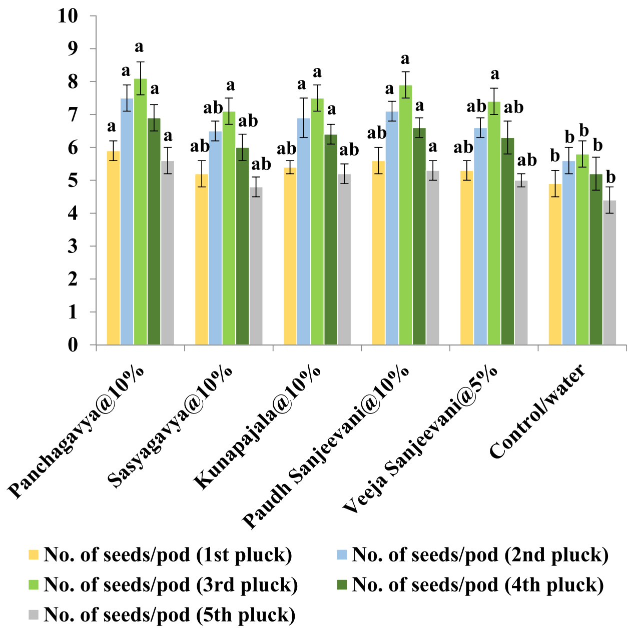

Fig. 5 Impact of organic liquid manures on no. of seeds/pod of garden pea

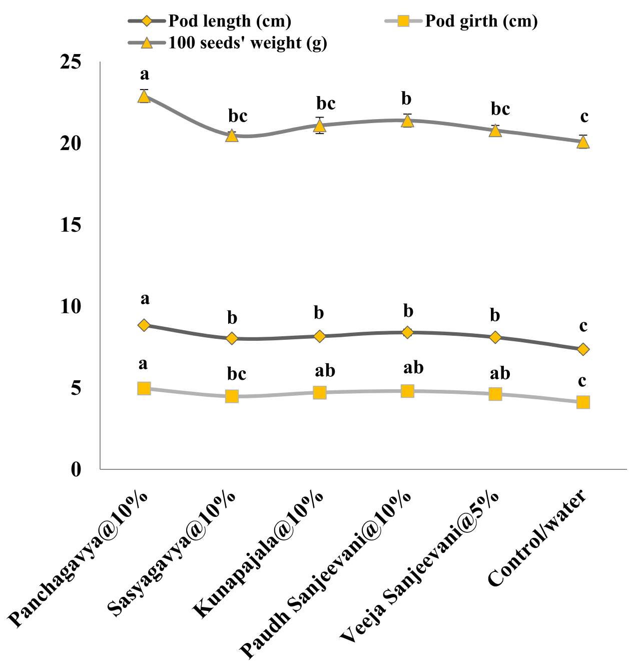

Fig. 6 Impact of organic liquid manures on pod length, girth and 100 seeds' weight of garden pea

higher; seeds/pod: 14.3%, 26.8%, 36.2%, 26.9% and 20.5% higher at the 1st, 2nd, 3rd, 4th and 5th pluckings, respectively; pod length: 14.1%; pod girth: 16.5%; 100 seed weight: 6.5% higher than the control/water) and Kunapajala@10% (T_3) (pods/plant: 13.8%, 25.0%, 16.7%, 30.4% and 38.9% higher; seeds/pod: 10.2%, 23.2%, 29.3%, 23.1% and 18.2% higher at 1st, 2nd, 3rd, 4th and 5th pluckings, respectively; pod length: 10.9%; pod girth: 14.3%; 100 seed weight: 5.0% higher than the control/water). Treatments T_4 and T_1 were statistically the same regarding all the yield attributes of garden pea. The influence of organic liquid manures on yield attributes was sequentially $T_1 > T_4 > T_3 > T_5 > T_2 > T_6$.

Green pod yield

Because of yield attributes, the green pod yield of garden pea varied significantly ($p < 0.05$) among different organic liquid manures and control (Fig. 7). At each plucking as well as in total, the green pod yield of garden pea was better influenced by organic liquid manures over control. Among different organic liquid manures, green pod yield of garden pea was maximum (19.3, 24.6, 24.3, 22.0, 17.3 and 107.5 q/ha at 1st, 2nd, 3rd, 4th, and 5th pluckings and total, respectively) under spraying of Panchagavya@10% (T_1) which was respectively 35.9%, 59.7%, 51.9%, 89.7%, 55.9% and 57.2% higher than the control/water. It was closely followed by the application of Paudh Sanjeevani@10% (T_4) (22.5%, 48.7%, 43.1%, 69.0%, 43.2% and 44.3% higher than the control/water at 1st, 2nd, 3rd, 4th, 5th pluckings and total, respectively) and Kunapajala@10% (T_3) (12.0%, 38.3%, 28.8%, 59.5%, 31.5% and 32.7% higher than the control/water at 1st, 2nd, 3rd, 4th, 5th pluckings and total, respectively). Both the Paudh Sanjeevani and Panchagavya applications remained statistically indifferent.

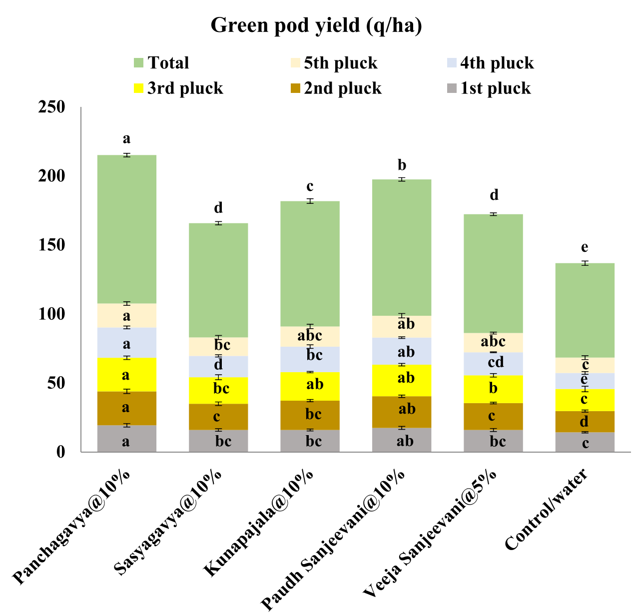

Fig. 7 Impact of organic liquid manures on green pod yield of garden pea

Quality attributes

Quality attributes of garden pea seeds such as total sugar and protein did not show statistically significant variations among the organic manures and control, while ascorbic acid (vitamin-C) varied significantly ($p < 0.05$) among the organic manures and control (Figs. 8 and 9). All the organic liquid manures improved the quality of garden pea seeds over control. Among the liquid manures, application of Panchagavya@10% (T_1) exhibited the highest total sugar (12.19%), protein (19.1%) and vitamin-C (217.2 mg/100 g), which were 20.8%, 11.0% and 28.1% greater than the control/water. It was closely followed by Paudh Sanjeevani@10% (T_4) (total sugar: 11.72%, protein: 18.9%, vitamin-C: 204.5 mg/100 g) and Kunapajala@10% (T_3) (total sugar: 11.29%, protein: 18.5%, vitamin-C: 197.6 mg/100 g), which were respectively 16.2% and 11.9% higher in total sugar, 9.9% and 7.6% higher in protein as well as 20.6% and 16.6% higher in vitamin-C than the control/water. Both Paudh Sanjeevani and Panchagavya applications remained statistically at par with each other in case of vitamin-C.

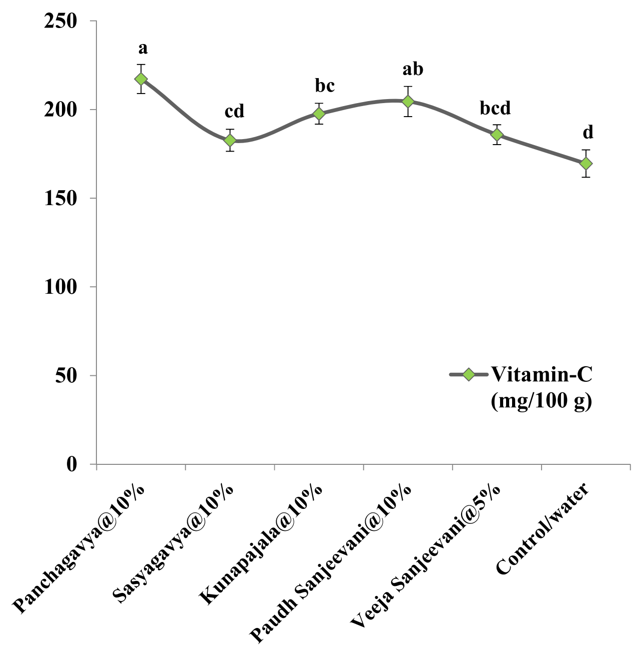

Fig. 9 Impact of organic liquid manures on vitamin-C of garden pea seeds

Production economics

Production economics of garden pea indicated that use of organic liquid manures incurred a higher cost of cultivation of over control (Table 2). Among the manures, use of Panchagavya@10% (T_1) required the maximum cost of cultivation (₹83,102/ha) of garden pea. It was perhaps due to the cost of various cow-based products used for the preparation of Panchagavya. However, because of the high green pod yield, the use of Panchagavya@10% (T_1) ensured maximum gross return (₹5,37,660/ha), net return (₹4,54,558/ha) and B:C (6.47). It was closely followed by the application of Paudh Sanjeevani@10% (T_4) (gross return: ₹4,93,416/ha, net return: 4,14,281/ha and B:C of 6.24) and it remained statistically at par with that under application of Panchagavya. Control or water application (T_6), on the other hand, recorded lowest gross return (₹3,42,083/ha), net return (₹2,70,693/ha) and B:C (4.79) because of poor growth and yield of garden pea.

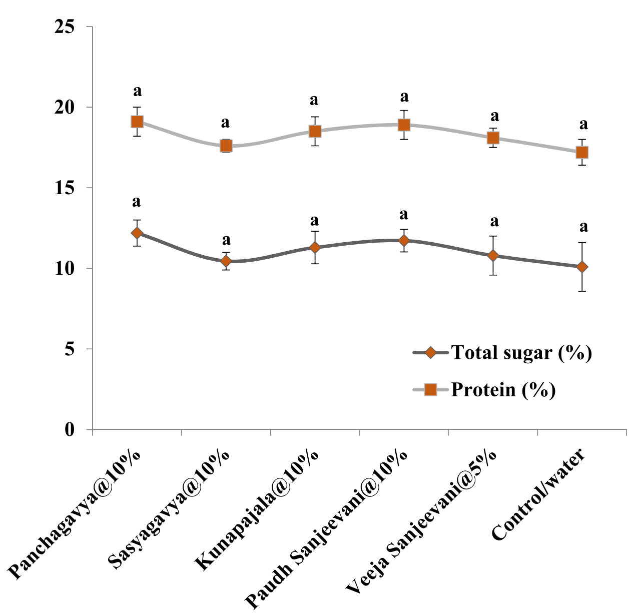

Fig. 8 Impact of organic liquid manures on total sugar and protein of garden pea seeds

Discussion

Different organic liquid manures have undergone significant changes in the growth characteristics of garden pea at 50 and 75 DAS. It might be due to variation in the microbial and nutritional properties of them (Biswas et al 2023). At 30 DAS, plant height and numbers of leaves/plant did not vary among the manures and control because of the fact that spraying of organic liquid manures was first done at 30 DAS. However, the Veeja Sanjeevani treatment recorded slightly better plant height and leaves/plant over others as seeds were initially treated with it before sowing. Veeja Sanjeevani is abundant in nutrients, growth-promoting agents, and beneficial microbes that possibly improved metabolic processes such as water uptake and the hydrolase, phosphatase, lipase, and proteinase breakdown of seed

Table 2 Impact of organic liquid manures on production economics of garden pea

Treatment	Cost of cultivation (₹/ha)	Gross return* (₹/ha)	Net return (₹/ha)	B:C
T_1:Panchagavya@10%	83,102	5,37,660	4,54,558	6.47
T_2:Sasyagavya@10%	77,020	4,14,197	3,37,177	5.38
T_3:Kunapajala@10%	80,246	4,54,195	3,73,949	5.66
T_4:Paudh Sanjeevani@10%	79,135	4,93,416	4,14,281	6.24
T_5:Veeja Sanjeevani@5%	76,111	4,30,255	3,54,144	5.65
T_6:Control/water	71,390	3,42,083	2,70,693	4.79
SEm ±	–	14,805	13,433	0.09
CD $_{(P=0.05)}$	–	44,413	40,297	0.26

*Price of green pods: ₹50/kg

storage materials (Bewley and Black 1985), which in turn impacted positively on seed germination and made the seedlings robust against soil and seed borne pathogens (Lim et al 2013; Tao et al 2015). However, at later stages, the impact of liquid manures on garden pea was prominent as they might help the plants to absorb nutrients and moisture more quickly due to the presence of growth-regulating hormones and enzymes. Thus, it made taller plants by making emergence of more nodes and internodes with new leaves (Chakraborty and Sarkar 2019). In the present study, liquid organic manures specially Panchagavya and Paudh Sanjeevani remained statistically similar as they were probably rich in various macro and micronutrients, beneficial micro-organisms, plant growth promoting hormones etc. which altogether contributed to cell division and elongation, emergence of leaves resulting in high growth of garden pea plants. Shakila and Anburani (2008) observed high cell division and elongation in tomato plants under Panchagavya application due to the high synthesis of GA_3 and IAA. The result was also in conformity with the finding of Dutta et al (2018) in which they obtained the best garden pea growth using Panchagavya and the biodynamic formulation BD 501. Plant population at maturity was not variable among different liquid manure formulations and control possibly due to the fact that the first spraying of organic manures was done at 30 DAS during which plants had already germinated and were established in the field.

The influence of organic liquid manures on yield attributes was like $T_1 > T_4 > T_3 > T_5 > T_2 > T_6$. Increment in yield attributes reflected the positive influence of liquid manures specially Panchagavya and Paudh Sanjeevani on growth attributes. Greater amounts of N from these liquid manures might influence the production of chlorophyll in leaves, which enabled the crop to absorb more CO_2 and sunlight for the production of larger levels of DMA through photosynthesis and thereafter, efficient dry matter partitioning from vegetative parts to reproductive parts of the crop (Biswas et al 2020). Earlier, Somasundaram et al (2003) obtained a greater number of seeds per pod and grain yield under Panchagavya@3% than others in green gram. Maximum pickings of garden pea pods and seeds/pod was found in the 2nd and 3rd plucking, respectively and they gradually declined in subsequent plucking. It was perhaps due to less dry matter translocation to later formed pods. Panchagavya and Paudh Sanjeevani were superior to control as their raw materials possibly contained high nutritional properties as well as growth regulating potentials which improved crop's photosynthetic efficiency and translocation of assimilates to reproductive parts resulting in higher yield attributes. Positive influence of organic liquid manures on the development of N-fixing, P-solubilizing, cellulose-decomposing, and other advantageous bacteria perhaps positively changed the physical and chemical characteristics of the soil leading to better uptake and utilization of nutrients resulting in the development of yield attributes (Liao et al 2019).

Green pod yield of garden pea also showed an identical trend of yield attributes, in which control influenced the crop least and organic liquid manures specially, Panchagavya outperformed others. Paudh Sanjeevani also ensured a high green pod yield of garden pea at different plucking and showed statistical indifference with Panchagavya. Presence of growth promoting substances like IAA, GA_3, cytokinin, all the essential nutrients, and beneficial microorganisms like *Lactobacillus, Acetobacter, Azosprillum, Phosphobacterium* etc. was speculated as the reason behind the high yield of garden pea under Panchagavya and Paudh Sanjeevani applications. Additionally, Panchagavya probably contained beneficial bacteria which secreted growth promoting substances resulting in high growth and yield of garden pea (Maheswari et al 2016). Upon application of organic liquid manures, the various components present in them work in synergy with soil microorganisms to provide crop with a continuous supply of nutrients through the breakdown and mineralization of organic materials, carbon sequestration, and resistance to biotic and abiotic stressors, leading to better growth, development of reproductive organs and the yield of garden pea (Ye et al 2016; Lian et al 2017). In contrast, poor growth and development of the reproductive parts of garden pea was the reason behind the lowest green pod yield under control treatment. The result corroborated the finding of Dutta et al (2018).

The study further explored that the organic liquid manures improved the quality of garden pea seeds over control. Higher total sugar and protein contents under organic liquid manures (especially, Panchagavya and Paudh Sanjeevani) over control were probably due to higher uptake of nutrients specially nitrogen and water as well as dry matter production. It was previously documented by Woese et al (1995) that stressful environment makes plants to synthesize antioxidants in a more favorable condition. As organically cultivation of garden pea (growing of crop in organic soil as well as use of organic liquid manures) created a stressful environment through slow and less release of nutrients for plant uptake than chemical-based farming, the synthesis of antioxidants especially, ascorbic acid was high. Control also recorded relatively better vitamin-C content due to the high stress posed under no application of organic liquid manures. The result agreed the findings of Bahadur et al (2006) and Dutta et al (2018).

Use of organic liquid manures incurred a higher cost of cultivation of over control because of the requirement of various raw materials for their preparations as well as applications. On the other hand, because no liquid manure was used, the cultivation cost from the control was the lowest. However, organic liquid manures allowed the crop to fetch a greater gross return, net return and thereby, benefit–cost ratio over control/water application. The higher influence of Panchagavya and Paudh Sanjeevani on crop growth and yield was the possible reason behind the high economic profitability from garden pea cultivation over others (Gopal and Gurusiddappa 2022; Yogananda et al 2019).

Conclusions

Overall, the investigation stated that spraying of organic liquid manures was highly effective over control in influencing garden pea growth, yield attributes, green pod yield, quality, and economic viability. On the view of all the growth, yield, quality and economics, Panchagavya@10% or Paudh Sanjeevani@10% at 30 and 60 DAS showed the best performance for garden pea cultivation in Eastern plateau and hill zone of India. Therefore, based on the findings, it is concluded that application of either Panchagavya or Paudh Sanjeevani@10% at 30 and 60 DAS can be beneficial for achieving maximum growth, yield, quality, and economic profitability of organically grown garden pea in Eastern Plateau and hill zone of India.

Declarations

Conflict of interests Authors declare that there exists no competing interest in this article.

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