



Performance of Different Organic Liquid Manures on Growth, Yield and Economics of Field Pea (*Pisum sativum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment was carried out during Rabi season of 2021 at Crop Research Farm, NAI, SHUATS to study about the Performance of different organic liquid manures on growth and yield of Field Pea (*Pisum sativum* L.). The experiment consisted of 9 treatments which includes 3 doses of Panchagavya i.e., Panchagavya 2%, 4% and 6% and 3 doses of Jeevamruth i.e., Control, Jeevamruth 500 l/ha, and Jeevamruth 1000 l/ha, whose effect is observed on Field pea (var. RACHANA). The experiment was laid out in Randomized Block Design with nine treatments replicated thrice. The treatment with the application of Panchagavya 6% + Jeevamruth 1000 l/ha recorded significantly higher plant height (100.8 cm), number of Nodules per plant (28.3), plant dry weight (32.98 g), number of pods per plant (23.3), number of seeds per pod (5.13), Seed index (22.07 g) Seed yield (2.57 t/ha), Stover yield (3.81 t/ha) and Harvest index (40.23%) compared to other treatment combinations. The maximum gross return (INR 238700.00/ha), net return (INR 1,68,752.00/ha) and B:C ratio (2.41) is recorded in treatment with the application of Panchagavya 6% + Jeevamruth 1000 l/ha.

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1. INTRODUCTION

Pulses have a particular role in agriculture since they are high in protein, ranging from 17 to 27%. They are not only a good source of protein, but they also help to preserve soil fertility via biological nitrogen fixation, which helps to promote sustainable agriculture.

Field pea (*Pisum sativum* L.) is a pulse crops belonging to Leguminaceae family. It is a cool-season annual plant that is cultivated in many regions of the world. The field pea (*Pisum sativum* L.) comes in two types: indeterminate (climbing) and determinate (bush or dwarf) [1].

Flowers appear on racemes that emerge from the leaf axils and are highly self-pollinated. The blossoms are white or reddish-purple in most types. Field peas (*Pisum sativum* L.) are generally consumed by humans or fed to cattle. It is an annual herbaceous plant with stems that develop to be 2 to 4 feet long. A leaf has one to three pairs of leaflets and a branching tendril at the end. The leaves are light green and have a white bloom on top. The plant matures into a prostrate vine. Seeds are the major source of protein in a balanced diet, and protein from peas is less expensive than protein from animals. The ripe seeds can be eaten whole or broken into 'dhal.' Field peas are high in protein, 62.1 percent carbohydrates, 1.8 percent fat, and low in fibre, with 86-87 percent total digestible elements, making them a good cattle feed [2]. At the global level, Canada leads in both area (21%) and production (35%) while China is second (13.70%) and Russia is third (12.94 percent). In terms of area (10.53 percent) and output, India is placed fourth (5.36 percent). The most productive country is Ireland (5000 kg/ha), followed by the Netherlands (4766 kg/ha), and Denmark (4048 kg/ha). India's production, on the other hand, is just 955 kg/ha. Field peas (*Pisum sativum* L.) are farmed on an industrial scale in rich nations, but are grown on a subsistence level in poor countries and are regarded a staple crop.

Organic farming has grown in popularity in recent years as more people become aware of the inherent benefits it brings in terms of agricultural yield, soil nutrient status, and environmental safety. In contemporary farming, liquid manure plays a critical role in increasing yields while reducing fertiliser use [3]. Panchagavya, Jeevamruth, and Sanjivak are eco-friendly liquid

organic preparations prepared from cow products such as dung, urine, milk, curd, ghee, legume flour, and jaggary, among others, which promote crop development, yield, and quality. They are high in macronutrients, micronutrients, vitamins, and vital amino acids are all necessary. IAA, GA, and beneficial microbes are all growth promoters [4].

In India, organic farming was well developed during the past such as 'Vedas' which has specified use of 'Panchgavya' and jeevamrutha in agriculture. In Sanskrit, panchgavya refers to a mixture of five products obtained from a desi cow, each of which is referred to as a 'Gavya' and collectively as a 'Panchagavya,' which is a mixture of five cow products such as cow dung, cow urine, milk, ghee, and curd in a proper ratio (5:3:2:2:1) to which banana, jaggary, and coconut water It possesses fertiliser and bio pesticide characteristics [5]. Chemical fertilisers and pesticides were used in agriculture areas, major source of environmental damage and the need for an alternative. Panchagavya has the ability to stimulate growth and increase immunity. It contains approximately 0.10, 0.017, and 0.019 percent NPK, respectively.

Jeevamruth boosts soil biological activity and offers nutrients for crop growth. It is made by combining cow urine, cow dung, pulse flour, and jaggary and fermenting it for a week. The filtered extract is applied to the soil, enriching it microbiologically. Jeevamruth has a high population of nitrogen fixers, phosphate solubilizers, and siderophore makers, according to reports.

2. MATERIALS AND METHODS

A field experiment was conducted during *Rabi* (*Winter*) season of 2021 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.4), medium in organic carbon (0.48%), medium in available Nitrogen (146.43 kg/ha), low in available Phosphorous (19.03 kg/ha) and medium in available Potash (238.1 kg/ha). The treatments consist of three concentrations of panchagavya viz., panchagavya 2%, panchagavya 4% and panchagavya 6% and Jeevamruth viz., Control, Jeevamruth 500 l/ha and Jeevamruth 1000 l/ha whose effect is observed on Field pea (var.

RACHANA). The experiment was laid out in Randomized Block Design with nine treatments replicated thrice. The experiment comprising nine possible treatment combination of above mentioned factor, viz., T₁: Panchagavya 2% + Control T₂: Panchagavya 2% + Jeevamruth 500 l/ha, T₃: Panchagavya 2% + Jeevamruth 1000 l/ha, T₄: Panchagavya 4% + Control, T₅: Panchagavya 4% + Jeevamruth 500 l/ha, T₆: Panchagavya 4% + Jeevamruth 1000 l/ha, T₇: Panchagavya 6% + Control, T₈: Panchagavya 6% + Jeevamruth 500 l/ha, T₉: Panchagavya 6% + Jeevamruth 1000 l/ha, observations regarding growth and yield attributes was recorded during the field experiment.

3. RESULTS AND DISCUSSION GROWTH

When compared to other treatments, the findings indicated that the constant rise in growth

characteristics of Field Pea (*Pisum sativum* L.) recorded maximum plant height (100.8 cm), maximum number of nodules (28.3), and plant dry weight (32.98 g) in treatment with the application of Panchagavya 6% + Jeevamruth 1000 l/ha.

Plant height of field pea (*Pisum sativum* L.) increased significantly during all stages of crop growth. This could be because combined application of panchagavya and jeevamrutha provides better response of plants and also facilitates the plant with nutritional requirements throughout the cropping season, enabling the plant to grow with less competition, resulting in the production of a greater number of branches and leaves per plant and thus increasing plant height. Similar findings were reported by Choudhary et al. [6].

Table 1. Growth attributes of Field pea (*Pisum sativum* L.) at harvest as influenced by different organic liquid manures

Growth attributes			
Treatment	Plant height (cm)	No. of nodules/plant	Plant dry Weight (g)
Panchagavya 2% + Control	90.7	23.9	28.88
Panchagavya 2% + Jeevamrutha 500 liters/ha	92.3	24.7	29.55
Panchagavya 2% + Jeevamrutha 1000 liters/ha	94.0	26.2	30.63
Panchagavya 4% + Control	94.4	24.3	30.25
Panchagavya 4% + Jeevamrutha 500 liters/ha	94.7	27.6	30.51
Panchagavya 4% + Jeevamrutha 1000 liters/ha	99.8	28.1	31.75
Panchagavya 6% + Control	92.8	25.6	30.28
Panchagavya 6% + Jeevamrutha 500 liters/ha	100.2	26.9	30.82
Panchagavya 6% + Jeevamrutha 1000 liters/ha	100.8	28.3	32.98
F- test SEm(±)	S	S	S
	0.42	0.27	0.399
CD (p=0.05)	1.25	0.82	1.197

Table 2. Yield attributes of Field pea (*Pisum sativum* L.) at harvest as influenced by different organic liquid manures

Yield attributes			
Treatment	No. of pods/plant	No. of seeds/ pod	Seed index (g)
Panchagavya 2% + Control	15.6	3.07	21.44
Panchagavya 2% + Jeevamrutha 500 liters/ha	17.2	3.60	21.55
Panchagavya 2% + Jeevamrutha 1000 liters/ha	20.0	4.87	21.69
Panchagavya 4% + Control	17.3	3.33	21.56
Panchagavya 4% + Jeevamrutha 500 liters/ha	17.8	3.80	21.64
Panchagavya 4% + Jeevamrutha 1000 liters/ha	22.6	4.87	21.81
Panchagavya 6% + Control	19.7	3.87	21.78
Panchagavya 6% + Jeevamrutha 500 liters/ha	22.5	5.00	21.92
Panchagavya 6% + Jeevamrutha 1000 liters/ha	23.3	5.13	22.07
F- test SEm(±)	S	S	S
	0.32	0.12	0.002
CD (p=0.05)	0.96	0.36	0.006

Table 3. Yield of field pea (*Pisum sativum* L.) at harvest as influenced by different Organic liquid manures

Treatment	Yield		
	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
Panchagavya 2% + Control	1.29	3.14	29.12
Panchagavya 2% + Jeevamrutha 500 liters/ha	1.60	3.22	33.12
Panchagavya 2% + Jeevamrutha 1000 liters/ha	1.67	3.42	32.83
Panchagavya 4% + Control	1.33	3.24	29.02
Panchagavya 4% + Jeevamrutha 500 liters/ha	1.82	3.74	32.67
Panchagavya 4% + Jeevamrutha 1000 liters/ha	2.33	3.49	39.98
Panchagavya 6% + Control	1.51	3.69	29.09
Panchagavya 6% + Jeevamrutha 500 liters/ha	2.09	3.59	36.70
Panchagavya 6% + Jeevamrutha 1000 liters/ha	2.57	3.81	40.23
F- test SEm(±)	S	S	S
	0.78	0.40	1.013
CD (p=0.05%)	0.24	0.12	3.04

Table 4. Economics of field pea (*Pisum sativum* L.) at harvest as influenced by different Organic liquid manures

Treatment	Economics			
	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
Panchagavya 2% + Control	40,900.00	120280	79,380.00	1.94
Panchagavya 2% + Jeevamrutha 500 liters/ha	53,424.00	148490	95,066.00	1.78
Panchagavya 2% + Jeevamrutha 1000 liters/ha	65,948.00	155620	89,672.00	1.36
Panchagavya 4% + Control	42,900.00	123380	80,480.00	1.88
Panchagavya 4% + Jeevamrutha 500 liters/ha	55,424.00	168950	1,13,526.00	2.05
Panchagavya 4% + Jeevamrutha 1000 liters/ha	67,948.00	216380	1,48,432.00	2.18
Panchagavya 6% + Control	44,900.00	140740	95,840.00	2.13
Panchagavya 6% + Jeevamrutha 500 liters/ha	57,424.00	194370	1,36,946.00	2.38
Panchagavya 6% + Jeevamrutha 1000 liters/ha	69,948.00	238700	1,68,752.00	2.41

*Data was not subjected to statistical analysis

3.1 Yield Attributes

In comparison to other treatments, the treatment with Panchagavya 6% + Jeevamruth 1000 l/ha had the highest number of pods/plant (23.3), number of seeds/pod (5.13), and seed index (22.07 g) according to yield characteristics data collected and analysed at harvest.

The combination of panchagavya and jeevamrutha must have caused a stimulation in the plant system that affected physiological processes and biochemical activities that modify plant anatomy and morphology of yield characteristics in plants, resulting in an increase in the number of pods/plants as reported by Kumawat et al. [7-9].

3.2 Yield

After analysing the data collected after crop harvesting, it was found that the treatment with Panchagavya 6% + Jeevamruth 1000 l/ha had considerably greater seed yield (2.57 t/ha) and harvest index (40.23%) than the other treatments.

Increased yield may be owing to the synergistic impact of the combinational application of panchagavya and jeevamrutha contain all essential micro and macronutrients which is essential for crop growth and yield both of which play important roles in vegetative and reproductive development, and therefore in the production of economic component These results

findings are under the confirmation of Choudhary et al. [6].

3.3 Economics

After harvesting the crop and analysing the economic return based on market price, the results showed a developing trend in with increasing yield across treatments.

In comparison to other treatments, the application of Panchagavya 6% + Jeevamruth 1000 l/ha obtained the highest Gross return (Rs. 238,700/ha), Net return (Rs. 1,68,752.00/ha), and B: C ratio (2.41).

4. CONCLUSION

Based on the results of the foregoing experiments, it was determined that applying Panchagavya 6% + Jeevamruth 1000 l/ha was the most appropriate dose of liquid organic manures to use, as it was proven to be remunerative, lucrative, and economically efficient.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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