



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 1493-1496
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www.thepharmajournal.com

Received: 07-02-2022

Accepted: 16-04-2022

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Effect of organic liquid manure and spraying schedule on growth, yield and economics of field pea (*Pisum sativum* L.) under cow based natural farming

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Abstract

A field experiment was conducted during *Rabi* season of 2021 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP) to investigate the effect of liquid organic manure and spraying schedule on growth and yield of Field pea. The treatments consists of liquid organic manure (panchagavya 2.5%, 5.0%, and 7.5%) and spraying schedule (every 7 days, 14 days, and 21 days) 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 7.5% + Every 7 days recorded significantly higher plant height (100.29 cm), number of Nodules per plant (27.60), plant dry weight (32.45 g), number of pods per plant (23.53), number of seeds per pod (4.93), Seed index (22.01 g) Seed yield (2.77 t/ha), Stover yield (3.70 t/ha) and Harvest index (42.50%) compared to other treatment combinations. The maximum gross return (INR 257300.00/ha), net return (INR 192150.00/ha) and B:C ratio (2.95) is recorded in treatment with the application of panchagavya 7.5% + Every 7 days as well.

Keywords: Field pea, panchagavya, schedule of application, growth, yield, economics

Introduction

Pulses are an important food crop grown globally as a source of stable protein. Among which, India is the world's leading producer and consumer of pulses. Pulses have a wide range of uses as food, feed, and fodder as it provide protein rich food for humans, nutrient rich feed and fodder for cattle, in addition to being a less expensive source of protein. Pulses have been known for significant role in preserving and enhancing the soil's fertility. Pulses cultivation develops a method to fix atmospheric nitrogen in their root nodules, allowing them to satisfy their nitrogen needs to a large extent. Because of which pulse crops fit well into the cropping system. Pulses can withstand drought conditions better than cereal, millets and other crops because of their unique plant types, early maturity, low water and fertiliser requirements and deep-rooted system.

Field pea (*Pisum sativum* L.) is a pulse crops belonging to Leguminaceae family. It is a self-pollinating, annual cool-season leguminous crop that is widely grown around the world. Field pea is the world's most significant pulse crop and India's third most popular *rabi* pulse after chickpea and lentil. Canada rank first in area (21%) and production (35%) at Global level, while China stands second position in area (13.70%) followed by Russia (12.94%). India is ranked fourth in terms of area (10.53 percent) and fifth in terms of output (5.36 percent). Ireland has the highest productivity (5000 kg/ha), followed by the Netherlands (4766 kg/ha), and Denmark (4048 kg/ha). While, India's productivity is only 955 kg/ha. Field pea is grown both in developed and developing countries. In developed countries, field pea is grown on industrial scale, whereas in developing countries, these are grown on subsistence level and considered as staple food.

Organic farming is an age-old traditional practice evolved by our fore fathers where in only organic manures or natural inputs available on the farm are used. As a result, the cost of production is lower as compared to chemical inputs. Organic farming provides balanced nutrition thereby taking care of soil health by improving physical, chemical and biological properties of the soil through nutrient cycling. Organic farming is an age-old traditional practice evolved by our fore fathers where in only organic manures or natural inputs available on the farm are used. As a result, in comparison to chemical inputs, the cost of production is reduced. Organic farming provides balanced nutrition thereby taking care of soil health by

improving physical, chemical and biological properties of the soil through nutrient cycling.

In traditional farming practise, liquid manure plays a critical role in increasing yields while reducing fertiliser use. Panchagavya, Jeevamrut, and Sanjivak are eco-friendly liquid organic preparations created from cow products such as dung, urine, milk, curd, ghee, legume flour, and jaggary, among others, that promote crop development, yield, and quality. They are high in macronutrients, vital micronutrients, vitamins, essential amino acids, growth factors such as IAA and GA, and beneficial microbes. In the current organic farming method, where FYM and compost are employed as fertiliser sources, soil productivity depletes during the transition period (until soil fertility, structure, and microbial activity are restored), resulting in poor yield levels in the first years of cultivation (Natarajan, 2002) [5].

Panchagavya means blend of five substances obtained from desi cow, each individual of these five products is called 'Gavya' and together termed as 'Panchagavya' which is mixture of five products of cow such as cow dung, cow urine, milk, ghee and curd in a proper ratio (5:3:2:2:1) to this banana, jaggary and coconut water is added that allows it to ferment and the end product is known as panchgavya. It is highly effective organic product recommended for crop improvement in organic agriculture (Sangeetha and Thevanathan, 2010) [6]. Panchagavya has made a major contribution to pest and disease resistance, which has resulted in increased overall seed yields (Tharmaraj *et al.*, 2011) [9]. Spraying of panchgavya induces early flowering, high seed setting percentage and also it increases the growth and yield components with growth promoting activity and it is a low-cost technology. It possess the properties of fertilizers and bio pesticides (Sireesha, 2013) [8]. It has resulted in positive effect on growth and productivity of crops (Somasundaram *et al.*, 2003). Panchagavya affects the quality of fruits and vegetables in a big way.

Materials and Methods

A field experiment was conducted during *Rabi 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 (278.93 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 2.5%, panchagavya 5.0% and panchagavya 7.5% and spraying schedule *viz.*, every 7 days, every 14 days and every 21 days 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 2.5% + Every 7 Days T₂: Panchagavya 2.5% + Every 14 Days, T₃: Panchagavya 2.5% + Every 21 Days, T₄: Panchagavya 5.0% + Every 7 Days, T₅: Panchagavya 5.0% + Every 14 Days, T₆: Panchagavya 5.0% + Every 21 Days, T₇: Panchagavya 7.5% + Every 7 Days, T₈: Panchagavya 7.5% + Every 14 Days, T₉: Panchagavya 7.5% + Every 21 Days, observations regarding growth and yield

attributes was recorded during the field experiment.

Result and Discussion

Growth

The results revealed that the steady increase in growth attributes of Field Pea recorded maximum plant height (100.29 cm), maximum number of nodules (27.60) and plant dry weight (32.45 g) were found significantly higher in treatment with the application of Panchagavya 7.5% + Spraying at 7 days interval as compared to other treatments. The plant height of field pea increased significantly during all crop growth stages, this might be due to the application of panchagavya at frequent intervals leads to better adaption of plants and also supplied the plant with required nutrients throughout the cropping season, this allowed the plant to grow with lesser nutrient competition, because of which production of more number of branches and leaves per plant were observed and thus enhanced the plant height. Similar findings were reported by Choudhary *et al.* (2017) [1].

Yield attributes

According to the yield characteristics data that was collected and analysed at harvest, the treatment with the application of Panchagavya 7.5% + Spraying at 7 days interval recorded maximum number of pods/plant (23.53), number of seeds/pod (4.93) and seed index (22.01 g) as compared to other treatments.

Increase in number of pods/plant could be attributed to the fact that application of panchagavya concentrations at different intervals must have created a stimuli in the plant system that altered physiological process and biochemical activities which modify plant anatomy and morphology of the yield attributes in plants as reported by Kumawat *et al.* (2009) [3].

Yield

After evaluated the data recorded post harvesting of crop show that significantly higher seed yield (2.77 t/ha) and harvest index (42.50%) was recorded in treatment with the application of Panchagavya 7.5% + Spraying at 7 days interval as compared to other treatments.

Increase in yield may be due to synergetic effect of panchagavya application, which plays a vital role in vegetative growth and reproductive growth, eventually the production of economic part. Increase in the yield may also be due to fact that nodulation work as medium for the supply of nitrogen, which is essential for crop growth and yield. These results findings are under the confirmation of Kumar, *et al.* (2011) [2].

Economics

The economic return of Field pea was analyzed after harvesting the crop based on market pricing, the result indicated a growing trend in with the increasing yield trend across treatment.

The maximum Gross return (INR 2,57,300.00 /ha), Net return (INR 1,92,150.00 /ha) and B: C ratio (2.95) were recorded in treatment with the application of Panchagavya 7.5% + Spraying at 7 days interval as compared to other treatments.

Table 1: Growth attributes of Field pea at harvest as influenced by Organic liquid manure and Spraying schedule

Treatment	Growth attributes		
	Plant height (cm)	No. of nodules/plant	Plant dry Weight (g)
Panchagavya 2.5% + Every 7 Days	96.34	26.27	30.93
Panchagavya 2.5% + Every 14 Days	94.21	25.20	29.39
Panchagavya 2.5% + Every 21 Days	92.51	24.87	27.80
Panchagavya 5.0% + Every 7 Days	98.65	27.27	31.19
Panchagavya 5.0% + Every 14 Days	95.57	26.33	30.49
Panchagavya 5.0% + Every 21 Days	94.12	25.40	29.17
Panchagavya 7.5% + Every 7 Days	100.29	27.60	32.45
Panchagavya 7.5% + Every 14 Days	99.13	27.00	31.29
Panchagavya 7.5% + Every 21 Days	96.43	26.13	30.61
S.Em(±)	0.49	0.25	0.15
CD (p=0.05)	1.48	0.76	0.45

Table 2: Yield attributes of Field pea at harvest as influenced by Organic liquid manure and Spraying schedule

Treatment	Yield attributes		
	No. of pods/plant	No. of seeds/pod	Seed index (g)
Panchagavya 2.5% + Every 7 Days	20.47	4.00	21.70
Panchagavya 2.5% + Every 14 Days	16.60	3.27	21.58
Panchagavya 2.5% + Every 21 Days	15.27	2.67	21.48
Panchagavya 5.0% + Every 7 Days	23.00	4.47	21.78
Panchagavya 5.0% + Every 14 Days	17.67	3.60	21.65
Panchagavya 5.0% + Every 21 Days	16.60	3.27	21.62
Panchagavya 7.5% + Every 7 Days	23.53	4.93	22.01
Panchagavya 7.5% + Every 14 Days	22.65	4.27	21.90
Panchagavya 7.5% + Every 21 Days	18.80	4.87	21.82
S.Em(±)	0.32	0.23	0.01
CD (p=0.05)	0.97	0.70	0.01

Table 3: Yield of Field pea at harvest as influenced by Organic liquid manure and Spraying schedule

Treatment	Seed Yield (t/ha)	Stover Yield (t/ha)	Harvest Index (%)
Panchagavya 2.5% + Every 7 Days	1.70	2.99	33.65
Panchagavya 2.5% + Every 14 Days	1.48	3.24	31.35
Panchagavya 2.5% + Every 21 Days	1.27	3.16	28.58
Panchagavya 5.0% + Every 7 Days	2.27	3.47	38.88
Panchagavya 5.0% + Every 14 Days	1.60	3.35	32.33
Panchagavya 5.0% + Every 21 Days	1.37	3.27	29.40
Panchagavya 7.5% + Every 7 Days	2.77	3.70	42.50
Panchagavya 7.5% + Every 14 Days	1.77	3.57	33.11
Panchagavya 7.5% + Every 21 Days	1.66	3.49	32.21
S.Em(±)	0.20	0.13	1.96
CD (p=0.05)	0.59	0.38	5.87

Table 4: Economics of Field pea at harvest as influenced by Organic liquid manure and Spraying schedule

Treatments	Economics			
	Cost of Cultivation	Gross returns	Net Returns	B:C ratio
Panchagavya 2.5% + Every 7 Days	47,650.00	158410	1,10,760.00	2.32
Panchagavya 2.5% + Every 14 Days	43,275.00	137640	94,365.00	2.18
Panchagavya 2.5% + Every 21 Days	42,025.00	117800	75,775.00	1.80
Panchagavya 5.0% + Every 7 Days	56,400.00	210800	1,54,400.00	2.74
Panchagavya 5.0% + Every 14 Days	47,650.00	148800	1,01,150.00	2.12
Panchagavya 5.0% + Every 21 Days	45,150.00	127100	81,950.00	1.82
Panchagavya 7.5% + Every 7 Days	65,150.00	257300	1,92,150.00	2.95
Panchagavya 7.5% + Every 14 Days	52,025.00	164300	1,12,275.00	2.16
Panchagavya 7.5% + Every 21 Days	48,275.00	154380	1,06,105.00	2.20

Conclusion

Based on the above experimental findings, it is concluded that application of Panchagavya 7.5% + Spraying at 7 days interval was found the most suitable dose of liquid organic manure to be adopted as it was found to be remunerative, profitable and economically efficient.

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