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Effect of foliar spray of vermiwash and *panchgavya* on yield, quality and nutrient uptake of field pea

KN Prajapati, PH Patel and SR Rabari

Abstract

A field experiment on effect of foliar spray of vermiwash and *panchgavya* on growth and yield of field pea was carried out at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during Rabi 2020-21 in loamy sand soil. Ten treatments comprising of RDF (20:40:00 kg NPK/ha), 75% RDF + vermiwash @ 5 and 10% (at 30, 45, 30 and 45 DAS, respectively) and 75% RDF + *panchgavya* @ 4% (at 30, 45, 30 and 45 DAS) were tried in randomized block design with four replications. 75% RDF + *panchgavya* @ 4% at 30 and 45 DAS resulted in significantly higher growth attributes viz., vine length (cm), number of branches/plant, days to physiological maturity and 50 per cent flowering, number of root nodules/plant and fresh weight (mg) of nodules per plant as well as yield attributes viz., pods/plant, seed weight/plant(g), seed index(g), seed (1957 kg/ha) and haulm yield (2515 kg/ha). The same treatment also recorded the maximum net return (₹67635/-) and benefit: cost ratio (BCR) (2.92). A fertilizer saving of 25% was possible by adopting either foliar spray of *panchgavya* @ 4% or vermiwash @ 10% at 30 DAS along with 75% NPK application. It also enhanced yield and economic parameters.

Keywords: Field pea, economics, vermiwash, *panchgavya*, growth and yield attributes, loamy sand

Introduction

Pulses are considered as life blood of agriculture because they occupy unique position almost in all cropping systems as main, catch, cover, green manure, intercrop and its inclusion in crop rotation. They keep the soil alive and productive as well as enrich the soil fertility in terms of addition of organic matter and nitrogen through biological nitrogen fixation through *Rhizobia*. Pulses are wonderful gift of nature to us as when they are in combination with cereals, a balanced diet is formed for relatively a large number of vegetarian Indians. Field pea (*Pisum sativum* L.) is an important popular pulse crop in India. Among pulses, pea is an important pulse crop with high nutritional quality. This legume is grown in cool season and which belongs to Fabaceae (Leguminosae) family and Middle East Region as native. It can be grown on wide range of soils, from light sandy loam to heavy clay, but in any soil, there must be good drainage as it is susceptible to water-logged conditions. It is primarily used for human consumption or as a livestock feed throughout the world.

Pea seeds serve as the main source of protein in the balanced diet and protein obtained from pea is cheaper than the protein obtained from animal origin. The mature seeds are used as whole grain or split in to 'dal'. It contains approximately 21-25 per cent protein, 62.1 per cent carbohydrates, 1.8 per cent fat and low in fiber and contains 86-87 per cent total digestible nutrients, which makes them an excellent livestock feed. It contains, 5 to 20 per cent less of the trypsin inhibitors as compared to soybean.

This allows, it to be directly fed to the livestock without going through the extrusion heating process. *Panchgavya*, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. It consists of eight products viz., cow-dung, cow-urine, cow-milk, curd, jaggery, ghee, banana and water. When properly mixed and used, these have miraculous effects. Physico-chemical properties of *panchgavya* show that they possess almost all the major nutrients, micronutrients and growth hormones (IAA and GA) required for crop growth. It contains properties like naturally occurring, beneficial, effective microorganisms, predominantly lactic acid bacteria, yeast, actinomycetes and photosynthetic bacteria. It is an organic growth promoter for crops. It comprises cow-dung, cow-urine, cow-milk, cow-milk curd and cow-ghee, suitably mixed to give a beneficial growth effect on plants when sprayed on them. It is being applied as a better source of N₂ (Somasundaram *et al.* 2004) [6]. Vermiwash is the spent wash collected at the passage of water through a column of earthworm culture.

The spent wash collected through a drainage pipe provided at the bottom of the vermicompost pit. Vermiwash contains 0.50 per cent nitrogen, 0.39 per cent phosphorus and 0.46 per cent potassium (Jasmin, 1999) [2]. It is coelomic fluid extraction which contains several enzymes, plant growth stimulating hormones like cytokinins, Gibberellin and vitamins along with micro-nutrients and macro-nutrients as nitrogen in the form of mucus, nitrogenous excretory substances (Tripathi and Bhardwaj, 2004) [9]. It also increases the disease resistant power of crop (Yadav *et al.*, 2005) [11]. Vermiwash contains enzymes and secretions of earthworms which ultimately influences the growth of crops.

Material and Methods

The field experiment was conducted at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Total 10 treatments *viz.*, T₁: RDF (20: 40: 00 kg NPK/ha) + water spray, T₂: 75% RDF + vermiwash @ 5% at 30 DAS, T₃: 75% RDF + vermiwash @ 5% at 45 DAS, T₄: 75% RDF + vermiwash @ 5% at 30 and 45 DAS, T₅: 75% RDF + vermiwash @ 10% at 30 DAS, T₆: 75% RDF + vermiwash @ 10% at 45 DAS, T₇: 75% RDF + vermiwash @ 10% at 30 and 45 DAS, T₈: 75% RDF + *panchgavya* @ 4% at 30 DAS, T₉: 75% RDF + *panchgavya* @ 4% at 45 DAS, T₁₀: 75% RDF + *panchgavya* @ 4% at 30 and 45 DAS were tried in randomised block design with four replications. Field pea variety Dantiwada Field pea 1 was used as a test crop. The soil of experimental field was loamy sand in texture, neutral to alkaline in reaction, normal with respect to salinity and soluble salt content under safe limit, low in organic carbon and available N, medium in available P₂O₅ and having sufficient available K₂O status.

Results and Discussion

Plant population

Plant population (30 DAS and at harvest) of field pea was not varied significantly due to application of different treatments.

Effect on yield and quality parameters

Data presented in the table 1, revealed that Spectacular enhancement in seed and haulm yields(1957 kg/ha and 2515 kg/ha respectively) was achieved under 75% RDF + foliar application of *panchgavya* @ 4% at 30 & 45 DAS followed by 75% RDF + *panchgavya* @ 4% at 30 DAS and 75% RDF + vermiwash @ 10% at 30 and 45 DAS. Also, 75% RDF + foliar application of *panchgavya* @ 4% at 30 and 45 DAS

recorded significantly higher protein content (18.65%) over rest of the treatments. Significantly the lowest protein content (15.49%) was obtained with treatment T₉ (75% RDF + *panchgavya* @ 4% at 45 DAS). It is clearly seen from the data presented in Table 1 that a foliar application of 75% RDF + *panchgavya* @ 4% at 30 and 45 DAS (T₁₀) recorded significantly higher protein yield (365.21 kg/ha) over rest of the treatments, but remained at par with treatments T₈ (338.44 kg/ha), T₇ (325.45 kg/ha), T₄ (318.81 kg/ha) and T₅ (316.09 kg/ha). The application of bio-enhancer *panchgavya* had registered maximum seed yield which ultimately increased protein yield. Similar findings were reported by Kumawat *et al.* (2009) [3], Suresh *et al.* (2011) [8], Waghmode *et al.* (2015) [10] and Gopal *et al.* (2017) [11].

Effect on nutrient content

The data presented in Table 1 indicated that significantly higher nitrogen content in seed (2.99%) and haulm (1.20%) was estimated with 75% RDF + foliar application of *panchgavya* @ 4% at 30 and 45 DAS (T₁₀) than other treatments. The lowest nitrogen content in seed (2.48%) and haulm (1.04%) was noted with treatment T₉ (75% RDF + *panchgavya* @ 4% at 45 DAS). However, higher nitrogen content in seed remained statistically at par with treatments T₈ (2.97%), T₇ (2.88%), T₄ (2.87%) and T₅ (2.84%). Significantly higher nitrogen content in haulm (1.20%) remained statistically at par with treatments T₈ (1.19%), T₄ (1.19%), T₇ (1.17%), T₅ (1.15%) and T₂ (1.12%). These results are also supported by Somasundaram *et al.* (2007) [7], Kumawat *et al.* (2009) [3], Kumar *et al.* (2011), Patel (2012) [5] and Patel *et al.* (2018) [4].

Significantly higher phosphorus content in seed (0.46%) was estimated with treatment T₁₀ (75% RDF + *panchgavya* @ 4% at 30 and 45 DAS) over other treatments, but it remained statistically at par with treatments T₈ (0.44%), T₄ (0.43%) and T₇ (0.43%). The lowest phosphorus content in seed (0.33%) was noted with treatment T₉ (75% RDF + *panchgavya* @ 4% at 45 DAS). The data presented in Table 1 shows that treatment T₁₀ (75% RDF + *panchgavya* @ 4% at 30 and 45 DAS) recorded significantly higher phosphorus content in haulm (0.28%) than other treatments, but was found statistically at par with treatments T₈ and T₇ having phosphorus content each of 0.26%. The lowest phosphorus content of haulm was found with treatment T₉ (0.17%). These results are in close vicinity with the findings of Kumawat *et al.* (2009) [3], Patel (2012) [5] and Patel *et al.* (2018) [4].

Table 1: Effect of foliar spray of vermiwash and Panchgavya on yield and nutrient content of field pea

Treatments		Seed yield (kg/ha)	Haulm yield (kg/ha)	Protein content (%)	Protein yield (kg/ha)	N content (%)		P content (%)	
						Seed	Haulm	Seed	Haulm
T ₁ :	RDF (20: 40: 00 kg NPK/ha) + water spray	1584	2200	16.62	262.45	2.66	1.07	0.35	0.20
T ₂ :	75% RDF + vermiwash @ 5% at 30 DAS	1627	2198	17.29	281.22	2.77	1.12	0.39	0.20
T ₃ :	75% RDF + vermiwash @ 5% at 45 DAS	1672	1948	17.47	292.19	2.79	1.09	0.38	0.20
T ₄ :	75% RDF + vermiwash @ 5% at 30 and 45 DAS	1779	2201	17.96	318.81	2.87	1.19	0.43	0.24
T ₅ :	75% RDF + vermiwash @ 10% at 30 DAS	1784	1763	17.72	316.09	2.84	1.15	0.40	0.22
T ₆ :	75% RDF + vermiwash @ 10% at 45 DAS	1544	2091	16.30	253.72	2.61	1.05	0.34	0.18
T ₇ :	75% RDF + vermiwash @ 10% at 30 and 45 DAS	1815	2211	18.02	325.45	2.88	1.17	0.43	0.26
T ₈ :	75% RDF + <i>panchgavya</i> @ 4% at 30 DAS	1827	2214	18.52	338.44	2.97	1.19	0.44	0.26
T ₉ :	75% RDF + <i>panchgavya</i> @ 4% at 45 DAS	1524	1873	15.49	236.00	2.48	1.04	0.33	0.17
T ₁₀ :	75% RDF + <i>panchgavya</i> @ 4% at 30 and 45 DAS	1957	2515	18.65	365.21	2.99	1.20	0.46	0.28
S.Em.±		95	142	0.67	19.93	0.11	0.03	0.01	0.01
C.D. (P = 0.05)		275	413	1.95	57.83	0.31	0.10	0.03	0.02
C.V.%		11.09	13.42	7.71	13.33	7.72	6.16	5.29	5.66

Effect on nutrient uptake

The data showed that uptake of nitrogen by seed differed significantly due to different treatments of *panchgavya* and vermiwash. 75% RDF + foliar application of *panchgavya* @ 4% at 30 and 45 DAS (T₁₀) recorded significantly higher uptake of nitrogen (58.45 kg/ha) by seed of field pea over other treatments, but it was found statistically at par with treatment T₈ (54.18 kg/ha), T₇ (52.06 kg/ha), T₄ (50.99 kg/ha) and T₅ (50.59 kg/ha). Significantly, the lowest total nitrogen uptake was noted with Treatment T₉ (75% RDF + *panchgavya* @ 4% at 45 DAS). Uptake of nitrogen by haulm varied significantly due to different treatments of *panchgavya* and vermiwash. 75% RDF + foliar application of *panchgavya* @ 4% at 30 and 45 DAS (T₁₀) recorded significantly higher uptake of nitrogen (30.18 kg/ha) by haulm of field pea over other treatments, but it was found statistically at par with

treatment T₈ (26.30 kg/ha), T₇ (25.75 kg/ha) and T₄ (26.13 kg/ha). Significantly, the lowest total nitrogen uptake was noted with Treatment T₉ (19.48 kg/ha).

Significantly, higher phosphorus uptake by field pea seed (9.03 kg/ha) was seen with treatment T₁₀ (75% RDF + *panchgavya* @ 4% at 30 and 45 DAS) as compared to other treatments. However, it was found statistically at par with treatment T₈ (8.07 kg/ha). The drastic increase in total phosphorus uptake was observed under treatment T₁₀ followed by treatment T₈ might be due to significantly, higher phosphorus content in seed as well as higher seed yield ultimately led to higher phosphorus uptake. Higher phosphorus uptake by field pea haulm (7.08 kg/ha) was seen with treatment T₁₀ (75% RDF + *Panchgavya* @ 4% at 30 and 45 DAS) as compared to other treatments.

Table 2: Effect of foliar spray of vermiwash and Panchgavya on nutrient uptake of field pea

Treatments	N uptake		P uptake	
	Seed	Haulm	Seed	Haulm
T ₁ : RDF (20: 40: 00 kg NPK/ha) + water spray	41.94	23.69	5.56	4.39
T ₂ : 75% RDF + vermiwash @ 5% at 30 DAS	44.98	24.54	6.34	4.44
T ₃ : 75% RDF + vermiwash @ 5% at 45 DAS	46.71	21.23	6.35	3.85
T ₄ : 75% RDF + vermiwash @ 5% at 30 and 45 DAS	50.99	26.13	7.67	5.36
T ₅ : 75% RDF + vermiwash @ 10% at 30 DAS	50.59	20.32	7.14	3.83
T ₆ : 75% RDF + vermiwash @ 10% at 45 DAS	40.55	22.11	5.28	3.80
T ₇ : 75% RDF + vermiwash @ 10% at 30 and 45 DAS	52.06	25.75	7.86	5.81
T ₈ : 75% RDF + <i>panchgavya</i> @ 4% at 30 DAS	54.18	26.30	8.07	5.79
T ₉ : 75% RDF + <i>panchgavya</i> @ 4% at 45 DAS	37.75	19.48	5.06	3.19
T ₁₀ : 75% RDF + <i>panchgavya</i> @ 4% at 30 and 45 DAS	58.45	30.18	9.03	7.08
S.Em.±	3.19	1.84	0.43	0.36
C.D. (P = 0.05)	9.25	5.35	1.23	1.03
C.V.%	13.34	15.37	12.46	14.99

Conclusion

It is concluded that for securing higher seed yield and profitability as well as improving quality, field pea crop should be applied with 75% of recommended dose (20:40:0 kg/ha N:P₂O₅:K₂O) per hectare along with foliar spray of either *panchgavya* @ 4% or vermiwash @ 10% at 30 days after sowing.

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