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Effect of Foliar Spray of Vermiwash and *Panchgavya* on Growth, Yield and Economics of Field Pea

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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 rich source of protein (20 to 25%) having ability to fix atmospheric nitrogen (30-150 kg/ha) and consistent source of income and employment to small and marginal farmers. Considering their importance, 2016 was declared as "International Year of Pulses" by United Nations with the objectives of increasing production and consumption of pulses and creating awareness of benefits of pulses by utilizing social media. The per capita availability of pulses has been declined from 64.5 g in 1960 to 56.0 g in 2018 as against the minimum requirement of84 g per day *per capita* (Anonymous, 2018). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka are the top-five pulses producing states. Productivity of pulses is 764 kg/ha (Anonymous, 2020[b]). Fieldpea (*Pisum sativum* L.) is an important popular pulse crop in India. Among pulses, pea is an important pulse crop with high nutritional quality. It is of the indeterminate (climbing) type or determinate (bush or dwarf) type. 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. The mature seeds are used as whole grain or split in to 'dal'. *Panchgavya*, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. *Panchgavya* consists of eight products *viz.*, cow-dung, cow-urine, cow-milk, curd, jaggery, ghee, banana and water. It is being applied as a better source of N_2 (Somasundaram *et al.*, 2004). 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 (Dhama *et al.*, 2005). Gopal *et al*. (2017) reported that foliar spray of *Panchgavya* @ 4% showed significantly higher growth and yield parameters as compared to other treatments. *Panchgavya* @ 6% recorded higher growth parameters, yield parameters and the highest seed yield per plant (6.73g) which was 59.10 % higher over control (Vighneshawaran *et al*., 2020). 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. The wash is a collection of excretory products and excess secretions of earthworms along with micronutrients

from soil organic molecules (Yuvaraj, 2007). It is coelomic fluid extraction which contains several enzymes, plant growth stimulating hormones like cytokinins, gibberlines and vitamins along with micro-nutrients and macro-nutrients as nitrogen in the form of mucus, nitrogenous excretory substances. (Tripathi and Bhardwaj 2004). It also increases the disease resistant power of crop (Yadav *et al.*, 2005). Vermiwash obtained from dissolution of organic matter by earthworm is also found as good liquid manure and affects significantly the growth and productivity of crop during foliar spray (Subasasri, 2003). Vermiwash contains 0.50 per cent nitrogen, 0.39 per cent phosphorus and 0.46 per cent potassium (Jasmin, 1999). Apart from organic acids, it also contains a rich source of soluble plant nutrients stimulating crop growth (Shivsubramanian and Ganeshkumar, 2004). Jijogeorge *et al*. (2019) carried out an experiment at Tamil Nadu and he noticed that the growth parameters were found optimum in 100 % vermiwash. Hassan and Elbatran (2020) at Agricultural Research Center, Egypt reported that the application of vermiwash gave the highest values of root nodulation, plant growth, nutritional content (N, P and K), yield, pod characteristics and seed compositions (protein, carbohydrates and dry matter) of field pea. Rajasooriya and Karunarathna (2020) also reported that the growth and yield parameters were significantly higher with the application of 50% dose of recommended basal fertilizer and top dressing supplemented with 75% of vermiwash in their experiment conducted at Sri Lanka.

MATERIAL AND METHODS

The field experiment was conducted at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Total 10 treatments *viz.*, T_1: RDF(20: 40 : 00kg NPK/ha)+ water spray, T_2: 75% RDF + vermiwash@5% at 30 DAS, T_3: 75% RDF + vermiwash@5% at 45 DAS, T_4: 75% RDF + vermiwash@5% at 30 and 45 DAS, T_5: 75% RDF + vermiwash@10% at 30 DAS, T_6: 75% RDF + vermiwash@10% at 45DAS, T_7: 75% RDF + vermiwash@10% at30 and 45 DAS, T_8: 75% RDF + *panchgavya*@4% at 30DAS, T_9: 75% RDF + *panchgavya*@4% at 45 DAS, T_{10}: 75% RDF + *panchgavya*@4%at 30 and 45DAS were tried in randomised block design with four replications. Field pea variety Dantiwada Field pea1 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 inorganic carbon and available N, medium in available $P_2O_5$and having sufficient available K_2O status.

RESULTS AND DISCUSSION

A. Plant population

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

B. Effect on growth attributes

The remarkable improvement of all growth attributes *viz.*, vine length (31.97cm), number of branches per plant (2.89), days to physiological maturity (92.37 days), days to 50% flowering (59.06 days), number of root nodules per plant (20.15) and fresh weight of root nodules per plant (47.82mg) was observed due to 75% RDF + foliar application of *panchgavya@* 4% at 30 & 45 DAS (T_{10}) followed by 75% RDF + *panchgavya@* 4% at 30 DAS (T_8) and 75% RDF + vermiwash @ 10% at 30 and 45 DAS (T_7). Weight of dry root nodules of plant did not influence significantly due to different treatments.

Table 1: Effect of different treatments of vermiwash and panchgavya on growth attributes of field pea.

Treatment	Vine length at harvest (cm)	Number of branches /plant	Days to 50 % flowering	Daysto Physiological maturity	Number of root nodules /plant	Wt. of fresh root nodules/ plant	Wt. of dry root nodules/ plant
T_1	26.11	1.81	64.48	109.69	17.64	40.29	26.86
T_2	28.49	2.05	63.97	106.47	18.15	41.88	26.75
T_3	27.19	2.14	62.57	106.66	17.13	40.77	26.33
T_4	28.67	2.70	60.87	102.44	18.30	45.87	29.58
T_5	27.57	2.25	62.55	103.50	18.05	44.16	28.58
T_6	25.89	1.87	67.49	108.40	17.18	39.96	25.28
T_7	28.87	2.62	60.66	96.44	19.03	46.08	30.22
T_8	30.45	2.81	59.73	93.25	19.68	47.45	30.63
T_9	26.74	1.93	73.49	107.96	16.73	40.77	26.95
T_{10}	31.97	2.89	59.06	92.37	20.15	47.82	31.33
S.Em.±	1.27	0.13	2.88	4.30	0.68	2.06	1.70
C.D.(P =0.05)	3.69	0.36	8.35	12.48	1.96	5.97	NS
C.V.%	9.03	10.84	9.06	8.37	7.44	9.45	12.05

Treatment T_{10} (75% RDF + *panchgavya@* 4% at 30 and 45 DAS) accounted for significantly altering the growth attributes. This might be due to application of *panchgavya* contains favourable macro and micro nutrients, growth hormones and microorganism *viz.*, *Azospirillum*, *Azotobacter*, *Phosphobacter* and *Pseudomonas* in liquid formulation which played an import ant role in root development and proliferation resulting in better nodule formation and nitrogen

fixation by supplying as similar test other roots and better environment in rhizosphere for growth and development. The findings are in accordance with the findings of Kumar *et al.* (2011); Patel *et al.* (2013); Anuja and Vijayalakshmi (2014); Chongre *et al.* (2019); Vighneshawaran *et al.* (2020).

C. Effect on yield attributes and yield

With regard to improvement in yield attributes viz., number of pods per plant(19.1), seed index(15.16g) and seed weight per plant(8.93 g) were registered under 75% RDF + foliar application of *panchgavya* @ 4% at 30 and 45 DAS followed by 75% RDF + *panchgavya* @ 4% at 30 DAS and 75% RDF + vermiwash @ 10% at 30 and 45 DAS. However, different treatments failed to exert their significant influence on number of seeds per pod. 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. Harvest index (%) of field pea was not varied significantly due to different treatments. The findings are in close accordance with Choudhary *et al.* (2017); Sutar *et al.* (2018); Kumavat *et al*. (2011) ; Yadav *et al*. (2016) ; Bhargavi *et al.* (2018).

Table 2: Effect of different treatments of vermiwash and panchgavya on yield attributes and of field pea.

Treatment	Number of pods per plant	Number of seeds /pod	Seed weight /plant(g)	Seed index (g)	Yield (kg/ha)		Harvest index(%)
					Seed	Haulm	
T_1	15.4	3.51	6.95	13.51	1584	2200	41.96
T_2	16.0	3.76	7.85	14.05	1627	2198	42.55
T_3	15.8	3.53	7.55	13.64	1672	1948	46.19
T_4	16.1	3.80	8.20	14.55	1779	2201	44.64
T_5	15.9	3.61	8.00	14.30	1784	1763	50.30
T_6	15.2	3.47	6.88	13.18	1544	2091	43.12
T_7	17.7	3.80	8.38	14.65	1815	2211	44.86
T_8	17.9	3.60	8.85	14.92	1827	2214	45.45
T_9	15.0	3.52	6.75	12.92	1524	1873	44.87
T_{10}	19.1	4.05	8.93	15.16	1957	2515	43.76
S.Em.±	0.8	0.17	0.53	0.50	95	142	1.78
C.D.(P =0.05)	2.3	NS	1.53	1.46	275	413	NS
C.V.%	9.56	9.42	13.43	7.12	11.09	13.42	7.94

D. Effect on economics

The highest net return (₹67635/ha) and benefit : cost ratio (BCR) (2.92) were realized by 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. These findings are in accordance with those recorded by Swaminathan *et al.* (2007); Boraiah (2017); Jadhav and Shyamrao (2016); Choudhary *et al.* (2017).

Table 3: Economics of field pea as influenced by different treatments.

Treatment	Seed yield(kg/ha)	Haulm yield(kg/ha)	Cost of cultivation (₹/ha)	Gross realization (₹/ha	Net realization (₹/ha)	BCR
T_1	1584	2200	32428	83600	51171	2.58
T_2	1627	2198	32688	85745	53057	2.62
T_3	1672	1948	32688	87496	54808	2.68
T_4	1779	2201	33557	93351	59794	2.78
T_5	1784	1763	33216	92726	59510	2.79
T_6	1544	2091	33216	81382	48167	2.45
T_7	1815	2211	34612	95171	60559	2.75
T_8	1827	2214	33532	95779	62247	2.86
T_9	1524	1873	33532	79945	46413	2.38
T_{10}	1957	2515	35245	102880	67635	2.92

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 $N:P_2O_5:K_2O$) per hectare along with foliar spray of either *panchgavya*@ 4% or vermiwash @ 10% at 30 days after sowing.

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Conflict of Interest. None.

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