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Short *Communication*

Effect of organic sources of nutrients on growth and growth indices of cowpea (*Vigna unguiculata)* under mid hill conditions of Himachal Pradesh

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Abstract

A field experiment was conducted at Research Farm, Department of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during the *Kharif* 2019, to evaluate the effect of organic nutrient sources on growth and growth indices of cowpea. The experiment was laid out in randomized block design consisting of eight treatments [T_1 -*Bijamrita* + *Jiwamrita* (5%, 10% and 10%, respectively at 21, 42 & 63 DAS), T_2–*Bijamrita*+ *Ghanajiwamrita* (250 kg/ha), T_3 - *Bijamrita* + *Jiwamrita* (5%, 10% and 10%, respectively at 21, 42 & 63 DAS) + *Ghanajiwamrita* (250 kg/ha), T_4 - Farm yard manure (10 t/ha), T_5 - Farm yard manure (10 t/ha) + *Ghanajiwamrita* (250 kg/ha), T_6 - Biofertilizers (Rhizobium + PSB @ 10g/kg of seed) + Farm yard manure (10 t/ha) + Vermiwash at 15,30 & 45 DAS (1:10), T_7 - Biofertilizers (Rhizobium + PSB @10 g/kg of seed) + Vermicompost (7.5 t/ha) + Vermiwash at 15, 30 & 45 DAS (1:10), T_8 - Absolute control]. Application of farm yard manure @10 t/ha + *Ghanajiwamrita*@ 250 kg/ha resulted in the significantly higher values of plant height, dry matter accumulation, absolute growth rate and unit area efficiency over rest of the treatments.

Key words: Cowpea, dry matter accumulation, nutrients, plant height.

Among pulses, cowpea (*Vigna unguiculata*) is an important *Kharif* pulse crop. It is used as a grain crop, animal fodder or as a vegetable. Its green pods are known by various names such as 'Snake bean', 'Asparagus bean', 'Yard long bean','Black-eyed pea', 'Crowder pea' and 'Southern pea'. The mature cowpea seeds contain around 25 per cent protein, 63.6 per cent carbohydrates, 1.9 per cent fat, 6.3 per cent fiber, 0.00074 per cent thiamine, 0.00042 per cent riboflavin and 0.0028 per cent niacin (Davis *et al*. 2000). In Indian agriculture, cowpea is grown as a major pulse mainly in Kerala, Punjab, West Bengal, Tamil Nadu, Andhra Pradesh and Gujarat. In world, cowpea was grown over an area of 12.5 million hectare with a production of 7.23 million tonnes and a productivity of 5788 kg/ha for the crop year 2018 (Anonymous 2018). During the crop year 2009, it was grown over an area of 3.9 million hectare with a production of 2.21 million tonnes and an average productivity of 683 kg/ha (Singh *et al.* 2012). In Himachal Pradesh, it is one of important *Kharif* pulses grown as sole as well as intercrop. In Himachal Pradesh, *Kharif* pulses are an integral component of prevailing cropping systems and for the crop year 2016 grown over an area of 23 thousand hectares (Anonymous 2017).

The information on comparative effect of organic sources of nutrient in zero budget natural farming and organic farming on cowpea is scarce. The field experiment was conducted at the Agronomy Research Farm, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh during *Kharif* 2019. The Research Farm is situated at 32˚6′ N latitude, 76˚3′ E longitude and at an altitude of 1290.8 m above mean sea level. Palampur falls under mid hill sub humid zone of the state and is endowed with mild summers (March to June) and cool winters with high rainfall mainly during monsoon (June to September).The weekly maximum and minimum temperature ranged from 21.00 (46th standard week: November) to 31.64 degree celsius (26th standard week: June-July) and 9.43 (45th standard week: November) to 20.60 degree celsius (27th standard week: July), respectively.

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The total rainfall and mean sunshine hours recorded during cropping season were 204.33 mm and 4.78 hours, respectively.

The experiment was laid out in randomized block design. There were eight treatments which were replicated thrice and allocated randomly in each plot. The different treatments of the experiment were T_1– *Bijamrita* (100 ml/kg of seed) + *Jiwamrita* (5%, 10% and 10%, respectively applied at 21, 42 & 63 DAS), T_2–*Bijamrita* (100 ml/kg of seed) + *Ghanajiwamrita* at sowing (250 kg/ha), T_3 – *Bijamrita* (100 ml/kg of seed) + *Jiwamrita* (5%, 10% and 10%, respectively at 21,42 & 63 DAS) + *Ghanajiwamrita* at sowing (250 kg/ha), T_4 - Farm yard manure (10 t/ha), T_5 - Farm yard manure (10 t/ha) + *Ghanajiwamrita* at sowing (250 kg/ha), T_6 - Biofertilizer (Rhizobium + PSB @10 g/kg of seed) + Farm yard manure (10 t/ha) + Vermiwash applied at 15, 30 & 45 DAS (1:10), T_7 - Biofertilizer (Rhizobium + PSB @10 g/kg of seed) + Vermicompost (7.5 t/ha) + Vermiwash at 15, 30 & 45 DAS (1:10), T_8 - Absolute control. The experimental soil was silty clay loam in texture and acidic (5.38) in reaction with 0.221 dS/m EC, 0.45 organic carbon percentage, 172.30 available nitrogen, 21.03 available phosphorus and 248.40 available potassium (kg/ha). The observations recorded on growth were subjected to analysis of variance with mean comparison of 5 per cent level of significance.

Plant height was significantly affected by different

Table 1. Effect of treatments on periodic plant height and dry matter accumulation

Treatment		Plant height (cm)				Dry matter accumulation (g/plant)			
		30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest
T_1	*Bijamrita* + *Jiwamrita*	32.5	102.6	142.9	152.9	0.68	18.7	39.7	47.4
T_2	*Bijamrita* + *Ghanajiwamrita* (250 kg/ha)	32.0	100.0	137.9	`147.3	0.64	16.1	37.4	45.2
T_3	*Bijamrita* + *Jiwamrita* + *Ghanajiwamrita* (250 kg/ha)	32.7	105.5	151.5	162.9	0.78	19.0	42.7	51.1
T_4	FYM (10 t/ha)	35.7	107.3	165.2	181.9	0.80	20.2	44.3	52.9
T_5	FYM (10 t/ha) + *Ghanajiwamrita* (250 kg/ha)	40.9	121.2	191.5	209.0	1.02	27.9	53.9	62.9
T_6	Biofertilizers (Rhizobium & PSB) + FYM (10 t/ha) + Vermiwash (1:10)	37.1	115.7	165.1	177.5	0.84	23.1	49.3	58.3
T_7	Biofertilizers (Rhizobium & PSB) + Vermicompost (7.5 t/ha) + Vermiwash (1:10)	36.7	111.8	175.5	191.4	0.83	21.2	47.8	56.9
T_8	Absolute control	31.4	98.1	137.1	148.8	0.63	15.9	36.8	44.5
	SEm±	0.84	1.81	4.66	1.49	0.02	1.13	0.51	0.52
	CD (P=0.05)	2.55	5.50	14.14	4.52	0.08	3.43	1.54	1.58

Jiwamrita applied @ 5, 10 and 10 % at 21, 42 and 63 DAS, respectively; Vermiwash applied @ 15, 30 and 45 DAS; *Bijamrita* applied @ 100 ml/kg of seed; Biofertilizers applied @ 10 g/kg of seed

treatments at 30, 60, 90 days after sowing and at harvest as well. The tallest plants were observed in treatment T_5 (FYM + *Ghanajiwamrita*) while the shortest plants were in T_8 (Absolute control) at all growth stages (Table 1). The plant height recorded in T_4 (FYM), T_6 (Biofertilizers + FYM + Vermiwash) and T_7 (Biofertilizers + Vermicompost + Vermiwash) was significantly higher than rest of the treatments except T_5. The plant height recorded in T_8 was statistically similar with the plant height noted in T_1 (*Bijamrita* + *Jiwamrita*), T_2 (*Bijamrita* + *Ghanajiwamrita*) and T_3 (*Bijamrita* + *Jiwamrita* + *Ghanajiwamrita*), respectively. Shorter plants in different treatments may be due to poor nutrient availability. These results are in close conformity with the findings obtained by Yogananda *et al*. (2015).

Dry matter accumulation was significantly affected by different treatments at all growth stages including 30, 60, 90 days after sowing and at harvest (Table 1). The highest dry matter accumulation was observed in T_5 (FYM + *Ghanajiwamrita*) while the lowest was in T_8 (Absolute control). T_4 (FYM), T_6 (Biofertilizers + FYM + Vermiwash) and T_7 (Biofertilizers + Vermicompost + Vermiwash) were second better treatments in respect of dry matter accumulation, respectively. The dry matter accumulation observed in T_8 (Absolute control) was statistically at par with the dry matter accumulation recorded in T_1 (*Bijamrita* + *Jiwamrita*) and T_2 (*Bijamrita* + *Ghanajiwamrita*), respectively. Less plant nutrient availability in absolute control may have resulted in reduced rate of cell division and lower biomass formation. Similar results have also been reported by Pargi *et al*. (2016).

Absolute growth rate was significantly affected by different treatments at 30 and 60 DAS whereas no significant effects were observed at harvest (Table 2). Absolute growth rate was found to be the highest in T_5 (FYM + *Ghanajiwamrita*) which was followed by T_6

Table 2. Effect of treatments on absolute growth rate, dry matter efficiency and unit area efficiency

Treatment		Absolute growth rate (g/day)			Dry matter efficiency	Unit area efficiency
		30 DAS	60 DAS	90 DAS	(%/day)	(kg/ha/day)
T_1	*Bijamrita* + *Jiwamrita*	0.022	0.601	0.698	0.133	6.001
T_2	*Bijamrita* + *Ghanajiwamrita* (250 kg/ha)	0.021	0.516	0.709	0.122	5.462
T_3	*Bijamrita* + *Jiwamrita* + *Ghanajiwamrita* (250 kg/ha)	0.025	0.608	0.788	0.137	6.368
T_4	FYM (10 t/ha)	0.026	0.647	0.803	0.132	6.528
T_5	FYM (10 t/ha) + *Ghanajiwamrita* (250 kg/ha)	0.033	0.896	0.864	0.116	7.434
T_6	Biofertilizers (Rhizobium & PSB) + FYM (10 t/ha) + Vermiwash (1:10)	0.028	0.742	0.872	0.113	6.883
T_7	Biofertilizers (Rhizobium & PSB) + Vermicompost (7.5 t/ha) + Vermiwash (1:10)	0.027	0.68	0.884	0.127	6.797
T_8	Absolute control	0.021	0.50	0.697	0.123	5.327
	SEm±	0.001	0.04	0.036	0.178	0.177
	CD (P=0.05)	0.003	0.11	NS	NS	0.536

Jiwamrita applied @ 5, 10 and 10 % at 21, 42 and 63 DAS, respectively; Vermiwash applied @ 15, 30 and 45 DAS; *Bijamrita* applied @ 100 ml/kg of seed; Biofertilizers applied @ 10 g/kg of seed

(Biofertilizer + Farm Yard Manure + Vermiwash) and T_7 (Biofertilizer + Vermicompost + Vermiwash). The lowest absolute growth rate was recorded in T_8 (Absolute control) which was found to be at par with T_1 (*Bijamrita* +*Jiwamrita*) and T_2 (*Bijamrita* + *Ghanajiwamrita*). Dry matter efficiency was not significantly affected by different treatments (Table 2). However, numerically maximum dry matter efficiency was recorded in T_3 **(***Bijamrita* + *Jiwamrita* + *Ghanajiwamrita***)** which was followed by T_1 (*Bijamrita* + *Jiwamrita*) and T_4 (FYM). Minimum dry matter efficiency was recorded in T_8 (Absolute control) followed by T_6 (Biofertilizer + Farm Yard Manure + Vermiwash).

Different treatments have shown significant effects on unit area efficiency (Table 2). The highest values of unit area efficiency were recorded in T_5 (FYM + *Ghanajiwamrita*) which was followed by T_6 (Biofertilizer + Farm Yard Manure + Vermiwash) and T_7 (Biofertilizer + Vermicompost + Vermiwash). T_8 (Absolute control) resulted in the lowest unit area efficiency which was at par with T_2 (*Bijamrita* + *Ghanajiwamrita*).

The present study inferred that farm yard manure + *Ghanajiwamrita* is the best treatment for enhancing growth of cowpea under mid-hill conditions of Himachal Pradesh.

Conflict of interest: The authors have no conflict of interest.

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