Original Research Article

Combinative Effect of Liquid Organic Manures and Spraying Schedule on Growth and Yield of Cowpea Under Natural Farming

ABSTRACT

A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) during *Zaid, 2022*. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), organic carbon (0.75%), available N (269.96 kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The treatments applied were of Panchagavya (30 ml/lit), Jeevamrutha (250 ml/lit), cow urine (100 ml/lit), and spraying schedule on every 7, 10 & 15 different days. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. Based on the objectives taken maximum plant height (88.07 cm), number of total branches (5.02/m^2), number of nodules (40.87), plant dry matter accumulation (20.66 g/plant), number of pods per plant (25.67), number of seeds per pods (11.60), seed yield (1.62 t/ha), stover yield (3.89 t/ha), biological yield (5.54 t/ha) were recorded significantly higher in treatment combination of Panchagavya (30 ml /lit) spraying interval at 10 days interval. However, the maximum gross returns (₹ 97,200.00/ha), net returns (₹ 61,385.00/ha), and benefit: cost ratio (1.71) were recorded higher in treatment combination of Panchagavya (30 ml /lit) spraying interval at 10 days interval.

***Keywords*:** *Panchagavya, Jeevamrutha, Cow urine, Cowpea, Growth, and Yield.*

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INTRODUCTION

Cowpea (*Vigna unguiculata* L.), is one of the most important pulse crops. Cowpea is a multipurpose arid grain legume referred to as southern pea, black-eyed pea, etc., and is extensively cultivated in arid and semiarid regions of Africa and Asia. It is native to central Africa. It belongs to family Fabaceae. It is commercially grown throughout India for its green pods which are used as vegetable. It is one of the most ancient human food sources and has probably been used as a crop plant since Neolithic time. It is used as a pulse or green pod vegetable and haulm as an excellent animal feed. The amino acid profile reveals that lysine, leusine and phenylanine content are relatively higher in cowpea. Cowpea plays an important role in the Indian diet on account of a high percentage of protein (23.14 %), which is double that of cereals. It also contains carbohydrates (56.8 %), fibre (3.9%), ash (3.20 %) and fat (1.3 %). Cowpea is grown as catch crop, mulch crop, intercrop, mixed crop and green crop. Cowpea contributes to the improvement of soil fertility by the atmospheric nitrogen fixation in the soil (56 kg N/ha to the subsequent crop) in association with symbiotic bacteria under favorable conditions (**Kalegore *et al.* 2018**). The result of this symbiosis is to form nodules on the plant root, within which the bacteria can convert atmospheric nitrogen into ammonia thatcan be used by the plant.

India is the largest producer (25 % of global production), the consumer (27 % of world consumption), and the importer (14 %) of pulses in the world **(Annonymous, 2015)**. In India vegetable cowpea is grown over an area of 23,012 ha with production of 1,33,587 tons of green pod and productivity of 5800 kg/ha. The leading states are UP, Bihar, Jharkhand, West Bengal, Odisha etc. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable agriculture. Chemical agriculture has made an adverse impact on the healthcare of not only soil but also the beneficial soil microbial communities and the plants cultivated in these soils. This eventually has led to a high demand for organic produce by the present day health conscious society and sporadic attempts are being made by farmers all over the world to detoxify the land by switching over to organic farming dispensing with chemical fertilizersand pesticides. Organic manure serves as an alternate practice to mineral fertilizers for improving soil structure (**Dauda *et al.*, 2008**) and microbial biomass (**Suresh *et al.*, 2004**). Inorganic fertilizers are costly and cause pollution. There is a huge gap between the requirement and availability of fertilizers. Cow urine is having nutrients like N 1%, K_2O 1.9%, and P_2O_5 in traces.

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Jeevamrutha is a low-cost improvised preparation that enriches the soil with indigenous microorganisms required for the mineralization of the soil **(Gore *et al.,* 2011)**. Organic liquid formulations like jeevamrutha and panchagavya help in the quick buildup of soil fertility through enhanced activity of soil microflora and fauna **(Kumar *et al.,* 2008).**

Panchagavya, an organic product is a potential source to play a growth promoting and providing immunity in the plant system **(Natarajan, 2002).** The presence of naturally occurring, beneficial, effective micro-organisms (EMO's) in panchagavya predominantly, lactic acid bacteria, yeast, actinomycetes, photosynthetic bacteria, growth promoting factors like IAA, GA and certain fungi have the beneficial effect especially in improving soil quality, growth, and yield of crops (**Singh et al., 2022; Patel et al., 2021**). The spraying schedule helps in the supply of recommended nutrients to the crop regularly. **Vallimayil and Sekar (2012)** reported to Panchagavya is an organic product blended from five different cow products, commonly applied to crop plants in organic farming. It is used as foliar spray, soil application and seed treatment.

Cow urine contains N, P, K, Na, S, Ca, Mg, Cu, I, NH_3, silver, urea, uric and oxalic acid, lead, hippuric acid, creatinine, eltine, enzymes, steroids phosphates, lead, propylene oxide, ethylene oxide, glycosides, glucose, citric acid, alkaline, acetate, andesine, carbolic acid and growth substances **(Agrawal, 2002). (Suemitsu *et al.,* 1968)** examined cow urine for its acidic and phenolic content. They obtained benzoic acid (68.4%), phenylacetic acid (17.4%), α-hydroxybenzoic acid (1.75%) α-phenyl propionic acid (0.7%), 3- indole acetic acid (0.1%), β-3-indole propionic acid (0.55%), 3, 4-dimethoxy benzoic acid (0.99%). They also obtained phenolic compounds in cow urine

By keeping these points in mind, the present investigation entitled, **"Combinative Effect of Liquid Organic Manures and Spraying Schedule on Growth and Yield of Cowpea Under Natural Farming"**, was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *Zaid* season of 2022, with the following objectives.

1. To Evaluate the effect of cow-based liquid manures and spraying schedule on growth and yield of cowpea under natural farming.
2. To work out the economics of different treatment combinations

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MATERIALS AND METHODS

The methodology, materials, and the techniques adopted in this present experiment entitled, **"Combinative Effect of Liquid Organic Manures and Spraying Schedule on Growth and Yield of Cowpea Under Natural Farming"**, was carried out at Crop Research Farm of the Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during *Zaid* season of 2022. The soil of the experimental field constitutes a part of central Gangetic alluvium and is neutral and deep. The soil was sandy loamin texture, low in organic carbon (0.75%) and medium in available nitrogen (269.96 kg/ha), phosphorus (33.10 kg/ha), and low in potassium (336 kg/ha), pH (7.1) and zinc. The experimental field was laid out in Randomized Block Design (RBD). The treatments comprised of panchagavya, Jeevamrutha and Cow urine with different spraying intervals. There were 9 treatments each replicated thrice, randomly arranged in each replication and divided into 27 plots. The treatment combinations are T_1:Panchagavya (30 ml/lit) + at an interval of 7 days, T_2:Panchagavya (30 ml/lit) + at an interval of 10 days, T_3:Panchagavya (30 ml/lit) + at an interval of 15 days, T_4: Jeevamrutha (250 ml/lit) + at an interval of 7 days, T5: Jeevamrutha (250 ml/lit) + at an interval of 10 days, T_6 : Jeevamrutha (250 ml/lit) + at an interval of 15 days, T_7: Cow urine (100 ml/lit) + at an interval of 7 days, T_8: Cow urine (100 ml/lit) + at an interval of 10 days, T_9 :Cow urine (100 ml/lit) + at an interval of 15 day.

RESULT AND DISCUSSION

GROWTH PARAMETERS

At 80 DAS, significantly higher plant height (88.07 cm) was recorded with application of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (84.71), Panchagavya (30 ml/lit) + at an interval of 15 days (80.86 cm), Jeevamrutha (250 ml/lit) + at an interval of 10 days (83.38 cm) and Cow urine (100 ml/lit) + at an interval of 7 days (86.27 cm) were statistically at par with Panchagavya + at an interval of 10 days.

The IAA and GA present in panchagavya when applied as foliar spray could have created stimuli in the plant system and increased the production of growth regulators in cell system and the

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action of growth regulators in plant system ultimately stimulated the necessary growth and development. Similar findings were also reported by **Patel (2012)**

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Number of branches/ plant - The data recorded that significantly maximum number of branches (5.02) wasrecorded with application of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (4.65), Jeevamrutha (250 ml/lit) + at an interval of 10 days (4.78) and Panchagavya (30 ml/lit) + at an interval of 15 days (4.59), were statistically at par with Panchagavya (30 ml/lit) + at an interval of 10 days.

The auxin content in Panchagavya upon its application leads to the activation of cell division and cell elongation in the auxiliary buds which had a promoting effect in increased number of branches, leaves and leaf area. The application of panchagavya would have induced the endogenous synthesis of native auxins resulting in an early active growth **(Reshma *et al.*, 2018)**.

Number of nodules/ plant - The data recorded the significantly maximum nodules (40.87 nodules/plant) recorded with application of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Jeevamrutha (250 ml/lit) + at an interval of 7 days (38.32), Jeevamrutha (250 ml/lit) + at an interval of 10 days (40.07), Jeevamrutha (250 ml/lit) + at an interval of 15 days (39.44) and Cow urine (100 ml/lit) + at an interval of 10 days (38.65) were statistically at par with Panchagavya (30 ml/lit) + at an interval of 10 days. Enhanced growth parameters due to interaction of jeevamrutha and panchagavya might be due to synergistic effect of *Rhizobacteria* with Panchagavya spray and soil application of jeevamrutha has helped translocation of carbohydrates to developing root nodules as reported by **Sait and Mehmet Kibritei (2016) and Velmurgan and Mahendran (2015).**

Plant dry weight - The data recorded the maximum dry matter accumulation (20.66 g/plant) was recorded with application of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (18.84 g/plant), Jeevamrutha + at an interval of 7 days (19.52 g/plant) and Cow urine (100 ml/lit) + at an interval of 7 days (18.56 g/plant) were statistically at par with Panchagavya (30 ml/lit) + at an interval of 10 days.

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Yield and yield parameters

Number of pods/ plant - The data recorded the significantly higher number of pods/plants were observed in the treatment combination of Panchagavya (30 ml/lit) + at an interval of 10 days recording 25.67 pods/plant. Treatment Panchagavya (30 ml/lit) + at an interval of 15 days (23.00 pods/plant) and Jeevamutha + at an interval of 10days (24.20 pods/plant) were statistically at par with Panchagavya (250 ml/lit) + at an interval of 10 days.

Number of seeds/ pod - The data recorded significantly maximum number of seeds/pod (11.60) was observed in the treatment combination of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (10.33 seeds/pod), Jeevamutha (250 ml/lit) + at an interval of 10 days (11.06 pods/plant) and Cow Urine (100 ml/lit) + at an interval of 7 days (10.23 seeds/pod) were statistically at par with Panchagavya (30 ml/lit) + at an interval of 10 days. The minimum number of seeds per plant (8.47) was observed in Cow urine (100 ml/lit) + at an interval of 15 days.

Seed index - The significantly maximum seed index (23.33) was recorded in the treatment Jeevamutha (250 ml/lit) + at an interval of 10 days. The minimum test weight (20.67) was recorded in the treatment combination Cow urine (100 ml/lit) + at an interval of 10 days.

Seed yield - The significantly maximum seed yield of cowpea (1.62 t/ha) was observed in the treatment combination of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (1.54 t/ha), Jeevamutha (250 ml/lit) + at an interval of 7 days (1.19 t/ha), Jeevamutha (250 ml/lit) + at an interval of 10 days (1.38 t/ha) and Jeevamutha (250 ml/lit) + at an interval of 15 days (1.32 t/ha) were statistically at par Panchagavya (30 ml/lit) + at an interval of 10 days. Crop yield is the complex function of physiological processes and biochemical activities,which modify plant anatomy and morphology of the growing plants. Seed and stover yield of chickpea were significantly influenced by different treatments of panchagavya application **Pratik *et al.* (2020).**

Stover yield - The significantly maximum stover yield of cowpea (3.89 t/ha) was observed in the treatment combination of Panchagavya (30 ml/lit) + at an interval of 10 days. However, Panchagavya (30 ml/lit) + at an interval of 7 days (3.43 t/ha), Jeevamutha (250 ml/lit) + at an interval of 7 days (3.20 t/ha), Cow urine (100 ml/lit) + at an interval of 7 days (3.37 t/ha) were statistically at par Panchagavya (30 ml/lit) + at an interval of 10 days.

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Harvest index - Significantly higher Harvest index of cowpea was observed in the treatment combination of Jeevamutha (250 ml/lit) + at an interval of 10 days (30.63%).

Improvement in yield and yield attributes might be due to stimulation in root growth by inorganic nutrients as well better absorption of water and nutrients complementary effect of Jeevamrutha and Panchagavya after fermentation which favors the higher yield. These findings are in line with those reported by **Avudaithai *et al.* (2010) and Kumar *et al.* (2011).**

Economics

The result revealed (Table3) that maximum gross return (97,200.00 INR/ha), higher net returns (61,385.00 INR/ha), and highest benefit cost ratio (1.71) was recorded in the treatment Panchagavya (30 ml/lit) + at an interval of 10 days

CONCLUSION

As per my research trial, the treatment combination of Panchagavya (30 ml/lit) spraying interval at 10 days interval. was found to be more productive. Although the findings are based on one season, further research is needed to confirm the findings and their recommendation.

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Table 1. Effect of Liquid Organic Manures and Spraying Schedule on growth parameters of Cowpea.

S. No.	Treatment Combinations	Plant height (cm)	No. of branches/ plant	No. of nodules/ plant	Plant dry weight (g/plant)
1	Panchagavya (30 ml/lit) + at an interval of 7 days	84.71	4.65	34.40	18.84
2	Panchagavya (30 ml/lit) + at an interval of 10 days	88.07	5.02	40.87	20.66
3	Panchagavya (30 ml/lit) + at an interval of 15 days	80.86	4.59	36.79	16.67
4	Jeevamrutha (250 ml/lit) + at an interval of 7 days	79.46	4.42	38.32	19.52
5	Jeevamrutha (250 ml/lit) + at an interval of 10 days	83.38	4.78	40.07	16.78
6	Jeevamrutha (250 ml/lit) + at an interval of 15days	78.80	4.37	39.44	17.08
7	Cow urine (100 ml/lit) + at an interval of 7 days	86.27	4.49	37.67	18.56
8	Cow urine (100 ml/lit) + at an interval of 10 days	77.85	4.42	38.65	17.43
9	Cow urine (100 ml/lit) + at an interval of 15 days	78.66	3.56	37.43	15.87
	F test	S	S	S	S
	SEm±	2.41	0.15	1.83	1.04
	CD (P = 0.05)	7.30	0.47	5.49	3.20

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Table 2. Effect of Liquid Organic Manures and Spraying Schedule on Yield attributes of Cowpea

S. no.	Treatment combinations	Pods/ plant	Seeds/ pod	Seed Index(g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index(%)
1	Panchagavya (30 ml/lit) + at an interval of 7 days	22.27	10.33	22.67	1.54	3.43	28.09
2	Panchagavya (30 ml/lit) + at an interval of 10 days	25.67	11.60	21.00	1.62	3.89	29.78
3	Panchagavya (30 ml/lit) + at an interval of 15 days	23.00	9.80	22.00	1.19	2.45	28.78
4	Jeevamrutha (250 ml/lit) + at an interval of 7 days	19.33	8.67	21.00	1.38	3.20	26.94
5	Jeevamrutha (250 ml/lit) + at an interval of 10 days	24.20	11.06	23.33	1.32	2.99	30.63
6	Jeevamrutha (250 ml/lit) + at an interval of 15days	22.67	9.47	22.67	1.02	2.67	25.21
7	Cow urine (100 ml/lit) + at an interval of 7 days	21.27	10.23	21.67	1.03	3.37	26.74
8	Cow urine (100 ml/lit) + at an interval of 10 days	19.60	9.27	20.67	0.88	2.88	23.40
9	Cow urine (100 ml/lit) + at an interval of 15 days	17.33	8.47	21.33	0.96	3.02	24.12
	F test	S	S	NS	S	S	S
	SEm±	0.95	0.42	0.42	0.13	0.20	0.83
	CD (P = 0.05)	2.87	1.40	-	0.45	0.69	2.63

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Table 3. Economics of Cowpea on Effect of Liquid Organic Manure and Spraying Schedule

S.no	Treatment combinations	Total cost ofcultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	Panchagavya (30 ml/lit) + at an interval of 7 days	41,515.00	92,400.00	50,885.00	1.23
2.	Panchagavya (30 ml/lit) + at an interval of 10 days	35,815.00	97,200.00	61,385.00	1.71
3.	Panchagavya (30 ml/lit) + at an interval of 15 days	30,115.00	71,400.00	41,285.00	1.37
4.	Jeevamrutha (250 ml/lit) + at an interval of 7 days	39,315.00	82,800.00	43,485.00	1.11
5.	Jeevamrutha (250 ml/lit) + at an interval of 10 days	34,215.00	79,200.00	44,985.00	1.31
6.	Jeevamrutha (250 ml/lit) + at an interval of 15days	29,115.00	61,200.00	32,085.00	1.10
7.	Cow urine (100 ml/lit) + at an interval of 7 days	24,465.00	61,800.00	37,335.00	1.53
8.	Cow urine (100 ml/lit) + at an interval of 10 days	23,415.00	52,800.00	29,385.00	1.25
9.	Cow urine (100 ml/lit) + at an interval of 15 days	22,365.00	57,600.00	35,235.00	1.58

*Economics not subjected to data analysis

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