The Pharma Innovation Journal 2022; 11(5): 1568-1572

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 1568-1572

www.thepharmajournal.com
Received: 25-03-2022
Accepted: 02-05-2022

Ravi Kumar Dwivedi
M.Sc. Scholar, Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj Uttar Pradesh, India

Umesha C
Assistant Professor, Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj Uttar Pradesh, India

Lalit Kumar Sanodiya
Ph.D., Scholar, Department of Agronomy, SHUATS, Prayagraj Uttar Pradesh, India

Corresponding Author:
Ravi Kumar Dwivedi
M.Sc. Scholar, Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj Uttar Pradesh, India

Influence of integrated nutrient management on growth indices and economics of Cowpea (*Vigna unguiculata* L) in sandy loam soil

Ravi Kumar Dwivedi, Umesha C and Lalit Kumar Sanodiya

Abstract
The field experiment was conducted during *Zaid* season (2021) at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, (Uttar Pradesh). I worked with objective to work out the economics of different treatment combination. The soil of experimental plot was sandy loam in texture, nearly natural in soil reaction (pH 7.2), low in organic carbon (0.48%), available N (171.48 kg/ha), available P (13.6 kg/ha) and available K (215.4 kg/ha). The experiment was laid out in Randomized Block Design with 9 treatment replicated thrice. The results reported that the application of Vermicompost 1.5t/ha + RDF 100%(T_1) recorded maximum plant dry weight at 45 DAS (7.83 g/plant) and 60 DAS (16.14 g/plant), crop growth rate at 30-45 DAS (3.01 g/m^2/day) and 45-60 DAS (4.11 g/m^2/day), relative growth rate at 30-45 DAS (0.1005 g/g/day) and 45-60 DAS (0.0482 g/g/day), maximum Gross returns (161,040 INR/ha), net returns (113,394 INR/ha) and B:C ratio (2.38).

Keywords: CGR (Crop Growth Rate), FYM (Farm Yard Manure), Panchagavya, RGR (Relative Growth Rate), RDF (Recommended Dose of Fertilizer)

Introduction
Pulses are one of India's most important sources of protein. However, due to low pulse yield and population growth, our per capita availability of pulses per day is just 43 g, compared to the minimum of 52 g advised by the Indian Council of Medical Research (ICMR), New Delhi (Barik, 2021) [2]. As a result, it is imperative that India focus on expanding pulse crop yield through effective agronomic and crop development measures. Cowpea is produced on 12.5 million hectares worldwide, with a total grain production of 3 million tonnes. Nigeria produces the most of the crop, followed by Brazil. Senegal, Ghana, Mali, and Burkina Faso are among the leading producers in Africa. Only India and Myanmar are major producers in Asia. Cowpea is cultivated on 3.9 million hectares in India, yielding 2.21 million tonnes with a productivity of 567 kg per hectare (Singh *et al.* 2012) [13]. Cowpea is an important kharif season grain legume that needs more attention from researchers, both from an agronomic and breeding standpoint, because it is a drought tolerant and resilient crop that can survive in most harsh settings (Bisikwa *et al.* 2014; Ddamulira *et al.* 2015) [3]. It also improves soil fertility by fixing atmospheric nitrogen, which is especially important in small-holder agricultural farming systems where little or no fertilizer is used and output requires little input (Kyei-Boahen *et al.* 2017) [7]. Cowpea's green pods and leaves are eaten as a vegetable, while the grain is utilised in cooking. Cowpea is a low-cost, high-quality protein source because its leaves contain between 27 and 43 percent protein, while the dried grain contains between 21 and 33 percent protein (Ahenkora *et al.* 1998; Ddamulira *et al.* 2015) [1]. Cowpea can be utilized as cattle fodder as well as a green manure crop (Singh *et al.* 2003; Maamallan *et al.* 2021) [15].
With these and other crop-related difficulties in mind, the integrated nutrient management (INM) system, which is crucial for preserving soil health and crop output, is becoming increasingly important. The primary idea of integrated nutrient management (INM) is to optimize benefits from all potential sources of plant nutrient in an integrated way in order to sustain desired crop production by maintaining or modifying soil fertility and providing nutrient to plants to an optimum level (Tondon, 1992) [17]. FYM enhances soil structure, which promotes root growth conditions. FYM also improves soil moisture retention and stimulates microbial growth, making soil nutrient recycling more effective (Prasad and Sinha, 2000; Khan *et al.* 2010; Mengistu and Mekonnen, 2011) [11, 6, 9].

Vermicompost is created when organic matter degrades in the presence of earthworms and microorganisms (Edwards and Burrows, 1988) [4]. Nutrients such as nitrates, phosphates, exchangeable calcium, and soluble potassium are found in vermicompost and are necessary for plant growth (Orozco *et al.* 1996) [10]. Panchagavya includes growth regulators like IAA, GA, and Cytokinin, as well as essential plant nutrient and beneficial microbes like Lactic Acid Bacteria, Yeast, and Actinomycetes (Venkatalakshmi *et al*. 2009) [18]. In terms of agricultural yields and quality, INM is the complementary use of organic, inorganic, and biological sources of plant nutrients to maintain and sustain soil fertility and boost crop output in an environmentally friendly, socially appropriate, and economically feasible manner.

Material and Methods

These experiments was conducted during *Zaid* season of 2021.The experiment was conducted in Randomized Block Design consisting of nine treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The average temperature of this region 42°C to 44°C. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.2) with low level of organic carbon (0.48%), available N (171.48Kg/ha), P (13.6 kg/ha) and higher level of K (215.4 kg/ha). The treatment combinations are T1 - Vemicompost 1.5t/ha + RDF 100%, T_2 -Vermicompost 1.5t/ha + RDF 75%, T3 - Vermicompost 1.5t/ha + RDF 50%, T_4 -FYM 5t/ha + RDF 100%, T_5 -FYM 5t/ha + RDF 75%,T_6 - FYM 5t/ha + RDF 50%, T_7 -Panchagavya 6% + RDF 100%, T_8 -Panchagavya 6% + RDF 75%, T9 -Panchagavya 6% + RDF 50%. The observations were recorded on different parameters *viz.* plant dry weight (g), crop growth rate (g/m^2/day), and relative growth rate (g/g/day).

Result and Discussion

A. Plant dry weight

The data pertaining to Plant dry weight at 15 DAS and 30 DAS depicts that the influence of integrated nutrient management on Plant dry weight (g/plant) of Cowpea (*Vigna unguiculata* L.) were found to be non-significant. The result at 45 DAS shows that the effect of T_1 i.e., Vermicompost at 1.5 t/ha along with RDF 100% over plant dry weight per plant was found to be highest (7.83 g/plant) and significantly superior over other treatment combinations except with T_2 i.e., Vermicompost at 1.5 t/ha along with RDF 75% which was found at par with treatment T_1. However, effect of T_6 i.e., Farm Yard Manure at 5 t/ha along with RDF 50% over plant dry weight per plant was found to be significantly lowest (6.12 g/plant).The data at 60 DAS shows that the effect of T_1 i.e., Vermicompost at 1.5 t/ha along with RDF 100% over plant dry weight per plant was found to be highest (16.14 g/plant) and significantly superior over other treatment combinations except with T_2 i.e., Vermicompost at 1.5 t/ha along with RDF 75% which was found at par with treatment T_1. However, effect of T_6 i.e., Farm Yard Manure at 5 t/ha along with RDF 50% over plant dry weight per plant was found to be significantly lowest (10.6 g/plant).

Higher dry matter was recorded in T_1 due to the availability of readily available nitrogen for rapid initial growth and cumulative improvement in most of the growth parameters as a result of sustained availability of macro and micronutrient and due to better soil physical conditions during the entire season from vermicompost. Similar results were reported by Yadav and Malik (2005) [19] and Magdi *et al.* (2011) [8].

B. Crop growth rate (g/m^2/day)

The data pertaining to crop growth rate at 15-30 DAS depicts that the influence of integrated nutrient management on Crop Growth Rate (CGR) (g/m^2/day) of Cowpea (*Vigna unguiculata* L.) were found to be non-significant. The data at 30-45 DAS shows that the effect of T_1 i.e., Vermicompost at 1.5 t/ha along with RDF 100% over CGR was found to be highest (3.01 g/m^2/day) and significantly superior over other treatment combinations except with T_2 i.e., Vermicompost at 1.5 t/ha along with RDF 75% which was found at par with treatment T_1. However, effect of T_6 i.e., Farm Yard Manure at 5 t/ha along with RDF 50% over CGR was found to be significantly lowest (2.21 g/m^2/day).The result at 45-60 DAS shows that the effect of T_1 i.e., Vermicompost at 1.5 t/ha along with RDF 100% over CGR was found to be highest (4.11 g/m^2/day) and significantly superior over other treatment combinations except with T_2 i.e., Vermicompost at 1.5 t/ha along with RDF 75% which was found at par with treatment T_1. However, effect of T_6 i.e., Farm Yard Manure at 5 t/ha along with RDF 50% over CGR was found to be significantly lowest (2.21 g/m^2/day).

C. Relative growth rate (g/g/day)

The data pertaining to influence of integrated nutrient management on Relative Growth Rate (RGR) (g/g/day) of Cowpea (*Vigna unguiculata* L.) shows that the relative growth rate was found to be non-significant during the entire cropping period. Also, it was found that relative growth rate were higher during vegetative stage and decreased gradually up to maturity stage. However, the effect of treatments on RGR values was more or less similar throughout the crop growth stages.

Economics

The economics of treatments is an important goal in determining the best treatments that improve income and are acceptable. Because of the variable application of organic manures and different levels of inorganic fertilizers, the cost of cultivation varied from 47646 INR/ha to 43421 INR/ha. Treatment T_1, i.e., Vermicompost at 1.5 t/ha + RDF 100% (161,040 INR/ha), had the highest gross returns when compared to the other treatments. Highest Net returns (113,394 INR/ha) was recorded in treatment T_1, i.e., Vermicompost at 1.5 t/ha + RDF 100%. Also, Highest Benefit Cost ratio (2.38) was recorded in treatment T_1.Highest gross return and net return was found under the application of T_1. Also, highest B:C ratio was found under the treatment T_1. It was because of T_1 was found the best among all other Treatments. The findings are in complete agreement with the findings of Ghanshyam *et al.* (2010) [5]; Singh *et al*. (2010) [16]; Singh *et al*. (2008) [14] and Ramawter *et al.* (2013) [12].

Table 1: Influence of integrated nutrient management on Plant dry weight (g) of Cowpea (*Vigna unguiculata* L.)

S. No.	Treatment symbols	Treatment combinations	Plant dry weight (g)			
			15 DAS	30 DAS	45 DAS	60 DAS
1	T_1	Vermicompost at 1.5 t/ha + RDF 100%	0.49	1.73	7.83	16.14
2	T_2	Vermicompost at 1.5 t/ha + RDF 75%	0.48	1.72	7.74	15.94
3	T_3	Vermicompost at 1.5 t/ha + RDF 50%	0.43	1.68	6.49	12.16
4	T_4	Farm Yard Manure at 5 t/ha + RDF 100%	0.45	1.7	6.99	13.66
5	T_5	Farm Yard Manure at 5 t/ha + RDF 75%	0.44	1.69	6.76	12.93
6	T_6	Farm Yard Manure at 5 t/ha + RDF 50%	0.41	1.65	6.12	10.6
7	T_7	Panchagavya at 6% + RDF 100%	0.47	1.72	7.53	15.13
8	T_8	Panchagavya at 6% + RDF 75%	0.46	1.71	7.26	14.41
9	T_9	Panchagavya at 6% + RDF 50%	0.42	1.67	6.34	11.54
		F-Test	NS	NS	S	S
		S.EM=	0.04	0.05	0.04	0.12
		CD (5%) =	0.12	0.16	0.12	0.37

Table 2: Influence of integrated nutrient management on Crop Growth Rate (CGR) (g/m^2/day) of Cowpea (*Vigna unguiculata* L.)

S. No.	Treatment symbols	Treatment combinations	15-30 DAS	30-45 DAS	45-60 DAS
1	T_1	Vermicompost at 1.5 t/ha + RDF 100%	0.62	3.01	4.11
2	T_2	Vermicompost at 1.5 t/ha + RDF 75%	0.61	2.97	4.05
3	T_3	Vermicompost at 1.5 t/ha + RDF 50%	0.62	2.38	2.8
4	T_4	Farm Yard Manure at 5 t/ha + RDF 100%	0.62	2.61	3.29
5	T_5	Farm Yard Manure at 5 t/ha + RDF 75%	0.61	2.5	3.05
6	T_6	Farm Yard Manure at 5 t/ha + RDF 50%	0.61	2.21	2.21
7	T_7	Panchagavya at 6% + RDF 100%	0.62	2.87	3.75
8	T_8	Panchagavya at 6% + RDF 75%	0.62	2.74	3.53
9	T_9	Panchagavya at 6% + RDF 50%	0.62	2.31	2.56
		F-Test	NS	S	S
		S.EM=	0.02	0.03	0.06
		CD (5%) =	0.08	0.1	0.19

Table 3: Influence of integrated nutrient management on Relative Growth Rate (RGR) (g/g/day) of Cowpea (*Vigna unguiculata* L)

S. No.	Treatment symbols	Treatment combinations	15-30 DAS	30-45 DAS	45-60 DAS
1	T_1	Vermicompost at 1.5 t/ha + RDF 100%	0.0846	0.1005	0.0482
2	T_2	Vermicompost at 1.5 t/ha + RDF 75%	0.0848	0.1002	0.0481
3	T_3	Vermicompost at 1.5 t/ha + RDF 50%	0.0908	0.0901	0.0418
4	T_4	Farm Yard Manure at 5 t/ha + RDF 100%	0.0894	0.0943	0.0447
5	T_5	Farm Yard Manure at 5 t/ha + RDF 75%	0.0897	0.0927	0.0433
6	T_6	Farm Yard Manure at 5 t/ha + RDF 50%	0.0938	0.0874	0.0367
7	T_7	Panchagavya at 6% + RDF 100%	0.0869	0.0986	0.0465
8	T_8	Panchagavya at 6% + RDF 75%	0.0872	0.0964	0.0457
9	T_9	Panchagavya at 6% + RDF 50%	0.0935	0.0889	0.0399
		F-Test	NS	NS	NS
		S.EM=	0.0058827	0.00225973	0.00071251
		CD (5%)=	NS	0.00677468	s0.0021361

Table 4: Influence of integrated nutrient management on Economics of Cowpea (*Vigna unguiculata* L)

S. No.	Treatment symbols	Treatment combinations	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net Return (INR/ha)	B:C
1	T_1	Vermicompost at 1.5 t/ha + RDF 100%	47646	161040	113394	2.38
2	T_2	Vermicompost at 1.5 t/ha + RDF 75%	45409	152640	107231	2.36
3	T_3	Vermicompost at 1.5 t/ha + RDF 50%	43171	98460	55289	1.28
4	T_4	Farm Yard Manure at 5 t/ha + RDF 100%	47896	117000	69104	1.44
5	T_5	Farm Yard Manure at 5 t/ha + RDF 75%	45659	105840	60181	1.32
6	T_6	Farm Yard Manure at 5 t/ha + RDF 50%	43421	80880	37459	0.86
7	T_7	Panchagavya at 6% + RDF 100%	43296	139980	96684	2.23
8	T_8	Panchagavya at 6% + RDF 75%	41059	124920	83861	2.04
9	T_9	Panchagavya at 6% + RDF 50%	38821	87540	48719	1.25

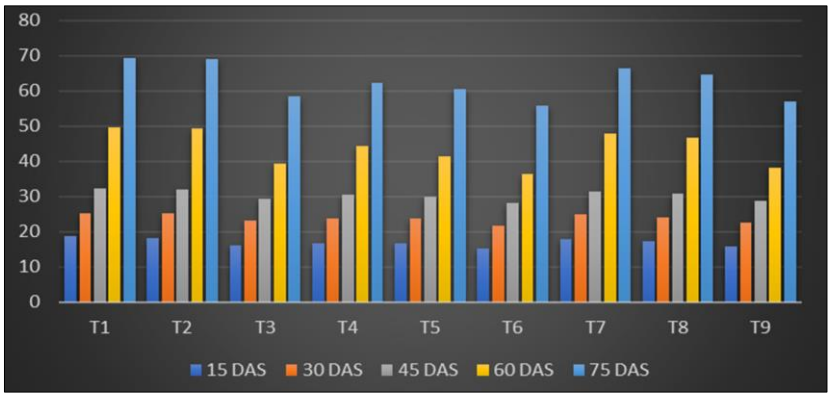

Fig 1: Plant dry weight (g)

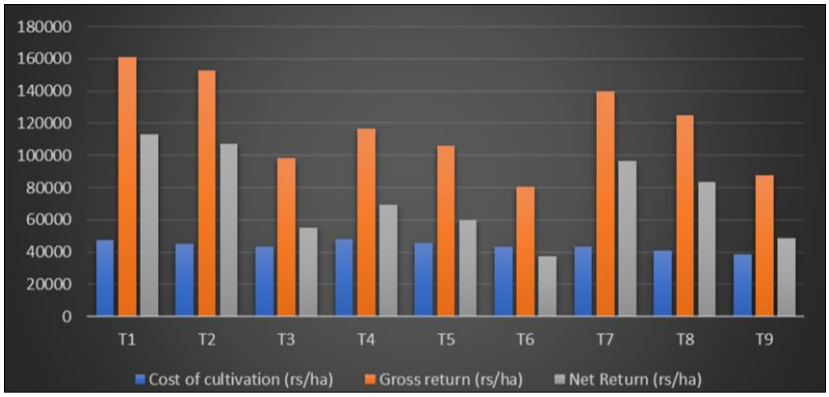

Fig 2: Cost of cultivation, gross & net return

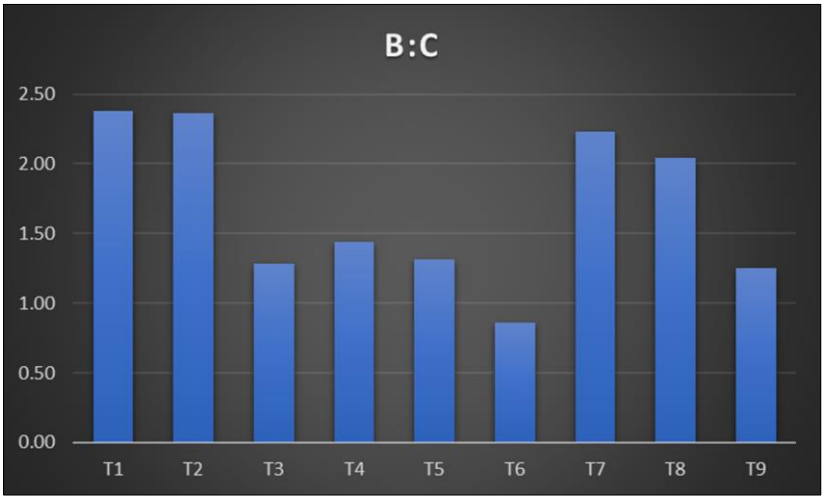

Fig 3: Show the B:C

Fig 4: Collection of sample for dry matter finding

Conclusion

From the economics point of view, It may be concluded that Treatment T_1 i.e., Vermicompost 1.5 tones along with RDF 100% was found the highest B: C ratio. Since this is based on one season trail therefore, further evaluation trails are needed to substantiate the findings.

Acknowledgement

I am thankful to all faculties of Teaching staff, Non-Teaching staff, seniors and classmates of my department (Department of Agronomy), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj – 211007, Uttar Pradesh, India for providing me necessary facilities to undertake the studies.

Reference

1. Ahenkora K, Dapaah HA, Agyemang A. Selected nutritional components and sensory attributes of cowpea (*Vigna unguiculata* L.) leaves. Plant Foods for Human Nutrition. 1998;52(3):221-229.
2. Barik AK. Pulse Cultivation-A Venture for Food, Nutrition and Livelihood. International Journal of Bio-resource and Stress Management, 2021.
3. Bisikwa J, Kawooya R, Ssebuliba JM, Ddungu SP, Biruma M, Okello DK. Effects of plant density on the performance of local and elite cowpea (*Vigna unguiculata* L.) varieties in Eastern Uganda. African Journal of Applied Agricultural Sciences and Technologies. 2014;1(1):28-41.
4. Edwards CA, Burrows I. Potential of earthworm composts as plant growth media. Earthworms in waste and environmental management/edited by Clive A. Edwards and Edward F. Neuhauser, C. A. (Ed.), Earthworms in Environmental and Waste Management. SPB Academic Publishing, The Hague, the Netherlands, 1988, 211-220.
5. Ghanshyam kumar R, Jat RK. Productivity and soil fertility as affected by organicmanure and inorganic fertilizer in green gram (*Vigna radiata*) wheat (*Triticum aestivum*) system. Indian Journal of Agronomy. 2010;55:16-21.
6. Khan NI, Malik AU, Umer F, Bodla MI. Effect of tillage and farm yard manure on physical properties of soil. International Research Journal of Plant Science. 2010;1(4):75-82.
7. Kyei-Boahen S, Savala CE, Chikoye D, Abaidoo R. Growth and yield responses of cowpea to inoculation and phosphorus fertilization in different environments. Frontiers in plant science. 2017;8:646.
8. Magdi TA, Selim EM, Ghamry AM. Integrated effects of bio and mineral fertilizers and humic substances on growth, yield and nutrient contents offertigatd cowpea (*Vigna unguiculata* L.). J Agron. 2011;10(1):34-39.
9. Mengistu DK, Mekonnen LS. Integrated agronomic crop managements to improve tef productivity under terminal drought. Water Stress. Vienna Tech. 2011;1:235-254.
10. Orozco FH, Cegarra J, Trujillo LM, Roig A. Vermicomposting of coffee pulp using the earthworm Eisenia fetida: effects on C and N contents and the availability of nutrient. Biology and fertility of soils. 1996;22(1):162-166.
11. Prasad B, Sinha SK. Long-term effects of fertilizers and organic manures on crop yields, nutrient balance, and soil properties in rice–wheat cropping system in Bihar. Long-Term Soil Fertility Experiments in Rice-Wheat Cropping Systems. Rice-Wheat Consortium Paper Series. 2000;6:105-119.
12. Ramawtar Shivran AC, Yadav BL. Effect of NP fertilizers, vermicompost and sulphur on growth, yield and quality of clusterbean (*Cymopsis tetragonoloba* L) wheat (*Triticum aestivum* L.), Legume Research. 2013;36(1):74-78.
13. Singh AK, Bhatt BP, Sundaram PK, Kumar S, Bahrati RC, Chandra N, *et al*. Study of site specific nutrient management of cowpea seed production and their effect on soil nutrient status. Journal of Agricultural Science. 2012;4(10):191-198.
14. Singh A, Singh VK, Rana NS, Kumar S, Panwar GS, Kumar Y. Response of urdbean to farmyard manure and phosphorus application under urdbean-wheat cropping sequence. Journal of Food Legumes. 2008;21(2):119-121.
15. Singh BB, Ajeigbe HA, Tarawali SA, Fernandez-Rivera S, Abubakar M. Improving the production and utilization of cowpea as food and fodder. Field Crops Research. 2003;84(1-2):169-177.
16. Singh Q, Sekhon HS, Ram H, Sharma P. Effect of farmyard manure, phosphorus and phosphate solubilizing bacteria on nodulation, growth and yield of kabuli chickpea. Journal of Food Legume. 2010;23(3&4):226-229.
17. Tondon HLS. Fertilizers, organic manures, recyclable wastes and biofertilizers, New Delhi: Fertilizer Development and Consultation, 1992, 148p.
18. Venkatalakshmi K, Balasubramanian A, Sankaran N. Influence of seed treatment and foliar spray of panchagavya on growth, yield attributes and yield of Amaranthus viride. Madras Agricultural Journal. 2009;96(1-6):135-138.
19. Yadav RD, Malik CVS. Effect of Rhizobiuxn inoculation and various sources of nitrogen on growth and yield of cowpea (*Vigna unguiculata* (L.). Leg. Res. 2005;28(1):38-41.