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Growth of cowpea [*Vigna unguiculata* (L.) Walp.] Cv. Pusa Komal influenced by application of organic manures and vermiwash spray

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Abstract
From June to November 2019, studies at the Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan investigated how different doses of organic manure combined with the application of vermiwash influenced cowpea growth. A randomised complete block design with three replications was used in the experiment. Under current agro-climatic conditions, cowpea crop for green pods fertilised with 1/2 recommended dose of nitrogen through farm yard manure + 1/2 recommended dose of nitrogen through neem cake with vermiwash spray at 10% concentration at early flowering stage proved most efficient in enhancing cowpea growth. The treatment T13 had the greatest plant length at 60 days after sowing, 75 days after sowing, and at harvest (33.95 cm, 85.54 cm, and 86.67 cm), the greatest number of leaves per plant at 60 and 75 days after sowing (84.57 and 88.75), the greatest number of branches per plant (10.20), the shortest time taken for the first picking (50.33 days), and the greatest number of pickings (5.5).

Keywords: Cowpea, growth, vermiwash, compost, farm yard manure, neem cake

Introduction
Cowpea is an annual legume that is also known as black eyed pea, southern pea, niebe, coupe, and Lubia, or frile (Aleem *et al*., 2014) [1]. Belongs to the Leguminosae family and has the chromosomal number 2n=22. Worldwide production of cowpea crop is 8 million tons, and average yield of cowpea is 1.4 tonne/ha in the world. In India production of cowpea is 3 million tone. Cowpea seeds contain 24.1% protein, 0.1% fat and 54.5% carbohydrates. Cowpea grains are a cheap and nutritious source of protein for low income urban dwellers (Aliyu, 2011) [3]. The green tender pod contain carbohydrate (8.0%), fat (0.2%), protein (4.6%), moisture (84.6%) and rich source of phosphorus, iron, calcium *etc*. (Aykroyd, 1963) [4]. Organic manures such as FYM, compost, vermicompost, and neem cake improve soil structure, aeration, and water retention capacity. Furthermore, it stimulates the action of microbes, which allows the plant to obtain macro and micronutrients from side to side enhanced biological processes, enhances nutrient solubility, and changes soil salinity, sodicity, and pH. (Alabadan and colleagues, 2009) [2]. Vermicompost contains plant nutrients such as Ca, Fe, Mn, P, N, Zn, S, K, Mg, Cu, and B, the absorption of which improves plant nutrition, photosynthesis, chlorophyll content of the leaves, and the nutrient content of the various plant components (fruits, roots, and shoots). Vermicompost contains a high concentration of humic acids, which benefits to plant health by promoting the production of phenolic compounds such as anthocyanins and flavonoids, which can increase plant quality and function as a barrier against pests and diseases (Theunissen *et al*., 2010) [8]. A nutrient reservoir is created by neem seed cake, which improves soil pH, aeration, and other physical and chemical qualities (Uma Singh and Pokhriyal, 1997) [18]. To survive in the environment, earthworms secrete bodily fluid through their dorsal pores. Vermiwash is the name given to the earthworm's bodily liquid. It contains nutritional components such as enzymes like cytokinins, auxin, and others like vitamin that are found in earthworm secretions that stimulate crop growth and yield and help to build resistance in crops that spray with vermiwash; such preparation would undoubtedly have more soluble plant nutrients in addition to other organic acids and mucus of earthworms and microbes (Shivasubramanian and Ganesh Kumar, 2004) [14].
Organic manures such as farm yard manure (FYM), compost, vermicompost, neem cake green manuring, and so on not only offer organic matter but also improve soil fertility (Mohammadi *et al*., 2011) [10].

Organic manures, organic acids such as humic acid that aid in the dissolution of soil nutrients and make them available to plants (Husson, 2013) [7]. Since the rising cost of chemical fertilisers, combined with their inability to provide the soil with the desired health, attention has been focused on organic manure (Oyedeji *et al*, 2014) [11].

Materials and Methods

The experiment was carried out in the Horticulture farm, Rajasthan College of Agriculture, MPUAT, Udaipur, during June and November 2019. Udaipur is geographically located at 24° 34' N latitude and 73° 42' E longitude, and has an elevation of 582.17 metres above mean sea level. This region of India is classified as agro-climatic zone IV A, or "Sub-Humid Southern Plain and Aravalli Hills" in the state of Rajasthan. This zone has typical subtropical climatic conditions, with warm winters and moderate summers, as well as high relative humidity from July to September. Udaipur's average annual rainfall is 630 mm, with a range of 373-1140 mm, the majority of which is given by the S-W monsoon from July to October.

A random number table was used to allocate treatment combinations in the layout (Fisher, 1950) [6]. The experiment was designed using a Randomised Block Design with three replications, 13th treatments combinations, and a seed rate of 15 kg ha-1. Ten plants were chosen at random from each replication and treatment to record observations.

Table 1: Nitrogen content of inputs

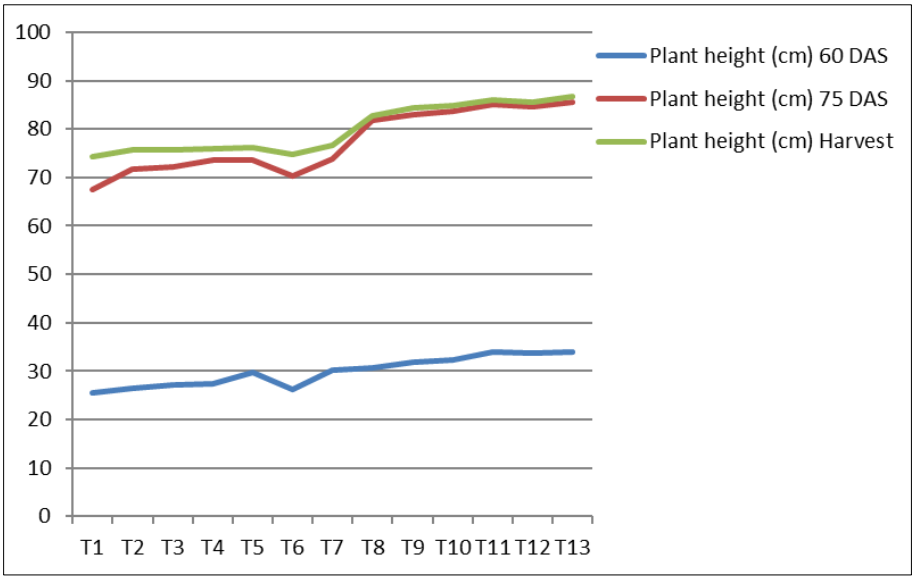
S No.	Name of manure	N (%)
1	FYM	0.50
2.	Vermicompost	1.5
3.	Compost	1.30
4.	Neem cake	5.2
5.	Vermiwash	0.40

Table 2: Treatment detail is following

	Treatments
T_1	Control
T_2	100%Recommended dose of nitrogen through FYM
T_3	100% Recommended dose of nitrogen through compost
T_4	100% recommended dose of nitrogen through vermicompost
T_5	100% recommended dose of nitrogen through neemcake
T_6	Vermiwash10% spray at early flowering stage
T_7	100% recommended dose of nitrogen through FYM +Vermiwash 10%spray at early flowering stage
T_8	100% recommended dose of nitrogen through compost +Vermiwash10% spray at early flowering stage
T_9	100% recommended dose of nitrogen through vermicompost + Vermiwash 10%spray at early flowering stage
T_{10}	100% recommended dose of nitrogen through neem cake+ Vermiwash10%spray at early flowering stage
T_{11}	1/2 recommended dose of nitrogen through FYM +1/2 recommended dose of nitrogen through vermicompost +Vermiwash 10% spray at at early flowering stage
T_{12}	½ recommended dose of nitrogen through FYM +1/2 recommended dose of nitrogen through compost+Vermiwash10% spray at early flowering stage
T_{13}	½ recommended dose of nitrogen through FYM +1/2 recommended dose of nitrogen through neem cake +Vermiwash10% spray at early flowering stage

Results and Discussion

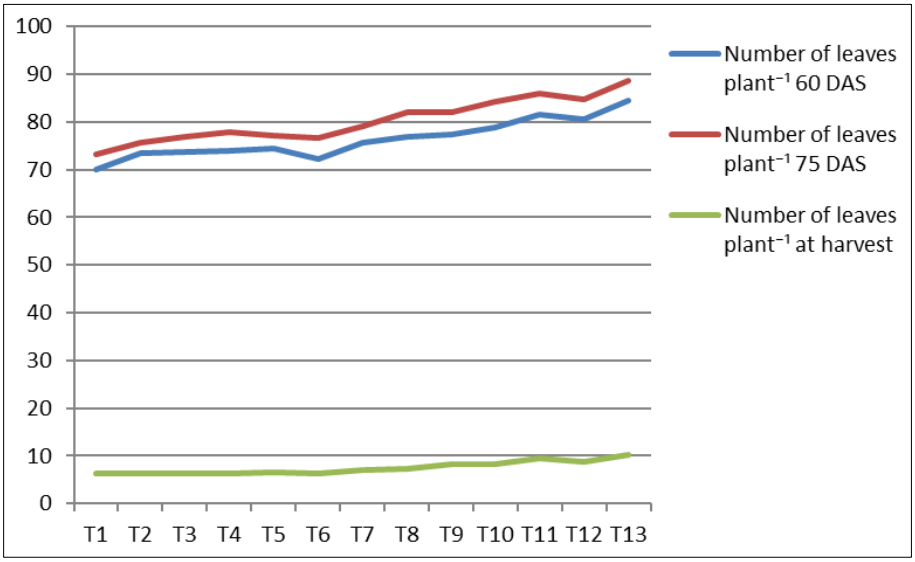
Growth parameters



Graph 1: Plant Height of Cowpea is affected by application of vermiwash spray and organic manure.

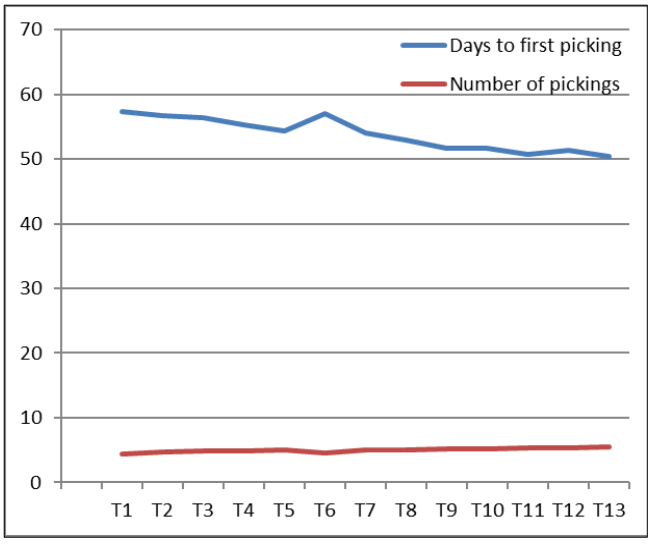
A significant variance had seen in treatment T13 (1/2 recommended dose of nitrogen through farm yard manure + 1/2 recommended dose of nitrogen through neem cake + Vermiwash 10% spray at early flowering stage). The highest

plant length at 60 days after sowing, 75 days after sowing and at harvest (33.95 cm, 85.54 and 86.67 cm). Minimum values were observed in control. Such results can be attributed to the high abundance of plant nutrients in neem cake combine with farm yard manure and vermiwash. Neem seed cake acts as a nutrient reservoir, enhancing soil pH, aeration, and other physical and chemical qualities (Uma Singh and Pokhriyal, 1997) [18]. This was consistent with Rizvi *et al*. (2013)'s finding that neem seed cake is a rich source of organic matter value that can improve and enhance soil physical qualities as well as fertility. The use of neem seed cake can improve nutrient accessibility to crops by increasing mineralization and the provision of readily available nutrients to the soil microbial population (Yusuf *et al*., 2011) [20].



Graph 2: Number of leaves of Cowpea is affected by appliance of vermiwash spray and organic manure

In this treatment in cowpea plant number of leaves per plant and number of branches per plant number of leaves per plant at 60 and 75 60 days after sowing (84.57 and 88.75) in addition to number of branches per plant at harvest (10.20) recorded in treatment T_{13} (1/2 recommended dose of nitrogen through FYM + 1/2 recommended dose of nitrogen through neem cake + 10% spray of vermiwash at early flowering stage) and the minimum values were observed in control.



Graph 3: Days to first picking and number of picking in Cowpea is influenced by application of vermiwash spray and organic manure

In this treatment, the shortest days to first picking (50.33) were observed in treatment T_{13} (half recommended dose of nitrogen through FYM + half recommended dose of nitrogen through neem cake + Vermiwash 10% spray at early flowering stage) and the longest were reported in treatment control. Similarly, the maximum number of picks was seen in treatment T_{13} and the lowest in control treatment. This is due to the effect of nutrient assimilation by neem cake, which enhances physiological growth of the plant and increases growth, in combination with the application of vermiwash at the flowering stage, which promotes improved shoot and root growth and improves nutrient assimilation and uptake by the plant, resulting in enhanced growth and development. Because of the presence of several hormones such as cytokinins, auxin, amino acids, vitamins, enzymes, and so on. *Azadirachta* cake not only feeds the plant, but also increases the number of soil living organisms and produces organic acids, which aids in the reduction of soil alkalinity, resulting in a better rhizosphere for plant growth and development. Singh *et al*. (1986) [15] discovered that Azadirachta seed cake increased the number of branches per plant in tomato plants. In addition, Azadirachta seed cake increases crop shoot, root length, and dry weight when compared to crops not treated with neem cake. These findings are consistent with those reported by Umadevi *et al*. (2019) [5] in cowpea, Yadav *et al*. (2007) [19], Rao *et al*. (2013) [12], and Singh *et al*. (2015) [16] in green gram.

Conclusion

On the basis of results emanated from the present investigation conducted during *Kharif* 2019 it could be concluded from this study that under prevailing agro-climatic conditions, in cowpea crop among different combination vermiwash with different doses of different manures application of treatment T_{13} exhibited remarkably the maximum vegetative growth parameter *i.e.* plant height (86.67 cm), number of leaves per plant (88.75), number of branches per plant(10.20), days to first picking (50.33) and Number of pickings (5.5) followed by application of treatment T_{11} and treatment T_{12}. The lowest vegetative growth

parameters were recorded in control. Hence treatment T13 *i.e.* 1/2 recommended dose of nitrogen through FYM + 1/2 recommended dose of nitrogen through neem cake + Vermiwash 10% spray at early flowering stage was found best combination of organic manure and vermiwash in Pusa Komal variety of cowpea. The application of neem cake and vermiwash showed a better improvement in growth of cowpea.

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Conflict of interest: None

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