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Effects of Different Combinations of Cow Dung and Jeewamirtha Application on Growth and Yield of *Vigna Unguiculata* L.

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***Abstract* - Cowpea is one of the important vegetable crop in Sri Lanka as well as many other countries. Chemical fertilizer application of cowpea production leads to hazardous effect of agro ecological system. In this regard, an experiment was conducted to study the effects of different combinations of Cow dung and Jeewamirtha on growth and yield of *Vigna unguiculata*. The experiment was laid out in Completely Randomized Design with six treatments and ten replications. The treatments are T1 (100% Jeewamirtha), T2 (75% Jeewamirtha + 25% Cow dung), T3 (50% Jeewamirtha + 50% Cow dung), T4 (25% Jeewamirtha + 75% Cow dung), T5 (100% Cow dung), T6 (control). The Experimental results showed that, T2 treatment, the plants treated with 75% Jeewamirtha and 25% Cow dung significantly increased the Fresh and Dry weight of shoot (38.90 %, 47.2 %), Days for 50 % flowering (23..6%),Number of pods per plant (44.5 %), 100 seeds (34.0 %) and Total yield per hectare (50.%) in comparison to plants treated with Control treatment (T6). Therefore, the 75% Jeewamirtha and 25% Cow dung fertilizer could be recommended for the cultivation of *Vigna unguiculata* in order to enhance the growth and yield which is environmentally friendly for sustainable Agriculture.**
Keywords: **Chemical Fertilizer, Cow Dung, Growth, Jeewamirtha, *Vigna unguiculata*, Yield**

I. INTRODUCTION

Grain legumes are the most important crop species after the cereals in worldwide. (Kebede *et al*., 2020). Among the grain legumes, cowpea is one of the most prominent grain legume and fodder crop belongs to family Fabaceae (Maletsema *et al*., 2020).

It has the unique ability of maintaining and restoring the fertility of soil through active biological nitrogen fixation and addition of huge amount of manure to the soil (Anilkumar, *et al.,* 2019). Cowpea is an annual, herbaceous grain legume under the genus vigna. It originated to Africa and grown in various part of the world including tropical and sub-tropical regions covering Africa, Asia, the United States, Europe, and central and south America (Ana *et al*.,2019). The largest cowpea production is in Africa, with Nigeria and Niger predominating even in Brazil, Haiti, India, Myanmar, Sri Lanka, Australia, the United States and Bosnia with significant production (Falayi, 2017). Cowpea used as a dual purpose crop, providing food for human consumption and fodder for livestock (Mfeka., *et al.,* 2019).

Cowpea is valued mainly for its edible seeds, pods and leaves. More than that, cowpea serves as feed, forage, hay, and silage for livestock and green manure and cover crop (Kebede *et al.,* 2020).Due to increasing global population, the demand for the food also increasing so, farmers are using chemical fertilizers to increase crop production and to satisfy the global food demand for growing global population (Frona, 2019). Chemical fertilizers play a vital role in terms of quick increasing soil fertility and also crop yield due to their high nutrient availability. Even though over usage of chemical fertilizer leads to water and air pollution, reducing nutrients efficiency, damaged the soil structure, emission of greenhouse gases, hardening the soil, moreover chemical fertilizers bringing hazard affects to human health and environment as well (Shanika and Premanandarajah, 2015). Continuous use of chemical fertlizers decreases the essential soil nutrients and minerals which are naturally found in fertile soil. Due to these hazardous affects and high cost of chemical fertilizers make them undesirable and also uneconomical for cultivation. Therefore, using low cost organic fertilizer instead of chemical fertilizer is playing a crucial role in sustainable agriculture production system and conserve the soil fertility for the next generation (Fernando and Brintha, 2020).

In the organic agriculture production, more number of organic liquid fertilizers is used such as Panchagavya, Beejamrutha, Jeewamirtha. Among them Jeewamirtha is one of the important Organic liquid fertilizer which has been used by the Indian farmers. Jeewamirtha is a fermented microbial culture it used as a plant growth promoters prepared with locally available materials, and it has the ability to increasing the biological activities in the soil and makes the nutrient available to the crop (Palekar, 2005). The nutrients in organic fertilizer are released gradually so, they are kept in soil for a long period of time and it making sure more prolonged remaining effects, higher crop yield and improved root development. It contains beneficial microorganisms, macronutrients, micronutrients, essential amino acids, growth promoting factors such as GA, IAA and other many vitamins (Fazeel *et al*., 2019). In addition to that Jeewamirtha increasing the activity of soil microorganisms and maintain soil

productivity (Viyasan *et al.,* 2020).Therefore, this present study was undertaken with the following objective to Compare the effects of different combinations of Cow dung and Jeewamirtha application on growth and yield of *Vigna unguiculata* (cv. Dhawala).

II. METHODOLOGY

A. Experimental Location

A pot experiment was conducted at the home garden, in Kinniya, Eastern Province Sri Lanka during the period of May to September in 2021. It is located in the latitude of 8° 30' N and the Longitude of 81° 11' E. This location comes under the Agro Ecological Zone of Low Country Dry Zone.

B. Variety Used

Cowpea variety Dhawala seeds were used. Seeds were collected from the sales center of Agrarian Development center, Kinniya.

C. Preparation of Poly Bags

This experiment was conducted using black colour polythene bags. The height and the diameter of the poly bags were 30 cm and 30 cm. The poly bags were filled with compost: top soil in the ratio of 1:1 and a distance of 3 cm was left unfilled from the top of the soil to facilitate irrigation.

D. Planting of Seeds

Each poly bag was seeded with two seeds.

E. Agronomic Practices

Irrigation was done twice a day in the morning and evening during early stage of growth. After that it was reduced as once per day up to final harvest. Fertilizers were applied according to the treatment structure. Compost was used as basal fertilizer for each treatment. Hand weeding was done at one-week interval. Plants were maintained weed free up to final harvest for the control of pest and disease, Neem extract was applied two times in a week. Treatments were applied once in two weeks and the measurements were taken once in two week interval. Data measured were statistically analyzed using SAS 9.1 and the mean comparison within treatments was performed by Duncan Multiple Range Test at 5% significant level.

F. Steps Involved with the Preparation of Jeewamirtha

1. 10 Kg fresh Cow dung, 10 L Cow urine, 2 Kg Jaggery, 2 Kg Pulse powder were added in to plastic container.
2. 200 L of clean water and hand full of living soil were added to that plastic container and mixed well.
3. Container was covered by cotton cloth for 3 days for fermentation.
4. It was stirred twice every morning and evening (to activate microbes). 3 days after it was ready to apply, and it can be used up to 8 days.
5. Before the application, Jeewamirtha was diluted 10 times with water.

G. Treatment Structure

The experiment consists of six treatments with ten replications and the experimental units were arranged in Complete Randomized Design. Treatment and description is given below in Table I.

TABLE I TREATMENT AND DESCRIPTION

Treatment No.	Description
T1	100% Jeewamirtha
T2	75% Jeewamirtha + 25% Cow dung
T3	50% Jeewamirtha + 50% Cow dung
T4	75% Cow dung + 25 % Jeewamirtha
T5	100% Cow dung
T6	No fertilizer application (Control)

H. Data Collection and Statistical Analysis

Growth and yield data such as fresh and dry weight of shoot, number of days for 50% flowering, number of pods, 100 seeds weight and total yield recorded. The collected data were statistically analyzed using SAS statistical software and mean comparison was done using DMRT at 5% significance level.

III. RESULTS AND DISCUSSION

A. Fresh and Dry Weight of Shoot

Effects of different combinations of Cow dung and Jeewamirtha on fresh and dry weight of shoot of *Vigna unguiculata* was shown in Table II. The results showed that combination of Cow dung and Jeewamirtha significantly ($P<0.05$) influenced the fresh and dry weight of shoots of *Vigna unguiculata*. There was significant differences ($P < 0.05$) was recorded in fresh and dry weight of shoot between T2 and other treatments. Maximum fresh and dry weight of shoot was recorded in T2 and the minimum fresh and dry weight of shoot was recorded in T6. The treatment T2, the plant treated with 75% Jeewamirtha and 25% Cowdung, fresh and dry weight of shoot were increased by 38 .90 % and 47.2 % compared to control treatment (T6) at 8 WAP. This might be due to the result of better plant growth as reflected by increased plant height, more branches and higher number of leaves production of photosynthesis and its effective utilization might be a reason for the increased biomass. Improved performance might be due to faster decomposition of organic manure, thereby

increased availability of nutrients, especially nitrogen which helps in protein synthesis and ultimately resulting in more dry matter production (Babalad, 2005).Therefore in these experiment combinations of 75% Jeewamirtha and 25% Cow dung application in T2 gave the highest fresh and dry weight of shoots in *Vigna unguiculata.*

TABLE II EFFECTS OF DIFFERENT COMBINATIONS OF COW DUNG AND JEEWAMIRTHA ON FRESH AND DRY WEIGHT OF SHOOT OF *VIGNA UNGUICULATA*

Treatments	Fresh weight of shoot (g)	Dry weight of shoot (g)
T1	61.0 ± 4.55^{b}	6.0 ± 0.56^{b}
T2	78.9 ± 6.10^{a}	8.1 ± 0.76^{a}
T3	63.7 ± 4.45^{b}	6.1 ± 0.52^{b}
T4	59.4 ± 4.74^{b}	5.9 ± 0.67^{b}
T5	58.7 ± 3.19^{b}	5.6 ± 0.44^{b}
T6	56.8 ± 4.78^{b}	5.5 ± 0.39^{b}
F- Test	*	*

Value represents mean ± standard error of 10 replicates.
* Represents significant at 5% level of probability. Mean values in a column having the dissimilar letter/letters indicates significant difference at 5% level of significance by Duncan's Multiple Range Test

B. Number of Days for 50% Flowering

Effects of different combinations of Cow dung and Jeewamirtha on number of days for 50% flowering of Vigna *unguiculata* showed in Table III. The results showed there were significant differences ($P < 0.05$) on days for 50% flowering among the treatments. Minimum duration of 32 days was taken by T2 to attain the 50% flowering and maximum time period of 39 days was taken by T6 to attain the 50% flowering. The treatment T2, the plant treated with 75% Jeewamirtha and 25% Cow dung, days for 50% flowering was decreased by 23% compared to control treatment (T6) at 8 WAP. It might be due to the combined application of organic manure and Jeewamirtha. It has resulted in more vegetative growth and early flowering (Lyngdo *et al.,* 2017). Plant growth promoters such as IAA and GA_3 enhance the growth of the plants and high amount of N available in the Jeewamirutha and other micronutrients promotes early flowering of the plants, therefore it leads to short duration of flowering (Sornalatha *et al.,* (2018). P and K present in the organic manure increases the emergence of flowers in the plant (Romheld and Kirkby 2010).Therefore in these experiment combinations of 75% Jeewamirtha and 25% Cow dung application in T2 gave early flowering in *Vigna unguiculata.*

C. Number of Pods

Effects of different combinations of Cow dung and Jeewamirtha on number of pods on a plant of *Vigna unguiculata* at 8 WAP was shown in Table 03.The results showed there was significant differences ($P < 0.05$) on number of pods among the treatments. Maximum number of pods per plant was recorded in T2 followed by T3, T1, T4, T5, and the minimum number of pods was recorded in T6 at 8 WAP. The treatment T2, the plant treated with 75% Jeewamirtha and 25% Cow dung, number of pods was increased by 44.5% compared to control treatment (T6) at 8 WAP. It might be due to the N, P and K present in organic fertilizer and the presence of macro and micro nutrient as well as growth substances (Cytokinin).

Cytokinin is active in very low concentration and regulates a number of plant functions including the cell division (Koda and Okazawa, 1983) and it was in agreement with Esfahani *et al.,* (2018). Jeewamirta which have macro and micro nutrients as well as growth regulators as cytokine and gibbrellic acid which help in producing higher biomass and better recovery of N and P in plant (Boraiah *et al*., 2017). The increase in number of pods in T2 resulted due to the increase in plant growth and dry matter accumulation by the application of organic manure (Klausner and Guest, 1981). Sandeep *et al.,* (2019) reported that application of micro nutrients enhanced the number of pods per plant than control. Therefore, in this experiment combinations of 75% Jeewamirtha and 25% Cow dung application in T2 gave the highest number of pods in *Vigna unguiculata.*

D. 100 Seeds Weight

The Table III showed the 100 seeds weight (g) of *Vigna unguiculata*. The data revealed that effects of different combinations of Cow dung and Jeewamirtha significantly ($P<0.05$) affected the 100 seeds weight of *Vigna unguiculata.* Maximum 100 seeds weight was obtained in T2 followed by T3, T1, T4,T5 and minimum weight of 100 seeds was obtained in T6.The treatment T2, the plant treated with 75% Jeewamirtha and 25% Cow dung, 100 seed weight was increased by 34% compared to control treatment (T6) at 8 WAP. It might be due to the availability of N and other nutrients in the Cowdung and Jeewamirtha, while minimum 100 seed weight in T6 might be attributed to deficiency of macro nutrients throughout the plant life especially at the time of flowering and seed setting (Shah *et al*., (2003).

Ziaeian and Malakouti, (2001) reported that presence of Zn, Mn, and Cu in organic fertilizers significantly increased 100 grain weight. Similar finding was in agreement with Grotz and Guerinot (2006) who reported where significant increase in 100 grains weight with application of micro nutrients. Higher microbial activity due to the application of organic manure produces the organic acids thus increases the availability of native P and other nutrients through decomposition process (Palekar, 2005). Therefore, in this experiment combinations of 75% Jeewamirtha and 25% Cow dung application in T2 gave the maximum 100 seed weight in *Vigna unguiculata.*

E. Total Yield (t/ha)

The Table III showed the total seed yield per hectare of *Vigna unguiculata*. The data showed that application of

75% Jeewamirta with 25 % cow dung fertilizer had highest total yield when compared to other treatments. The maximum yield was recorded in T2 followed by T3, T1, T4, T5 and the minimum yield was recorded in T6. In T2 treatment most of the parameters such as plant height, leaf number, number and weight of nodules, pod number, pod weight has increased. Therefore, yield have been increased. Organic liquid fertilizer which contain macro (N,P,K) and micro nutrients (Mn,Fe,Cu,Zn) increase the yield performances of crop (Esfahani *et al.,* 2018). The treatment T2, total seed yield was increased by 50% compared to control treatment (T6).It might be due to the higher availability of growth promoting substances such as IAA, GA, cytokinin, kinetin, essential plant nutrients, effective microorganisms were present in Jeewamirtha that directly influenced in photosynthetic activity and assimilate partitioning from source to sink might be attributed to increased yield in T2 (Devakumar *et al.,* 2018). These results was in agreement with the findings of Sreenivasa *et al.,* (2010) Therefore in this experiment combinations of 75% Jeewamirtha and 25% Cow dung application in T2 gave the highest total seed yield in *Vigna unguiculata.*

TABLE III EFFECTS OF DIFFERENT COMBINATIONS OF COW DUNG AND JEEWAMIRTHA ON NUMBER OF DAYS FOR 50% FLOWERING, NUMBER OF PODS PER PLANT, 100 SEEDS WEIGHT AND TOTAL YIELD

Treatments	No. of days for 50% flowering	No. of pods per plant	100 seeds weight (g)	Total yield (t/ha)
T1	36.9 ± 1.30^{ab}	6.7 ± 0.77^{b}	16.2 ± 1.10^{b}	1.1 ± 0.25^{b}
T2	32.2 ± 0.41^{c}	10.1 ± 0.60^{a}	20.4 ± 0.71^{a}	2.6 ± 0.18^{a}
T3	35.8 ± 1.22^{b}	6.8 ± 0.78^{b}	16.3 ± 1.52^{b}	1.2 ± 0.16^{b}
T4	38.1 ± 1.19^{ab}	5.3 ± 0.51^{bc}	16.0 ± 1.04^{b}	0.9 ± 0.11^{b}
T5	39.3 ± 1.03^{a}	4.7 ± 0.36^{c}	15.8 ± 0.99^{b}	0.7 ± 0.12^{b}
T6	39.8 ± 0.93^{a}	4.5 ± 0.67^{c}	15.2 ± 2.32^{b}	0.7 ± 0.15^{b}
F- test	*	*	*	*

Value represents mean ± standard error of 10 replicates

*Represents significant at 5% level of probability. Mean values in a column having the dissimilar letter/letters indicates significant difference at 5% level of significance by Duncan's Multiple Range Test

IV. CONCLUSION

This investigation was conducted to find out the effects of different combinations of Cow dung and Jeewamirtha on growth and yield of *Vigna unguiculata* (cv. Dhawala). The soil application of 75% Jeewamirtha and 25 % Cowdung significantly ($P < 0.05$) increased the growth and yield of *Vigna unguiculata*. According to this study, 75% of Jeewamirta and 25% Cowdung significantly gave the best performance on growth and yield of *Vigna unguiculata* when compared to control plants. The 75% Jeewamirta and 25% Cowdung (T2) increased the Fresh and Dry weight of shoots(38 .90 %, 47.2 %), Days for 50 % flowering (23..6%), Number of pods per plant (44.5%), 100 seeds weight (34.0 %) and Total yield per hectare (50.%) in comparison to plants treated with Control treatment (T6). Therefore, the 75% Jeewamirtha and 25% Cowdung could be recommended for the cultivation of *Vigna unguiculata* in order to achieve ecologically sound and better growth and yield in Cowpea.

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