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Influence of irrigation regimes and organics on the productivity and quality of vegetable cowpea (*Vigna unguiculata* (L) Walp)

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Abstract
A field experiment was conducted at Agricultural College and Research Institute, Killikulam during *Rabi* season (October 2018 - January 2019) in order to identify a suitable irrigation regime and organic nutrientfor vegetable cowpea (*Vigna unguiculata* (L) Walp). The experiment was laid out in strip plot design with three replications.There were ten treatment combinations, consistingof two horizontal treatments (irrigation regimes IW: CPE ratio I1-0.4 and I2-0.6) and five vertical treatments (sources of organic. M1-Enriched FYM, M2-Poultry manure, M3-vermicompost, M4-pressmud andM5- inorganic fertilizer). The objectives of the study were to analyze the productivity and quality of vegetable cowpea influenced by irrigation and organic nutrients sources.The results indicated that irrigation at IW: CPE ratio 0.6 showed significantly higher growth and yield parameters which was associated with sources of organic. Enriched FYM gave significantly better results in green pod yield, quality parameters compared to other organic manure.The combination of the treatment (I2M1) both irrigation regimes and organic (IW: CPE ratio 0.6 and enriched FYM) produced the highest yield in vegetable cowpea during *Rabi* 2018-19.

Keywords: Vegetable cowpea, IW: CPE, sources of organic, green pod yield

1. Introduction
Vegetables play important role in day- to-day life, because it provides carbohydrates, protein, minerals and vitamins for human healthy activities. Cowpea (*Vigna unguiulata* (L) Walp.) is most widely grown as *kharif* pulses in India and it is grown as both vegetable and pulse crop as it contains 24.6 per cent protein and it is commonly known as *Lobia.* It is a warm season crop well adapted to many areas of the humid tropics and sub tropical zones. It is used all over India for its long, green vegetable pods, seeds. Pulses hold a unique position in every system of the Indian farming, as a main crop, catch crop, cover crop, green manure crop and intercrop in India. The immature pods are variously known as 'Asparagus bean', 'Snack bean' and 'Yard long bean'. Cowpea originated in India and Ethiopia and is widely grown in India as well as all over the world.

Cowpea seeds are a very good nutritious component for human diet as well as for livestock feed. In cowpea, seeds are rich in amino acids viz tryptophan, lysine when it is compared to cereal grain but, it is deficient in methionineand cystine when it is compared to animal protein therefore it supplies more nutrition in vegetative stage. Among the various factors of production, irrigation and nutrition play pivotal role in increasing the cowpea production.Being a vegetable crop, cow pea responds well to organic nutrients. Climatological approach based on the ratio between irrigation water and cumulative pan evaporation (IW:CPE) is the most widely adopted method of irrigation scheduling as this conceptinvolves all the weather parameters giving them their natural weightage in given soil water plant continuum.

In India during the past three decades, intensive agriculture involving exhaustive high yielding varieties has led to heavy withdrawal of nutrients from the soil. Further more, imbalanced use of chemical fertilizers by farmers has deteriorated soil health and declined soil organic carbon content. FYM is being used as major source of organic manure in field crops. Application of organic manures significantly increased the organic carbon content of the soil (Kanwar 2014) [7].

Hence, with the objectives of studying the effect of different irrigation regimes through climatological approach and to evaluate the effect of organic manures, a study was taken up with different irrigation regimes and organic sources with their combinations in vegetable cowpea (*Vigna unguiculata* (L) Walp)

2. Material and methods

The field experiment was conducted at Central Farm, Agricultural College and Research Institute, Killikulam. The experimental field was geographically located in the southern part of Tamil Nadu at 8°46' N latitude and 77°42' E longitude with an altitude of 40 m above MSL. The experiment was laid out in strip plot design with three replications. The following treatments were imposed: Horizontal strips (I1- IW: CPE of 0.4), (I2- IW: CPE of 0.6), Vertical strip (M1-100% RDF through Enrich FYM), (M2-100% RDF through Poultry manure), (M3-100%RDF through Vermicompost), (M4-100% RDF through Pressmud) and (M5-100% RDF through Inorganic fertilizer) Each experimental unit had 5.9m x 4.3m gross plot and 5.0m x 4.0m net plot. The vegetable cowpea variety Pusa Komal was sown with pre treatment of *rhizobium* culture @ 400gm/20 kg seeds. It was dry sown at 45cm row to row and 15cm plant to plant distance. The crop was fertilized with RDF (Recommended Dosage of Fertilizer) through organic manure and inorganic manures as per the treatments. RDF adopted for vegetable cow peawas 25:50:0 kg NPK ha^{-1}. The weather conditions were favourable for normal growth of vegetable cowpea during the crop season. The different irrigation treatments (IW:CPE ratios) were imposed with the help of 7.5 Parshall flume application of irrigation according to climatological approach. The growth parameters and the yields were recorded and worked out on per hectare basis. The data were statistically analyzed.

3. Results and Discussion

Table 1: Effect of different irrigation regimes and organic nutrients on Plant height, Dry matter production and Leaf area index of vegetable cowpea (at harvest)

Treatment	Plant height (cm)	Dry matter production (kg ha^{-1})	Leaf area index (LAI)
Irrigation regimes (I)			
I1: 0.4 IW:CPE ratio	48.50	1817	2.54
I2:0.6 IW:CPE ratio	50.26	2237	2.71
SEd ±	0.42	49.6	0.05
CD(P=0.05)	NS	213.4	NS
Sources of organic(M)			
M1- 100% RDF Enriched FYM	55.78	2405	3.29
M2-100% RDF Poultry manure	50.47	2172	2.69
M3-100% RDF Vermicompost	49.25	2041	2.57
M4-100% RDF Pressmud	46.98	1838	2.36
M5-100% RDF Inorganic check	45.44	1683	2.2
SEd ±	1.26	74.4	0.09
CD(P=0.05)	2.90	171.5	0.2
Interaction			
I ×M	NS	NS	NS
CD(P=0.05)	2.12	206.02	0.12

*NS-Not significant

*RDF (Recommended dosage of Fertilizer)

3.1 Plant Height

Plant height is an indicator of growth performance of crop, as influenced by environment and management factors. The plant height was measured at vegetative stage and at harvest stages. The plant height was increasing with the advancement of crop growth from vegetative stage and it reached maximum at harvest stage. The different irrigation regimes and organic sources practices significantly influenced the plant height at growth stages. The results revealed that the different irrigation regimes had a significant effect on the plant height. Among different irrigation regimes, 0.6 of IW: CPE ratio (I2) produced significantly taller plants at harvest stage 50.26 cm and IW: CPE ratio 0.4 (I1) observed discernibly shorter plant height at harvest stages 48.5 cm.

The organics sources at harvest also significantly influenced the plant height as the maximum plant height was recorded with Enriched FYM (M1) 55.78 cm it was followed by poultry manure (M2) 50.47cm and inorganic fertilizer (M5) 45.44cm were found poor treatment and all these treatment results are associated with IW: CPE ratio 0.6 and it is on par with IW: CPE ratio 0.4 These results were in agreement with earlier findings as reported by Babaji *et al.*, 2011, Anju and Vijayalakshmi 2014, Uikey, *et al*., 2015 and Dasila, *et al*., 2016 and Anita and Lakshmi 2015 [3, 1, 13, 4, 2].

3.2 Dry matter production

Dry matter production (DMP) was highly significantly influenced by irrigation regimes and organic manure. The DMP assessed at harvest stages indicated that distinct irrigation and organics showed positive influence on DMP and attained maximum at harvest stage. Among the irrigation management practices, IW: CPE ratio 0.6 (I2) produced significantly higher DMP assessed at harvest stages 2237 kg ha^{-1}.Whereas, lesser DMP was noticed in IW:CPE ratio 0.4 (I1) at harvest stage 1817 kg ha^{-1} but both are significant each other. The highest dry matter production was recorded with Enriched FYM (M1) 2405 kg ha^{-1} which was followed by poultry manure (M2) 2172 kg ha^{-1} and the lowest DMP was recorded under inorganic fertilizer (M5) 1683 kg ha^{-1}. The results indicated that there was no significant influence on DMP of cow pea when the irrigation scheduling (IW: CPE ratios) and organic sources were combined though they gave positive response individually. The similar findings were reported by Pargi *et al.,* 2018, Kaviti Vijaya Lakshmi *et al.*, 2018 and Wanjari *et al.*, 2018 [10, 8, 14].

3.3 Leaf Area Index (LAI)

Measurement of leaf area and assessment of LAI are the basic tools for growth analysis.The leaf area index was progressively increasing at harvest stage of the crop. Among the irrigation management practices, IW: CPE ratio 0.6 (I2) produced higher LAI assessed at harvest stages 2.71.Whereas, lesser LAI was noticed in IW: CPE ratio 0.4 (I1) at harvest stage 2.54. The organics sources at harvest shows significantly maximum leaf area index was recorded with Enriched FYM (M1) 3.29 then followed by with poultry

manure (M2) 2.69 and inorganic fertilizer (M5) 2.2 were found poor treatment and all these treatment results are associate with IW: CPE ratio 0.6 then IW: CPE ratio 0.4 show lower dry matter production. The results indicated that the interaction effect between irrigation scheduling (IW: CPE ratios) and organic of plant height was non-significant. These similar findings were reported by Rajasingh *et al.*, 2014, Anju and Vijayalakshmi, 2014 [11, 1].

Table 2: Effect of different irrigation regimes and organic nutrients on green pod yield of vegetable cowpea

Treatment	Green pod yield (kg ha^{-1})
Irrigation regimes (I)	
I1: 0.4 IW:CPE ratio	6202
I2:0.6 IW:CPE ratio	6505
SEd ±	13.2
CD(P=0.05)	56.65
Sources of organic(M)	
M1- 100% RDF Enriched FYM	7161.5
M2-100% RDF Poultry manure	6666
M3-100% RDF Vermicompost	6369
M4-100% RDF Pressmud	6010
M5-100% RDFInorganic check	5562.5
SEd ±	51.9
CD(P=0.05)	119.75
Interaction	
I ×M	44.39
CD(P=0.05)	102.38

*RDF (Recommended dosage of Fertilizer)

3.4 Green Pod yield (kg ha^{-1})

The study indicated significant variations on the green pod yield due to the adoption of different irrigation regimes and organic nutrients. Among the irrigation management practices, IW: CPE ratio 0.6 (I2) recorded higher green pod yields (6505 kg ha^{-1}) when compare to 0.4 ratio (I1) (6202 kg ha^{-1}). Application of Enriched FYM significantly influenced the green pod yield of cow pea which recorded the highest yield (7162 kg ha^{-1}). This was followed by poultry manure (M2) (6666 kg ha^{-1}). The green pod yields were lower when inorganic fertilizers were applied (M5) (5687 kg ha^{-1}).

The field study also revealed that the irrigation regimes had positive influence on the pod yields when they were combined with the organic sources. IW: CPE ratio 0.6 (I2) combined with Enriched FYM application registered the highest green pod yields in cow pea. Similar findings were reported earlier by Panda *et al.*, 2017, Dasila *et al*., 2016, Deewan, 2010 and Joshi *et al*., 2016 [9, 4, 5, 6].

4. Conclusion

Based on the study, it is concluded that application of Enriched FYM @ 1.6 t ha^{-1} as basal along with climatological approach of scheduling irrigation water at IW: CPE ratio of 0.60 could be recommended for higher green pod yields in vegetable cowpea grown during *Rabi* season in southern parts of Tamil Nadu.

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