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Influence of canopy modification and Biofertigation treatment on yield attributes and yield in organic pigeonpea

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Abstract
A field experiment was carried out during two consecutive years *viz.*, 2017 and 2018 at Post Graduate Institute Research Farm, Central Campus, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India) to study the Influence of Canopy Modification and Biofertigation Treatment on Yield Attributes And Yield In Organic Pigeonpea. The results revealed that application of jeevamrut at 400 l ha-1 and canopy modification *i.e* nipping at 50 DAS significantly influenced yield attributes and yield of pigeonpea. It was significant in enhancing the grain yield, stalk yield and harvest index of pigeonpea besides improvement in yield attributes like number of pods plant-1 and pod weight plant-1. Based on two years of experimentation it could be concluded that, in organic cultivation of pigeonpea, canopy modification through nipping at 50 days after sowing and application of farm yard manure at 5 t ha-1 with biofertigation of jeevamrut @ 400 l ha-1 in four equal split at 30, 45, 60 and 75 DAS found suitable for obtaining higher productivity.

Keywords: Grain yield, biofertigation, jeevamrut, canopy modification (nipping)

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.), commonly known as red gram or tur or Arhar, is a very old crop of India. After gram, arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as 'dal' Its soil rejuvenation qualities such as release of soil bound phosphorous, atmospheric nitrogen fixation, recycling of soil nutrients and addition of organic matter and other nutrients make the pigeonpea crop an ideal crop of sustainable agriculture in the tropical and sub-tropical regions of India. Apical bud nipping is known to alter the source- sink relationship by arresting the vegetative growth and hastening the reproductive phase. It also helps in production of more pod bearing branches with luxuriant foliage thus, enhances the photosynthetic activity, accumulation of more photosynthates, ultimately resulting in better seed quality with higher seed yield (Thakral *et al.* 1991). As nipping practice does not require any tools and equipment, it can be a handy and cost effective practice for small farmers as well.

The introduction of a reckless chemical based agricultural policy in the recent decades has had adverse impact on the Indian agricultural practices and serious environmental concerns have been raised. Sustainable agriculture is of most importance and this can be achieved by encouraging the use of organic farming, which is currently limited to an area of just 41,000 ha in India, only 0.03% of the total cultivated area. This comes in complete contrast to the area usage around the world which varies between 3.70%-11.30%. The global increase in the area under organic farming is a result of high awareness of health problems caused by contaminated food, ill effects of environmental degradation, appropriate support by government and organisation and have gained strong support not only by local governments but also by international organisations such as European Union and International Federation of Organic Agriculture Movement (IFOAM). Some of the countries abroad have shown an increase in the organic production by 20%.

Organic manures such as FYM, compost, oil cakes and vermicompost *etc*. maintains soil health but they are bulky in nature, required in large quantity and also release nutrients slowly and due to that limit the availability immediately to growing crop. In other hand liquid organics called bioinoculants *viz.*, Jeevamrut, Cow urine, EM solution, Liquid biofertilizers, Humic acid and waste decomposer which contain microbial count and plant growth promoting substances (PGPR) stimulate growth, yield and quality of crops (Devkumar, *et al.* 2008) [3].

Although, these organic formulations may not provide enough nutrients at the site of its application, they help in quick build up of soil fertility through enhanced activity of soil micro flora and fauna (Yadav and Mowade, 2004) [15]. Keeping these facts in view, field study was planned.

Material and Methods

A field experiment was carried out during two years *viz.*, 2017 and 2018 at Post Graduate Institute Research Farm, Central Campus, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India) to study the effect of canopy modification and biofertigation on yield of organic pigeonpea. The soil of the experimental field was clay loam in texture, low in available nitrogen (224.24 kg ha-1), medium in available phosphorus (15.67 kg ha-1) and high in potassium content (380.23 kg ha-1) with 0.51 per cent organic carbon content. The soil was slightly alkaline in reaction (pH 8.1) with 0.38 dSm-1 electrical conductivity. Soil physical properties *viz.*, bulk density (1.32 g cm-3), field capacity (33.53 %) and permanent wilting point (18.11%) indicate that the soil was moisture rentative. The DTPA micronutrient status indicates that the soil was sufficient in respect of Fe (4.55 mg kg-1), Mn (2.20 mg kg-1) and Cu (0.41 mg kg-1) and deficient in Zn (0.59 mg kg-1).The experiment was laid out in Split Plot Design with four replication. The main plot consist of three treatments of canopy modification (nipping) *viz.*,

N1- No Nipping, N2- Nipping at 50 DAS and N3 - Nipping at 70 DAS with six sub plot treatments of biofertigation *viz.*, B1- No biofertigation, B2- Biofertigation with EM @10 l ha-1, B3-Biofertigation with jeevamrut @ 400 l ha-1, B4-Biofertigation with humic acid @10 l ha-1, B5- Biofertigation with cow urine @ 200 l ha-1and B6-Biofertigation with recommended liquid biofertilizer *Rhizobium* and PSB @ 20 l ha-1in four equal split at 30, 45, 60 and 75 DAS. The gross and net plot sizes were 10.0 m x 7.20 m and 8.80 m x 3.60 m, respectively. Biofertigation of each bioinoculant was done in four equal splits in 15 days interval after 30 Days onwards sowing of crop up to 75 DAS. FYM @ 5 t ha-1 was applied common to all treatment. The entire quantity of FYM was applied before sowing or transplanting the crops. Canopy modification *i.e.* nipping was done by hand means removal of apical bud from 10 cm top of main branch at 50 DAS and 70 DAS as per treatment was undertaken.

Organic liquid formulations preparation and application

Bioinoculants in which EM, jeevamrut, humic acid, cow urine and Liquid biofertilizers (*Rhizobium* and PSB) were used in the present study. The bioinoculant solution was injected in to the drip system by suction generated through venturi. As per water requirement of crop the drip irrigation system was operated. While applying the liquid organic formulation as per treatment, first only irrigation was started for all treatments, then the treatments wise bioinoculants given through drip system and then drip system run only for five system. All organic formulations were applied in four split through drip system at 30, 45, 60 and 75 DAS.

Jeevamrut

Jeevamrut was prepared by mixing 10 kg of desi cow dung, 10 litre of desi cow urine, 2 kg of jaggery, 2 kg of gram flour and hand full of soil collected from farm. All these were put in 200 litre plastic drum and mixed thoroughly and volume was made up to 200 litres. The mixture was stirred well in clock wise direction and kept the plastic drum in shade covered with wet jute bag. The solution so prepared was stirred clockwise in the morning, afternoon and evening for 7 days. After filtration it was ready for use. Prepared jeevamrut 100 l ha-1 per split was applied through drip at regular intervals of 30, 45, 60 and 75 days after sowing (DAS) as per treatments during both years.

Cow urine

Deshi cow urine was diluted at 1:1 proportion with water. Cow urine 50 l ha-1 per split was applied through drip at regular intervals of 30, 45, 60 and 75 days after sowing (DAS) as per treatments during both years.

Effective Microorganism (EM) solution

EM was available in a dormant state and it required activation before application. EM was prepared by adding 17 litre of water, 2 kg of jaggery and 1 litre of EM-1 Solution. The mixture was then transferred into a clean air tight plastic container and kept away from direct exposure to sunlight at ambient temperature for 7 days. Open the lid of container twice in a day to remove gas. During the period of activation, a white layer of actinomycetes formed on the top of the mixture accompanied by a sweet smell. For the activated EM, the pH is a determining factor and it should be below 4.0. This indicates the activation of Effective Microorganisms. EM-2 solution 50 l ha-1 per split after dilution with 50 l of water was applied through drip at regular intervals of 30, 45, 60 and 75 days after sowing (DAS) as per treatments during both years.

Humic acid

Humic acid (Humic acid-organic manure, liquid) 2.5 litre per split after dilution with 97.5 l water was applied through drip at regular intervals of 30, 45, 60 and 75 days after sowing (DAS) as per treatments during both years.

Liquid biofertilizers

Liquid biofertilizers *i.e. Rhizobium* and PSB used in these experiment prepared by microbiology department of MPKV, Rahuri. *Rhizobium* and PSB biofertilizer 5 l ha-1 per split after dilution with 95 l of water was applied through drip at regular intervals of 30, 45, 60 and 75 days after sowing (DAS) as per treatments during both years.

Yield and yield parameter Studies Number of pods plant-1

Numbers of pods obtained from five observational plants were counted and worked out average for recording pods plant-1.

Dry pod weight plant-1 (g)

Treatment wise pods were separated from five observational plants. The weight of pods was recorded on electronic weighing balance and work out the average weight per plant and expressed in grams.

Number of grains pod-1

The pods plucked from five observational plants from each net plot were threshed separately and number of seeds were counted and reported on mean plant basis.

Grain weight plant-1 (g)

Treatment wise grains were separated from five observational plants. The weight of grains were recorded on electronic weighing balance and work out the average weight per plant and expressed in grams.

100 grain weight (g)

After harvesting and threshing of all samples from each treatment, a composite sample of grains were obtained treatment wise from each net plot yield and counted 100 grains and recorded weight on electronic weighing balance and expressed in grams.

Grain yield (kg plot-1)

The grain yield was recorded after threshing all the pods of each net plot. Final grain yield from each net plot was obtained by adding grain weight of five observational plants of respective net plots. From this data treatment wise grain yield in kg per net plot and q ha-1 was computed by multiplying it with hectare factor.

Stalk yield (kg plot-1)

After harvesting all the plants from net plot of each treatment, the plants were cut close to ground and left in the field for sun drying. Then recorded the weight with the help of spring balance and expressed in kilograms.

Harvest index

Harvest index for pigeonpea was calculated by using the following formula (Donald and Humblin, 1976) [5].

$$\text{Harvest index (\%)} = \frac{\text{Economical yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

Results And Discussion

Yield Studies

The data regarding yield contributing attributes *viz*. number of pods plant-1, dry pod weight plant-1, number of grains pod-1, grain weight plant-1 and also grain yield, stalk yield and harvest index of pigeonpea were found significantly higher with the treatment of nipping at 50 DAS than rest of the treatment during both years and pooled mean basis. However, the minimum

yield and yield attributing character found in no nipping treatment. The data regarding yield contributing attributes *viz*. number of pods plant-1, dry pod weight plant-1, number of grains pod- 1, grain weight plant-1,100 grain weight of pigeonpea and grain yield, stalk yield and harvest index were found higher with the application of bioinoculant jeevamrut @ 400 l ha-1 in four equal split at 30, 45, 60 and 75 DAS than rest of the biofertigation treatment during both the years and on pooled mean. However, it was at par with treatment of EM @ 10 l ha-1 and humic acid @ 10 l ha-1 treatment applied in four equal split at 30, 45, 60 and 75 DAS during both the years and on pooled mean. The increase in grain yield and yield attributing parameters noticed with nipping at 50 DAS was mainly due to production of more number of productive branches. The nipping is known to accumulate more photosynthates which are utilized for production of more number of pod bearing branches and more number of grain pod-1. Grain yield itself is a

complex genetic trait and several other parameters like branches plant-1, days to flowering,

number of pods plant-1 *etc.* have significant role on final yield. Khan *et al.*, (2006) [6] opioned that although the correlation between number of branches and seed yield is always positive and their magnitude has been increased considerably with nipping. Similar increase in seed yield and yield parameters with nipping were also reported by Aziz (2002) [1]. Plants nipped at 50 DAS appeared to have rooted effectively to the soil and able to direct assimilates to the lateral buds thereby optimum vegetative growths without interrupting floral bud initiation which could have resulted in their superiority over the other treatment in terms of overall performance. Plants nipped at 70 DAS showed slightly higher values than non-nipped plants possibly due to short recovery time they experienced which made them unable to put up improved vegetative growths before they.

entered reproductive phase. The findings of the study were in agreement with the findings of Sharma *et al.*, (2003) [10] Baloch and Zubair (2010) [2], Manjunatha lambani (2017) [7], Dhaka *et al.*, (2018) [4] and Srinivasan *et al.*, (2019) [12].

In the present study all the growth attributing parameter and yield attributing parameters were significantly higher in jeevamrut @ 400 l ha-1 in four equal split at 30, 45, 60 and 75 DAS which might be due to the favourable effects of IAA, GA3, macro and micro nutrients and also beneficial microorganisms present in the jeevamrut (Somasundaram, 2003). When these bioinoculant were applied in four times, they act as a stimulus in the plant system and in turn increased the production of growth regulators in the cell system. Production of total dry matter and

its accumulation in plants plays a important role in the yield attributing characters and yield of pigeonpea. In the present study application of jeevamrut @ 400 l ha-1 in four equal split at 30, 45, 60 and 75 DAS recorded significantly higher total dry matter production over other bioinoculants application. This could be attributed to its beneficial effects as a growth regulator resulting in increased assimilating area and it's functioning which helps in increased production of carbohydrates and their distribution in plant. Palekar (2006) [8]; Vasanthkumar (2006) [14], Devakumar *et al.*, (2008) [3] Sutar *et al.*, (2017) [13] and Ravina Kumari *et al.*, (2019) reported that the beneficial effects of jeevamrut was attributed to huge quantity of microbial load and growth hormones, which might have enhanced the soil biomass, thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately resulted in growth and yield of crops. These findings are in conformity with the findings of Sharma and Thomas (2010) [11].

Table 1: Yield attributes of pigeonpea as influenced by different canopy modification (nipping) and biofertigation treatments (2017, 2018 and Pooled)

Treatment	Number of pods plant-1			Number of grains pod-1			Pods weight plant-1 (g)			Grain weight plant-1(g)			100 grain weight (g)		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
Canopy modification *i.e* Nipping (N)															
N1-No nipping	353.44	373.33	363.39	2.54	2.73	2.63	228.00	240.04	234.02	110.06	120.06	115.06	11.84	12.01	11.93
N2-Nipping at 50 DAS	478.00	499.61	488.81	2.59	2.75	2.67	358.78	383.34	371.06	133.44	143.61	138.53	11.74	11.96	11.85
N3-Nipping at 70 DAS	451.78	470.83	461.31	2.54	2.74	2.64	327.36	342.13	334.74	125.27	131.83	128.55	11.82	11.87	11.84
S.Em+	2.67	5.05	2.00	0.07	0.05	0.08	6.60	4.78	3.93	1.71	5.20	2.9	0.13	0.19	0.20

C. D. at 5%	10.49	19.83	6.30	NS	NS	NS	25.92	18.77	12.34	6.73	20.42	7.84	NS	NS	NS
Biofertigation (B)															
B1-No Biofertigation	376.56	385.78	381.17	2.46	2.49	2.48	233.00	242.33	237.67	100.32	103.33	101.83	10.89	11.08	10.98
B2-EM@ 10 l ha-1	442.00	474.22	458.11	2.63	2.82	2.73	337.56	357.49	347.52	132.22	143.67	137.94	11.98	12.20	12.09
B3-Jeevamrut @ 400 l ha-1	455.00	490.78	472.89	2.64	2.84	2.74	352.52	379.50	366.01	136.33	148.89	142.61	12.19	12.13	12.16
B4-Humic acid @ 10 l ha-1	443.56	471.11	457.33	2.58	2.76	2.67	332.22	352.86	342.54	128.33	141.44	134.89	11.99	12.11	12.05
B5-Cow urine@ 200 l ha-1	423.33	427.78	425.56	2.50	2.73	2.62	281.43	295.82	288.63	118.44	124.78	121.61	11.89	12.02	11.96
B6-Liquid biofertilizers (*Rhizobium* and PSB) @ 20 l ha-1	426.00	437.89	431.94	2.56	2.78	2.67	291.53	303.04	297.29	121.89	128.89	125.39	11.87	12.11	11.99
S.Em+	8.83	8.86	5.43	0.09	0.07	0.10	11.01	9.68	7.09	3.74	4.04	2.70	0.16	0.22	0.24
C. D. at 5%	25.51	25.60	15.28	NS	NS	NS	31.79	27.95	19.98	10.79	11.68	7.63	0.45	0.64	0.67
Interaction (N x B)															
Between two sub plots means at same level of main plots means															
S.Em+	15.30	15.35	8.92	0.15	0.12	0.17	19.07	16.76	12.031	6.47	7.00	4.78	0.27	0.39	0.41
C. D. at 5%	NS	NS	25.12	NS	NS	NS	NS	NS	33.88	NS	NS	13.48	NS	NS	NS
Between two main plots means at same level of sub plot means															
S.Em+	14.22	14.89	-	0.16	0.12	0.17	18.61	16.03	-	6.15	8.24	-	0.28	0.40	0.42
C. D. at 5%	NS	NS	-	NS	NS	NS	NS	NS	-	NS	NS	-	NS	NS	NS
General Mean	427.74	447.93	437.83	2.56	2.74	2.65	304.71	321.84	313.28	122.92	131.83	127.38	11.80	11.94	11.87

Table 2: Yield of pigeonpea as influenced by different canopy modification (nipping) and biofertigation treatment (2017, 2018 and pooled)

Treatment	Grain yield (q ha-1)				Stalk yield (q ha-1)			Harvest index (%)		
	2017	2018	Pooled	% increase over control	2017	2018	Pooled	2017	2018	Pooled
N1-No nipping	20.05	22.46	21.26	-	49.28	51.83	50.56	28.41	30.23	29.32
N2-Nipping at 50 DAS	25.04	25.86	25.45	19.91	56.22	56.66	56.44	30.81	31.42	31.11
N3-Nipping at 70 DAS	22.10	23.89	22.99	8.13	52.67	53.59	53.13	29.82	31.01	30.41
S.Em +	0.28	0.32	0.37	-	0.58	0.73	0.81	-	-	-
CD at 5%	1.12	1.25	1.21	-	2.28	2.88	2.64	-	-	-
B1-No Biofertigation	16.87	17.09	16.98	-	46.67	47.06	46.86	27.37	27.50	27.43
B2-EM @ 10 l ha-1	24.47	26.57	25.52	50.29	54.56	56.22	55.39	30.91	32.12	31.51
B3-Jeevamrut @ 400 l ha-1	25.07	27.06	26.06	53.47	55.78	57.00	56.39	31.07	32.24	31.65
B4-Humic acid @ 10 l ha-1	24.21	26.33	25.27	48.82	54.33	56.11	55.22	30.80	31.95	31.37
B5-Cow urine @ 200 l ha-1	21.76	23.60	22.68	33.57	53.00	54.22	53.61	29.24	30.34	29.79
B6-Liquid biofertilizers (*Rhizobium* and PSB) @ 20 l ha-1	22.00	23.77	22.89	34.81	54.00	55.56	54.78	28.95	29.97	29.46
S.Em +	0.31	0.25	0.35	-	1.37	0.96	1.45	-	-	-
CD at 5%	0.90	0.73	0.99	-	3.97	2.76	4.10	-	-	-
S.Em+	0.54	0.44	0.51	-	2.38	1.65	1.65	-	-	-
CD at 5%	NS	NS	1.53	-	NS	NS	4.93	-	-	-
S.Em+	0.57	0.51	-	-	2.26	1.71	-	-	-	-
CD at 5%	NS	NS	-	-	NS	NS	-	-	-	-
General Mean	22.40	24.07	23.23	-	53.06	54.36	53.71	29.72	30.69	30.20

Conclusion

Based on two years of experimentation it could be concluded that, in organic cultivation of pigeonpea, canopy modification through nipping at 50 days after sowing and application of farm yard manure at 5 t ha-1 with biofertigation of jeevamrut @ 400 l ha-1 in four equal split at 30, 45, 60 and 75 DAS found suitable for obtaining higher yield.

References

1. Aziz MA. Response of chickpea to nipping. Pakistan Journal of Scientific Industrial Research 2002;43(3):191-193.
2. Baloch MS, Zubair M. Effect of nipping on growth and yield of chickpea. The Journal of Animal and Plant Sciences 2010;20(3):208-210.
3. Devakumar N, Rao GGE, Shubha S, Imrankhan, Nagaraj, Gowda SB. Activities of Organic Farming Research Centre. Navile, Shimoga, University of Agriculture Sciencee, Bangalore-65 2008.
4. Dhaka AK, Kumar S, Singh B, Singh K, Kumar A, Kumar N. Nitrogen use efficiency, economic return and yield performance of Pigeonpea [*Cajanus cajan* (L.) Millsp.] as influenced by nipping and fertility levels. International Journal of Legume Research 2018. Print ISSN: 0250-5371 / Online ISSN:0976-0571.
5. Donald CM, Humblin HB. The biological yield and harvest index of cereals as agronomic and plant breeding criteria. Adances in Agroomy 1976;28:361-405.
6. Khan H, Latif A, Mahmood S, Khan MSS. Effect of nipping at various stages on yield and yield components of chickpea (*Cicer aritnum L.*). Journal of Research Science 2006, 235-240.
7. Manjunatha Lambani. Studies on nipping and row spacing on growth and yield of pigeonpea (*cajanas cajan*), M.Sc. Agriculture Thesis. Agronomy Department, University of Agricultural Sciences, Bengluru, Karnataka (India) 2017.
8. Palekar S. Text book on shoonya bandovalada naisargika krushi, published by Swamy Anand, Agri Prakashana, Bangalore 2006, 67.
9. Ravina Kumari, Kuldeep ST, Noel Lalhruaitluangi. Effect of different organic nutrient sources on soil properties in onion (*Allium cepa L.*). International Journal of Current Microbiology and Applied Sciences 2019;8(04):1783-1792.
10. Sharma A, Potdar MP, Pujari BT, Dharmaraj PS. Studies on Response of Pigeonpea to Canopy Modification and Plant Geometry. Karnataka Journal Agriculture Science

2003;16(1):1-3.
11. Sharma V, Thomas A. Response of Blackgram (*Vigna mungo* L.) to nitrogen, zinc and farm yard manure. Legume Reseaech 2010;33(4):295-298.
12. Srinivasan G, Gobi R, Balasubramanian A, Sathiyamurthi S. Influence of nipping and nutrient management practices on growth, yield attributes and yield in pigeonpea. Plant Archives 2019;19(1):737-740.
13. Sutar R, Sujith GM, Devakumar N. Growth and yield of Cowpea [*Vigna unguiculata* (L.) Walp] as influenced by jeevamrutha and panchagavya application. www.arccjournals.com/www.legumeresearch.in. LR-3932. 2017.
14. Vasanthkumar HHA. Jeevamrut slurry preparation, Siri Samruddhi 2006, 4-5.
15. Yadav AK, Mowade SM. Organic manures and compost. In: Organic Farming. Ray of Hope for Indian Farmer 2004, 109.