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## Effect of organic manures and plant extracts on growth and yield of chickpea, *Cicer arietinum* L. at Limboor village of Nizamabad district, Telangana state

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### Abstract

A field experiment on “Effect of Organic Manures and Plant Extracts on growth and yield of Chickpea, *Cicer arietinum* L.” was carried out at Limboor village of Nizamabad District, Telangana State. The highest plant height 60.493 cm was observed in T<sub>1</sub>-Vermicompost (10 t/ha) + NSKE (5%) followed by T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit) with 57.963 which was on par with T<sub>2</sub> - Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub> -Vermicompost (10 t/ha) + tobacco leaf decotion (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%). The more branches per plant 7.567 no. was recorded in T<sub>1</sub>, which was on par with T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 7.620 no. followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%). T<sub>1</sub>-Vermicompost (10 t/ha) + NSKE (5%) recorded the highest i.e. 69.94 no. of pods per plant with 1569.45 kg/ha grain yield and it was significantly different from other treatments followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%).

**Keywords:** organic manures, plant extracts, growth, yield, *Cicer arietinum*

### Introduction

Chickpea (*Cicer arietinum* L.) is a major pulse crop grown in India and it is one of the world's most valuable food grain legumes. Over the last several years, India has been the top producer of chickpeas and in 2019, the production volume of chickpeas in India amounted to nearly 9.94 million metric tons (Statistia, 2021) [1]. It is also referred to as "Chana" or "Bengal gram" as a leguminous pulse crop. It is a very important component of dry, rain-fed cropping systems since it can repair nitrogen fixation of eighty to one hundred and twenty kilograms (Golding & Dong, 2010) [3]. There are two major types of chickpea distinguished by seed size, shape and colour. One is desi-type characterized by relatively smaller seeds of angular shape with a dark seed coat, whereas another Kabuli-type is characterized by large owl or head-shaped seeds with a beige coloured seed coat. It is the most important crop with high acceptability and widely user. It has high nutritive value enriched with vegetable protein, carbohydrate, and cholesterol-lowering fiber, oil, ash, calcium and phosphorus. It is an essential energy, protein and soluble & insoluble fiber are supply. There are 60-65% carbohydrates, 6% fat and about 12 to 31% in old seed, which is better than any other pulses.

Nearly 60 insect species are known to damage chickpea, of which black cutworm, *Agrotis ipsilon* (Hfn.), leaf miner, *Liriomyzaciccerina* (Rondani), aphid, *Aphis craccivora* Koch, pod borer, *Helicoverpa armigera* (Hubner), and the bruchid, *Callosobruchus chinensis* L. are the major pests worldwide (Sharma *et al.* 2007; Chen *et al.* 2011) [8, 2], among which the pod borer, *H. armigera* is the major constraint to chickpea production (Sharma, 2005).

Among the botanical insecticides currently marketed, neem oil, neem seed kernel extract, chilli garlic extract, tobacco leaf decotion and pongamia seed extract are the least toxic to humans and show very low toxicity to beneficial organisms, so it is, therefore, very promising for the control of many pests. Nonpesticidal management (NPM) is one of the best alternatives, presently attracting a lot of attention. It is a combination of eco-friendly practices such as cultural and agronomic practices by incorporating vermicompost, poultry manure, sheep manure Physical method (light trap), biological methods, parasitoids, predators and traditional

farmers practices like spray with to manage the crop pests without using any insecticides.

### Materials and Methods

Limboor is bound on its side by Lendriver, is one of the important tributaries of the Manjira River and the majority of the area are black soil. The experiment was laid out in a Randomized Block Design (RBD) with 10 treatments, each replicated thrice. Plots measuring a size of 24 m<sup>2</sup> (6 x 4 m) were laid out by forming the bunds all around with irrigation channels between replications according to the design. The individual plots were divided into ridges and furrows with a distance of 50 cm between adjacent ridges. The field was

ploughed thrice with a tractor-drawn cultivator and evenly leveled after removing all the stubbles and weeds. Seed @ 60 kg/ha and plant density of 25-30 plants per square meter and the seeds of chickpea variety swetha were sown in the experimental field with a spacing of 60x30cm.

All the test treatments were applied as foliar sprays and the first spray was given soon after the incidence of pest was noticed at 30 days after planting and thereafter, repeated at ten days interval. The measured quantities of biopesticides were mixed with a small quantity of water and the remaining quantity of water was added to it subsequently to make up the volume. The spray fluid was evenly mixed with a stick before spraying.

### Treatment details

S. No.	Treatments
1	Vermicompost (10 t/ha) + NSKE (5%)
2	Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit)
3	Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v)
4	Vermicompost (10 t/ha) + pongamia seed extract (5% W/v)
5	Poultry manure (5 t/ha) + NSKE (5%)
6	Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit)
7	Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v)
8	Poultry manure (5 t/ha) + pongamia seed extract (5% W/v)
9	Recommended dose of fertilizers (25 kg N, 125kg P & 125 kg K/ha) + spinosad (0.3 ml/lit)
10	Control

**Note:** Vermicompost @ 10 t/ha and poultry manure @ 5t/ha were applied at the basal application before planting of chickpea.

The data were recorded from five plants randomly selected from a given plot which is tagged in each treatment and the population counts were recorded. The data on growth and yield takes at each plot and were pooled and subjected to statistical analysis. The treatments' overall efficacy by combining observations was done by analyzing the data through ANOVA.

### Results

#### Plant height (cm)

The data on plant height of chickpea which was influenced by on organic manures and plant extracts, has tabulated in Table 1 and results are as follows

All the treatments have shown significant effect on plant height because organic amendments not only useful in controlling insect pests and also supplied nutrients to plant growth. The highest plant height 60.493 cm was observed in T<sub>1</sub>-Vermicompost (10 t/ha) + NSKE (5%) followed by T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit) with 57.963 which was on par with T<sub>2</sub> -Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub>-Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%).

The next best treatment was T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 56.33 cm which was also on par with T<sub>2</sub> -Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub> -Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/ha) + spinosad (0.3 ml/lit).

In 2015-16, the plant height of chick pea (60.593 cm) recorded more in T<sub>1</sub>. The next best treatment was T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) with plant height of 57.727 cm which was also on par with T<sub>2</sub> -Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub>-Vermicompost (10 t/ha) +

tobacco leaf decoction (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%), T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit), T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v), T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125 kg P & 125 kg K/ha) + spinosad (0.3 ml/lit). The lowest plant height was recorded in t10.

In pooled data of both seasons of 2014-15 and 2015-16, the plant height of chickpea was influenced by the conjunctive use of organic manures and plant extracts and the results are tabulated in table 1. The results revealed that all the treatments have a profound effect on plant height and the best treatment was recorded in T<sub>1</sub> with 60.54 cm plant height. The next best treatment was T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit) with 58.01 cm plant height which was also on par with T<sub>2</sub> -Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub> -Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) and T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v) with 57.65, 56.97, 57.06, 57.68 and 56.84 cm plant height respectively which was followed by T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/ha) + spinosad (0.3 ml/lit), T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 57.00 cm of plant height.

A similar result has also been reported by Bajracharya *et al.*, (2007) [1]. Jat and Ahlawat (2004) [5] also observed a significantly increased in straw yield with the application of vermicompost only.

#### Branches per plant (no.)

The results in seasons 2014-15 revealed that, all the treatments of organic manures and plant extracts had shown significant effect in increasing the no. of branches in chickpea (Table 1). The more branches per plant 7.567 no. was recorded in T<sub>1</sub>, which was on par with T<sub>8</sub> - Poultry manure (5

t/ha) + pongamia seed extract (5% W/v) with 7.620 no. followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%). The next best treatment was T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v) with 7.22 no. of branches per plant followed by T<sub>3</sub> & T<sub>2</sub>. The lowest no. of braches per plant (6.920) was recorded in T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit).

In *Rabi* season 2015-16 revealed that all the treatments of have significantly differed from one another and helped increase the no. of branches in chickpea. The more branches per plant 7.717 no. was recorded in T<sub>1</sub>, which was on par with T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 7.77 no. followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) with 7.62 no. of branches per plant. The next best treatment was T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v) with 7.37 no. of branches per plant followed by T<sub>3</sub> & T<sub>2</sub>. The lowest no. of braches per plant was recorded in T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit).

The pooled results in the *Rabi* seasons of 2014-15 and 2015-16 revealed that, all the treatments of organic manures and plant extracts have shown profound effect in increasing the no. Of branches in chickpea. The more no. of branches per plant (7.64 no.) was recorded in T<sub>1</sub>, which was on par with T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 7.70 no. of branches per plant followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) with 7.55 no. of branches per plant. The next best treatment was T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v) with 7.30 no. of branches per plant followed by T<sub>3</sub> & T<sub>2</sub>. The lowest no. Of braches per plant was recorded in T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit).

Similar results by Sanu *et al.*, 2014 Vermicompost with an equal ratio of soil (5 kg each/pot) also produced the highest mean grain yield of 10.6 gm per pot. Such a compost usually known as “vermicompost” is rich in plant nutrients and contains a higher number of microorganisms, which are responsible for the decomposition process (Yami *et al.*, 2003)<sup>[10]</sup>.

### Pods per plant (No.)

The data on the effect of organic manures and plant extracts on the improvement of pods per plant is presented in Table 2 and results revealed that in 2014-15, the best treatment was recorded T<sub>1</sub> as it was recorded highest i.e. 69.94 no. of pods per plant and it was significantly different from other treatments followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) which was recorded 69.84 no. of pods per plant. The next best treatment was T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit) with 67.94 no. of pods per plant, which was on par with T<sub>2</sub>. The moderate no. of pods per plant was observed in next treatments T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v), T<sub>3</sub> -Vermicompost (10 t/ha) + tobacco leaf decotion (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit) with 66.94, 65.94, 64.94, 63.94 no. of pods per plant respectively.

In 2015-16, the best treatment was recorded T<sub>1</sub> as it was recorded highest no. of pods per plant (71.61) and it was significantly different from other treatments followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) which was recorded 71.51 no. of pods per plant. The next best treatment was T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit) with 69.61 no. of pods per plant, which was on par with T<sub>2</sub>.

The moderate no. of pods per plant was observed in next treatments T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v), T<sub>3</sub>, T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit) with 68.61, 67.61, 66.61, 65.61 no. of pods per plant, respectively. The least no. of pods per plant was observed in the control plot.

In the *Rabi* seasons of 2014-15 and 2015-16, the best treatment was recorded T<sub>1</sub> as it was recorded highest no. Of pods per plant (70.78) and it was significantly different from other treatments followed by T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) which was recorded at 70.68 no. of pods per plant. The next best treatment was T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit), which was on par with T<sub>2</sub>. The moderate no. of pods per plant was observed in next treatments T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v), T<sub>3</sub> -Vermicompost (10 t/ha) + tobacco leaf decotion (5% W/v), T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit). The least number of pods per plant (43.78) was observed in the control plot. Similar effects on the grain yield have been reported by savitha *et al.* (2013)<sup>[7]</sup>, when vermicompost was applied with mineral fertilizers.

### Grain yield (kg/ha)

Best treatment was recorded in T<sub>1</sub> as more no. Of grain yield 1571.33 kg/ha was achieved. The next best treatments were viz., T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%), T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub>, T<sub>2</sub> with 1565, 1490, 1425, 1475 1571.33 kg/ha grain yield respectively and moderate yield was recorded in T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v) which was on par with T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) and T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit). The lowest yield was recorded in control

In 2015-16, the best treatment T<sub>1</sub>-Vermicompost (10 t/ha) + NSKE (5%) with 1567.56 kg/ha grain yield which was also on par with T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%) with 1564 kg/ha grain yield. The The next best treatments were viz., T<sub>6</sub> - Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit), T<sub>3</sub>, T<sub>4</sub> -Vermicompost (10 t/ha) + pongamia seed extract (5% W/v), T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 1487, 1432, 1389, 1374 kg/ha grain yield respectively. Moderate yield was recorded in T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v) with 1358 kg/ha grain yield which was on par with T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit).

In 2014-15 and 2015-16 rabi seasons of chickpea, the best treatment was T<sub>1</sub>-Vermicompost (10 t/ha) + NSKE (5%) with 1569.45 kg/ha grain yield. Next best treatments were T<sub>5</sub> - Poultry manure (5 t/ha) + NSKE (5%), T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> - Vermicompost (10 t/ha) + pongamia seed extract (5% W/v) and T<sub>8</sub> - Poultry manure (5 t/ha) + pongamia seed extract (5% W/v) with 1564, 1485.50, 1428.50, 1399.50, 1392.50 kg/ha grain yield. Moderate grain yield was recorded T<sub>9</sub> - RDN (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit) which was on par with T<sub>7</sub> - Poultry manure (5 t/ha) + tobacco leaf decotion (5% W/v).

Similar positive results were also observed by Sanu *et al.*, 2014 studied the effects of the treatments were significant on grain yield of chickpea in both the years . In the first year, treatment 2 (equal amount of soil and vermicompost)

produced the highest mean grain yield of 14.2 gm per plot followed by treatment 5 (equal amount of soil and

vermicompost plus half of the recommended mineral fertilizers) with the mean grain yield of 14.03 gm per plant.

**Table 1:** Effect of organic manures and plant extracts on plant height and branches per plant of chickpea (Pooled data)

Treatment No.	Particulars	Plant height (cm)			Branches per plant (no.)		
		2014-15	2015-16	mean	2014-15	2015-16	mean
T <sub>1</sub>	Vermicompost (10 t/ha) + NSKE (5%)	60.493a	60.593a	60.54a	7.567a	7.717a	7.64a
T <sub>2</sub>	Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit)	57.597b	57.697b	57.65bc	7.030d	7.180d	7.11d
T <sub>3</sub>	Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v)	56.920bc	57.020bc	56.97bc	7.070d	7.220d	7.15d
T <sub>4</sub>	Vermicompost (10 t/ha) + pongamia seed extract (5% W/v)	57.013bc	57.113bc	57.06bc	6.940e	7.090e	7.02e
T <sub>5</sub>	Poultry manure (5 t/ha) + NSKE (5%)	57.627b	57.727b	57.68bc	7.470b	7.620b	7.55b
T <sub>6</sub>	Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit)	57.963b	58.063b	58.01b	7.040d	7.190d	7.12d
T <sub>7</sub>	Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v)	56.787bc	56.887b	56.84bc	7.220c	7.370c	7.30c
T <sub>8</sub>	Poultry manure (5 t/ha) + pongamia seed extract (5% W/v)	56.333c	56.433bc	56.38c	7.620a	7.770a	7.70a
T <sub>9</sub>	Recommended dose of fertilizers (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit)	56.947bc	57.047bc	57.00c	6.920e	7.070e	7.00e
T <sub>10</sub>	Control	56.040c	56.140c	56.09c	6.520f	6.670f	6.60f
	C.D.	1.408	1.405	1.41	0.052	0.052	0.05
	SE(m)	0.470	0.469	0.47	0.017	0.017	0.02
	SE(d)	0.665	0.664	0.66	0.024	0.025	0.02

**Table 2:** Effect of organic manures and plant extracts on pods per plant and grain yield of chickpea (Pooled data)

Treatment No.	Particulars	Pods per plant (No.)			Grain yield (kg/ha)		
		2014-15	2015-16	mean	2014-15	2015-16	mean
T <sub>1</sub>	Vermicompost (10 t/ha) + NSKE (5%)	69.94a	71.61a	70.78a	1571.33a	1567.56a	1569.45a
T <sub>2</sub>	Vermicompost (10 t/ha) + chilli garlic extract (100 gm/lit)	66.94c	68.61c	67.78c	1475.00d	1496.00b	1485.50c
T <sub>3</sub>	Vermicompost (10 t/ha) + tobacco leaf decoction (5% W/v)	65.94e	67.61e	66.78c	1425.00e	1432.00d	1428.50d
T <sub>4</sub>	Vermicompost (10 t/ha) + pongamia seed extract (5% W/v)	64.94f	66.61f	65.78f	1410.00g	1389.00e	1399.50e
T <sub>5</sub>	Poultry manure (5 t/ha) + NSKE (5%)	69.84b	71.51b	70.68b	1565.00b	1564.00a	1564.50b
T <sub>6</sub>	Poultry manure (5 t/ha) + chilli garlic extract (100 gm/lit)	67.94c	69.61c	68.78c	1490.00c	1487.00c	1488.50c
T <sub>7</sub>	Poultry manure (5 t/ha) + tobacco leaf decoction (5% W/v)	66.94d	68.61d	67.78d	1414.00f	1358.00g	1386.00g
T <sub>8</sub>	Poultry manure (5 t/ha) + pongamia seed extract (5% W/v)	65.94e	67.61e	66.78e	1411.00f	1374.00f	1392.50f
T <sub>9</sub>	Recommended dose of fertilizers (25 kg N, 125kg P & 125 kg K/Ha) + spinosad (0.3 ml/lit)	63.94g	65.61g	64.78g	1415.00f	1362.00g	1388.50g
T <sub>10</sub>	Control	42.94h	44.61h	43.78h	940.00h	315.00h	627.50h
	C.D.	0.075	0.089	0.08	4.103	5.469	4.79
	SE(m)	0.025	0.030	0.03	1.370	1.465	1.42
	SE(d)	0.036	0.042	0.04	1.938	2.451	2.19

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