

## Research Article

## EFFECT OF ORGANIC MANURES ON GROWTH AND YIELD OF ACID LIME

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**KEYWORDS:**

Acid lime, Organic manures, Yield

**ABSTRACT**

A research was conducted at Citrus Research Station, Sankarankovil to study the effect of organic manures on growth and yield in acid lime during 2017–2019. The trial had been laid out in a farmer's field at Vannikonenthal village, Sankarankovil Taluk, Tirunelveli District. Treatments were imposed in five years old acid lime trees with 8 treatments and 3 replications. Organic manures viz. Vermicompost (10 kg plant<sup>-1</sup>), Neemcake (15 kg plant<sup>-1</sup>) and Pressmud (15 kg plant<sup>-1</sup>) were applied individually and in combination with 50 % RDF (Recommended Dose of Fertilizers). Treatment applied with 100 % RDF (Recommended Dose of Fertilizers) serves as control. The results indicated that plants applied with Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg plant<sup>-1</sup>) + Press mud (15 kg plant<sup>-1</sup>) along with 50 % RDF gave more yield with more number of fruits per tree as that of plants applied with 100 % RDF. Pressmud, Vermicompost and Neem cake application had also improved the microbial population of the soil. Cost Benefit Ratio for application of organic manures is on par with 100 % RDF. Based on these results, Press mud (15 kg plant<sup>-1</sup>) + Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg plant<sup>-1</sup>) and 50% RDF (Recommended Dose of Fertilizers) can be applied to get higher yield in Acid lime instead of applying 100 RDF (Recommended Dose of Fertilizers).

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**INTRODUCTION**

India is the largest producer of acid lime in the world. In Tamil Nadu, acid lime is cultivated both under rain fed and irrigated conditions in the districts of Dindigul, Tirunelveli, Virudhunagar, Ramnad, Madurai, Tiruchi, Tuticorin and Theni in an area of 7463 ha with a production of 21886 tonnes. Tirunelveli District ranks second in the cultivation of acid lime with an area of 2178 ha and production of 6387 tonnes. The major area of cultivation of acid lime in Tirunelveli District is in Sivagiri, Sankarankovil, Vasudevanallur, Tenkasi, Kadayanallur and Kadayam blocks. Usually acid lime growers do not apply inorganic fertilizers and apply only a very small quantity of organic manures which are not adequate for supply of required nutrients to the tree. As a result, the trees are very poor in health and vigour resulting in low coupled with below average yield of both quality and quantity. Hence, the study had been conducted with the following objectives: to study effect of organic manures viz. Vermicompost, Neem cake and Press mud along with RDF (Recommended Dose of Fertilizers) on growth and yield in acid lime, to standardise

the package of organic manures viz. Vermicompost, Neem cake and Press mud along with RDF (Recommended Dose of Fertilizers) for acid lime in Tirunelveli District and Working out the cost benefit ratio.

**MATERIALS AND METHODS**

The study was conducted at Citrus Research Station, Sankarankovil during 2017-2019. Treatments were imposed in a farmer's field at Vannikonenthal village, Sankarankovil Taluk, Tirunelveli District of Tamil Nadu. Organic manures viz. Vermicompost, Neem cake and Pressmud were applied individually and in combination along with 50 % RDF (Recommended Dose of Fertilizers).

**Treatments**

- T<sub>1</sub> - 100 % RDF ( 500 : 175 : 220 g of NPK plant<sup>-1</sup> )
- T<sub>2</sub> - 50 % RDF + Vermicompost (10 kg plant<sup>-1</sup>)
- T<sub>3</sub> - 50 % RDF + Neem cake (15 kg plant<sup>-1</sup>)
- T<sub>4</sub> - 50 % RDF + Press mud (15 kg plant<sup>-1</sup>)
- T<sub>5</sub> - 50 % RDF + Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg plant<sup>-1</sup>)

- **T<sub>6</sub>**- 50 % RDF + Vermicompost (10 kg plant<sup>-1</sup>) + Press mud (15 kg plant<sup>-1</sup>)
- **T<sub>7</sub>**- 50 % RDF + Neem cake (15 kg plant<sup>-1</sup>) + Press mud (15 kg plant<sup>-1</sup>)
- **T<sub>8</sub>**- 50 % RDF + Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg plant<sup>-1</sup>) + Press mud (15 kg plant<sup>-1</sup>)

Nitrogen was applied in the month of March where as Phosphorus, Potassium and organic manures were applied in October. Microbial inoculants viz. Azospirillum and Phosphobacteria (200 g each) were applied to all the treatments. All the eight treatments were applied in three replications. In each replication four trees had been taken

for the study. Available Nitrogen, Phosphorus and Potassium content in leaf and soil samples were analysed before and after application of manures. The growth parameters viz. Plant height, Number of branches, Plant spread (North, South) and (East West) were recorded. Canopy volume was calculated by using the formula  $m^3 = \frac{4}{3} a^2 b$  (where  $m^3$  = Canopy volume,  $a$  = half of the plant height,  $b$  = Average of east west and North South plant spread). The yield parameters viz. Number of fruits per plant, fruit weight, fruit length, fruit diameter and fruit yield were recorded. Microbial count of Fungi, Bacteria and Actinobacteria were also observed.

**Table 1. Growth parameters in acid lime**

Treatments	Plant height (m)		No. of branches		Canopy volume	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T <sub>1</sub>	3.50	3.90	5.0	7.6	18.15	22.23
T <sub>2</sub>	4.03	4.50	5.0	6.0	29.79	38.08
T <sub>3</sub>	3.48	3.90	5.0	6.0	20.06	24.83
T <sub>4</sub>	4.07	4.50	6.67	6.0	32.13	27.24
T <sub>5</sub>	4.07	4.50	4.33	5.3	28.11	34.31
T <sub>6</sub>	4.00	4.40	4.33	5.3	18.86	27.77
T <sub>7</sub>	3.47	3.80	3.33	4.3	20.98	23.23
T <sub>8</sub>	3.47	3.80	4.67	5.0	17.80	23.22
<b>S.Ed</b>	<b>0.15</b>	<b>0.15</b>	<b>0.64</b>	<b>0.64</b>	<b>2.12</b>	<b>363.69</b>
<b>CD (0.05%)</b>	<b>0.33</b>	<b>0.33</b>	<b>1.38</b>	<b>1.38</b>	<b>4.55</b>	<b>NS</b>
<b>CV %</b>	<b>4.34</b>	<b>4.49</b>	<b>16.58</b>	<b>13.65</b>	<b>11.20</b>	

**Table 2. Yield parameters in acid lime**

Treatments	No. of fruits		Fruit length (cm)		Fruit diameter (cm)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T <sub>1</sub>	673	690	4.65	4.66	13.40	13.41
T <sub>2</sub>	438	446	4.28	4.29	14.23	14.24
T <sub>3</sub>	427	435	4.25	4.26	13.60	13.61
T <sub>4</sub>	657	674	4.42	4.43	13.50	13.49
T <sub>5</sub>	441	450	4.34	4.35	13.80	13.81
T <sub>6</sub>	423	431	4.33	4.34	13.90	13.91
T <sub>7</sub>	431	439	4.21	4.22	13.30	13.31
T <sub>8</sub>	643	655	4.53	4.54	13.80	13.81
<b>S.Ed</b>	<b>14.80</b>	<b>15.13</b>	<b>0.41</b>	<b>0.41</b>	<b>1.33</b>	<b>1.39</b>
<b>CD (0.05%)</b>	<b>30.20</b>	<b>32.47</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>CV %</b>	<b>3.34</b>	<b>3.52</b>				

## RESULTS AND DISCUSSION

Organic manures viz. Vermicompost (10 kg plant<sup>-1</sup>), Neem cake (15 kg plant<sup>-1</sup>) and Press mud (15 kg plant<sup>-1</sup>) were applied along with 50% RDF (Recommended Dose of Fertilizers). Treatment with 100% RDF (Recommended Dose of Fertilizers) served as control. Growth parameters

viz. Plant height, Number of branches, Canopy volume were recorded and presented in table 1.

Maximum plant height of 4.07 cm and 4.50 cm were recorded in **T<sub>4</sub>** (50 % RDF + Press mud (15 kg plant<sup>-1</sup>) during 2017–18 and 2018–19 respectively. Plants applied with 100 % RDF (**T<sub>1</sub>**) have more number of branches (7.6)

followed by T<sub>4</sub> (6.67). Canopy volume was maximum in T<sub>2</sub> (38.08) followed by T<sub>4</sub>.

**Table 3. Yield parameters in acid lime**

Treatments	Fruit weight (g)		Fruit yield (kg)	
	2017-18	2018-19	2017-18	2018-19
T <sub>1</sub>	45.40	44.50	29.24	29.77
T <sub>2</sub>	44.20	44.20	19.38	19.71
T <sub>3</sub>	43.00	45.20	18.37	18.67
T <sub>4</sub>	43.50	45.20	28.59	29.08
T <sub>5</sub>	39.90	38.80	17.57	17.87
T <sub>6</sub>	41.20	44.40	17.47	17.75
T <sub>7</sub>	42.10	43.20	18.15	18.45
T <sub>8</sub>	44.30	44.30	28.37	28.86
<b>S.Ed</b>	<b>1.44</b>	<b>3.09</b>	<b>1.02</b>	<b>1.04</b>
<b>CD (0.05%)</b>	<b>3.10</b>	<b>NS</b>	<b>2.19</b>	<b>2.23</b>
<b>CV %</b>	<b>4.13</b>		<b>5.66</b>	<b>5.66</b>

**Table 4. Available N, P & K content in leaf samples**

Treatments	Nitrogen (kg/ha)	Phosphorous (kg/ha)	Potassium (kg/ha)
Before application	1.17	0.18	1.38
T <sub>1</sub>	<b>2.32</b>	<b>0.22</b>	<b>1.43</b>
T <sub>2</sub>	1.07	0.14	<b>1.68</b>
T <sub>3</sub>	<b>2.35</b>	0.18	1.34
T <sub>4</sub>	1.84	<b>0.21</b>	1.77
T <sub>5</sub>	1.92	0.17	1.29
T <sub>6</sub>	1.94	0.19	1.41
T <sub>7</sub>	1.74	0.18	1.34
T <sub>8</sub>	2.24	0.18	1.00

The yield parameters viz. Number of fruits, Fruit length, Fruit diameter, fruit weight and Fruit yield were also

**Table 5. Available N, P & K content in soil samples**

Treatments	N (kg/ha)	Rating	P (kg/ha)	Rating	K (kg/ha)	Rating
Before application	174	Low	21	Medium	465	High
T <sub>1</sub>	<b>213</b>	Low	<b>24</b>	<b>High</b>	<b>485</b>	High
T <sub>2</sub>	196	Low	12	Medium	<b>337</b>	High
T <sub>3</sub>	183	Low	14	Medium	468	High
T <sub>4</sub>	168	Low	13	Medium	379	High
T <sub>5</sub>	178	Low	11	Medium	348	High
T <sub>6</sub>	186	Low	<b>23</b>	High	440	High
T <sub>7</sub>	176	Low	15	Medium	380	High
T <sub>8</sub>	179	Low	18	Medium	409	High

Treatment T<sub>4</sub> (Pressmud 15 kg plant<sup>-1</sup>) recorded high yield with more number of fruits per tree. This is in accordance

recorded and presented in table 2 and 3. More number of fruits (673 & 690) were noticed in T<sub>1</sub> (100% RDF) followed by T<sub>4</sub> (657 & 674) during 2017–18 & 2018–19 respectively. Treatment T<sub>1</sub> (50% RDF + Press mud (15 kg plant<sup>-1</sup>) recorded high yield of 29.24 kg plant<sup>-1</sup> and 29.77 kg plant<sup>-1</sup> followed by T<sub>4</sub> (28.59 kg plant<sup>-1</sup> and 29.08 kg plant<sup>-1</sup> in 2017–18 & 2018–19 respectively. Fruit length and fruit diameter were non-significant among the treatments. Maximum fruit weight (45.40 g) was observed in treatment T<sub>1</sub> followed by T<sub>8</sub> and T<sub>4</sub>. On statistical analysis, the treatments T<sub>1</sub>, T<sub>4</sub> and T<sub>8</sub> are on par for number of fruits per tree, fruit weight and yield per tree (Perunkotturselvi and John Koilraj, 2015).

Nitrogen, Phosphorus and Potassium content of leaf samples were analysed before and after application of fertilizers and manures (i.e) at harvest stage. High N, P & K content were recorded in leaf samples collected from T<sub>1</sub> (100 % RDF) followed by T<sub>3</sub> and T<sub>4</sub>.

Available soil N, P & K were also analysed before and after application of fertilizers and manures. Organic manures application had improved N, P & K content in soils. N and P content were maximum in T<sub>1</sub> followed by T<sub>2</sub> and T<sub>6</sub>. Microbial activity was found out by taking count of Bacteria, Fungi and Actinobacteria and presented in table 6. Bacterial population was maximum in T<sub>3</sub> followed by T<sub>1</sub> where as fungi and actinobacteria population was found to be more in T<sub>8</sub>. Cost Benefit Ratio was worked and found that it was on par for T<sub>1</sub>, T<sub>4</sub> and T<sub>8</sub>.

Plant height was increased by application of 50 % RDF + Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg plant<sup>-1</sup>) + Press mud (15 kg plant<sup>-1</sup>) (T<sub>2</sub>, T<sub>4</sub> and T<sub>5</sub>) than control. Similar results were obtained by application of Vermicompost 10 kg plant<sup>-1</sup> + Neem cake 5 kg plant<sup>-1</sup> in Acid lime under Malwa Plateau conditions by Ninoma (2013). Vermicompost contains phytohormones viz. Auxin, Gibberellin and Cytokinin which are responsible for significant increase in growth or plant height in the present study.

with the results of Perunkotturselvi and JohnKoilraj (2015). In Ginger also significantly higher rhizome yield was

obtained through application of pressmud (10 t ha<sup>-1</sup>) as reported by Sharath Pal *et al.*, 2014. The increased yield in the present study might be due to the application of Neem cake and Pressmud. Because neem cake is an excellent soil conditioner and it provides macro nutrients which are essential for plant growth. Pressmud application also improves the available macro nutrient status of the soil.

**Table 6. Microbial population**

Treatments	Bacteria ( $\times 10^8$ CFU/g)	Fungi ( $\times 10^5$ CFU/g)	Actinobacteria ( $\times 10^{3187}$ CFU/g)
T <sub>1</sub>	<b>187</b>	38	41
T <sub>2</sub>	216	50	44
T <sub>3</sub>	<b>232</b>	47	43
T <sub>4</sub>	190	40	39
T <sub>5</sub>	158	<b>52</b>	44
T <sub>6</sub>	173	50	57
T <sub>7</sub>	164	49	45
T <sub>8</sub>	193	<b>52</b>	<b>80</b>

Press mud, Vermicompost and Neem cake application had improved the microbial population of the soil which produce favourable environment for better crop growth and yield in the present investigation. Cost Benefit Ratio for application of organic manures with 50 % RDF (Recommended Dose of Fertilizers) and 100% RDF (Recommended Dose of Fertilizers) is onpar. From the present study, it has been concluded that 50% (Recommended Dose of Fertilizers) can be applied along with Vermicompost (10 kg plant<sup>-1</sup>) + Neem cake (15 kg

plant<sup>-1</sup>)+Press mud (15 kg plant<sup>-1</sup>) instead of 100 % (Recommended Dose of Fertilizers).

**Table 7. Cost benefit ratios**

Treatments	CBR
T <sub>1</sub>	2.0
T <sub>2</sub>	1.3
T <sub>3</sub>	0.95
T <sub>4</sub>	2.0
T <sub>5</sub>	1.2
T <sub>6</sub>	1.2
T <sub>7</sub>	1.3
T <sub>8</sub>	2.0

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