



## Influence of micronutrients enriched organic manure with NPK levels on the sesame yield and soil fertility in coastal saline sandy soil

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### Abstract

Sesame is a promising oilseed crop generally grown in coastal saline sandy soil. The light texture coastal saline sandy soils are being poor in organic matter and exchange property, low nutrient and water retention capacity and also lesser availability of both macro and micro nutrients. These problems severely affect the productivity of crops in this region. Even the nutrients applied in adequate amount, due to poor physical and exchange characteristics which are leached out. This necessitates the increased rate of nutrients application especially NPK in such soil. Hence, increasing levels of NPK and micronutrients fortified organic manures application in such soils hold promise in improving the sesame yield and nutrient availability in coastal saline soil. Therefore, a field experiment was carried out in a coastal farmer's field during January – April 2017 to study the effect of micronutrients fortified organic manures with different NPK levels on yield of sesame and corresponding soil fertility in coastal saline soil. Texturally, the experimental soil was sandy and taxonomically classified as *Typic Usticpsammets* with the pH of 8.48 and EC of 4.15 dS m<sup>-1</sup>. The available NPK were low, low and medium status, respectively. The various treatments included in this study were T<sub>1</sub>-Control (100% NPK alone), T<sub>2</sub>-125% NPK, T<sub>3</sub>-150% NPK, T<sub>4</sub>-100% NPK+ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>5</sub>-125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>6</sub>-150% NPK+ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>7</sub>-100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + Composted coirpith (CCP) @ 12.5 t ha<sup>-1</sup>, T<sub>8</sub>-125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>, T<sub>9</sub>-150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>, T<sub>10</sub>-100% NPK + Micronutrients (Zn + Mn) Enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup>, T<sub>11</sub>-125% NPK + MNECCP @ 5 t ha<sup>-1</sup> and T<sub>12</sub>-150% NPK + MNECCP @ 5 t ha<sup>-1</sup>. The above treatments were arranged in a Randomized Block Design (RBD) with three replications and sesame var. TMV 7 was used as test crop. The results of the study clearly showed that application of 125% NPK + Micronutrients (Zn + Mn) Enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup> was superior in growth, yield characteristics and yield of sesame over rest of the treatments which also increased the soil nutrient availability in the post harvest soil. Therefore it can be a viable practice to improve the sesame yield and soil fertility in coastal saline sandy soil.

**Keywords:** coastal saline soil, NPK levels, micronutrients enriched organics, sesame yield, soil fertility

### Introduction

The intensive agriculture, uses of high analytical value of inorganic fertilizers, little or scarce use of organic manures and considerable reduction in recycling of crop residues resulted in deficiencies of nutrients in soil. Consequently, the deficiencies of macro and micronutrients in coastal salt affected soils have become major constraint for maintaining soil fertility as well as crop productivity. Wide spread of these micronutrients deficiencies particularly Zn, B, Fe and Mn has been observed in Indian soils. Now a day's the use of enriched/fortified organic manures with micronutrients is one of the effective methods to alleviate micronutrient deficiency. For better crop growth, it requires increasing dose of nutrients than RDF to improve the growth and yield components in coastal areas. Enriching composted coirpith (CCP) with inorganic fertilizers like zinc and manganese boost crop grain yield and harvest index significantly through improving the physico-chemical properties of the soil and sustain crop productivity in coastal soils. The nutrient enriched organic manures being cheaper and eco-friendly and could be used as an alternative of chemical fertilizers for improving crop productivity and sustainability

of the system (Bhadu *et al.*, 2017) [3]. The Indian coastal region stretching over a length of 8129 km long over the eastern and western border are severely degraded and pose serious problems for agricultural production. Out of 10.78 m ha of land under coastal agro ecosystem in India, there exist 3.1 m.ha of coastal saline soil and nearly 2.04 l.ha was in Tamil Nadu. Almost the entire coastal tracts suffer from soil salinity, sodicity and seawater intrusion which resulted in the low productivity of crops (Laxminarayana and Archanamainaik, 2016) [7]. Nearly one billion people in the world lives along the coastline and contribute to the national economy to a significant extent through farming. Sesame is one of the vegetable oil yielding crops and one among the oldest oilseed crop. It is commonly called as Queen of Oilseeds. Sesame oil is widely used for domestic and industrial purposes. India occupies larger area under sesame in the world where sesame is cultivated in an area of 19.47 lakh ha with the production of 8.66 lakh tonnes. However, the productivity is low (413 kg ha<sup>-1</sup>) when compare to world average productivity (535 kg ha<sup>-1</sup>). In Tamilnadu, it is grown in 0.446 Lakh ha with the production of 0.244 lakh tonnes and the average productivity is 548 kg ha<sup>-1</sup> (Policy

Note, 2020) [11]. Traditional it has been cultivated in the coastal regions. However, the productivity is very less when compare to national average due to presence of salts. Soil salinity hampers crop production in the coastal ecosystem to greater extent. Further, coastal salt affected soils are most commonly suffered due to micronutrients especially zinc and manganese which plays an important role in various enzymatic activities in the growth and development of sesame production (Beema, 2016) [2]. It is now established that micronutrient deficiency is the prime factor responsible for that low productivity of sesame in coastal areas. Hence, inclusion of increasing dose of NPK along with micronutrient (Zn and Mn) enriched organic manure in the fertilization programme becomes an imperative need to improve the yield of sesame. Therefore, the present investigation was carried out to study the influence of micronutrients fortified organic manure with NPK levels on yield of sesame and soil fertility in coastal saline soil

### Materials and Methods

A field experiment was conducted in a farmer's field at Ponnanthittu coastal village, near Chidambaram in Cuddalore district of Tamilnadu State, India during January–April, 2017 to find out the influence of micronutrients enriched/fortified organics manures and different levels of NPK on yield of sesame and soil nutrient availability in coastal saline soil. The treatments consisted of T<sub>1</sub>-Control (100% NPK alone), T<sub>2</sub>-125% NPK, T<sub>3</sub>-150% NPK, T<sub>4</sub>-100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>5</sub>- 125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>6</sub>-150% NPK+ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>, T<sub>7</sub>-100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>+ Composted coirpith (CCP) @ 12.5 t ha<sup>-1</sup>, T<sub>8</sub>-125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>+ CCP @ 12.5 t ha<sup>-1</sup>, T<sub>9</sub>-150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>, T<sub>10</sub>-100% NPK + Micronutrients (Zn + Mn) Enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup>, T<sub>11</sub>-125% NPK + MNECCP @ 5 t ha<sup>-1</sup> and T<sub>12</sub>-150% NPK + MNECCP @ 5 t ha<sup>-1</sup>. The experiment was laidout in Randomized Block Design (RBD) with three replications and sesame variety TMV 7 was used as test crop. The initial experimental soil was sandy texture with pH- 8.48; EC- 4.15 d Sm<sup>-1</sup>; organic carbon-2.31 g kg<sup>-1</sup>; zinc 0.73 mg kg<sup>-1</sup> and manganese status of 0.95 mg kg<sup>-1</sup>. The soil registered low organic carbon status of 2.31 g kg<sup>-1</sup>, 145.12 kg ha<sup>-1</sup> of alkaline KMnO<sub>4</sub>-N; 9.65 kg ha<sup>-1</sup> in medium status of Olsen-P and 165.74 kg ha<sup>-1</sup> of NH<sub>4</sub>OAc-K. A fertilizer dose of 35:23:23 kg N: P<sub>2</sub> O<sub>5</sub>: K<sub>2</sub>O ha<sup>-1</sup> was followed and applied through urea, super phosphate and muriate of potash, respectively as per the treatment. Required quantities of zinc sulphate and manganese sulphate as per the treatment schedule were incorporated just before sowing. Various growth components like plant height, number of branches plant<sup>-1</sup>, dry matter production (DMP) and yield components viz., number of capsules plant<sup>-1</sup>, number of seeds capsule<sup>-1</sup> and 1000 seed weights were recorded at harvesting stage. At harvest seed and stalk yield were recorded. The soil samples were collected at harvest and analyzed for available

N, P, K, Zn and Mn using standard procedure of Jackson (1973) [7].

## Results and Discussion

### Growth Characters

The application of different levels of NPK along with micronutrients fortified organic manures significantly influenced the growth characters viz., plant height, number of branches plant<sup>-1</sup> and dry matter production of sesame. Among the various treatments, application of 150 per cent NPK along with MNECCP @ 5 t ha<sup>-1</sup> (T<sub>12</sub>) recorded the highest growth characters like plant height (131.53 cm), number of branches plant<sup>-1</sup> (10.15) and dry matter production (2088 kg ha<sup>-1</sup>), respectively. This was comparable with T<sub>11</sub>. This was followed by the treatments T<sub>10</sub> (100% NPK + Micronutrients (Zn + Mn) Enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup>), T<sub>9</sub> (150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>+ CCP @ 12.5 t ha<sup>-1</sup>) and T<sub>8</sub> (125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>+ CCP @ 12.5 t ha<sup>-1</sup>). The treatment T<sub>9</sub> and T<sub>8</sub> were found to be on par. This was followed by the treatments arranged in the descending order like T<sub>7</sub> > T<sub>6</sub> > T<sub>5</sub> > T<sub>4</sub> > T<sub>3</sub> and T<sub>2</sub>. The lowest growth parameters were recorded in the control (RDF alone) as compared to all other treatments. The increased growth characters obtained with application of 125% NPK along with micronutrients (Zn and Mn) fortified composted coirpith @ 5 t ha<sup>-1</sup> were better than NPK alone. This might be due to micronutrients fortification along with addition of organics increased the plant metabolites and encouraged the growth of sesame by sustained supply of essential nutrients to the growing plants. These results are in conformity with Meena *et al.* (2008) [9] and Arulrajasekaran (2019) [11].

### Yield characters

The application of micronutrients fortified organics along with NPK levels significantly and positively increased the yield characters of sesame. Among the three levels of NPK, the highest mean yield characters were recorded with 150 per cent NPK. Between the organics tried, application of micronutrient enriched composted coirpith was significantly superior in increasing yield characters of sesame in all treatments. This was followed by the without enriched CCP applied treatments. The highest number of capsules plant<sup>-1</sup>, number of seeds capsule<sup>-1</sup> and 1000 seed weight was found with T<sub>12</sub>-combined application of 150 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup>. However, it was found to be equally efficacious with application of 125 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup> (T<sub>11</sub>) which recorded 55.62 number of capsules plant<sup>-1</sup>, 58.17 number seeds capsule<sup>-1</sup> and 3.43 g of 1000 seed weight, respectively. This was followed by the treatment T<sub>10</sub>-100 per cent NPK along with MNECCP @ 5 t ha<sup>-1</sup> recorded number of capsules plant<sup>-1</sup> (53.08), number seeds capsule<sup>-1</sup> (55.05) and 1000 seed weight (3.24 g), respectively. This was followed by the treatment T<sub>9</sub> closely on par with treatment T<sub>8</sub>. This was followed by the treatments arranged in the descending order like T<sub>7</sub> > T<sub>6</sub> > T<sub>5</sub> > T<sub>4</sub> > T<sub>3</sub> and T<sub>2</sub>. The lowest number of capsules plant<sup>-1</sup> (29.64), number of seeds capsule<sup>-1</sup> (28.01) and 1000 seed weight (1.74 g) was recorded in the control (NPK alone). The increase in yield attributes of sesame might be due to sustained release of nutrient from conjunctive use of NPK along with micronutrients and organics sources of nutrient (Elayaraja, 2015) [6]. In addition, response of sesame to

micronutrient application of ZnSO<sub>4</sub> and MnSO<sub>4</sub> through fortification of composted coirpith along with RDF significantly increased the yield attributes may be ascribed to better nutrient availability of soils (Chaurasia *et al.*, 2009)<sup>[4]</sup>. Further, the addition of micronutrients enriched composted coirpith treatments and their subsequent decomposition in soil released the plant nutrients slowly throughout the crop growth and thus improved all the yield characters of sesame. Similar findings were also reported by Duhoon *et al.* (2004)<sup>[5]</sup>.

### Sesame Yield

Among the various treatments, the highest seed yield (748 kg ha<sup>-1</sup>) and stalk yield (1682 kg ha<sup>-1</sup>) was recorded with combined application of 150% NPK + MNECCP @ 5 t ha<sup>-1</sup> (T<sub>12</sub>). This was on par with application of 125 per cent NPK along with MNECCP @ 5 t ha<sup>-1</sup> (T<sub>11</sub>). This was followed by the treatments T<sub>10</sub> (100 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup>), T<sub>9</sub> (150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>) and T<sub>8</sub> (125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>). The treatment T<sub>9</sub>, it was found to be on par with 125 per cent NPK + ZnSO<sub>4</sub> + MnSO<sub>4</sub> along with FYM (T<sub>8</sub>). The treatment (T<sub>7</sub>), application of 100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> along with Composted coirpith (CCP) @ 12.5 t ha<sup>-1</sup> alone without micronutrients enriched organic manures significantly increased the seed and stalk yield to 610 and 1396 kg ha<sup>-1</sup> respectively. This was followed by the treatments which received recommended NPK and micronutrients alone T<sub>6</sub>, application of 150% NPK along with ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> and T<sub>5</sub>, application of 125% NPK along with ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> without organics registered a comparable seed and stalk yield to the tune of 560 and 1288 kg ha<sup>-1</sup> respectively as compared to NPK applied treatments (T<sub>4</sub> and T<sub>3</sub>). Of all the treatments, the combined application of both the micronutrients *viz.*, ZnSO<sub>4</sub> + MnSO<sub>4</sub> enriched CCP along with 125 per cent NPK recorded the higher seed yield (739 kg ha<sup>-1</sup>) and stalk yield (1666 kg ha<sup>-1</sup>) as compared to seed and stalk yield of 705 and 1584 kg ha<sup>-1</sup> recorded in 100 per cent NPK which represented 42.08 and 39.49 per cent yield increased as compared to treatments without micronutrients and enriched organics. The increased sesame yield with the application of enriched micronutrients (Zn and Mn) composted coirpith along with recommended dose of NPK might be attributed to the rapid mineralization of N, P and K from inorganic fertilizers and steady supply of these nutrients to the crop at the critical stages as opined by (Beema *et al.*, (2016)<sup>[2]</sup>. In addition, Zn and Mn through activation of various enzymes and increased basic metabolic rate in plants facilitated the synthesis of nucleic acids and hormones, which in turn enhanced the seed yield due to greater availability of nutrients and photosynthates. These results are in agreement with those of Chaurasia *et al.* (2009)<sup>[4]</sup>.

### Major nutrients Availability (NPK)

The available NPK status in the soil was significantly increased due to the application of enriched organics along with micronutrients. The application of 150% NPK + Micronutrients (Zn + Mn) enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup> (T<sub>12</sub>) registered the highest alkaline KMnO<sub>4</sub>, Olsen-P and NH<sub>4</sub>OAc-K content of 153.63, 11.69 and 159.96 kg ha<sup>-1</sup> at the harvest stages, respectively.

However, it was found to be on par with the treatment T<sub>11</sub>, the application of 125 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup>. This was followed by the treatments T<sub>10</sub>, application of 100 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup> and T<sub>9</sub>, application of 150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup> recorded the significant amount of NH<sub>4</sub>OAc-K content at all the stages of sesame growth. The treatment T<sub>9</sub>, was found to be comparable with the treatment T<sub>8</sub>, the application of 125 per cent NPK + CCP @ 12.5 t ha<sup>-1</sup> + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>. These two treatments registered a comparable NPK availability of soil. A similar trend was also observed with the treatments T<sub>7</sub> (100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>), T<sub>6</sub> (150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>) and T<sub>5</sub> (125% NPK + FYM @ 12.5 t ha<sup>-1</sup>). This was followed by the treatments T<sub>4</sub> (100% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup>), T<sub>3</sub> (150% NPK) and T<sub>2</sub> (100% NPK). The treatments T<sub>3</sub> and T<sub>2</sub> which were recorded a comparable NPK availability of soil at post-harvest stages. The control (100% NPK) recorded the lowest NPK availability in soil. The availability of NPK increased in the soil due to the application of NPK, organics fortified with micronutrients like zinc and manganese. This may be attributed to the addition of nutrients from both organics and inorganic sources. Inorganic sources sustain the crop demand in initial stage while organic source owing to their slow release contribute at the later stage. Similar results were reported by (Sridevi *et al.* 2010)<sup>[14]</sup>. Further the improved soil physico-chemical properties and microbial activity might have resulted in higher mineralization releasing more available NPK in soil. This corroborates the earlier report of Regar and Yadav (2017)<sup>[13]</sup>.

### Micronutrients Availability (Zn and Mn)

#### DTPA-Zinc

The highest available zinc status in post harvest soil (1.05 mg kg<sup>-1</sup>) was recorded with the combined application of 150 per cent NPK + along with MNECCP @ 5 t ha<sup>-1</sup> (T<sub>12</sub>). This was comparable with treatment which received 125% NPK + MNECCP @ 5 t ha<sup>-1</sup> (T<sub>11</sub>) application which recorded 1.03 mg kg<sup>-1</sup> of DTPA-Zn content of soil at harvest stage. This treatment was followed by 100 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup> (T<sub>10</sub>) and 150% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup> (T<sub>9</sub>). This treatment recorded 0.89 mg kg<sup>-1</sup> of available DTPA-Zinc content of soil at harvest stage and this could be comparable with treatment T<sub>8</sub>, the application of 125 per cent NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> along with CCP which recorded 0.88 mg kg<sup>-1</sup> of available DTPA-Zinc content of soil at harvest stage. The control registered the lowest DTPA-Zn availability of 0.52 mg kg<sup>-1</sup> at harvest stage. The increased use efficiency of applied micronutrient fertilizer and their availability with the addition of micronutrients along with increasing dose of NPK in organic humus complexing and mobilizing property might have increased the DTPA-Zinc content of the soil. Earlier report of Patnaik *et al.* (2012)<sup>[10]</sup> and Prasad (2008)<sup>[12]</sup> support the present findings.

#### DTPA-Manganese

The availability of manganese in the soil was also significantly increased with the application of increased NPK level along with micronutrients enriched organic manures. The highest DTPA-Mn was registered with 150

per cent NPK + MNECCP@ 5 t ha<sup>-1</sup> (T<sub>12</sub>) which recorded a Mn content of 1.45 mg kg<sup>-1</sup> at post harvest stage. However, it was found to be equally efficacious with the treatment T<sub>11</sub> (125% NPK + MNECCP@ 5 t ha<sup>-1</sup>). This treatment registered a comparable DTPA-Mn content of 1.43 mg kg<sup>-1</sup>, respectively at harvest stages of sesame. This was followed by the treatments T<sub>10</sub>, application of 100 per cent NPK + MNECCP @ 5 t ha<sup>-1</sup>, T<sub>9</sub>, application of 150 per cent NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup> and T<sub>8</sub>, application of 125% NPK + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + MnSO<sub>4</sub> @ 5 kg ha<sup>-1</sup> + CCP @ 12.5 t ha<sup>-1</sup>. The treatments T<sub>9</sub> and T<sub>8</sub> recorded a comparable DTPA-Mn content of 1.28 and 1.27 mg kg<sup>-1</sup> respectively at harvest stage, respectively. Among the various NPK levels, the application of 150%

NPK (T<sub>3</sub>) and 125% NPK (T<sub>2</sub>) recorded the lowest available Mn content as compared to micronutrients enriched organics and micronutrients alone or NPK alone applied treatments at all the stages of crop growth. The lowest DTPA-Mn was recorded with T<sub>1</sub>, the control treatment (100% NPK alone) that did not received fortified organics, zinc and manganese. The increased zinc and manganese availability might be attributed to the direct addition of these nutrients by fertilizer and micronutrients enriched organic manures, which maintain maximum available Zn and Mn status in post harvest soil. Further the complexation of micronutrients with applied organics might have mobilized and increased the availability of Zn and Mn in soil. These findings are accordance with Bhadu *et al.* (2017) [3].

**Table 1:** Influence of micronutrients fortified organics and NPK levels on the growth characters of sesame

| Treatments      | Plant height (cm) | Number of branches plant <sup>-1</sup> | Dry matter production (kg ha <sup>-1</sup> ) |
|-----------------|-------------------|--|--|
| T <sub>1</sub>  | 69.47             | 4.79                                   | 1216   |
| T <sub>2</sub>  | 78.68             | 5.50                                   | 1351   |
| T <sub>3</sub>  | 80.66             | 5.64                                   | 1370   |
| T <sub>4</sub>  | 87.71             | 6.33                                   | 1472   |
| T <sub>5</sub>  | 94.70             | 6.97                                   | 1587   |
| T <sub>6</sub>  | 96.23             | 7.10                                   | 1608   |
| T <sub>7</sub>  | 103.33            | 7.65                                   | 1726   |
| T <sub>8</sub>  | 111.34            | 8.43                                   | 1829   |
| T <sub>9</sub>  | 114.25            | 8.54                                   | 1846   |
| T <sub>10</sub> | 121.14            | 9.23                                   | 1957   |
| T <sub>11</sub> | 128.65            | 9.97                                   | 2059   |
| T <sub>12</sub> | 131.53            | 10.15                                  | 2088   |
| SE <sub>D</sub> | 3.06              | 0.23                                   | 47.31  |
| CD(p=0.05)      | 6.37              | 0.51                                   | 98.40  |

**Table 2:** Influence of micronutrients fortified organics and NPK levels on the yield characters and yield of sesame

| Treatments      | Number of capsules plant <sup>-1</sup> | Number of seeds capsule <sup>-1</sup> | 1000 seed weight (g) | Yield (kg ha <sup>-1</sup> ) |       |
|-----------------|--|---------------------------------------|----------------------|------------------------------|-------|
|                 |  |                                       |                      | Seed                         | Stalk |
| T <sub>1</sub>  | 29.64                                  | 28.01                                 | 1.74                 | 428                          | 1008  |
| T <sub>2</sub>  | 35.33                                  | 3.70                                  | 1.97                 | 473                          | 1106  |
| T <sub>3</sub>  | 36.43                                  | 35.60                                 | 2.03                 | 482                          | 1117  |
| T <sub>4</sub>  | 39.68                                  | 39.59                                 | 2.24                 | 520                          | 1206  |
| T <sub>5</sub>  | 42.57                                  | 43.46                                 | 2.44                 | 560                          | 1288  |
| T <sub>6</sub>  | 43.61                                  | 44.57                                 | 2.51                 | 573                          | 1305  |
| T <sub>7</sub>  | 46.62                                  | 47.66                                 | 2.69                 | 610                          | 1396  |
| T <sub>8</sub>  | 49.38                                  | 51.00                                 | 2.91                 | 651                          | 1480  |
| T <sub>9</sub>  | 50.40                                  | 52.08                                 | 2.96                 | 662                          | 1495  |
| T <sub>10</sub> | 53.08                                  | 55.05                                 | 3.24                 | 705                          | 1584  |
| T <sub>11</sub> | 55.62                                  | 58.17                                 | 3.43                 | 739                          | 1666  |
| T <sub>12</sub> | 56.51                                  | 59.14                                 | 3.51                 | 748                          | 1682  |
| SE <sub>D</sub> | 1.03                                   | 1.29                                  | 0.06                 | 16.98                        | 37.75 |
| CD(p=0.05)      | 2.16                                   | 2.70                                  | 0.13                 | 35.32                        | 78.54 |

**Table 3:** Influence of micronutrients fortified organics and NPK levels on the nutrients availability in coastal saline soil

| Treatments      | Major nutrients (kg ha <sup>-1</sup> ) |         |                       | Micronutrients (mg kg <sup>-1</sup> ) |         |
|-----------------|--|---------|-----------------------|---------------------------------------|---------|
|                 | Alkaline KMnO <sub>4</sub> -N          | Olsen-P | NH <sub>4</sub> OAc-K | DTPA-Zn                               | DTPA-Mn |
| T <sub>1</sub>  | 85.56                                  | 5.86    | 96.60                 | 0.52                                  | 0.82    |
| T <sub>2</sub>  | 95.45                                  | 6.67    | 105.71                | 0.60                                  | 0.91    |
| T <sub>3</sub>  | 97.42                                  | 6.83    | 108.06                | 0.62                                  | 0.93    |
| T <sub>4</sub>  | 104.40                                 | 7.51    | 115.37                | 0.68                                  | 1.01    |
| T <sub>5</sub>  | 113.72                                 | 8.25    | 123.52                | 0.74                                  | 1.08    |
| T <sub>6</sub>  | 115.82                                 | 8.40    | 125.53                | 0.75                                  | 1.10    |
| T <sub>7</sub>  | 124.70                                 | 9.05    | 133.47                | 0.82                                  | 1.19    |
| T <sub>8</sub>  | 133.71                                 | 9.82    | 141.68                | 0.88                                  | 1.27    |
| T <sub>9</sub>  | 135.74                                 | 10.01   | 143.23                | 0.89                                  | 1.28    |
| T <sub>10</sub> | 143.72                                 | 10.82   | 150.87                | 0.96                                  | 1.35    |
| T <sub>11</sub> | 151.78                                 | 11.57   | 157.88                | 1.03                                  | 1.43    |
| T <sub>12</sub> | 153.63                                 | 11.69   | 159.96                | 1.05                                  | 1.45    |
| SE <sub>D</sub> | 3.05                                   | 0.28    | 3.33                  | 0.02                                  | 0.02    |

|            |      |      |      |      |      |
|------------|------|------|------|------|------|
| CD(p=0.05) | 6.35 | 0.59 | 6.93 | 0.05 | 0.06 |
|------------|------|------|------|------|------|

### Conclusion

The present investigation clearly concluded the beneficial effect of micronutrients enriched organic manures along with NPK levels for increasing sesame yield and improving soil fertility in coastal saline soil. Application of 125 per cent recommended dose of NPK along with Micronutrients (Zn + Mn) Enriched composted coirpith (MNECCP) @ 5 t ha<sup>-1</sup>, NPK + composted coirpith @ 12.5 t ha<sup>-1</sup> was identified as best treatment combination and it can be recommend to the farmer's of coastal areas to realize the maximum profit in sesame yield and to sustain soil health in coastal saline sandy soil.

### References

1. Arulrajasekaran. Studies on the effect of fortified organic manure with micronutrients and bio active compounds on the growth, yield and micronutrients bio fortification of blackgram in coastal saline soil. M.Sc. (Agri.) Thesis, Dept. of Soil Science and Agrl. Chem., Faculty of Agriculture, Annamalai University, Annamalainagar, 2019.
2. Beema M. Effect of vermicompost and micronutrients fertilization on the productivity of sesame in coastal saline soil. M.Sc. (Ag.) Thesis, Annamalai University, Annamalainagar, TamilNadu, 2016.
3. Bhadu V, J Chaudhari, BA Patel. Influence of organic manure enrichment on growth and yield of crops and soil properties: A review. Int. J. Chem. studiess,2017:5(5):925-928.
4. Chaurasia SK, J Neetha, J Narmata. Effect of integrated use of fertilizers, organic manures and micronutrients and productivity of sesame (*Sesamum indicum*). Ann. Agrl. Res. New Series,2009:30(3&4):91-94.
5. Duhoon SS, A Jyotishi, MR Deshmukh, NB Singh. Optimization of sesame (*Sesamum indicum* L.) production through bionatural inputs proceedings of the 4<sup>th</sup> International Crop Science Congress, Brisbane, Australia, 26 September 1<sup>st</sup> October, 2004.
6. Elayaraja D. Response of sesame (*Sesamum indicum* L.) to micronutrients and NPK levels on the growth, yield and nutrients uptake in coastal sandy soil. J. Oilseeds Res,2015:32(2):179-182.
7. Jackson ML. Soil chemical analysis. Prentice Hall of India Pvt. Ltd, New Delhi, 1973.
8. Laxminarayana K, Archanamainaik. Enumeration of microbes and microbial activities in coastal saline soils of Eastern India. J. Indian Soc. Soil Sci,2016:63(3):276-284.
9. Meena MC, KP Patel, DD Rathod. Effect of Zn and Fe Enriched FYM on yield and removal of nutrients under Mustard-Sorghum fodder cropping sequence in semiarid region of Gujarat. Indian J. Dryland Agric. Res. & Dev,2008:23(2):28-34.
10. Patnaik M, Chandini Raju, Sreenivasa Raj, G Bhupal. Zinc requirement of hybrid rice – bhendi and its influence on zinc fraction in an alfisols of Andhra Pradesh. J. Indian Soc. Soil Sci,2012:59(4):368-375.
11. Policy Note. Policy note, Demand No. 5 – Agriculture, 2020 – 2021, Government of Tamilnadu, India, 2020.
12. Prasad V. Restoration of soil fertility and productivity of degraded coastal soil for sustainable rice production. Ph.D. Thesis, Dept. of Soil Science and Agrl. Chem.,

Faculty of Agriculture, Annamalai University, Annamalainagar, 2008.

13. Regar KL, J Yadav. Influence of PGPR and Zinc Enriched FYM on growth and yield of rice at different levels of phosphorus in an Inceptisol of Varanasi. Int. J. Curr. Microbiol. App. Sci,2017:6(4):1453-1464.
14. Sridevi G, M Vijay Sankar Babu, B Gayathri, S Anil Kumar. Effect of zinc enriched organic manures on nutrient uptake and yield of rice ADT-45 in zinc deficient Typic Ustopepts. Indian J.Agric. Res,2010:44(2):150-153.