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Effect of enriched organic manures and micronutrients on yield attributes and yield of groundnut (*Arachis hypogaea* L.)

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Abstract
Integrated use of organic and inorganic fertilizers can improve crop productivity and sustain soil health and fertility. The present research was conducted at Rallakothur village, Ambur taluk of Thirupathur district, during Karthigaipattam (Nov 2022-Mar 2023) to study the effect of integrated nutrient management on yield attributes and yield of groundnut. The results of the experiment revealed that application of N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS(T_6) shown its supremacy by registering better yield attributes *viz*., number of pods $plant^{-1}$ (20.83), shelling percentage (70.49), 100 kernel weight (37.52) and yield *viz*., pod yield (2165 kg ha^{-1}) and haulm yield (3259 kg ha^{-1}). This treatment is on par with application of N & K2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS (T_9).

Keywords: Enriched poultry manure, enriched sheepyard manure, $ZnSO_4$, boron, humic acid, seaweed extract

Introduction
Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops in tropical and subtropical countries. Groundnut is considered the "King of Oilseed Crops" due to its high oil content (45-50%) and is also known as the poor man's nut or earth nut, monkey nut, goober peas, jack nuts, manila nuts and pig nuts (Solaimalai *et al*., 2020) [13]. Among India, Gujarat is the leading producer of groundnut with a share of 33% followed by Rajasthan and Tamilnadu. Globally, groundnut is cultivated over an area of 30.69 million hectares, with a production of 51.89 million metric tonnes and a productivity of 1.69 metric tonnes ha^{-1} annually (USDA, 2022) [15]. In India, groundnut occupies an area of 5.75 million hectares with a production of 10.11 million tonnes and a productivity of 1759 kg ha^{-1} (MAFW, 2022) [7], whereas in Tamil Nadu, groundnut is cultivated over an area of 0.37 million hectares with a production of 0.95 million tonnes and a productivity of 2553 kg ha^{-1} (MAFW, 2022) [7].
Among the various agronomic practices, nutrient management has an important role in maximizing the pod yield of groundnut. Judicial use of fertilizers is crucial in increasing agricultural production and reduce environmental pollution because continuous use of chemical fertilizers has deleterious effects on soil which in turn cause decline in productivity. Use of organics alone does not result in spectacular increase in crop yields, due to their low nutrient status (Chaudhari *et al*., 2018) [4]. None of the sources of nutrient alone can meet the total plant nutrients. Thus, Integrated use of organic and inorganic fertilizers is the most efficient way to supply plant nutrients for sustained crop productivity and improved soil fertility (Chaudhari and Bhanwaria, 2018) [4].
To evaluate the potentiality of various source of nutrients in increasing the yield of groundnut the following organic and inorganic amendments *viz*., organic manures (Enriched farmyard manure, Enriched sheepyard manure, Enriched poultry manure), Micronutrients ($ZnSO_4$, Boron) and Bio-stimulants (Humic acid, Seaweed extract) were subjected to field trails.

Materials and Methods

A field experiment was conducted at Rallakothur village, Ambur taluk of Thirupathur district, during karthigaipattam (Nov 2022-Mar 2023) to study the effect of integrated nutrient management on yield attributes and yield of groundnut. The experimental field was geographically situated at 12.81º N latitude, 78.67º E longitude with an altitude of +290 meters above mean sea level. It is located at North-Eastern agro-climate zone of Tamil Nadu. The soil of the experimental field was sandy loam in texture. The soil was low in available nitrogen, medium in available phosphorus and medium in available potassium with a pH and EC of 7.4 and 0.18/dSm, respectively. The experiment was laid out in Randomized Block Design (RBD) with three replications. The details of the field treatments were T_1 - Control (100% recommended dose of fertilizers), T_2 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application), T_3 -N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} +Borax @ 10 kg ha^{-1} (Basal application), T_4 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application), T_5 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS, T_6 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS, T_7 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Humic acid @ 2% on 25 and 45 DAS, T_8 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Seaweed extract @ 5% on 25 and 45 DAS, T_9 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS, T_{10} - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} +$ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Seaweed extract @ 5% on 25 and 45 DAS.

The experimental field was ploughed twice to ensure fine tilth. Beds and channels were formed by manual labour and individual plots were demarked and levelled. The 100 per cent recommended dose of fertilizer *viz*., 25 kg nitrogen, 50 kg phosphorus and 75 kg potash per hectare were followed. The entire dose of P_2O_5 applied through enriching process or as basal (through fertilizer -T_1), half dose of K_2O and 50 percent N were applied as basal and the remaining 50 percent N and K_2O were applied in two equal splits at 20 DAS and 45 DAS. In addition to this, zinc sulphate @ 15 kg ha^{-1} and 10 kg Borax was applied as basal. For enhancing the crop growth, 2% Humic acid or 5% Sea weed extract was sprayed at 25 and 45 DAS, based on the treatment schedule. Required quantities of well decomposed organic manures such as phosphate enriched farmyard manure, phosphate enriched sheepyard manure, phosphate enriched poultry manure were incorporated in the soil at the time of last ploughing as basal based on the treatment schedule. The standard crop management practices were followed during the cropping period.

Five representative plant samples in each plot were marked randomly for recording biometric observations. At harvest yield characters *viz*., number of pods $plant^{-1}$, shelling percentage, 100 kernel weight) and yield *viz*., pod yield and haulm yield were recorded. The estimated data were analyzed as per the procedure outlined by Gomez and Gomez (1994) [6] and critical difference was worked out at 5 per cent probability level for significant results. The treatment differences which were not significant were denoted as "NS".

Results and Discussion

Number of pods $plant^{-1}$ and 100 Kernel weight

The maximum number of pods $plant^{-1}$ (20.83) and 100 kernel weight (37.52) was observed under application of N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS (T_6) which is on par with N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS (T_9). Adequate supply of N, P, K, humic acid and poultry manure enhanced availability at critical growth stages, resulting in enhanced yield characters *viz.*, number of pods $plant^{-1}$, weight of pods $plant^{-1}$ and 100 kernel weight are presented in (Table 1). These results are in agreement with Shankar Lal Choudhary *et al*. (2017) [11] and (Rajkumar and Paramasivan, 2019) [8]. Uko *et al*. (2016) [14] stated that application of poultry manure produced a higher number of pods $plant^{-1}$, which culminated in higher yields as a result of vigorous foliar growth and increased meristematic and physiological activities in the plant, resulting in higher production of assimilates used in the formation of pods. The increased yield attributes might be due to higher nutrient uptake and increased photosynthetic efficiency, as evident from increased LAI values.

This increase in the number of pods $plant^{-1}$ and kernel weight could be explained by the fact that the application of recommended dose of mineral fertilizers and humic acid foliar spray increased the uptake of nutrients by plants and consequently increased growth rate. The beneficial interaction effects of those fertilizers could be attributed to their ability to enhance the easy release of nutrients into soil solutions and to encourage their penetration through plant roots, as well as their antagonistic impacts on pests and plant diseases (Salwa and Eisa, 2011) [10].

Shelling percentage

Among the different treatments, application of N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha-1 + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS (T_6) recorded maximum shelling percentage (70.49) are presented in (Table 1). Foliar application of humic acid significantly increased the shelling percentage. It has been speculated that an increase in shelling percentage of groundnut might be due to the fact that humic substances might have various biochemical effects either at the cell wall or membrane level in the cytoplasm, which in turn result in enhanced photosynthesis. These results corroborate the findings of Bakry *et al*. (2014) [2] and Reddy *et al*. (2020) [9].

Table 1: Effect of enriched organic manures and micronutrients on yield characters of groundnut

Treatment	Number of pods plant^{-1}	100 Kernel weight (g)	Shelling %
T_1 – RDF (Recommended dose of fertilizers)	14.80	36.82	66.75
T_2 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} +Borax @ 10 kg ha^{-1} (Basal application)	16.26	37.25	70.15
T_3 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} +Borax @ 10 kg ha^{-1} (Basal application)	17.43	37.32	70.23
T_4 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application)	16.80	37.29	70.19
T_5 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS	18.63	37.38	70.33
T_6 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS	20.83	37.52	70.49
T_7 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Humic acid @ 2% on 25 and 45 DAS	19.63	37.47	70.41
T_8 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS	18.40	37.36	70.28
T_9 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS	20.66	37.50	70.46
T_{10} - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} +$ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Seaweed extract @ 5% on 25 and 45 DAS	19.42	37.44	70.38
SEm±	0.12	0.49	0.92
CD (p=0.05)	0.35	NS	NS

Table 2: Effect of enriched organic manures and micronutrients on pod and haulm yield (kg ha^{-1}) of groundnut

Treatment	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest Index
T_1 – RDF (Recommended dose of fertilizers)	1579	2782	36.20
T_2 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} +Borax @ 10 kg ha^{-1} (Basal application)	1839	2914	38.69
T_3 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} +Borax @ 10 kg ha^{-1} (Basal application)	1954	3045	39.08
T_4 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application)	1898	2982	38.89
T_5 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS	2036	3120	39.44
T_6 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS	2165	3259	39.90
T_7 - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Humic acid @ 2% on 25 and 45 DAS	2102	3192	39.70
T_8 - N & K_2O + Enriched farmyard manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS	2010	3101	39.32
T_9 - N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS	2143	3243	39.77
T_{10} - N & K_2O + Enriched sheepyard manure @ 750 kg ha^{-1} +$ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Seaweed extract @ 5% on 25 and 45 DAS	2078	3174	39.56
SEm±	12.17	16.74	-
CD (p=0.05)	36.16	49.73	NS

Harvest index - Statistically not analysed

Pod and Haulm yield

Among the different treatments, application of N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS (T_6) significantly recorded the highest pod yield of (2165 kg ha^{-1}) and haulm yield (3259 kg ha^{-1}) are presented in (Table 2) which is on par with N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) +Seaweed extract @ 5% on 25 and 45 DAS (T_9). The increase in pod and haulm yield might due to increased growth and yield attributes. This might be due to an adequate and steady supply of all nutrients to plants at all stages of crop growth. This corroborates the earlier reports of Snehal *et al*. (2014) [12], Basu *et al*. (2008) [3] and Rajkumar and Paramasivan (2019) [8]. Higher economical and biological yields in poultry manure might be due to the fact that ammonium-N (NH_4-N) is a significant part of total N in poultry manure, which additionally contains uric acid. Uric acid metabolizes rapidly to NH_4-N in most soils, and the net result of the high NH_4-N and uric acid contents in poultry waste is that a large percentage of N can be converted to nitrate-N (NO_3-N) within a few weeks. Poultry manure improves the number of pods plant^{-1}, pod yield and haulm yield in groundnut (Veeramani *et al*. 2012) [16].

The increase in pod, haulm, and kernel production was attributable to the fact that humic acid increased the permeability of the cell membrane, allowing more potassium to enter the cell, thereby increasing the pressure within the cell and facilitating cell division. Increased energy within the cells, on the other hand, leads to increased chlorophyll production and higher photosynthesis rates. The growth process then quickened, nitrogen absorption into the cells increased, nitrate generation might have decreased, and production was eventually enhanced.

These results are in agreement with the findings of Reddy *et al*. (2020) [9].

Increasing the application of zinc fertilizer increased the yield and yield attributes, which might be due to the significant improvement in growth parameters leading to improved nodulation through activation of various enzymes and the basic metabolic rate in plants, which in turn enhanced the pod yield due to greater availability of nutrients and photosynthates. Similar finding was reported by Aboyeji *et al*. (2019) [1].

Conclusion

Based on the results of the experiment it can be concluded that application of N & K_2O + Enriched poultry manure @ 750 kg ha^{-1} + $ZnSO_4$ @ 15 kg ha^{-1} + Borax @ 10 kg ha^{-1} (Basal application) + Humic acid @ 2% on 25 and 45 DAS increased growth and yield attributes, which greatly led to higher productivity and nutrient uptake of groundnut besides improving soil available nutrients after harvest. Due to the affordable cost of inputs, the treatment also recorded the highest net returns and B:C ratio. Furthermore, it has been discovered to be a successful integrated nutrient management practice for boosting yield of groundnut growers.

References

1. Aboyeji C, Dunsin O, Adekiya AO, Chinedum C, Suleiman KO, Okunlola FO, *et al*. Zinc sulphate and boron-based foliar fertilizer effect on growth, yield, minerals, and heavy metal composition of groundnut (*Arachis hypogaea* L.) grown on an alfisol. Int. J Agron. 2019, 1-7.
2. Bakry AB, Taha MH, Abdelgawad ZA, Abdallah MMS. The role of humic acid on growth, chemical constituents and yield quantity of three flax cultivars grown under saline soil conditions. Agric. Sci. 2014;5:1566-1575.
3. Basu M, Bhadoria PBS, Mahapatra SC. Growth, nitrogen fixation, yield and kernel quality of peanut in response to lime, organic and inorganic fertilizer levels. Bioresour. Technol. 2008;99(11):4675-4683.
4. Chaudhari PK, Chaudhari PP, Desai NH. Yield and quality of kharif groundnut (*Arachis hypogaea* L.) as influenced by organic and inorganic sources of nutrients. Int. J Agric. Sci. 2018;10(6):5424-5426.
5. Chaudhari R, Bhanwaria R. Influence of organic manures and iron on growth and yield of groundnut (*Arachis hypogaea* L.). Trends in Biosci. 2018;11(9):1945-1949.
6. Gomez KA, Gomez AA. Statistical produce for Agricultural research, 11th edition John Wiley and Sons., New York, 1994, p. 68.
7. MAFW. Agricultural Statistics at a Glance. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation and Farmers welfare, Directorate of Economics and Statistics, Government of India, 2022. https://agriwelfare.gov.in/ Documents/CWWGDATA/Agricultural_Statistics_at_a_Glance_2022_0.pdf.
8. Rajkumar A, Paramasivan M. An effect of organic and inorganic nutrients on growth, yield of groundnut (*Arachis hypogaea* L.) and soil fertility in an alfisol of tamiraparani tract. Int. J Agric. Sci. Res. 2019;9(4):131-136.
9. Reddy KS, Bhuvaneswari R, Karthikeyan PK. effect of foliar application of dap, humic acid and micronutrients on growth characters of groundnut (*Arachis hypogaea* L.) var. tmv 7 in sandy loam soil. Plant Arch. 2020;20(1):514-520.
10. Salwa A, Eisa AI. Effect of amendments, humic and amino acids on increases soils fertility, yields and seeds quality of peanut and sesame on sandy soils. Res. J Agric. Biol. Sci. 2011;7(1):115-125.
11. Shankar Lal Choudhary, Sharma OP, Gora MK, Choudhary RR. Effect of organic manures and molybdenum on growth, yield and quality of groundnut. Int. J Curr. Microbiol. Appl. Sci. 2017;6(1):736-742.
12. Snehal Patil R, Swati Kadam R, Kalegore NK, Dadgale PR. Effect of inorganic and biofertilizers on growth and yield of summer groundnut. Adv. Res. J Crop Improv. 2014;5(1):23-25.
13. Solaimalai A, Jayakumar M, Baskar K, Senthilkumar M. Sulfur fertilization in groundnut crop in India: A review. J. Oilseeds Res. 2020;37(1):1-10.
14. Uko AE, Binang WB, Ajah S. Effect of tillage methods and poultry manure application on the growth and yield of groundnut in Calabar. Crop science Society of Nigeria (CSSN): Third Annual National Conference; c2016. p. 172-186.
15. USDA. Foreign agricultural services office of global analysis report: USA; c2022. Available from https://www.fas.usda.gov/data/world-agricultural-production.
16. Veeramani P, Subrahmaniyan K, Ganesaraja V. Organic manure management on groundnut; A review. Wudpecker J Agric. Res. 2012;1(7):238-243.