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Response of seasoned pressmud, poultry manure, Zinc sulphate and Borax on yield attributes and uptake in Brinjal fruit

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Abstract

Brinjal is one of the widely grown vegetable with high nutritive value responsive to pressmud, poultry manure, $ZnSO_4$ and Borax application in soil. With this background the pot experiment were carried out at Department of Soil Science and Agricultural Chemistry, Annamalai University to evaluate the effect of seasoned pressmud, poultry manure, $ZnSO_4$ and boron in two different salts (Neutral and coastal saline soil). The treatments include 100% RDF, 75% RDF with Poultry Manure, Seasoned Pressmud soil application @ 6.25 t ha^{-1} and 25 t ha^{-1} $ZnSO_4$ and Borax soil application @ 25 kg ha^{-1} and 10 kg ha^{-1}, Foliar spray $ZnSO_4$ @ 0.5% and boron @ 0.25%. There were 13 treatment combination in FCRD with 3 replications. Among the treatments highest no. of fruits (24.62), fruit weight (42.1 g pot^{-1}), fruit yield (10.36.5g pot^{-1}), plant yield (602.3 g pot^{-1}), fruit dry weight (75 g pot^{-1}), fruit NPK uptake (1.9, 0.3136, 2.1 g pot^{-1}), Fe, Mn, Zn, Cu, B uptake (3.701, 3.369, 1.839, 1.449, 6.692 g pot^{-1}) were registered in treatment (S_1T_{10}) receiving Seasoned Pressmud @ 25 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} in neutral soil.

Key words : Brinjal, Seasoned pressmud, $ZnSO_4$, Boron, Fruit yield and uptake.

Brinjal or egg plant (*Solanum melongena* L.) belonging to Solanaceae family, is one of the most common and popular vegetable crop grown in India and occupying a pride of place in every food of all people. It is relatively easy to grow and suitable for both irrigated and rainfed conditions. The fruits have high nutritive value and a good source of vitamins and iron. It is highly productive and usually finds its place as the poor man's crop. It is cultivated in an area of 7.5 million ha with the production of 13.15 million tonnes in India[21]. The indiscriminate use of fertilizers over a period of time has resulted in built-up of certain

nutrient elements like zinc and boron in sandy loam soils. Depending upon the cropping pattern, considerable amount of nutrients are lost from soil every year. If intensive cropping is continued over a period of time without balanced fertilization and restoring of nutrients in soil, reduction in soil fertility and loss in crop yields is inevitable. Hence for sustainability of the present day agricultural system and balanced management of soil resources, it is imperative to emphasize on the rational management of soil fertility[12]. Coastal sandy soil has potential to be utilized in the biomass production process. In general, volume space of coastal sandy soil is dominated by the sand fraction. The soil texture ranges between sandy and loamy and does not form soil aggregates. The limitation of coastal sandy soil which does not form soil aggregates, causes this soil to have a high leaching capacity so that most of the nutrients can move downward through gravity water[27]. Micronutrients mixtures provide essential micronutrient in proportionate doses, thereby ensuring the crop yields through balance plant nutrition.

Being a hardy vegetable crop, the yield, DMP are largely influenced by application of fertilizers. Nutrient management is important for healthy crop lead to improved efficiency as well as system sustainability. Recent developments in intensive agriculture through contributed immensely towards surplus food, causes degradation of fertile land. Thus there is an increasing awareness through out the world about the sustainable agricultural practice[36].

Pressmud is a compost used to maintain soil fertility and enhance crop production because it is contains appreciable amount of essential plant nutrients *viz.,* organic carbon, nitrogen, phosphorus, potassium, calcium and magnesium along with traces of micronutrients like zinc, iron, copper and manganese so the beneficial effect of than compost for enhancing soil fertility and other improving crop productivity is well established. At time when cost of the chemical fertilizers is increasing day by day and no affordable by farmers, pressmud has promise as a most economic source of plant nutrient for sustainable crop production and improved in the physical (structure, texture, aeration, water holding capacity and porosity), chemical (pH, EC, CEC) and biological (microbial dynamics) properties of the composts amended soil[48].

Poultry manure is an excellent soil amendment that provides nutrients for growing crops and also improves soil quality when applied wisely, because it has high organic matter content accompanied with available nutrients such as nitrogen, phosphorus and potassium for growth of the plant. Addition of poultry manure as a soil conditioner reduce the bulk density of the soil. This is due to the inherent low bulk density of organic materials used which results in lower soil bulk density[42].

Zinc is regarded as the fourth most significant yield limiting nutrients after nitrogen, phosphorus and potassium. The average total Zn in Indian soil is 55 mg kg^{-1} and the available Zn 130.54 mg kg^{-1}. Zinc may be applied as soil application or foliar spray for fortification of crops with Zn and for better translocation of Zn to grain noted that Zn application not only corrects crops in deficiency but also enhances crop yield and productivity. Zinc sulphate is a major source of Zn and sulfur

and is being used worldwide. There are two methods for application of micronutrient which are soil application and foliar application. Foliar application is usually considered as costly because it needs high cost equipments for brinjal zinc application of 25 kg ha^{-1} was optimum[13].

Boron is one of the eight essential micronutrients need for plant growth and development. It helps in regulation of sugar concentration and pollen development in plans and is responsible for the cell formation. It has emerged as an important micronutrient in Indian agriculture. Boron deficiency has been realized as the second most important micro-nutrient constraint in crops after Zn as global scale[3]. In India, B deficiency was reported to be 52 percent[45]. Soil application of B through borax has resulted in greater loss of B by leaching loss thereby less availability to crops. The study on use of different sources and levels of B on brinjal crop is very limited. Among the micronutrients B plays an important role directly and indirectly in improving the yield[4].

The present investigation was carried out to study yield attributes, fruit yield, stover yield, dry matter production, NPK, micronutrient content and uptake.

A pot culture study has been conducted to study at Department of Soil Science and Agricultural Chemistry, Annamalai University during July to October, 2021.

Pot experiment :

Pot experiment were carried out to study the effect of Seasoned Pressmud, Poultry manure, $ZnSO_4$ and Borax application in two different soils.

Treatment details :

S_1 – Neutral soil
S_2 – Coastal saline soil
T_1 – Control (RDF 100:50:30 N, P_2O_5 and K_2O kg ha^{-1})
T_2 – 75% RDF + Poultry manure @ 6.25 t ha^{-1} + Soil application Zinc sulphate @ 25 kg ha^{-1}
T_3 – 75% RDF + Poultry manure @ 6.25 t ha^{-1} + Soil application Borax @ 10 kg ha^{-1}
T_4 – 75% RDF + Poultry manure @ 6.25 t ha^{-1} + Soil application Zinc sulphate @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}
T_5 – 75% RDF+ Poultry manure @ 6.25 t ha^{-1} + Foliar spray @ 0.5% Zinc sulphate on 45 and 75 DAT
T_6 – 75% RDF + Poultry manure @ 6.25 t ha^{-1} + Foliar spray @ 0.2% Borax on 45 and 75 DAT
T_7 – 75% RDF + Poultry manure @ 6.25 t ha^{-1} + Foliar spray @ 0.5% Zinc sulphate + 0.2% Borax on 45 and 75 DAT
T_8 – 75% RDF + Seasoned Pressmud @ 25 t ha^{-1} + Soil application Zinc sulphate @ 25 kg ha^{-1}
T_9 – 75% RDF + Seasoned Pressmud @ 25 t ha^{-1}+Soil application Borax @ 10 kg ha^{-1}
T_{10}– 75% RDF + Seasoned Pressmud @ 25 t ha^{-1} + Soil application Zinc sulphate @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}
T_{11}– 75% RDF + Seasoned Pressmud @ 25 t ha^{-1}+ Foliar spray @ 0.5% Zinc sulphate on 45 and 75 DAT.
T_{12}– 75% RDF + Seasoned Pressmud @ 25 t

ha^{-1} + Foliar spray @ 0.2% Borax on 45 and 75 DAT.

T_{13} –75% RDF + Seasoned Pressmud @ 25 t ha^{-1}+ Foliar spray @ 0.5% Zinc sulphate + 0.2% Borax on 45 and 75 DAT.

Each treatment is replicated three times in a Factorial Completely Randomized Design (FCRD) Soil samples were collected at the depths of 0-20 cm from 2 sites *i.e.* Vallampadugai, (Neutral soil), Therku Pichavaram (Coastal Saline Soil). Soil samples were air-dried and passed through a 2 mm sieve after removing coarse fragments and roots and stored at room temperature. 20 kg of air-dried processed soil was filled in 35×30 cm cement pot. The Seasoned Pressmud, Poultry Manure, $ZnSO_4$ and Borax were applied in soil basally. Foliar spray of $ZnSO_4$ and Borax were applied at vegetative and flowering stages of brinjal.

Yield attributes :
Harvest maturity :

Fruits were harvested at edible maturity stage when they are not fully ripened and have a bright purple colour and harvested.

Number of fruits plant^{-1} :

Average of fruits of all pickings were counted from the total number of fruits harvested.

Average fruit weight pot^{-1} :

After harvesting in the all pickings the brinjal were weighed with the help of electronic balance and average fruit weight in g was drawn. Then the average fruit weight pot^{-1} was also calculated.

$$\text{Average fruit weight (g pot}^{-1}) = \frac{\text{Total weight of fruits pot}^{-1}\text{ (g)}}{\text{Total no. of fruits plant}^{-1}}$$

Fruit yield (g pot^{-1}) :

Brinjal fruit was harvested in five picking with 7-15 days interval. Fresh weight yield of brinjal from each pot at each picking was recorded and total yield was recorded in g pot^{-1}.

Plant yield (g pot^{-1}) :

Brinjal plant yield was obtained by harvesting of crop from individual plot and weighing the harvested bundle and reported in g pot^{-1}.

Analysis of soil sample :

Soil samples were collected just before the start of the pot experiment. The collected soil samples were air dried in shade ground with wooden mallet, passed through 2 mm sieve and stored in polythene bags. Soil sample was collected and analyzed for various physico-chemical properties as per standard procedures (Table-1).

Dry weight of plant (g pot^{-1}) :

After taking fresh weight, samples were kept it in an oven at 80°C for 72 hours and then dry weight of these samples was taken.

Dry weight of the fruit (g pot^{-1}) :

The dry weight of the fruit was measured

after dehydrating the fruits by first sun drying and then oven drying at 80°C and then obtaining the weight through electronic weighing machine.

Nutrient uptake :

The dry matter obtained from each treatment and their respective nutrient contents were used to compute nutrient uptake at 45 and 75 DAT and at harvest.

$$\text{N/ P/K Uptake (g pot}^{-1}) = \frac{\text{N/P/K content (\%) X Dry matter yield (g pot}^{-1})}{100}$$

The micronutrient uptake by brinjal fruit was worked out using the following equation.

$$\text{Micronutrient uptake (mg pot}^{-1}) = \frac{\text{Nutrient content (mg kg}^{-1}) \times \text{Dry matter yield (g pot}^{-1})}{1000}$$

Methodology used for plant and fruit sample analysis.

Parameters	References
Total N (%)	Jackson (1973)
Total P (%)	Jackson (1973)
Total K (%)	Jackson (1973)
Total Fe, Mn Zn & Cu (mg kg^{-1})	Jackson (1973)
Boron (mg kg^{-1})	Page *et al.* (1982)

Fruit yield :

The data (Table-4) showed significant difference between soil types. Seasoned Pressmud, Poultry manure, $ZnSO_4$ and Borax application. The highest fruit yield (778.8 g pot^{-1}) was registered in neutral soil (S_1). Among the treatments the maximum fruit yield (968.15 g pot^{-1}) was recorded in the treatment T_{10}. With the interaction of soil types and treatments, the maximum was recorded in treatment S_1T_{10} (75% RDF + Seasoned pressmud @ 25 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}) registered fruit yield (1036.5 g pot^{-1}). Among organic manures, Seasoned Pressmud application along with fertilizers performed better.

Results regarding ionic attributes like NPK concentration in brinjal fruit are due to combined use of pressmud and inorganic fertilizers show significant higher results in ionic parameter in pressmud application[1]. With regard to poultry manure, that higher yields due to application of poultry manure may be attributed to the high level of nutrients along with growth stimulating substances[7].

Among micronutrients application $ZnSO_4$ and Borax incorporation performed better in yield attributes of brinjal. In addition, Zn and B through activation of various enzymes and increased basic metabolic rate in plants facilitated the synthesis of nucleic acid hormones, which in turn enhanced the yield due to greater availability of nutrients and photosynthates[16].

Plant Yield (g pot^{-1}) :

The data (Table-4) shows significant difference between two soil application of types, composts Boron and zinc sulphate application. The highest plant yield (452.2 g pot^{-1}) was recorded in neutral soil (S_1). Among the treatments, the maximum plant yield (590.7 g pot^{-1}) were registered in 75% RDF + Seasoned Presmud @ 25 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} in treatment

T_{10}. Among interactions the highest plant yield was registered plant yield (602.39 g pot^{-1}) in the treatment S_1T_{10} (Seasoned pressmud @ 25 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}) in neutral soil. The Seasoned pressmud influenced the improved plant yield. The positive influence of the application of Seasoned Pressmud lead to immediate supply of nutrients at the early stage of the crop and slow and steady supply of essential nutrients in proper ratio of plant and soil from pressmud through out the crop growth period improved adequate biomass production. The application of seasoned pressmud resulted in improving the growth of vegetable crops like plant height, number of branches $plant^{-1}$ lead to increase in plant yield[31]. The total biomass of a plant is called its fresh weight. The impact of poultry manure along with recommended dose of NPK on plant yield (598.7 g pot^{-1}) which was significant poultry manure improves the fresh weight significantly when compared with control treatment interm of statistics. The higher production of plant yield was due to application of poultry manure application resulted to slowly releasing available nutrients had favourable effect of growth and biomass production. Similar results were reported by Rama Devi *et al.*[40].

With regard to zinc sulphate application showed a positive influence in zinc in many enzymatic process and catalytic reactions which increase the growth of the plant thus leading to the development of higher fresh weight of the plant[29].

Application of borax increase in enzyme activation, membrane integrity, chlorophyll formation stomatal balance at early stages accelerated plant growth and fresh weight of the plant[17].

Dry weight of brinjal fruit and plant :

The data (Table-4) pertaining to showed significant difference between two soil types and treatments. The highest fruit dry weight (48.52 g pot^{-1}) and plant dry weight (65.90 g pot^{-1}) were recorded in neutral soil (S_1). Among the treatments the maximum brinjal fruit dry weight (69.98 g pot^{-1}) and plant dry weight (86.64 g pot^{-1}) were registered in treatment T_{10} (Seasoned Presmud @ 25 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}). In the interaction treatment S_1T_{10} (Seasoned pressmud @ 12.5 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}) recorded brinjal dry fruit weight (75 g pot^{-1}) and brinjal dry plant weight (88.35 g $plant^{-1}$) in neutral soil.

With regard to seasoned pressmud application registered fruit dry weight of 75 g pot^{-1} and plant dry weight 75.16 g pot^{-1}. This is because pressmud being a rich source of nutrients regulates the availability of nutrients to the brinjal fruit dry weight providing nutrients in the available form based on crop demand. Integrated nutrient application significantly increased the agronomical attributes of *Solanum melongena*. The findings are also in agreement with (Budiyanto, 2021). On the other hand, treatment of sugarcane pressmud and inorganic fertilizer integrated in influencing dry weight of brinjal plant. The application of sugarcane Pressmud provide nutrient for brinjal plant sugarcane Pressmud is also thought to improve the soil colloid complex. The application of sugarcane

pressmud can provide nutrients from the decomposition of pressmud[22].

Regarding poultry manure higher dry weight of fruit yield (63.18 g pot^{-1}) and dry weight of plant yield (87.75 g pot^{-1}) were recorded in treatment T_4 (Poultry manure @ 6.25 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1}). Poultry manure had favourable influence on dry fruit weight of brinjal. Poultry manures on soil characteristics and biological qualities, as well as their ability to solubilize available plant nutrients could explain the rise in dry matter content[30].

The brinjal dry weight was increased by zinc sulphate application over control. The increase in dry weight of fruit is due to influence of zinc on increasing metabolism, biosynthesis of auxins and better nutrient uptake[18]. A critical observation of data revealed that zinc sulphate application increase dry weight of brinjal fruit. It might be probably due to the fact that zinc increases the size of leaf area and dry matter content of leaves because zinc play important role in photosynthesis as well as biosynthesis of auxin, a growth promoting sulfane[25].

Data presented in Table-4 showed increase in dry weight of brinjal fruit and plant. Borax application @ 10 kg ha^{-1} was adequate to cause significantly higher increase in dry matter yield regardless of stage of crop grown. Further critical analysis of interaction effect of boron and organic manures revealed that statistically higher dry matter yield was recorded in brinjal[32].

NPK content :

The data (Table-5) shows highest fruit NPK content (2.593%, 0.388%, 2.778%), plant NPK content (3.079%, 0.406%, 2.483%) registered in neutral soil (S_1). Among the treatments maximum fruit NPK content (2.559%, 0.394%, 2.719%), plant NPK content (3.069%, 0.404%, 2.573%) were registered T_{10} (Seasoned Pressmud + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}). There is no significant difference among the interaction of soil and treatments.

Seasoned pressmud application revealed that significantly highest NPK concentration is fruit and plant were recorded in treatment T_{10}. Soil NPK content increased when NPK was applied with Seasoned Pressmud because separate application of Pressmud and inorganic fertilizer sustain the production of brinjal fruit[2]. These results are due to the positive effect of organic manures added to soil may be attributed to stimulating the activity of bacteria which promote the released availability of N in the soil enhances nitrogen absorption by brinjal roots. The results showed that high rate of pressmud increase the P content. Potassium nutrition in generally improved when plants were supplied with pressmud[6].

With regard to poultry manure application, nitrogen plays an important role in various physiological process of plants. It is an important part of many organic compounds like proteins and nucleic acid. It is an important component of chlorophyll and involves in energy process. Phosphorus is involved in many process like storage and supply in

Table-1. Physico-chemical properties of initial soil

S. No.	Parameters	Neutral soil	Coastal saline soil	Methods Employed
A	Physical properties			
1.	Mechanical Analysis			
	Sand (%)	65	76	
	Silt (%)	28	19	
	Clay (%)	6	4	
	Textural class	Sandy loam	Sandy	Bouyoucos (1962)
	Taxonomical class	*Typic Ustifluvents*	*Typic Ustipsamments*	
2	Bulk density ($Mg\ m^{-3}$)	1.50	1.55	Soil Survey Staff (1993)
3	Particle density ($Mg\ m^{-3}$)	2.62	2.61	Soil Survey Staff (1993)
B	Chemical Properties			
4	pH	7.2	8.4	Jackson (1973)
5	EC (dSm^{-1})	0.75	4.2	Bower and Wilcox (1965)
6	Organic carbon ($g\ kg^{-1}$)	4.7 (Medium)	0.99 (Low)	Walkley and Black (1934)
7	CEC [(cmol (p+)) kg^{-1}]	16.8	2.9	Chapman (1965)
8	$KMnO_4$–N ($kg\ ha^{-1}$)	159.6 (Low)	103.6 (Low)	Subbiah and Asija (1956)
9	Olsen–P ($kg\ ha^{-1}$)	50 (High)	23 (High)	Olsen *et al.* (1954)
10	NH_4OAC-K ($kg\ ha^{-1}$)	135.5 (Medium)	197 (Medium)	Hanway and Heidel (1952)
11	DTPA-Fe ($mg\ kg^{-1}$)	25.13 (Sufficient)	19.13 (Sufficient)	Lindsay and Norvell (1978)
12	DTPA-Mn ($mg\ kg^{-1}$)	12.56 (Sufficient)	9.56 (Sufficient)	Lindsay and Norvell (1978)
13	DTPA-Zn ($mg\ kg^{-1}$)	0.28 (Deficient)	0.22 (Deficient)	Lindsay and Norvell (1978)
14	DTPA-Cu ($mg\ kg^{-1}$)	1.53 (Sufficient)	0.55 (Sufficient)	Lindsay and Norvell (1978)
15	Hot water soluble B ($mg\ kg^{-1}$)	0.47 (Deficient)	0.32 (Deficient)	Hatcher and Wilcox (1950)

Table-2. Nutrient content in Seasoned Pressmud and Poultry manure

Material	N (%)	P (%)	K (%)	OC (%)	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
Seasoned Pressmud	1.525	1.09	0.99	23.6	500	300	64	125
Poultry manure	3.03	1.14	1.16	3.87	930	210	24	25

Table-3. Nutrient content of $ZnSO_4$ and borax

Micronutrient	Zn (%)	B (%)
Zinc sulphate ($ZnSO_4$)	36.5	–
Borax ($Na_2B_4O_7$)	–	11.36

Table-4. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on brinjal fruit yield, plant yield and dry weight of fruit and plant (g pot^{-1})

Treatments	Fruit yield (g pot^{-1})			Plant yield (g pot^{-1})			Dry weight content in fruit (g pot^{-1})			Dry weight content in plant (g pot^{-1})		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1	587.16	480.07	533.61	316.0	266.9	291.5	34.12	27.79	31.01	45.63	38.67	42.15
T_2	842.75	626.61	734.69	484.6	452.1	468.4	52.26	40.09	46.17	70.80	66.04	68.42
T_3	837.41	678.02	757.72	458.30	448.2	453.2	49.90	40.41	45.15	66.85	65.38	66.12
T_4	929.23	740.67	834.95	598.7	528.1	563.4	63.18	50.33	56.75	87.75	77.40	82.58
T_5	643.27	531.51	587.39	368.2	308.3	338.3	37.62	31.08	34.35	53.45	44.84	49.15
T_6	597.29	504.68	550.98	348.1	278.1	313.1	34.88	29.46	32.17	50.50	40.34	45.42
T_7	772.88	619.27	696.08	378.4	348.7	365.5	45.38	36.28	40.83	54.97	50.65	52.81
T_8	761.07	736.07	798.57	548.2	508.6	528.4	56.64	48.57	52.60	80.24	74.45	77.34
T_9	963.08	767.79	851.93	514.1	496.5	505.3	59.70	49.98	54.84	75.15	72.58	73.86
T_{10}	1036.16	900.13	968.15	602.3	579.1	590.7	75.00	64.96	69.98	88.35	84.94	86.64
T_{11}	629.11	573.86	632.99	408.8	361.4	385.1	40.32	33.62	36.97	59.52	51.57	55.54
T_{12}	647.08	541.26	594.17	384.7	358.8	371.7	37.98	31.77	34.87	55.87	52.19	54.03
T_{13}	741.88	623.15	682.52	467.7	404.5	463.1	43.69	36.69	40.19	67.68	58.96	63.32
Mean	778.80	640.24	709.52	452.2	410.71	431.43	48.52	40.08	44.30	65.90	59.85	62.87
	S	**T**	**S×T**	**S**	**T**	**S×T**	**S**	**T**	**S×T**	**S**	**T**	**S×T**
S.Ed.	1.63	4.18	5.91	1.31	3.30	1	0.14	0.36	0.52	0.14	0.36	0.52
CD (P=0.05)	3.29	8.38	11.86	2.61	6.71	9.61	0.29	0.74	1.04	0029	0.74	1.04

Table-5. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on brinjal fruit and plant NPK content (%)

Treat-ments	Fruit								
	N (%)			P (%)			K (%)		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1	2.536	2.339	2.438	0.359	0.309	0.334	2.719	2.539	2.629
T_2	2.613	2.419	2.516	0.397	0.352	0.374	2.793	2.623	2.708
T_3	2.609	2.413	2.511	0.394	0.347	0.370	2.791	2.620	2.766
T_4	2.639	2.448	2.544	0.414	0.364	0.389	2.814	2.634	2.724
T_5	2.559	2.367	2.463	0.367	0.325	0.346	2.729	2.579	2.654
T_6	2.549	2.349	2.449	0.363	0.314	0.339	2.739	2.559	2.649
T_7	2.556	2.372	2.484	0.370	0.327	0.348	2.749	2.589	2.609
T_8	2.629	2.438	2.464	0.412	0.361	0.386	2.812	2.631	2.721
T_9	2.624	2.428	2.533	0.409	0.357	0.383	2.807	2.623	2.715
T_{10}	2.649	2.469	2.526	0.419	0.369	0.394	2.819	2.620	2.719
T_{11}	2.579	2.398	2.559	0.379	0.334	0.356	2.787	2.607	2.694
T_{12}	2.569	2.377	2.489	0.377	0.331	0.354	2.775	2.604	2.690
T_{13}	2.600	2.406	2.473	0.381	0.339	0.360	2.784	2.619	2.699
Mean	2.593	2.402	2.503	0.388	0.341	0.364	2.778	2.603	2.691
	S	**T**	**S×T**	**S**	**T**	**S×T**	**S**	**T**	**S×T**
S.Ed.	0.005	0.014	0.020	0.001	0.002	0.003	0.006	0.016	0.023
CD(P=0.05)	0.011	0.029	NS	0.002	0.005	NS	0.013	0.033	NS

Plant								
N (%)			P (%)			K (%)		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
3.020	2.869	2.944	0.389	0.319	0.354	2.450	2.517	2.480
3.079	2.949	3.014	0.409	0.348	0.378	2.500	2.598	2.549
3.069	2.945	3.007	0.407	0.360	0.383	2.479	2.615	2.547
3.129	2.979	3.054	0.427	0.374	0.401	2.511	2.623	2.567
3.089	2.761	2.925	0.393	0.330	0.361	2.460	2.567	2.516
3.029	2.909	2.969	0.392	0.337	0.364	2.461	2.539	2.500
3.107	2.939	3.023	0.395	0.341	0.368	2.468	2.581	2.525
3.109	2.969	3.040	0.419	0.342	0.373	2.509	2.677	2.563
3.090	2.964	3.039	0.415	0.327	0.393	2.507	2.623	2.565
3.149	2.989	3.069	0.429	0.371	0.404	2.519	2.627	2.573
3.057	2.990	3.023	0.400	0.379	0.376	2.470	2.616	2.543
3.054	2.917	2.991	0.397	0.351	0.372	2.466	2.607	2.536
3.043	2.928	2.985	0.403	0.357	0.380	2.468	2.613	2.541
3.079	2.926	3.003	0.406	0.353	0.379	2.483	2.596	2.539
S	**T**	**S×T**	**S**	**T**	**S×T**	**S**	**T**	**S×T**
0.013	0.034	0.048	0.013	0.027	0.048	0.005	0.015	0.021
0.027	0.069	NS	0.034	0.069	NS	0.011	0.030	NS

Table-6. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on brinjal fruit and plant NPK uptake (mg pot^{-1})

Treat-ments	Fruit uptake								
	N			P			K		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1	0.80	0.60	0.70	0.1216	0.0846	0.1031	0.80	0.70	0.75
T_2	1.40	0.94	0.78	0.2066	0.1406	0.1736	1.50	1.10	1.30
T_3	1.30	0.93	1.12	0.1956	0.1396	0.1676	1.40	1.00	1.20
T_4	1.70	1.30	1.50	0.2606	0.1826	0.2216	1.80	1.32	1.56
T_5	0.91	0.80	0.86	0.1376	0.1006	0.1191	1.00	0.80	0.90
T_6	0.90	0.70	0.80	0.1256	0.0916	0.1086	0.90	0.71	0.81
T_7	0.92	0.81	0.87	0.1666	0.1176	0.1421	1.10	0.81	0.95
T_8	1.60	1.21	1.41	0.2326	0.1746	0.2036	1.70	1.31	1.50
T_9	1.41	1.20	1.31	0.2436	0.1776	0.2106	1.60	1.30	1.45
T_{10}	1.90	1.60	1.75	0.3136	0.2386	0.2761	2.10	1.70	1.90
T_{11}	1.14	0.91	1.02	0.1516	0.1116	0.1316	1.20	0.91	1.05
T_{12}	1.10	0.90	1.00	0.1426	0.1046	0.1236	1.11	0.90	1.01
T_{13}	1.20	0.92	1.06	0.1656	0.1236	0.1446	1.21	0.92	1.06
Mean	1.25	0.99	1.10	0.1895	0.1375	0.1635	1.34	1.04	1.19
	S	T	S×T	S	T	S×T	S	T	S×T
S.Ed.	0.01	0.03	0.04	0.0006	0.0015	0.0022	0.01	0.03	0.04
CD(P=0.05)	0.03	0.06	0.09	0.0012	0.0031	0.0044	0.03	0.06	0.09

Plant uptake								
N			P			K		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
1.40	1.10	1.25	0.170	0.120	0.145	1.10	0.90	1.00
2.20	1.90	2.05	0.291	0.242	0.266	1.61	1.71	1.66
2.11	1.80	1.95	0.271	0.232	0.251	1.60	1.70	1.65
2.70	2.30	2.50	0.370	0.291	0.331	2.10	2.00	2.05
1.70	1.40	1.55	0.211	0.150	0.181	1.30	1.10	1.20
1.50	1.30	1.40	0.191	0.131	0.161	1.31	1.00	1.16
1.71	1.50	1.61	0.220	0.172	0.196	1.32	1.30	1.31
2.50	2.10	2.30	0.331	0.280	0.305	2.00	1.90	1.95
2.30	1.91	2.11	0.301	0.271	0.286	1.81	1.80	1.81
2.71	2.50	2.61	0.380	0.320	0.350	2.21	2.20	2.21
1.80	1.70	1.75	0.242	0.183	0.213	1.41	1.40	1.41
1.72	1.51	1.62	0.221	0.182	0.202	1.33	1.31	1.32
2.10	1.71	1.91	0.270	0.210	0.240	1.51	1.50	1.51
2.03	1.74	1.85	0.267	0.214	0.240	1.58	1.52	1.55
S	T	S×T	S	T	S×T	S	T	S×T
0.01	0.03	0.04	0.001	0.003	0.004	1.01	0.03	0.04
0.03	0.06	0.09	0.003	0.006	0.009	0.02	0.07	0.09

Table-7. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on Fe, Mn, Zn, Cu and B brinjal fruit content (mg kg^{-1})

Treatments	Iron			Manganese		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1 – Control	3.009	2.660	2.830	2.840	2.607	2.724
T_2 – PM + $ZnSO_4$ @ 25 kg ha^{-1}	3.035	2.710	2.872	2.864	2.641	2.763
T_3 – PM + Borax @ 10 kg ha^{-1}	3.033	2.700	2.870	2.861	2.705	2.783
T_4 – PM + $ZnSO_4$ @ 25 kg ha^{-1} + PM + Borax @ 10 kg ha^{-1}	3.047	2.684	2.865	2.867	2.648	2.758
T_5 – PM + FS $ZnSO_4$ @ 0.5%	3.010	2.680	2.851	2.843	2.633	2.738
T_6 – PM + FS Borax @ 0.2%	3.050	2.670	2.860	2.845	2.612	2.728
T_7 – PM + FS $ZnSO_4$ @ 0.5% + PM + FS Borax @ 0.2%	3.021	2.682	2.851	2.850	2.621	2.735
T_8 – SPM + $ZnSO_4$ @ 25 kg ha^{-1}	3.041	2.711	2.800	2.863	2.646	2.755
T_9 – SPM + Borax @ 10 kg ha^{-1}	3.035	2.701	2.868	2.865	2.645	2.754
T_{10} – SPM + $ZnSO_4$ @ 25 kg ha^{-1} + SPM + Borax @ 10 kg ha^{-1}	3.049	2.712	2.870	2.869	2.678	2.774
T_{11} – SPM + FS $ZnSO_4$ @ 0.5%	3.020	2.683	2.851	2.856	2.631	2.773
T_{12} – SPM + FS Borax @ 0.2%	3.023	2.690	2.861	2.853	2.627	2.740
T_{13} –SPM + FS $ZnSO_4$ @ 0.5% + SPM + FS Borax @ 0.2%	3.030	2.691	2.862	2.857	2.634	2.745
Mean	3.029	2.690	2.861	2.856	2.640	2.748
	S	T	S×T	S	T	S×T
S.Ed.	0.006	0.016	0.023	0.008	0.022	0.031
CD (P=0.05)	0.013	NS	NS	0.017	NS	NS

Zinc			Copper			Boron		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
1.670	1.479	1.574	1.342	1.223	1.213	5.079	4.319	4.699
1.711	1.512	1.612	1.352	1.149	1.250	5.309	4.729	5.019
1.708	1.511	1.609	1.350	1.147	1.248	5.279	4.679	4.979
1.725	1.730	1.727	1.355	1.158	1.256	5.400	4.829	5.115
1.701	1.505	1.603	1.345	1.141	1.245	5.161	4.429	4.790
1.697	1.503	1.600	1.343	1.139	1.241	5.149	4.389	4.760
1.703	1.506	1.604	1.345	1.142	1.243	5.175	4.479	4.827
1.715	1.515	1.615	1.354	1.153	.253	5.389	4.800	5.094
1.714	1.514	1.614	1.353	1.156	1.254	5.362	4.747	5.054
1.732	1.532	1.632	1.357	1.159	1.257	5.409	4.830	5.119
1.705	1.509	1.607	1.347	1.149	1.245	5.189	4.579	4.884
1.703	1.507	1.605	1.346	1.143	1.244	5.183	4.519	4.851
1.707	1.508	1.606	1.348	1.145	1.247	5.200	4.600	4.900
1.707	1.602	1.654	1.349	1.154	1.251	5.252	4.609	4.930
S	T	S×T	S	T	S×T	S	T	S×T
0.003	0.009	0.013	0.014	0.036	0.052	0.030	0.077	1.109
0.007	0.018	NS	0.029	NS	NS	0.061	0.155	NS

Table-8. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on Fe, Mn, Zn, Cu and B plant content in brinjal (mg kg^{-1})

Treatments	Iron			Manganese		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1 – Control	3.667	3.257	3.462	3.339	3.089	3.214
T_2 – PM + $ZnSO_4$ @ 25 kg ha^{-1}	3.698	3.305	3.502	3.358	3.120	3.239
T_3 – PM + Borax @ 10 kg ha^{-1}	3.697	3.301	3.499	3.357	3.117	3.237
T_4 – PM + $ZnSO_4$ @ 25 kg ha^{-1} + PM + Borax @ 10 kg ha^{-1}	3.706	3.318	3.512	3.367	3.127	3.247
T_5 – PM + FS $ZnSO_4$ @ 0.5%	3.674	3.270	3.472	3.345	3.105	3.225
T_6 – PM + FS Borax @ 0.2%	3.670	3.261	3.466	3.343	3.093	3.218
T_7 – PM + FS $ZnSO_4$ @ 0.5% + PM + FS Borax @ 0.2%	3.669	3.283	3.476	3.346	3.105	3.226
T_8 – SPM + $ZnSO_4$ @ 25 kg ha^{-1}	3.701	3.315	3.508	3.363	3.125	3.244
T_9 – SPM + Borax @ 10 kg ha^{-1}	3.700	3.313	3.507	3.361	3.123	2.242
T_{10} – SPM + $ZnSO_4$ @ 25 kg ha^{-1} + SPM + Borax @ 10 kg ha^{-1}	3.701	3.319	3.509	3.369	3.129	3.249
T_{11} – SPM + FS $ZnSO_4$ @ 0.5%	3.682	3.289	3.485	3.350	3.112	3.231
T_{12} – SPM + FS Borax @ 0.2%	3.679	3.283	3.484	3.347	3.107	3.227
T_{13} –SPM + FS $ZnSO_4$ @ 0.5% + SPM + FS Borax @ 0.2%	3.683	3.297	3.492	3.352	3.114	3.233
Mean	3.687	3.293	3.490	3.370	3.110	3.240
	S	T	S´T	S	T	S´T
S.Ed.	0.007	0.020	0.028	0.007	0.018	0.026
CD (P=0.05)	0.028	NS	NS	0.014	NS	NS

Zinc			Copper			Boron		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
1.719	1.559	1.639	1.428	1.229	1.328	6.579	5.319	5.949
1.784	1.594	1.689	1.440	1.242	1.341	6.809	5.729	6.269
1.780	1.589	1.684	1.439	1.240	1.339	6.900	5.679	6.289
1.819	1.612	1.716	1.447	1.247	1.347	6.929	5.879	6.404
1.747	1.571	1.659	1.431	1.232	1.331	6.662	5.429	6.045
1.738	1.561	1.649	1.429	1.231	1.330	6.649	5.389	6.019
1.749	1.565	1.657	1.433	1.240	1.336	6.574	5.479	6.027
1.809	1.609	1.709	1.445	1.251	1.347	6.889	5.800	6.345
1.789	1.597	1.693	1.443	1.245	1.344	6.859	5.749	6.304
1.764	1.581	1.673	1.436	1.245	1.338	6.909	5.867	6.388
1.839	1.637	1.738	1.449	1.248	1.348	6.692	5.579	6.136
1.760	1.577	1.668	1.434	1.230	1.332	6.687	5.500	6.101
1.769	1.585	1.677	1.437	1.238	1.337	6.700	5.600	6.151
1.843	1.587	1.715	1.430	1.231	1.330	6.756	5.617	6.186
S	T	S´T	S	T	S´T	S	T	S´T
0.003	0.009	0.013	0.003	0.007	0.011	0.014	0.036	0.051
0.007	0.019	NS	0.006	NS	NS	0.028	0.072	NS

Table 9. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on Fe, Mn, Zn, Cu and B brinjal fruit uptake (mg pot^{-1})

Treatments	Iron			Manganese		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1 – Control	0.100	0.070	0.085	0.090	0.060	0.075
T_2 – PM + $ZnSO_4$ @ 25 kg ha^{-1}	0.151	0.130	0.141	0.150	0.110	0.130
T_3 – PM + Borax @ 10 kg ha^{-1}	0.150	0.110	0.130	0.140	0.101	0.121
T_4 – PM + $ZnSO_4$ @ 25 kg ha^{-1} + PM + Borax @ 10 kg ha^{-1}	0.190	0.141	0.165	0.180	0.150	0.165
T_5 – PM + FS $ZnSO_4$ @ 0.5%	0.110	0.080	0.455	0.100	0.080	0.090
T_6 – PM + FS Borax @ 0.2%	0.101	0.071	0.405	0.091	0.070	0.080
T_7 – PM + FS $ZnSO_4$ @ 0.5% + PM + FS Borax @ 0.2%	0.111	0.081	0.461	0.110	0.079	0.094
T_8 – SPM + $ZnSO_4$ @ 25 kg ha^{-1}	0.180	0.141	0.161	0.170	0.140	0.155
T_9 – SPM + Borax @ 10 kg ha^{-1}	0.170	0.140	0.155	0.160	0.130	0.145
T_{10} – SPM + $ZnSO_4$ @ 25 kg ha^{-1} + SPM + Borax @ 10 kg ha^{-1}	0.230	0.180	0.205	0.220	0.190	0.205
T_{11} – SPM + FS $ZnSO_4$ @ 0.5%	0.130	0.091	0.110	0.121	0.090	0.105
T_{12} – SPM + FS Borax @ 0.2%	0.120	0.090	0.105	0.120	0.089	0.105
T_{13} –SPM + FS $ZnSO_4$ @ 0.5% + SPM + FS Borax @ 0.2%	0.131	0.100	0.115	0.130	0.100	0.115
Mean	0.144	0.109	0.127	0.137	0.107	0.122
	S	T	S×T	S	T	S×T
S.Ed.	0.001	0.003	0.004	0.001	0.003	0.005
CD (P=0.05)	0.002	0.006	0.009	0.003	0.007	0.009

Zinc			Copper			Boron		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
0.040	0.039	0.039	0.040	0.030	0.035	0.170	0.120	0.145
0.090	0.062	0.076	0.071	0.050	0.061	0.270	0.191	0.231
0.080	0.061	0.071	0.070	0.045	0.058	0.260	0.190	0.225
0.101	0.080	0.091	0.090	0.061	0.075	0.340	0.241	0.290
0.060	0.050	0.055	0.050	0.040	0.045	0.190	0.140	0.165
0.050	0.041	0.046	0.041	0.031	0.036	0.180	0.130	0.155
0.061	0.051	0.056	0.051	0.041	0.046	0.210	0.141	0.175
0.100	0.071	0.085	0.081	0.060	0.071	0.320	0.240	0.275
0.091	0.070	0.081	0.080	0.051	0.065	0.310	0.230	0.270
0.140	0.090	0.115	0.100	0.080	0.090	0.410	0.310	0.360
0.071	0.053	0.062	0.060	0.043	0.051	0.221	0.160	0.190
0.070	0.052	0.061	0.051	0.042	0.047	0.220	0.140	0.180
0.072	0.060	0.066	0.061	0.044	0.053	0.240	0.170	0.205
0.078	0.060	0.069	0.065	0.048	0.056	0.232	0.185	0.209
S	T	S×T	S	T	S×T	S	T	S×T
0.001	0.003	0.005	0.002	0.006	0.009	0.001	0.003	0.004
0.003	0.007	0.009	0.004	0.12	0.017	0.002	0.007	0.009

Table 10. Effect of Seasoned Pressmud, Poultry manure, zinc sulphate and Borax on Fe, Mn, Zn, Cu and B brinjal plant uptake (mg pot^{-1})

Treatments	Iron			Manganese		
	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
T_1 – Control	0.170	0.120	0.145	0.150	0.120	0.135
T_2 – PM + $ZnSO_4$ @ 25 kg ha^{-1}	0.260	0.220	0.240	0.240	0.210	0.225
T_3 – PM + Borax @ 10 kg ha^{-1}	0.250	0.210	0.230	0.230	0.200	0.215
T_4 – PM + $ZnSO_4$ @ 25 kg ha^{-1} + PM + Borax @ 10 kg ha^{-1}	0.330	0.251	0.291	0.289	0.240	0.264
T_5 – PM + FS $ZnSO_4$ @ 0.5%	0.190	0.150	0.170	0.170	0.140	0.155
T_6 – PM + FS Borax @ 0.2%	0.180	0.130	0.155	0.180	0.121	0.151
T_7 – PM + FS $ZnSO_4$ @ 0.5% + PM + FS Borax @ 0.2%	0.191	0.170	0.181	0.181	0.160	0.171
T_8 – SPM + $ZnSO_4$ @ 25 kg ha^{-1}	0.290	0.250	0.270	0.270	0.231	0.251
T_9 – SPM + Borax @ 10 kg ha^{-1}	0.280	0.240	0.260	0.250	0.230	0.240
T_{10} – SPM + $ZnSO_4$ @ 25 kg ha^{-1} + SPM + Borax @ 10 kg ha^{-1}	0.331	0.280	0.305	0.290	0.270	0.280
T_{11} – SPM + FS $ZnSO_4$ @ 0.5%	0.220	0.172	0.196	0.190	0.162	0.176
T_{12} – SPM + FS Borax @ 0.2%	0.192	0.171	0.182	0.181	0.161	0.171
T_{13} –SPM + FS $ZnSO_4$ @ 0.5% + SPM + FS Borax @ 0.2%	0.240	0.180	0.210	0.220	0.180	0.200
Mean	0.240	0.195	0.218	0.219	0.187	0.203
	S	T	S′T	S	T	S′T
S.Ed.	0.001	0.003	0.004	0.001	0.003	0.004
CD (P=0.05)	0.003	0.007	0.009	0.004	0.009	0.012

Zinc			Copper			Boron		
S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean	S_1 (Neutral soil)	S_2 (Coastal saline soil)	Grand mean
0.080	0.060	0.070	0.050	0.030	0.040	0.300	0.210	0.255
0.122	0.120	0.121	0.100	0.081	0.091	0.480	0.380	0.430
0.120	0.110	0.115	0.091	0.080	0.085	0.460	0.360	0.410
0.159	0.130	0.145	0.130	0.092	0.111	0.609	0.450	0.529
0.081	0.070	0.075	0.080	0.060	0.070	0.350	0.240	0.295
0.082	0.061	0.072	0.070	0.040	0.036	0.330	0.220	0.275
0.090	0.080	0.085	0.082	0.061	0.071	0.360	0.279	0.319
0.140	0.122	0.131	0.120	0.091	0.105	0.550	0.430	0.490
0.130	0.121	0.125	0.110	0.090	0.100	0.520	0.420	0.470
0.160	0.140	0.150	0.131	0.110	0.121	0.610	0.490	0.550
0.110	0.090	0.100	0.084	0.063	0.074	0.390	0.290	0.340
0.100	0.081	0.090	0.083	0.062	0.073	0.370	0.280	0.325
0.119	0.100	0.109	0.090	0.070	0.080	0.450	0.330	0.390
0.115	0.098	0.106	0.094	0.071	0.083	0.445	0.337	0.391
S	T	S′T	S	T	S′T	S	T	S′T
0.001	0.003	0.004	0.001	0.003	0.004	0.001	0.003	0.004
0.002	0.007	0.009	0.003	0.007	0.009	0.003	0.006	0.009

energy, photosynthesis enzyme regulation and transplant of carbohydrates. Potassium plays an important role in different mechanisms like protein synthesis, glycolytic enzymes and photosynthesis. Results revealed that when level of poultry manure enhanced NPK content[5].

Likewise pressmud or poultry manure application along with $ZnSO_4$ accelerated NPK content of fruit and plant[39].

Boron soil and foliar application showed high accumulation of NPK content in leaves and fruit (Mohamed Elwan and Elhamahmy, 2015).

The data (Tables-7 and 8) showed that the highest iron fruit content (3.029 mg kg^{-1}) and plant content (3.687 mg kg^{-1}), manganese fruit content (2.856 mg kg^{-1}) and plant content (3.37 mg kgg^{-1}), zinc fruit content (1.707 mg kg^{-1}) and plant content (1.84 mg kg^{-1}), copper fruit content (1.349 mg kg^{-1}), plant content (1.430 mg kg^{-1}), boron fruit content (5.252%) and plant content (6.756%) registered in neutral soil S_1. Among the treatments there is no significant difference for Fe, Mn and Cu fruit and plant content. There is no interaction effect between soil and treatment. The maximum zinc fruit content (1.632%) and plant content (1.738%) were registered in treatment T_{10} (Seasoned pressmud + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1}). This may be due to direct application of zinc at basally helped in increasing its absorption on fruit and plant (Kandali *et al.,* 2021). The concentration of boron content of fruit (5.119%) and plant (6.388%) significantly highest due to application of RDF with borax as soil application (75% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}) in treatment T_{10}. Application of borax significantly enhanced the B concentration in fruit and plant[14].

NPK uptake :

It is observed from the data (Table-6) that the highest fruit N uptake (1.25 g pot^{-1}), P uptake (0.019 g pot^{-1}), K uptake (1.34 g pot^{-1}), plant N uptake (2.03 g pot^{-1}), P uptake (0.267 g pot^{-1}), K uptake (1.58 g pot^{-1}) in S_1 (Neutral soil). The maximum fruit N uptake (1.75 g pot^{-1}), P uptake (0.1895 g pot^{-1}), K uptake (1.90 g pot^{-1}), Plant N uptake (2.61 g pot^{-1}), P uptake (0.35 g pot^{-1}) and K uptake (2.21 g pot^{-1}) in T_{10} (Seasoned presmud + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}).

Among the interaction between soil and treatments higher fruit N uptake (1.9 g pot^{-1}), P uptake (0.3136 g pot^{-1}), K uptake (2.1 g pot^{-1}), plant N uptake (2.71 g pot^{-1}), P uptake (0.38 g pot^{-1}) and K uptake (2.21 g pot^{-1}) is registered in treatment S_1T_{10} (Seasoned pressmud @ 12.5 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} neutral soil).

The increase in uptake of NPK in pressmud amended pots could be attributed to the fact that organic manures after decomposition release the cations, which after becoming available for plant use increase their uptake by the plants. The nutrient uptake directly depends on the yield of the crop and nutrient concentration of the crop. The favourable effect of combination of chemical fertilizer with pressmud may be increased microbial activities which in turn release organic acids to bring

down the soil pH to a range where the availability of plant nutrients are maximum. The results are in conformity of the findings of Sheoran *et al.*[44].

This was closely followed by T_4 (Poultry manure @ + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}) registered fruit NPK uptake (1.50, 0.2606 and 1.560 g pot^{-1}). This might be attributed to greater fruit and plant production as well as nutrient concentration with combined use of organic and inorganic fertilizers. Better performance under these treatments might also be due to favourable soil environment which encouraged better root proliferation and ensured higher nutrient uptake. These results corroborate with the findings of Paul *et al.*[35]. The application of inorganic fertilizers recorded comparatively lower uptake of NPK as compared to integrated use of organic manures and 75% NPK. This might be due to lower supply by available nutrient resulting in lower yield and concentration of NPK in fruit and plant of brinjal. The lowest uptake of NPK of brinjal fruit and plant were recorded in control which may be attributed to lower fruit and plant production in this treatment T_1 - control.

Application of $ZnSO_4$ lead to increase in NPK uptake. The increase in total NPK uptake could be attributed to synergistic effect between N and Zn and due to the positive interaction of K and Zn, respectively[26]. The increased uptake of major nutrients was mainly due to the fact that boron are involved in nitrogen fixation and translocation into plant parts, which might have led to higher dry matter production. The higher nitrogen absorption may also be due to stimulatory effect of boron on nitrogen uptake. The higher P uptake may be due to the solubilization of native phosphorus by the organic acids in addition to applied fertilizers which ultimately resulted in better root growth and increased physiological activity of roots to absorbs more growth phosphorus. Increased K uptake might be due to better plant growth leading to higher uptake of nutrients and further on stimulatory effect of boron in absorption of potassium[37]. Application of $ZnSO_4$ tended to increase the P uptake the uptake of phosphorus was also influenced significantly by zinc sulphate along with inorganics and organic manure application. This favourable effect of $ZnSO_4$ and organic manures maintained a balance between P and Zn uptake for optimum growth[15].

Fe, Mn, Zn, Cu and boron uptake :

The data in Tables-9 and 10 concluded that highest Fe, Mn, Zn, Cu and boron fruit uptake (0.144, 0.137, 0.078, 0.065 and 0.232 mg pot^{-1}) and Fe, Mn, Zn, Cu and B plant uptake (0.24, 0.219, 0.115, 0.094 and 0.445 mg pot^{-1}) was registered in neutral soil (S_1). With regard to treatments the maximum Fe, Mn, Zn, Cu and B fruit uptake (0.205, 0.205, 0.115, 0.09 and 0.36 mg pot^{-1}) and Fe, Mn, Zn, Cu and B plant uptake (0.305, 0.280, 0.15, 0.121 and 0.55 mg pot^{-1}) in treatment T_{10} receiving Seasoned Pressmud @ 25 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}.

Among the interaction between soil and treatments higher Fe, Mn, Zn, Cu and B fruit uptake (0.23, 0.22, 0.14, 0.1 and 0.41 Mg pot^{-1}) in treatment S_1T_{10} (Seasoned pressmud @ 25 t ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} and Fe, Mn, Zn, Cu and B plant

uptake (0.331, 0.290, 0.160, 0.131 and 0.610 Mg pot^{-1}).

Application of Pressmud application recorded highest micronutrient uptake. Regarding the effect of pressmud application on micro-nutrient uptake as a result of addition of Pressmud and chemical fertilizers might be due to improvement in root proliferation and increase nutrient concentration in soil. This was also confirmed by Arunkumar *et al.*[8].

Poultry manure influenced growth parameters significantly and this could be attributed to the ability of poultry manure in supplying nutrient and organic matter to the soil and improving the soil physical and chemical properties and nutrient status. Their results showed that poultry manure application increased uptake of Fe, Mn, Zn and Cu by brinjal crop. Poultry manure improved soil nutrient contents led to increased uptake of nutrients. The increased availability of micronutrients Fe, Mn, Zn and Cu attribute to reduced soil pH[24].

Application of zinc sulphate in combination with organic manure resulted in higher uptake of zinc. The higher dry matter production as discussed earlier owing dominant role played by zinc in improving the photosynthetic ability and assimilating capacity of crop by being a component in various enzymatic and other biochemical reactions. This might be due to increase in zinc availability because of availability of macronutrients and micronutrients to the plant. The increased efficiency of applied zinc sulphate contributing to zinc uptake in zinc deficient soils. This promotes less binding through for formation of ternary complexes[41].

Application of organic manure with NPK and boron resulted in more boron uptake. This may be probably due to increase in availability and absorption of boron, when boron was applied to deficit soil in the nutrient. The increased uptake might have increased the yield[43].

From the above results, it may be concluded that application of seasoned pressmud @ 25 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1} in neutral soil performed the best for enhancing fruit and plant yield, NPK, Fe, Mn, Zn, Cu, B uptake (both fruit and plant).

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References :

1. Abbasi, G.H., Anwarul Haq, Moazzam Jamil Muhammad Anwar Ul Haq, Shafaqat Ali, Maqshoof ahmad, Fakhar Ul Zaman, Akhatar, Ifaz ahmad, Hamid Nawaz Khan and Muhammad Alikhad. (2014). Enhancement of maize production. *Journal of Pure and Applied Sciences, -24*(1-2): 7-16.
2. Abdul Fatah Soomro, Shamasuddin Tunio, Fateh Chand Oad, Inaitullah Raijpen, Mohammad Iqbal, Khuro and Mohammad Younis Arain. (2012). *International Journal of Scientific and Engineering Research, 3*(10): 1-9.
3. Allah Wasaya, Muhammad Shahzad Shabir, Mubshar Hussain, Muhammad

Ansar, Ahsan Aziz, Waseem Hassan and Ijaz Ahmad. (2017). *Journal of Soil Science and Plant Nutrition, 17*(1): 33-45.

4. Altaf Kunton, C.T. Subbarayappa, P.K. Basavoraj and G.K. Mukunda. (2021). *Journal of Indian Society of Soil Science, 69*(2): 203-209.
5. Amir Aziz, Bilal Ahmad Khan, Mukkram Ali Tahir, Muhammad Ali Nadeem, Muhammad ather Nadee, Muhammad Mohsin Amir, Qura-Tul-Ain, Muhammad Adnan, Nadeen Munawar, Ali Hussain Muhammad Khisham, Muhammad Danish Toor and Mehwish Sultan. (2020). *International Journal of Botany Studies, 5*(3): 401-406.
6. Arshad Nawaz Choudhary, Muhammad Shakin Farooq Muhammad Zeesham. (2017). *Advances in Crop Science and Technology, 5*(3): 1-6.
7. Arumugam Shakila and A. Anburani. (2008). *The Asian Journal of Horticulture, 3*(2): 273-276.
8. Arunkumar, S. Kamini Kumari and K. Arivazhagan. (2022). *Research Square, 7*(4): 575-583.
9. Bouyoucos, G.J. (1962). *Agronomy Journal, 54:* 464-465.
10. Bower, C.A. and L.Y. Wilcoz. (1965). Soluble salts. *In:* Black, C.A. *et al.* Methods of Soil Analysis. American Society of Agronomy, Madison, pp. 933-940.
11. Chapman, H.D. (1965). Cation-Exchange Capacity, A.G. Norman https://doi.org/ 10.2134/ agron.monogr9.216.
12. Chitdeshwari, T., R. Santhi, K. Radhika, S. Sivagnanam, S. Hemalatha, Pradeep Dey and A. Subba Rao. (2017). *Madras Agricultural Journal, 104*(7-9): 251-257.
13. Crop Production Guide Agriculture (2020). Directorate of Agriculture, Chepauk, Chennai 600 005 and Tamil Nadu Agricultural University, Coimbatore 641003.
14. Davis, J.M., D.C. Sanders, P.V. Nelson, C. Ling Midc and W.J. Sperry. (2003). *Journal of the American Society for Horticultural Science, 128:* 441-446.
15. Devendra Singh and Harendra Singh. (2012). *Annals of Plant Soil Research, 14*(1): 71-74.
16. Elayaraja, D. (2018). *Multilogic Science, 8*(7): 132-137.
17. Gugsuloth Priyanka, Banoth Murali-Krishna, H. Saikumar, Ramavath Sunilkumar and Joy Dawson. (2022). *The Pharma Innovation Journal, 11*(3): 1679-1682.
18. Gurmani, A.R., J.U. Dur, S.U. Khan, R. Andaleep, K. Waseem, A. Khan and Hadyat Ullah. (2012). *International Journal of Agricultural Biology, 14:* 91-96.
19. Hanway, J.J. and H. Heidal. (1952). *Iowa State College of Agriculture Bulletin, 57:* 1-31.
20. Hatcher, J.T. and L.Y. Wilcox. (1950). *Analytical Chemistry, 22*(4): 567-569.
21. Horticulture Statistics Division. (2021). 2nd Advance estimates.
22. Hou, Y.H., V. Hu, W. Yan, S. Zhang and L. Niu. (2013). *Agricultural Science, 4*(5B): 31-34.
23. Jackson, M.L. (1973). Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi.
24. Jamal Saeed Ahmed Deryque, Kamal

Abdel Salam, Abdel Kader, and Hasan Bendres Albaba. (2016). *Plant IOSR Journal of Agricultural and Veterinary Science, 9*(11): 12-18.

25. Kailash Sati, Manoj Rashow, Pooja Pandey, Umesh Chandra Sati and Lavlesh. (2018). *Journal of Pharmacognosy and Physiochemistry, 7*(2): 1825-1828.
26. Keram, K.S., B.L. Sharma and S.D. Sawakar. (2012). *International Journal of Science, Environment, 1*(5): 563-571.
27. Kumar, S., R.S. Meena, D. Jinger, H.S. Jatav and T. Banjara. (2017). *International Journal of Chemical Studies, 5*(2): 384-389.
28. Lindsay, W.L. and W.A. Norvell. (1978). *Soil Science Society of America Journal, 42:* 421-428.
29. Monika Peddapuli, B. Venkateswarlu and V. Sai Surya Gowthami. (2022). *Biological Forum–An International Journal, 14*(1): 1456-1461.
30. Narayan, S., R.H. Kanth, R. Narayan, F.A. Khan and S.V. Rehman (2015). *Potato Journal, 40:* 84-86.
31. Negim, O., A. Mustafa and H.A.Fouad. (2016). *Journal of Soil Science and Agricultural Engineering Mansoura University, 7*(8): 557-563.
32. Nikita Devi, L., Nongthomban Surbala Devi, Athokpam Herojit Singh Jankhosin Lhungduia and N. Gopimohan Singh. (2021). *The Pharma Innovation Journal, 10*(10): 353-356.
33. Olsen, S.R., C.V. Cole, F.S. Watanabe and L.A. Dean. (1954). Estimation of available phosphorus in soils by extraction with $NaHCO_3$, Circular, Washington, DC: US Department of Agriculture, Vol. 939, p. 19.
34. Page, A.L., R.H. Miller and D.R. Keeney. (1982). Methods of soil analysis. Part 2. Chemical and microbiological properties American Society of Agronomy, Soil Science Society of American Madison, Wisconsin, USA.
35. Paul, O.J., O.O. Frank and A.E. Ambrose (2017). *Journal of Agriculture and Rural Research, 1*(2): 112-117.
36. Premsekhar, M. and V. Rajashree. (2009). *American Eurasian Journal of Sustainable Agriculture, 3*(1): 6-8.
37. Radhika, K. and S. Meena. (2021). *The Pharma Innovation Journal, 10*(2): 541-546.
38. Rafia Md. Shiponmiah Hasan Taheri, M.d. Golam Rabbani and M.D. Abdur Rahim. (2020). *European Journal of Agriculture and Food Science, 2*(4): 1-4.
39. Rajkumar, J.P. Tiwari, Shant Lal, Mohit Kumar, Anshuman Singh and Ashwini Kumar. (2017). *International Journal of Current Microbiology and Applied Sciences, 6*(6): 1991-2002.
40. Rama Devi, B., Vikram Singh, Dhanajay Tiwari, M. Sudhakar and M. Rakesh. (2021). *Biological Forum–An International Journal, 13*(3): 402-406.
41. Ramiro Racena, Ana M. Garcia-Lopez and Antonio Delgado. (2021). *Agronomy, 11*(390): 1-12.
42. Renu Kumari, Sanjay Singh, Meena Goswami, Vikas Pathak and Vivek Sahu. (2022). Poultry manure composting : An innovative approach to waste management.
43. Shanoor Nadaf and H.T. Chandranath. (2019). *International Journal of Current Microbiology and Applied Sciences,*

8(6): 2490-2495.

44. Sheoran, S., D. Raj, R.S. Antil, V.S. Mor and D.S. Dahiya (2017). *Cereal Research Communications, 45*(2): 315-325.
45. Singh, M.V. (2012). Spread of micronutrient deficiencies specially boron in India and response of field crop. Brain storming workshop on soil test based nutrient including boron and other micronutrients organized by ICRISAT-Agriculture Directorate, Karnataka-Rio Tinto India at Bangalore, India.
46. Soil Survey Manual. (1993). Soil Survey Division Staff, Published by United States Department of Agriculture.
47. Subbiah, B.V. and Asija, G.L. (1956). *Current Science, 25:* 259-260.
48. Sunilkumar, R.S. Meena, Dinesh Jinger, H.S. Jadav and Tejram Banjara. (2017). *International Journal of Chemical Studies, 5*(2): 384-389.
49. Walkley, A. and C.A. Black, (1934). *Soil Science, 37:* 29-38.