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Effect of Spraying With Bread Yeast Suspension and The Addition of NPK+(TE) on The Chemical Content of The Leaves of Tamarind Young Plants (*Tamarindus indica* L.)

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Abstract

The experiment was carried out during the spring season from 1/3/2019 to 1/9/2019, to study the effect of foliar spraying with a suspension of bread yeast at concentrations 0.0, 2.5, 5.0 and 7.5 g.L⁻¹, and the addition of the compound chemical fertilizer NPK+Trace Elements(TE)20-20-20 for soil with three levels (0.0, 0.5 and 1.0 g.plant⁻¹) and their interactions in the chemical content of the leaves of two years old tamarind young plants. The research was carried out as a factorial experiment (4×3) according to the randomized complete block design (RCBD) with three replications. The indicators of the study showed that the foliar spraying with bread yeast suspension led to an improvement in most of the studied traits of tamarind young plants and the foliar spraying treatment with a concentration of 7.5 g.L⁻¹ excelled in achieving the best results in comparison with the control treatment of nitrogen, phosphorous, potassium and protein content in the tamarind young plants leaves. Total chlorophyll and carotene, yeast did not have any significant effect in any of the concentrations in the experiment. The compound chemical fertilizer NPK+Trace Elements improved all the studied characteristics of tamarind young plants, and the treatment at the level 0.5 g.plant⁻¹. While the concentration of one g.plant⁻¹ was superior in recording a significant increase of potassium concentration in the leaves. Whereas, the interaction between foliar spraying with bread yeast suspension and the addition of the neutral chemical fertilizer NPK+Trace Elements showed a significant effect in most of the studied traits, where the treatment was superior to 7.5 g.L⁻¹ yeast and 0.5 g.plant⁻¹ neutral fertilizer in recording the highest content in leaves of element N and protein in the leaves, while the treatment recorded 7.5 g.L⁻¹ yeast and 0g.plant⁻¹ neutral fertilizer was superior in the percentage of phosphorous, while the concentrations 7.5 g.L⁻¹ yeast and 1g.plant⁻¹. Neutral fertilizer were superior in percentage of Potassium in the leaves of tamarind young plants achieved a concentration of 0.0 g.L⁻¹ yeast and 0.5g.plant⁻¹ neutral fertilizer an outperformance in the leaf content of total chlorophyll while the treatment recorded 5 g.L⁻¹ yeast and 0 g.plant⁻¹ neutral fertilizer was superior in the percentage of carotene.

Keywords: Tamarind, *Tamarindus indica* L., Yeast, NPK+TE.

1. Introduction

The tamarind plant (*Tamarindus indica* L.) is a large evergreen tree with a height of about (25-30) meters. The leaf is feathery, compound and consisting of (9-12) pairs of leaves. The plant follows the order of the folate (Fabales family). Legumes Fabaceas Tribe Detarieae Genus *Tamarindus* Type *indica* [1]. The tamarind plant is known by several names, the most important of which is Humor or Al-Aradib. The foreign names are derived from the common name Tamarind, in France called Tamarindier, in Spain it is called Tamarindo, in Italy it is called Samandpalizio and in India it is called Ambli or Tamarind [2]. The tamarind plant contains many compounds that made it a highly effective food and therapeutic substance for humans, such as proteins, carbohydrates, pectins, fats, sugars and mineral elements. In addition, it contains therapeutic and medical compounds such as phenols and alkaloids, so it is of high nutritional value because its fruits contain 115 calories, 52 gm moisture, 3.10 gm protein, 0.1 gm fat, 5.6 gm fiber, 67.4 gm carbs, 170 mg calcium, 110 gm Phosphorous mine, 10.9 mg iron and 375 mg potassium, in addition to vitamins such as vitamin A 151 IU, thiamine 0.16 mg, riboflavin 0.07 mg, niacin 0.7 mg, ascorbic acid 3.0 mg and tartaric acid 23.8 mg [3]. It is spread in the equator regions such as tropical Africa and India to Caribbean islands and regions of the world with medium and high temperatures and high humidity, such as the Kingdom of Thailand [4].

India ranks first in the cultivation and production of tamarind, at a rate of 300,000 tons annually, with an area of about 58,624 hectares, and the equivalent of 10,200 tons is exported to the world from it to the Gulf countries and Europe [5]. Recently, the



studies have proven that the tamarind plant contains a lot of antibiotics. The antibiotic is capable of annihilating and destroying many different bacterial strains, as well as an effective antacid in the stomach [6].

Natural extracts are one of the most important materials that have contributed and contribute to the success of the cultivation of many plants. The most important of these natural extracts is the dry yeast extract, which has been considered since ancient times as a substance of high nutritional value as it contains many vitamins, salts, growth regulators and protein, and it has been used in natural fertilization. For plants, it is safe and devoid of any collateral damage in addition to being cheap in price. It has been used in fertilizing many vegetables, leafy crops, fruits and other crops [7,8]. It increases the speed of growth and increases the number of leaves and branches, as in oranges, apples, peaches and pears. Nitrogen can also be obtained from them, which is one of the most important elements that positively affect the growth and development of plants [9].

The addition of neutral fertilizer NPK+Trace Elements is ideal for preparing the plant with what it needs of these important elements, as it is constantly exposed to soil loss as a result of continuous washing, the soil had to be prepared with it to compensate for the lost. Phosphorous is a cofactor with nitrogen in the synthesis of nucleic acids necessary for making protein. It is also included in the synthesis of enzymatic chaperones such as (FAD, NADP, NAD) and energy compounds (ATP, GTP, CTP), which are essential in the supply of energy for all living cells [10,11]. Potassium contributes to regulating the osmotic effort and increasing the endurance of plants to different stress conditions [12,13].

In view of the importance of extracts and compound fertilizers as they contain initiators or activators of plant hormones, growth materials and major and minor elements important in plant growth and development [14]. The importance of the tamarind plant economically and medically, this study aimed to test the effect of foliar spraying with yeast suspension and addition Neutral chemical fertilizer NPK+TE20-20-20 and the interaction between them on the chemical content of tamarind young plants leaves.

2. Materials and Methods

The experiment was carried out during the spring season 2019 in the Lathhouse of the Agricultural Research Station / College of Agriculture / University of Basra. The experiment was conducted for the period from 1/3/2019 to 1/9/2019. Two years old tamarind young plants were brought and transferred from commercial bags to special plastic containers with a capacity of 12 kg containing peat moss and fine sand (dari) at a rate of 1:2 in 1/3/2019. The process of sterilizing the potting soil was carried out using the systemic fungicide Robin (granular pesticide - active substance Metalaxyl 5% G) at a rate of 10 g/pot and the systemic insecticide Rifadan (granular nematode- active substance , Carbofuran 10% G) at a rate of 2 g/ A potted plant and mixed with the soil. Random samples were taken from the agricultural soil and analyzed in the laboratory of the Department of Soil and Water Resources, College of Agriculture, University of Basra Table (1) represents some of the physical and chemical properties of agricultural soil.

After the completion of the transfer process to the pots for the experiment, the necessary service operations were carried out, including hoeing, weeding, and controlling insect and disease infections on a regular basis.

Table 1. Some chemical and physical properties of agricultural soil.

Measurement type	The value	Unit
EC (1:1)	3.18	ds.m ⁻¹
PH (1:1)	6.11	-
Organic matter	3.110	%
CaCO ₃	109.07	gm.kg ⁻¹
Ready Elements		
N	34.20	mg.kg ⁻¹
P	8.20	mg.kg ⁻¹
K	215.3	mg.kg ⁻¹
Soil Separators		
Clay	67.0	gm.kg ⁻¹
Loam	110.0	gm.kg ⁻¹
Sand	823.0	gm.kg ⁻¹
Soil Texture	Sandy Loam	

Table 2. Physical and chemical characteristics of the peat moss used in the experiment.

Measurement type	The value	Unit
pH	1:1	6.0 – 5.0
Organic matter	%	80
Total Nitrogen	Mg.L ⁻¹	170
Ready-made Phosphorous	Mg.L ⁻¹	190
Ready-made Potassium	Mg.L ⁻¹	215

According to the manufacturer.

2.1. Preparation of the suspension of dry bread yeast

Turkish-origin bread yeast was used and the required concentrations were prepared by dissolving (2.5, 5.0 and 7.5 g) in a liter of distilled water, while the control plants were treated with distilled water only, and sugar was added at a ratio (1:1) and left for (24 hours) This is for the purpose of activating and multiplying the yeast (20).(48).Table (3) shows the most important components of dry bread yeast used in the experiment.

Table 3. Analysis of the dry yeast bread used in the experiment.

No	Metallic composition	Quantity	No	Amino acids (mg/kg)	
1	N	23,20 mg.gm ⁻¹	1	Lysine	5,800
2	P	26,21 mg.gm ⁻¹	2	Histidine	7,600
3	K	20,47 mg.gm ⁻¹	3	Phenyl alanine	19,900
4	Mg	2,160 mg.gm ⁻¹	4	Methionine	4,200
5	Fe	0,036 µg/g	5	Cystine	21,600
6	Zn	0,210 µg/g	6	Glycine	7,810
7	Cu	0,015 µg/g	7	Glutamic	21,600
8	Se	7,800 µg/g	8	Aspartic	16,900
No	Other Elements		9	Threonine	14,300
1	glycyrrhizin	% 3,093	10	Arginine	1,200
2	sucrose	% 1,570			
3	glucose	% 3,841			
4	Gibberellins	0,620			

2.2. Preparation of the compound chemical fertilizer NPK+TE

The chemical fertilizer complex NPK+TE 20-20-20 was used through direct addition of pots soil to two-year-old tamarind young plants at three levels (0,0.5and 1)g. The Dutch brand was called Agrimel, and the control plants were not given fertilizer at all.

Table 4. The contents of the neutral compound fertilizer NPK+TE 20-20-20.

Macro Elements NPK	Content
Total Nitrogen(N)	20%
Water Soluble Phosphorus(P ₂ O ₅)	20%
Water Soluble Potassium(K ₂ O)	20%
Trace Elements Content(TE)	Ppm
Iron(Fe)	260
Copper(Cu)	75
Manganese(Mn)	320
Zinc(Zn)	230
Boron(B)	100
Molybdenum(Mo)	10

About the manufacturer Melspring International.

The experiment included a study of two factors. The first factor was foliar spraying with bread yeast suspension at concentrations of 0.0, 2.5, 5.0 and 7.5 g.L⁻¹, respectively, The spraying with distilled water as a control treatment. The plants were sprayed with yeast suspension once every 10 days of the experiment. As for the second factor, it represented the addition of the neutral chemical fertilizer NPK+TE20-20-20 to the soil at three levels:0.0 , 0.5 and 1.0 g.plant⁻¹. Once every 10 days of the experiment, alternating with the yeast suspension. Drops of diffuser (Tween20) were added with the spray solution to the yeast suspension. The plants were sprayed with the above concentrations of yeast suspension until completely wet using a hand sprayer. The research was carried out as a factorial experiment (4×3) according to the Randomized Complete Block Design (RCBD) and with three replications the data were analyzed according to the statistical program Genstat ,(2012) and the arithmetic averages were compared using the least significant difference test at the probability level of 0.05 [15].

The experiment included 36 experimental units, in each experimental unit 3 pots in each pot of one plant. Thus, the number of experimental plants were 108. Dry and ground plant samples of leaves were digested according to the method of [16]. The contents of the leaves were measured from the chemical elements, which are the percentage of nitrogen, which was estimated in the leaves of tamarind young plants according to the method described by [17], by using Micro Kjeldahl device, the percentage of phosphorus, which was estimated by the yellow color method in the leaves of tamarind young plants, according to the method described by [18]. Potassium was estimated by the flame-photometer, according to the method of [19].

The content of leaves of chlorophyll and total carotene was estimated in the green leaves of tamarind young plants at the end of the treatment period according to [20] method by extracting chlorophyll from mature leaf samples using acetone solvent 80%. The content of carotene in tamarind young plants was also estimated by the same method. The chlorophyll was extracted and the content was measured by a spectrophotometer at a wavelength of 480nm. The total protein concentration in the leaves was calculated based on their nitrogen content according to [21].

3. Results

Table results indicate (5) showed that all concentrations of yeast suspension led to a significant increase in most of the studied traits compared to the control treatment. The treatment of tamarind young plants with bread yeast suspension sprinkled on the leaves at a concentration of 7.5 g.L⁻¹ led to obtaining the highest percentage of nitrogen in tamarind young plants 3.183%, which was significantly superior to the control treatment 3.026%. It is clear from the table the effect of the treatment with a suspension of bread yeast at a concentration of 7.5 g.L⁻¹ spray on the leaves, which achieved the highest percentage of phosphorus in the leaves of tamarind young plants 0.204%, which it significantly outperformed the control treatment 0.171%. It is noted from the table that the treatment with a suspension of bread yeast sprinkled on the leaves of tamarind young plants led to a significant increase in potassium when treated with a concentration of 7.5 g.L⁻¹, which achieved the highest percentage of potassium for tamarind young plants reached 1.979% over the treatment 2.5g.L⁻¹ was 1.803%, and the control treatment amounted to 1.871%.

Yeast treatment was not significant difference in the concentration of chlorophyll in the leaves, control 9.359 mg.g⁻¹ fresh weight when spraying with bread yeast suspension, as well as the treatment 2.5 g.L⁻¹ reached 9.081 mg.g⁻¹ fresh weight, which it significantly outperformed the rest. other transactions. The treatment of spraying with bread yeast suspension led to the superiority of the control treatment 2.875 mg.g⁻¹ fresh weight over the rest of the other treatments in the content of carotene in the leaves. The treatment with a concentration of 7.5 g.L⁻¹ when treated with a suspension of bread yeast sprinkled on the leaves, which achieved the highest percentage of total protein in tamarind young plants, which amounted to 19.89% significantly compared to the control treatment 18.91%.

Table 5. Effect of foliar spraying with yeast suspension on the chemical content of leaves of tamarind young plants.

Yeast suspension	Effect of yeast suspension .g.L ⁻¹					
	N(%)	P(%)	K(%)	Total chlorophyll concentration (mg.gm ⁻¹ fresh weight)	Carotene concentration (mg.gm ⁻¹ fresh weight)	Protein(%)
0	3.026	0.171	1.871	9.359	2.875	18.91
2.5	3.134	0.171	1.803	9.081	2.861	19.59
5	3.154	0.184	1.851	8.867	2.749	19.71
7.5	3.183	0.204	1.979	8.839	2.739	19.89
LSD 0.05	0.172	0.021	0.181	0.481	0.359	1.08

The treatment of adding the neutral chemical fertilizer NPK+TE, the results of Table (6) showed that all treatments of adding fertilizer to the soil led to a significant increase in the nitrogen content of the leaves compared to the comparison treatment, the fertilizer treatment showed the significantly superiority of the treatment with concentration 0.5 g.plant⁻¹ amounted 3.256% on the control treatment reached 2.947%. Concerning of the effect on the percentage of phosphorus in the leaves of tamarind young plants, it showed non-significant differences between them, where the highest percentage was 0.189% in leaves were treated with concentration of 0.5 g.plant⁻¹.

The same table indicates the effect of adding the neutral chemical fertilizer NPK+TE to the soil on the percentage of potassium in the leaves of tamarind young plants, where the treatment with the concentration of 1 g.plant⁻¹, which it achieved a significant increase of 1.970% over the control treatment, which amounted to 1.702 %. Total chlorophyll content of tamarind young plants in the leaves, where the treatment with concentration 0.5 g.plant⁻¹ was superior reached 9.224 mg.g⁻¹ fresh weight it was significant over all other treatments and the control treatment which amounted to 9.146 mg.g⁻¹ fresh weight. While, adding neutral chemical fertilizer NPK+TE to the soil on the carotene content of leaves in tamarind young plants in control treatment 2.941 mg.g⁻¹ fresh weight over the rest of the other treatments in addition. The same table shows the effect of adding neutral chemical fertilizer NPK+TE to the soil on the percentage of total protein of tamarind young plants, where the treatment with concentration 1 g.plant⁻¹ which amounted to 19.71% it was significantly on the control treatment 18.91%.

Table 6. Effect of adding NPK + TE chemical fertilizer on the chemical content of tamarind seedling leaves.

The effect of neutral fertilizer NPK + TE 20-20-20.gm.plant ⁻¹							
NPK+TE	N(%)	P(%)	K(%)	Total chlorophyll concentration (mg.gm ⁻¹ fresh weight)	Carotene concentration (mg.gm ⁻¹ fresh weight)	Protein(%)	
0	2.947	0.184	1.702	9.146	2.941	18.91	
0.5	3.256	0.189	1.956	9.224	2.820	19.59	
1	3.169	0.174	1.970	8.739	2.658	19.71	
LSD 0.05	0.149	0.026	0.157	0.417	0.311	0.93	

The Table (7) showed the effect of the interaction between foliar spraying with yeast suspension and the addition of neutral chemical fertilizer to the soil a significant increase in all studied traits. The percentage of nitrogen in the leaves of tamarind young plants was superior to the treatment with concentration 7.5 g.L⁻¹ yeast and 0.5 g.plant⁻¹ fertilizer, which achieved significantly the highest percentage of nitrogen in tamarind young plants reached 3.401% over the control treatment 2.887%. The same table shows the percentage of phosphorus in the leaves of tamarind young plants, at a concentration of 7.5g.L⁻¹ yeast and 0.0 g.plant⁻¹ fertilizer, which achieved the highest percentage of phosphorous in tamarind young plants, which amounted to 0.227%, which it significantly outperformed the treatment 0 g.L⁻¹ yeast and 1.0 g.plant⁻¹ fertilizer reached 0.142 %,in addition to the control treatment, which amounted to 0.185%.

The treatment with concentrations of 7.5g.L⁻¹ yeast and 1g.plant⁻¹ fertilizer achieved significantly the highest percentage rate of potassium in tamarind young plants, which amounted to 2.092% on the treatment of 5 g.L⁻¹ yeast and 0g.plant⁻¹ fertilizer, which amounted to 1.583%, as well as the control treatment amounted 1.832%. The table also shows total chlorophyll of tamarind young plants, where the treatment with concentrations 0.0 g.L⁻¹ yeast and 0.5 g.plant⁻¹ fertilizer reached 9.677 mg.g⁻¹ fresh weight, which significantly outperformed the all other treatments and the control treatment which amounted to 9.347 mg.g⁻¹ fresh weight.

Carotene content of leaves in tamarind young plants, where the treatment was significantly superior at the concentration 5g.L⁻¹ yeast and 0.0 g.plant⁻¹ fertilizer by 3.079 mg.g⁻¹ fresh weight over the rest of the other treatments and the control treatment which reached 3.015 mg.g⁻¹ fresh weight. It is also noted from the same table the effect of the two interactions of spraying with a suspension of neutral chemical fertilizer NPK+TE to the soil on the percentage of total protein in the leaves of tamarind young plants, where the treatment with concentrations of 7.5 g.L⁻¹ amounted to 21.26% significantly over the control treatment 05%.

Table 7. Interference effect of foliar spraying with yeast suspension and neutral chemical fertilizer on the chemical content of leaves of tamarind seedling.

The effect of the interaction between the yeast suspension g.L^{-1} and the neutral fertilizer gm.plant^{-1} .							
NPK+TE g.plant^{-1}	yeast suspension g.L^{-1}	N(%)	P(%)	K(%)	Total chlorophyll concentration (mg.gm^{-1} fresh weight)	Carotene concentration (mg.gm^{-1} fresh weight)	Protein(%)
0	0	2.887	0.185	1.832	9.347	3.015	18.05
	2.5	2.980	0.158	1.587	9.009	3.060	18.63
	5	3.010	0.168	1.583	9.297	3.079	18.81
	7.5	2.911	0.227	1.807	8.931	2.609	18.19
0.5	0	3.115	0.185	1.977	9.677	2.912	19.47
	2.5	3.232	0.177	1.902	9.345	2.771	20.20
	5	3.278	0.191	1.907	8.891	2.769	20.49
	7.5	3.401	0.202	2.038	8.984	2.828	21.26
1	0	3.074	0.142	1.803	9.054	2.697	19.21
	2.5	3.191	0.178	1.921	8.887	2.754	19.94
	5	3.173	0.193	2.063	8.412	2.399	19.83
	7.5	3.238	0.184	2.092	8.603	2.780	20.23
LSD 0.05		0.299	0.052	0.314	0.833	0.622	1.87

4. Discussion

The results showed that foliar spraying of tamarind young plants with bread yeast suspension had a positive effect on most of the studied traits, where the treatment of spraying with a concentration of 7.5 g.L^{-1} was significantly superior in recording the best results in the leaves' content of nitrogen, phosphorous, potassium and protein. While, yeast concentrations had no significant effect in the concentration of total chlorophyll and carotene. The increase in the studied traits as a result of spraying with a suspension of bread yeast may be due to its content of nutrients and compounds that are quickly absorbed by the leaves in the plant [22], which it enhances the plant's ability to form a strong, large and branched root system. Thus, increases the ability of the plant to absorb, reduce and represent nitrates through the synthesis and activation of enzymes responsible for this reduction process, such as the enzyme nitrate reductase, and this leads to an increase in the accumulation of nitrogen in the tissues of the plant [23]. This result is consistent with the findings of, [24] on Mango plants, [25] on Grape plants and [26] on Apricot plants cultivar (Canino).

The reason for the increase in the concentration of the elements may be attributed to the content of the bread yeast suspension on a large number of nutrients and carbohydrates that enhance the activity of a large amount of enzymes that increase the plant's ability to absorb phosphorous and convert it from the unprepared form to the ready form and direct it to the leaves. This is consistent with what was found by [27] on Date Palm plantsvar. [28] on Ruby Grape plants. The increase in the percentage of protein may be attributed to the fact that the presence of nitrogen in the composition of the yeast suspension leads to an increase in the concentration of protein in the leaves because it is included in its composition [29,30]. Leaves lead to an increase in protein concentration [31]. This result is consistent with the findings of [32] on Olive plants.

The results showed that the addition of the neutral chemical fertilizer NPK+TE had a positive effect on all studied traits, where the treatment 0.5 g.plant^{-1} excelled in recording the best results in the content of nitrogen and phosphorous in leaves and the content of leaves of total chlorophyll, and protein, while the concentration of 1.0 g.plant^{-1} In the leaves content of potassium. The increase in nitrogen concentration may be due to the preparation of this important element of chemical fertilizer, of which nitrogen is one of the most important components, which is ready for the plant and is easy for the plant to absorb by the roots. This is due to the continuous need for it in all the vital processes inside the plant [33,34]. This is consistent with [3] on the Apricot plants, [36] on Apple plants, and [37] on Orange plants.

The presence of phosphorus in the basic composition of this fertilizer may be the most important reasons that lead to an increase in the concentration of phosphorous in the leaves, as it is the most important element in the formation of energy-bearing compounds such as adenosine triphosphate (ATP), which is one of the compounds that contribute to the formation of phosphorus [38]. In addition, the fertilizer itself contains good quantities of this element, which is ready for absorption by the plant. This result is consistent with the findings of [39] on Date Palms and [40] on Cranberry plants.

The reason for the increase in the concentration of potassium may be due to the fact that the fertilizer itself contains quantities of potassium, which is prepared for the plant directly from the soil through the roots, furthermore to the presence of other elements such as zinc, which facilitates the absorption of potassium and makes it ready for the plant, as it absorbs it easily and accumulates in Leaves [41] and this result agrees with what was found by [42] in the Strawberry plant, and [43] on Olive young plants. The increase in the concentration of chlorophyll may be due to the fact that fertilizer originally contains nutrients that are mainly involved in the synthesis of chlorophyll molecule, in addition to the ability of these major and minor elements to stimulate growth in general in the plant, thus increase the green area of the plant, which results in an increase in Chloroplasts that contain large amounts of chlorophyll and this leads to its accumulation in the leaves [44] and these results agree with the findings of [45] in Olive and [46] on Orange plants.

The presence of the major nutrients NPK within the basic composition of these fertilizers enhanced the plant's ability to produce additional amounts of protein, as these elements have the most prominent role in the production and formation of proteins. nitrogen enters the composition of amino and nucleic acids (DNA and RNA). Ready soil, along with the added fertilizer, increases the amount of it absorbed by the plant, and then increases its effect on the protein concentration in the plant [47]. Furthermore, the role of potassium in activating a large number of enzymes and the process of food transport and its role in the conversion of mineral forms nitrogen is absorbed into organic forms, thus increasing the plant's protein content [48]. this is consistent with what [49] mentioned on Date Palm plants Var.(Sayer).

Conclusion

The results of this study concluded that spraying with yeast suspension and the addition of neutral chemical fertilizer led to a noticeable and clear increase in the study indicators. The use of a suspension of bread yeast, especially at concentrations 5.0 and 7.5 g.L⁻¹, which achieved the highest values of nutritional chemical content NPK and chlorophyll content of leaves traits. The addition of neutral chemical fertilizer to the soil, especially at the level of 1.0 g.plant⁻¹, all of this led to raising the indicators of the nutritional status of tamarind plants. This is important to increase the ability of plants to grow and form strong growths capable of withstanding external influences, which leads to high productivity in the future. Therefore, we recommend using yeast suspension sprinkled on the leaves and adding neutral chemical fertilizer to the soil as a fertilizer to tamarind plants in order to improving plant growth and thus obtaining strong and ideal plants for growth.

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