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# TYPE OF APPLICATION DRY YEAST EXTRACT AND POULTRY MANURE ON GROWTH AND YIELD OF POTATO

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## Abstract

Organic fertilizer and dry yeast extract are alternative materials to be applied in agriculture in place of fertilizer synthetic. The study was carried out to evaluate performance of manure organic poultry residuals and type of application dry yeast extract on growth of potato. The experiment use organic poultry litter at 0 (without poultry manure), 1.5, or 3 Mt-ha$^{-1}$ combined with concentrations of: dry yeast extract at 0, 3 or 6 g-L$^{-1}$ which adding to soil or plant spray. The interaction of 3 Mt-ha$^{-1}$ poultry litter in combination with 6 g-L$^{-1}$ dry yeast extract adding to soil produced the plants with the longest stem, most stem, highest chlorophyll level, greatest leaf area, most tuber, heaviest tubers and most marketable and total yield. The interaction of 1.5 Mt-ha$^{-1}$ poultry manure in combination with 6 g-L$^{-1}$ dry yeast extract adding to soil achieved most percent of dry matter, starch and specific gravity tuber. The best response in increase total yield and marketable yield was with 3 Mt-ha$^{-1}$ poultry manure in combination with 6 g-L$^{-1}$ dry yeast extract adding to soil.

***Key words :*** *Solanum tuberosum* L., vegetable improvement, organic manure, dry yeast.

## Introduction

Potato (*Solanum tubersoum* L.) contains vitamin C & B, 15-29% dry matter, 10-25% starch, 1-2% protein, 18 amino acid, and 1% minerals "potassium, phosphors, calcium, magnesium, iron, manganese and iodine" (Boras *et al.,* 2006 ). In Iraq, the cultivated area of potatoes was 43500 hectares with a production of 586,000 tons (Arab Organization for Agricultural Development, 2013). Potato is a heavy feeder, need a high rate of synthetic fertilizer for growth and head yield development (Hassan, 2003). Recently, attention has been paid to the safety of the quality of the food product and food safety, and the pollution of soil and water has increased with residues of synthetic fertilizers and pesticides. It must be find alternative ways to improve yield quality and quantity, limitations can be overcome by using organic matter. Organic matter is a source of many nutrients needed for plant growth and microorganisms, as well as their contribution to the improvement of soil and physical properties. Organic matter contains carbohydrate, proteins, amino acids, and organic humic acids which contribute directly, or indirectly, to plant growth and development (Fartusi, 2003). The dry bread yeast "Saccharomyces cerevisiae" important source of bio-fertilization and so their ability to phosphate storage inside the cell, they also have the ability to produce hormones (Auxins, gibberellin and cytokines), amino acids, sugars and nutrients. Dry yeast and organic matter can be applied to any type of plant, without concern for harmful chemicals. Dry yeast and organic matter increased plant improvement and growth leaf area, macro nutrient content and quality and quantity yield (Sarhan, 2008; Ahmed *et al.,* 2011; Abo-Hanna and Merza, 2012; Khalil, 2015, and Manea, 2014). This study was undertaken to determine effects of Method of adding dry bread yeast extract and poultry manure on growth and yield of potato.

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## Materials and Methods

The experiment was carried out during the spring season of 2017 in Babylon governorate, Iraq to study type of application dry yeast extract and poultry manure on growth and yield of potato. Prior to the start of the experiment, random soil samples were obtained from 0–30-cm soil depth and analyzed at the Department of Horticulture, Faculty of Agriculture, to determine soil physical and chemical properties (Table 1). The sandy loam soil was prepared by disking once. Raised beds, 3 m in length and 0.75 m wide, with four beds per plot, were constructed with 1m between treatments and 2 between block. The treatments were, dry yeast extract solution (0, 3 and 6 gm. $L^{-1}$ ) both were applied to the soil and spraying on the plant and poultry manure (0, 1.5 and 3 Mt·$ha^{-1}$ ). The tuber of class E of the cv. Sylvana (HZPC, Edisonweg , Holland) in soil on 15 Jan. 2017 at a distance of 25 cm between the tuber and the other. The dry yeast extract solution (200 mL/plant) were added to the soil and plant spraying (sprayed with distilled water) in equal splits at 45 days after planting, 1 March 2017, 23 March 2017 and 14 April 2017.

The experiment was arranged in a split plot within a randomized complete block design with dry yeast extract as the main plots and poultry manure treatment as the subplot and with three replications. After the emergence of tuber maturation sixteen plants were tagged and assessed for plant length, number of stems per plant, chlorophyll content (spad), leaf area, percent of dry matter plant, number of marketable tubers, tuber weight, plant yield, total and marketable yield and percent of starch, percent of dry matter tuber and specific gravity tuber.

Data were subjected to analysis of variance using Genstat 2012 (Release 4.23DE, Genstat, copyright Lawes Agricultural Trust, Rothamsted Experiment Station, Hertfordshire, UK). Values significances were tested according, L.S.D at level (0.05)

**Table 1:** Chemical and physical properties of the soil of the experimental site.

| Values | Values unit | Parameter |
|---|---|---|
| 7.5 | - | pH |
| 2.7 | ds/m | Electrical conductivity |
| 1.6 | % | Organic matter |
| 69 | mg/kg | Total N |
| 6.1 | mg/kg | Available P |
| 100 | mg/kg | Exchangeable K |
| 25 | % | clay |
| 21 | % | sand |
| 54 | % | silt |

## Results and Dissuasion

Application dry yeast solution, affected plant length, number of stem, leaf area, chlorophyll and percent of vegetative dry matter. Poultry manure and the interaction affected all measured variables (Table 3). The interaction of 3 Mt-ha-1 poultry manure and 6 gm.$L^{-1}$ dry yeast extract adding to soil produced highest plants, leaf area and percent of vegetative dry matter at 0.01 and 0.05. The 3 Mt-$ha^{-1}$ and 3gm.$L^{-1}$ dry yeast extract adding to soil produced highest numbers of stem and chlorophyll at 0.01 and 0.05 and. The smallest plants, lowest numbers of stem, chlorophyll, leaf area and percent of vegetative dry matter were due to treatment of control without application dry yeast extract and without poultry manure (Table 4).

Number of tuber. tuber weight, plant yield, marketable

**Table 2**: Characteristics of poultry manure and extract dry yeast.

| Dry Yeast Solution | Unit | Parameter | Poultry manure | Parameter |
|---|---|---|---|---|
| 23.2 | mg.100$g^{-1}$ dry weight | Carbohydras | 6.5-7 | pH |
| 13.3 | mg.100$g^{-1}$ dry weight | Glucose | | Ec dS'"$m^{-1}$ |
| 3800 | mg.100$g^{-1}$ dry weight | P2O5 | | C % |
| 100 | mg.100$g^{-1}$ dry weight | Ca | 4 | N % |
| 50 | mg.100$g^{-1}$ dry weight | Fe | | C/N % |
| 50 | mg.100$g^{-1}$ dry weight | Cu | 3 | P % |
| 50 | mg.100$g^{-1}$ dry weight | Zn | 4 | K % |
| 5 | mg.100$g^{-1}$ dry weight | Mn | | Ca % |
| 5 | mg.100$g^{-1}$ dry weight | Co | 0.5 | Mg % |
| 2.7 | mg.100$g^{-1}$ dry weight | Thiamine | | Na % |
| 4.3 | mg.100$g^{-1}$ dry weight | Folic Acid | 0.1 | Fe % |
| 2.2 | mg.100$g^{-1}$ dry weight | Vit.B1 | 0.1 | Zn % |
| 1.3 | mg.100$g^{-1}$ dry weight | Vit.B2 | 0.1 | Mn % |
| 1.2 | mg.100$g^{-1}$ dry weight | Vit.B6 | | Cu % |

yield and total yield were affected by application dry yeast and poultry manure. The interaction affected all measured variables (Table 5). The interaction of application dry yeast extract and poultry manure affected all quantity parameters (Table 6); The treatment 3 Mt-ha$^{-1}$ poultry manure and 6 gm.L$^{-1}$ dry yeast extract adding to soil produced the most number of tuber, greatest tuber weight, most plant yield, marketable yield and total yield at 0.01 and 0.05. The smallest number tubers, tuber weight, plant yield and marketable and total yield were due to treatment without poultry manure and without application dry yeast extract (Table 6).

**Table 3:** ANOVA responses due to Application, fertilizer, and their interaction on plant length, number of stem, leaf area, chlorophyll and percent of dry matter plant.

| Source Length | Plant Stem | Number Area | Leaf | Chlorophyll | % Dry Matter Plant |
|---|---|---|---|---|---|
| Applications (A) | ** | ** | ** | ** | ** |
| Manure (M) | ** | ** | ** | * | ** |
| Interaction | | | | | |
| A × M | ** | ** | ** | ** | ** |

ns, *, ** not significant or significant at P<0.05 of P<0.01, ANOVA.

**Table 4:** Interaction effect due to fertilizer and application on plant length, number stem, leaf area, chlorophyll and percent dry matter plant.

| Fertilizer (Mt-ha$^{-1}$) × | Applied | Plant Length (cm) | Number Stem. plant$^{-1}$ | Leaf Area (cm$^2$) | Chlorophyll (spad) | Dry Matter Vegetative (%) |
|---|---|---|---|---|---|---|
| 0 | 0 | 83.3 | 1.33 | 4580 | 35.0 | 15.2 |
| | Spry plant yeast 3g.L$^{-1}$ | 86.0 | 1.42 | 6110 | 42.6 | 16.7 |
| | Spry plant yeast 6g.L$^{-1}$ | 91.5 | 2.10 | 7470 | 41.2 | 17.8 |
| | Soil adding yeast 3g.L$^{-1}$ | 95.6 | 1.55 | 10300 | 41.4 | 18.5 |
| | Soil adding yeast 6g.L$^{-1}$ | 102.6 | 2.10 | 13970 | 43.1 | 19.4 |
| 1.5 | 0 | 88.6 | 1.88 | 5940 | 41.2 | 15.7 |
| | Spry plant yeast 3g.L$^{-1}$ | 95.0 | 1.88 | 7230 | 41.6 | 16.8 |
| | Spry plant yeast 6g.L$^{-1}$ | 96.2 | 1.99 | 10510 | 42.8 | 18.5 |
| | Soil adding yeast 3g.L$^{-1}$ | 101.6 | 2.33 | 12790 | 42.0 | 20.1 |
| | Soil adding yeast 6g.L$^{-1}$ | 105.4 | 2.66 | 15490 | 43.8 | 22.7 |
| 3 | 0 | 92.2 | 1.88 | 7050 | 41.2 | 16.7 |
| | Spry plant yeast 3g.L$^{-1}$ | 94.4 | 2.55 | 9660 | 42.6 | 17.9 |
| | Spry plant yeast 6g.L$^{-1}$ | 96.6 | 2.44 | 12140 | 41.8 | 19.7 |
| | Soil adding yeast 3g.L$^{-1}$ | 100.5 | 2.97 | 16230 | 42.9 | 21.4 |
| | Soil adding yeast 6g.L$^{-1}$ | 105.7 | 2.88 | 20900 | 42.3 | 23.7 |
| L.S.D.0.01 | | 1.80 | 1.07 | 2988 | 6.7 | 1.12 |
| L.S.D.0.05 | | 1.08 | 0.79 | 2215 | 4.8 | 0.83 |

[a] The interaction analyzed with Least Squares Means at the 5% and 1% levels; means separated with LSD.

**Table 5:** ANOVA responses due to Application, fertilizer, and their interaction on number tuber, weight tuber, plant yield, marketable yield and total yield.

| Source | Number Tuber | Weight Tuber | Plant Yield | Marketable Yield | Total Yield |
|---|---|---|---|---|---|
| Applications (A) | ** | ** | ** | ** | ** |
| Manure (M) | ** | ** | ** | ** | ** |
| Interaction | | | | | |
| A × M | ** | ** | ** | ** | ** |

ns, *, ** not significant or significant at P<0.05 of P<0.01, ANOVA.

[a] control: (without poultry manure); poultry manure: 1.5 & 3.0 Mt.ha$^{-1}$.

**Table 6:** Interaction effect due to fertilizer and application on number tuber, weight tuber, plant yield, marketable yield and total yield.

| Fertilizer (Mt-ha$^{-1}$) × | Applied | Number Tuber | Weight Tuber (gm.) | Plant Yield (gm.) | Marketable Yield (ton.ha$^{-1}$) | Total Yield (ton.ha$^{-1}$) |
|---|---|---|---|---|---|---|
| 0 | 0 | 6.9 | 72.0 | 506.7 | 16.9 | 18.0 |
| | Spry plant yeast 3g.L$^{-1}$ | 7.6 | 80.2 | 606.7 | 21.1 | 12.6 |
| | Spry plant dry yeast 6g.L$^{-1}$ | 8.1 | 86.1 | 700.0 | 24.3 | 24.9 |
| | Soil adding yeast 3g.L$^{-1}$ | 9.2 | 89.2 | 826.0 | 28.6 | 39.4 |
| | Soil adding yeast 6g.L$^{-1}$ | 10.0 | 94.3 | 875.0 | 30.2 | 31.1 |
| 1.5 | 0 | 7.2 | 79.0 | 575.0 | 19.1 | 20.4 |
| | Spry plant yeast 3g.L$^{-1}$ | 8.3 | 83.4 | 693.3 | 22.1 | 24.7 |
| | Spry plant yeast 6g.L$^{-1}$ | 9.3 | 93.8 | 876.7 | 27.3 | 31.1 |
| | Soil adding yeast 3g.L$^{-1}$ | 10.4 | 100.6 | 1046.7 | 31.1 | 37.2 |
| | Soil adding yeast 6g.L$^{-1}$ | 11.4 | 118.2 | 1235.0 | 36.6 | 43.9 |
| 3 | 0 | 7.8 | 88.5 | 691.3 | 19.2 | 24.6 |
| | Spry plant yeast 3g.L$^{-1}$ | 8.4 | 95.8 | 811.0 | 23.5 | 28.9 |
| | Spry plant yeast 6g.L$^{-1}$ | 9.7 | 102.36 | 988.3 | 30.7 | 35.1 |
| | Soil adding yeast 3g.L$^{-1}$ | 11.2 | 109.4 | 1234.0 | 34.1 | 43.8 |
| | Soil adding yeast 6g.L$^{-1}$ | 13.0 | 119.7 | 1364.7 | 37.7 | 45.6 |
| L.S.D.0.01 | | 0.70 | 11.3 | 95.9 | 2.4 | 3.4 |
| L.S.D.0.05 | | 0.52 | 8.3 | 69.4 | 1.8 | 2.4 |

[a] The interaction analyzed with Least Squares Means at the 5% and 1% levels; means separated with LSD.

[a] control: (without poultry manure); poultry manure: 1.5 & 3.0 Mt.ha$^{-1}$.

**Table 7:** ANOVA responses due to Application, fertilizer, and their interaction on number tuber.

| Source | Dry matter | Starch | Specific Gravity Tuber |
|---|---|---|---|
| Applications (A) | ** | ** | ** |
| Manure (M) Interaction | * | * | * |
| A × M | ** | ** | ** |

Weight tuber, plant yield, marketable yield and total yield.

ns, *, ** not significant or significant at P<0.05 of P<0.01, ANOVA.

Application dry yeast extract affected all measured variables; poultry manure affected all measured variables, and the interaction affected all measured variables (Table 7). The interaction of application dry yeast extract and poultry manure affected all quality parameters (Table 8). The highest percent of dry matter, starch and specific gravity tuber were due to treatment with 1.5 Mt'"ha$^{-1}$ poultry and 6 gm.L$^{-1}$ dry yeast extract adding to soil at 0.01 and 0.05. The lowest dry matter, starch and specific gravity were achieved without poultry manure and without application dry yeast (Table 8).

This is due to the superiority of dry yeast extract to in plant length, leaf area, chlorophyll, percent of vegetative dry matter, number of tuber, tuber weight, plant yield and total and marketable yield it is possible the result of yeast extracts components like nutrient, vitamins, etc. Table 2, that stimulated division and extension of cells, growth of plant leaves, and their role in the balance of biological processes within plant tissues (Eata *et al.,* 2001). The positive effect of poultry manure has an important role in improving the physical properties of soil because it increases the degree of granulation of the organic matter with the clay particles and increase their ventilation and due to amounts of nutrition provided to plants and effects on physiological functions within the plant (Tisdale *et al.,* 2003 and Boiteau, 2004). Use of 3 Mt-ha$^{-1}$ poultry in combination with 6 gm.L$^{-1}$ dry yeast extract adding to soil was best for all growth parameters and all yield measured variable. Application of 1.5 Mt-ha$^{-1}$ poultry manure in combination with 6 gm.L$^{-1}$ dry yeast extract adding to soil was best for percent of dry matter, starch and specific gravity tuber.. Highest yield for potato can be carry out provided that optimal poultry manure and dry yeast extract management is followed.

**Table 8:** Interaction effect due to fertilizer and application on number tuber, weight tuber, plant yield, marketable yield and total yield.

| Fertilizer (Mt-ha$^{-1}$) × Applied | | Dry matter Tuber (%) | Starch (%) | Specific Gravity Tuber |
|---|---|---|---|---|
| 0 | 0 | 15.5 | 9.8 | 1.057 |
| | Spry plant yeast 3g.L$^{-1}$ | 18.3 | 12.3 | 1.070 |
| | Spry Plant yeast 6g.L$^{-1}$ | 19.2 | 13.1 | 1.075 |
| | Soil adding yeast 3g.L$^{-1}$ | 20.1 | 13.8 | 1.079 |
| | Soil adding yeast 6g.L$^{-1}$ | 21.1 | 15.0 | 1.081 |
| 1.5 | 0 | 17.4 | 11.5 | 1.066 |
| | Spry plant yeast 3g.L$^{-1}$ | 18.8 | 12.7 | 1.073 |
| | Spry plant yeast 6g.L$^{-1}$ | 19.4 | 13.2 | 1.075 |
| | Soil adding yeast 3g.L$^{-1}$ | 20.4 | 14.1 | 1.080 |
| | Soil adding yeast 6g.L$^{-1}$ | 21.7 | 15.3 | 1.087 |
| 3 | 0 | 16.1 | 10.3 | 1.060 |
| | Spry plant yeast 3g.L$^{-1}$ | 18.1 | 12.1 | 1.070 |
| | Spry plant yeast 6g.L$^{-1}$ | 19.4 | 13.2 | 1.075 |
| | Soil adding yeast 3g.L$^{-1}$ | 20.4 | 14.4 | 1.082 |
| | Soil adding yeast 6g.L$^{-1}$ | 21.3 | 14.9 | 1.085 |
| L.S.D.0.01 | | 1.10 | 0.98 | 0.005 |
| L.S.D.0.05 | | 0.81 | 0.73 | 0.003 |

[a] The interaction analyzed with Least Squares Means at the 5% and 1% levels; means separated with LSD. control: (without poultry manure); poultry manure: 1.5 & 3.0 Mt.ha$^{-1}$

## References


Abo-Hinna, M.A. and T.K. Merza (2012). Effect of Organic Manure, Tuber Weight and Ascorbic Acid Spraying on Some Vegetative Parameters and Marketable Yield of Potato ( *Solanum tuberosum* L. ) Grown in Sandy Soil. *Agri. Sci. Kufa Journal for Agriculture Sciences*, **4 (1):** 15 -29.

Ahmed, A.A., M.M.H. Abd-Baky, M.F. Zaki and F.S. Abd EL-Aal (2011). Effect of active yeast extract and zinc on growth, yield and quality of Potato plant (*Solanum tuberosum* L.). *Journal of Applied Sciences Research*. **7(12):**2479-2488.

Arab Organization for Development and Agriculture (2013). Arab Agricultural Statistics Yearbook. Vol. 33.

Boiteau, G. (2004). Assessing CPB control options and N fertility in organic potato production. New Brunswick Department of Agriculture, Fisheries and Aquaculture Canada Research Chairs Program. WWW.oacc.info.

Boras, M., B. Abu Trabi and I. Al-Basit (2006). Vegetable production. Publications of Damascus University of Agriculture. Syria.

Eata, A.M.H.A.E. Elsayed, H.M. Abd El-Naby, S.I. Gamilly and E.M.M. Salem (2001). Response of some tomato cultivars to natural soil salinity and use of some treatments to reduce salt injury. PhD Diss., Faculty Agriculture, Mansoura University, Mansoura, Egypt.

Fartusi, D.J. (2003). The effect of aqueous extracts of some organic wastes on the growth of wheat,

Genstat (2012). Release 4.23DE, copyright Lawes Agricultural Trust. Rothamsted Experiment Station, Hertfordshire, UK.

Hassan, A.A.M. (2003). Potato. AL Dar AL Arabia, Cairo, The Egyptian Arabic Republic.

Khalil, A.M.S. (2015). Effect of organic fertilizer and dry bread yeast on growth and yield of potato (*Solanum tuberosum* L.). *Journal Agriculture and Food Technology,* **5(1):**5-11.

Manea, A.A. (2014). Effect of organic-mineral fertilizer on the growth and yield of *Solanum tuberosum* L. and sweet maize *Zea mays* var. saccharta under intercropping system. PhD Diss., Technical College, Al-Musaib, Babylon, Iraq.

Sarhan, T.Z. (2008). Effect of bio fertilizers, animal residues and urea in the growth and yield of Potato plant *Solanum tuberosum* L. PhD Diss., Faculty of Agriculture and Forestry, University of Mosul, Mosul, Iraq.

Tisdale, S.L., W.L. Nelson, J.D. Beaton and J.L. Havlin (1993). Soil fertility and fertilizers, 3rd ed., MacMillan Publ., New York.