

# Evaluation the Effects of Humic Acid Foliar Application on Potato Yield

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**Abstract:** The purpose of this research is to investigate the effects of humic acid foliar spraying on potato yield, which was conducted as an experiment in the form of a completely randomized design in three replications at Chahardehi Dopi, on the farm of Mirza Mohammad Qaim Khan Bittani. The use of humic acid was at four levels (0, 30, 40 and 50 ml/l). The results showed that the difference between humic acid levels in terms of yield was significant at the 1% probability level. The highest yield was related to the 50 ml/l humic acid treatment with 3883.46 kg/1000 m<sup>2</sup> and the lowest was in the control treatment with 2912.16 kg/1000 m<sup>2</sup>. According to these results, it is recommended to use a concentration of 50 ml/liter of humic acid compared to other treatments.

**Keywords:** Humic Acid, Organic Fertilizer, Potato, Treatment and Yield.

## I. INTRODUCTION

The potato, by the scientific name (*Solanum tuberosum* L.), which is cultivated in more than 100 countries around the world, is one of the main ingredients of the human diet. Potato is an important raw material for industry. Growing conditions, genetic origin, and aging during postharvest storage can affect quality of potato. The chemical composition of potatoes is of great importance during processing on an industrial scale. Potato compounds such as starch, non-starch polysaccharides and minerals significantly affect the quality of potato and its products. Understanding the chemical structure of potato components is also important for the development of unique or new potato products. Potatoes are one of the most efficient sources of energy and other nutrients, including vitamins and minerals. Considering the great importance of the potato, it is perhaps surprising that very few books have been written about it [1]. A potato tuber is an underground stem that provides an opportunity for the potato plant to reproduce itself vegetative. Domestication by humans and selection as a food item provide for yield and more characteristics suitable for the fresh market and processing. As a result, potato is an extremely rich carbohydrate product [2]. Potato is the fifth agricultural product in the world, which plays an important role as a staple food in Mediterranean countries [3]. Humic acid is known as a nature-friendly organic fertilizer due to the harmful effects of chemical fertilizers on human health and the environment. They are different organic compounds that are extracted from different sources such as soil, humus, peat, oxidized lignite, coal, etc., which differ in molecular size and chemical structure. A very low amount of organic acids leads to an increase in soil fertility by improving the physical, chemical and biological characteristics of the soil [4]. Therefore, the use of natural fertilizers, including humic acid, without damaging the environment, can be very effective in increasing the yield of agricultural plants. Humic acid is a natural organic polymer compound that is formed as a result of the decay of soil organic matter, peat, lignin, etc., which can be used to increase the product and its quality [5]. Humic

acid is a desirable and promising natural resource that can be used as an alternative to chemical fertilizers or to reduce the side effects of chemicals to increase the production of agricultural products [6 - 8].

This organic matter increases the availability of nutrients and, as a result, increases plant growth and yield [9]. Other benefits of humic acid include the chelating properties of food elements (sodium, potassium, magnesium, calcium, iron, copper), etc. [10]. The use of this substance in plants increases the permeability of the cell membrane and facilitates the entry of potassium, which results in an increase in the internal pressure of cells and cell division. On the other hand, the increase in energy inside the cell has led to an increase in the production of chlorophyll and the rate of photosynthesis [11]. Therefore, the current research was conducted to investigate the effects of humic acid foliar application on potato yield.

## II. MATERIALS AND METHOD

This research was carried out in 2024 in Laghman Province, Chahardehi Dopi, on the farm of Mirza Mohammad Qaim Khan Bittani, located in the east of Afghanistan. This research was conducted as an experiment in the form of a randomized complete design in three replications. Humic acid fertilizer and combined components (12% humic acid, 10% potassium and 10% nitrogen) were used at 4 levels (0, 30, 40 and 50 ml/l). When the height of the potato plant reached 25-35 cm, humic acid foliar spraying was done with a manual sprayer. Before planting, the use of chemical fertilizers (NPK) was equally (45 kg/1000m<sup>2</sup>) distributed to all treatments in the field. The plot area of each treatment in each repetition was 1000 m<sup>2</sup> and planted in the form of stacks. It was 5m long and the distance between planting lines (stacks) was 0.5m and the width of the potato seed line was 0.4m. Potato seeds were sown by hand in vesicle and stacks at a density of 1000 m<sup>2</sup> and 280 kg. They were harvested on 9 of June to calculate yield. Harvesting was done when all the leaves turned yellow. To determine the yield first, 2 m<sup>2</sup> were taken from each plot and then weighed. As a result, their sum was considered as the total weight of the treatment in each plot. All the obtained data

was analyzed using (SAS 9.0) software and the average comparison was done based on an LSD test. Also, the process of yield changes was drawn using Excel software.

### III. RESULTS AND DISCUSSION

The results of variance analysis of the effect of humic acid foliar application on potato yield are shown in Table 1. that the treatment showed a significant effect on potato yield at the probability level of 1% (Table 1). The highest yield was related to the effect of 50 ml/l humic acid treatment with 3883.46 kg/1000 m<sup>2</sup> and the lowest was related to the control treatment with 2912.16 kg/1000 m<sup>2</sup> (Figure 1).

TABLE I. Variance analysis of the effect of humic acid foliar application on potato yield trait

Average of Squares Yield	Degrees of Freedom	Sources of Changes
672983.661**	3	Treatment
11.211	8	Test Error
0.092	-	Coefficient of Variation (Percentage)

\* and \*\* are significant at the probability level of 5 and 1 percent, respectively, and ns: non-significant

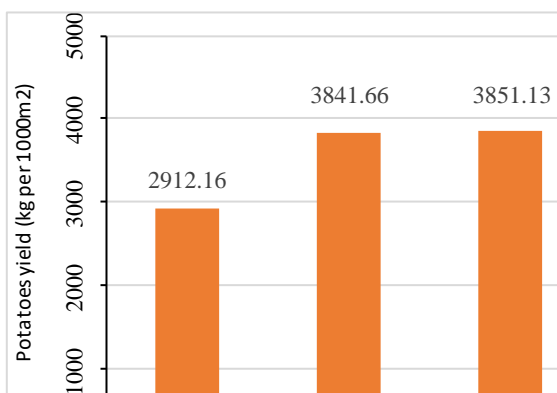


Fig. 1. yield due to foliar application of humic acid in potatoes.

The results of other research also indicate that the use of humic acid in the form of foliar spraying in wheat increased the yield of this plant by 24%, and humic acid increases the photosynthetic activity of the plant by increasing the activity of the Rubisco enzyme [12]. In the experiment of El-Sayed Hameda et al., (2011) [13], it was found that the use of humic substances increased the significance of vegetative traits, tuber performance and its components, including the number of tubers per plant and tuber weight, as well as potato quality characteristics. Humic acid causes the continuation of photosynthesizing tissues and increases the performance of plants, and also increases plant performance through positive physiological effects, including the effect on the metabolism of plant cells and increasing the concentration of leaf chlorophyll [14]. Humic acid creates more space for water penetration through physical modification and improvement of soil granularity. In addition, humic acid molecules form a bond with water molecules, which prevents water evaporation to a large extent [15]. In the study of the effect of humic substances on the chlorophyll content of leaves in wheat, it

was shown that the foliar spray of humic acid and folic acid on wheat leaves caused a significant increase in the chlorophyll content of leaves [16]. The use of humic acid in plants as a foliar spray increases auxin, cytokinin and gibberellin hormones in the plant [17]. This natural substance increases with the increase of soil organic matter, increasing the absorption and availability of nutrients such as nitrogen, potassium, phosphorus, calcium, manganese and iron [18]. Increasing water absorption, increasing the content of chlorophyll and increasing the transfer of photosynthetic materials and reducing the negative effects of environmental stress have improved the growth and yield of various plants [19].

### IV. CONCLUSION

The highest potato yield was related to foliar spraying of humic acid fertilizer at a concentration of 50 ml/l. In general, the use of humic acid can reduce the consumption of chemical fertilizers and reduce environmental pollution, and due to the lower cost of this type of fertilizer, it leads to greater efficiency. Finally, it can be said that the use of humic acid, in addition to increasing the yield of potatoes, can play a significant role in achieving the goals of sustainable agriculture.

### REFERENCES

- [1] Singh, J., Kaur, L., & McCarthy, O. J. Potato starch and its modification. In *Advances in potato chemistry and technology* (pp. 273-318). Academic Press. (2009).
- [2] Brown, C. R. Antioxidants in potato. *American journal of potato research*, 82, 163-172. (2005).
- [3] FAO. (2011). FAO Statistical Database. Production Crops. Rome, Italy, <http://faostat.fao.org/>
- [4] Natesan, R., Kandasamy, S., Thiyageshwari, S., and Boopathy, P.M. Influence of Lignite Humic Acid on the Micronutrient Availability and Yield of Blackgram in an Alfisol. The 18th World Congress of Soil Science, July 9-15, 2007, Philadelphia, Pennsylvania, USA.
- [5] Antoun, L. W. Sahar, M. Zakaria and H. Rafla Influence of compost Nmineral and Humic Acid on yild and chemical composition of Wheat plant. *Journal. Soil Science. And Agriculture. Engineer. Mansoura Univ., Vol.1 (11): 1131-1143.* (2010).
- [6] EL-Desuki, M. Response of onion plants to humic acid and mineral fertilizers application. *Annals of Agri. Sci. Moshtohor., 42: 1995-1964.* (2004).
- [7] Hafez, M.M. Effect of some sources of nitrogen fertilizer and concentration of humic acid on the productivity of squash plant. *Egyptian J. Applied Sci., 19: 293-309.* (2003).
- [8] Hartwigson, J.A., and Evans, M.R. Humic acid seed and substrate treatments promote seedling root development. *Hort Sci., 35: 1231-1233.* (2000).
- [9] Tan, K.H. *Humic Matter in Soil and Environment.* Marcel Dekker, New York (2003).
- [10] Verlinden G, Coussens T, De Vliegheer A, Baert G, Haesaert G, Effect of humic substances on nutrient uptake by herbage and on production and nutritive value of herbage from sown grass pastures. *Grass and Forage Science 65(1), 133-144.* (2010)
- [11] Giasuddin, A. B., Kanel, S. R., & Choi, H. Adsorption of humic acid onto nanoscale zerovalent iron and its effect on arsenic removal. *Environmental science and technology, 41(6), 2022-2027.* (2007). <https://doi.org/10.1021/es0616534>
- [12] Delfine, S, R, Tognetti, E Desiderio, A. Alvino. Effect of foliar application of N and humic acids on growth and yield of durum wheat. *Agron. Sustain. 25, 183- 191.* (2005).
- [13] El-Sayed Hameda EA, Saif-El-Dean A, Ezzat S and El-Morsy AHA. Responses of productivity and quality of sweet potato to phosphorus fertilizer rates and application methods of the humic acid. *International*

- Research Journal of Agricultural Science and Soil Science, 1(9): 383-393. (2011).
- [14] Naderi, S., Pizzeghello, D., Muscolo, A. and Vianello, A. Physiological effects of humic substances on higher plants. *Soil Biology and Biochemistry*, 34: 1527-1536. (2002).
- [15] Seruhan, v., kusvuran, A. and Babat, S. The effect humic acid fertilization on yield and yield componetst performances of common millet (*panicum milaceum L.*) *Science Research Essays* 6(3):663-669. (2011).
- [16] Shalan, M.n. Influence of bio fertilizers and chicken manure on growth, yield and seeds quality of *nigella sativa L.* plants. *Egyptian Journal Agricultural Research*.83 (1):59-69. (2005).
- [17] Tufail, M. K. Nawas, and M. Usman. Impact of Humicacid on the Morphology and Yield of wheat (*Triticum aestivum L.*). *Woeld Applied Sciences Journal* 30(4): 475-480, ISSN 1818-4952. (2014).
- [18] Yuan, T., Ji, J., Wang, J., Sun, X., Yan, J., Wang, Z., & Niu, J. Effect of combined application of humic acid and nitrogen fertilizer on nitrogen uptake, utilization and yield of winter wheat. *Chinese Journal of Eco-Agriculture*, 25(3), 365-372. (2017).
- [19] Haghparast, M., & Maleki Farahani, S. (Effect of water deficit irrigation and natural products on vegetative characteristics of different chickpea (*Cicer arietinum*) varieties. *Iranian Journal of Pulses Research*, 4(2), 77-86. (2013). [In Persian]