Available online at
www.agrospheresmagazine.vitalbiotech.org

ISSN (E): 2582 – 7022

Agrospheres:e- Newsletter, (2023) *4*(2), 8-10

Article ID: 472

Humic and Fulvic Acid for Sustainable Crop Production

Kritika Dogra[1*], Narender K. Sankhyan[2], Pardeep Kumar[3]

[1]Ph.D. Scholar, Department of Soil Science, CSK HPKV, Palampur, HP, India-176062
[2]Head cum Principal scientist, Department of Soil Science, CSK HPKV, Palampur, HP, India-176062
[3]Principal Scientist, Department of Soil Science, CSK HPKV, Palampur, HP, India-176062

*Corresponding Author
Kritika Dogra*

Article History
Received: 2.02.2023
Revised: 7.02.2023
Accepted: 10.02.2023

INTRODUCTION

The global population is rapidly expanding and is expected to reach 9.7 billion by 2050. Such a huge population coupled with increasing food demand is placing unprecedented pressure on all natural resources, including soils. To meet the high food demand owing to rise in population, intensive farming practices are commonly followed in modern day agriculture which have several harmful effects on soil and hence, is not a sustainable way of crop production. Sustainabble crop production refers to improving the agricultural productivity and crop quality while maintainig or enhancing the environmental quality. One of the important aspects of sustainable crop production is keeping the soil alive with organic matter. Humic and fulvic acids are vital constituents and an intimate part of soil organic matter, constituting largest fraction (85-90%) of soil organic matter beside humin.

Humic and fulvic acid

Humic and fulvic acids are formed as a result of humification, which is the second largest organic process on earth after photosynthesis. They are stable end products of decomposition and oxidation of organic matter. Humic and fulvic acids are traditionally defined according to their solubilities. The humic acid constitute the fraction of humic substances that is not soluble in water under acidic conditions (pH <2) but they are soluble at higher pH values. It has dark brown to black colour. Fulvic acid, on the other hand, is the fraction of humic substances that is soluble in water under all the pH conditions and have yellow to brownish-yellow colours. The two groups of molecules differ from each other in terms of degree of polymerization, molecular weight, color, acidity, carbon and oxygen content. The elemental composition of humic and fulvic acids vary as follows: humic acids (37.2-75.8% carbon, 7.9-56.6% oxygen, 1.6-11.7% hydrogen, 0.5-10.5% nitrogen and 0.1-8.3% sulfur) fulvic acids (35.1-75.7% carbon, 16.9-55.8% oxygen, 0.4-7.9% hydrogen, 0.5-8.2% nitrogen and 0.1-3.6% sulfur).

Several functional groups are present in humic and fulvic acids such as carboxylic, hydroxyl (phenolic and alcoholic), carbonyl, and amino groups. Humic and fulvic acid exist naturally in soils, beside soil they are also present in peats, oceans and fresh waters, rocks, coals etc. Leonardite, which is a humidified plant substance is a rich source of humic and fulvic acids. Humic and fulvic acids are soluble in basic medium and hence is used to extract them in liquid form by means of an alkaline substance such as potassium hydroxide. Subsequently, they are passed into an acidic medium in which humic acid precipitate it is insoluble in acidic medium while fulvic acid remain in the liquid phase. Several humic and fulvic acid products derived from different sources are being used in crop production in recent years along with other fertilizers and manures to ensure the sustainability of agriculture production.

Role of humic and fulvic acid for sustainable crop production

The application of humic and fulvic acids in soil improve the physical, chemical and biological properties of the soils which ultimately enhance the crop growth and productivity. They improve soil aggregation, water holding capacity, infiltration rate and water retention in soils. Humic and fulvic acids have greater water holding capacity than clay soils. Humic and fulvic acids can hold seven times as much water as their volume. The dark colour of these materials promotes sunlight absorption, which enhances the thermal characteristics of soils. The application of humic and fulvic acids influence the cation exchange capacity of the soils. Humic and fulvic acids contain several functional groups such as –OH, -COOH, phenolic etc. which allow them to form complexes or chelates with cations such as Ca^{2+}, Mg^{2+}, Fe^{2+} etc. and hence, improve their availability to crops. Application of humic and fulvic acids in soils alter the C:N ratios and makes carbonaceous substrates available to microbes that promotes growth of heterotrophic microbes.

The use of humic and fulvic acids to stimulate crop growth is frequently linked to improved nutrient use efficiency and nutrient cycling as a result of the stimulation of microbial activity. Besides, the humic acid and fulvic acid have been shown to stimulate crop growth in terms of increasing plant height, root growth and dry or fresh weight as well. Since several hormones have been found in the humus structure, the beneficial effects of humic and fulvic acids on root and shoot growth can be attributed to their hormone (auxin) like activities. Humic and fulvic acids assist plants and soils retain more moisture by lowering water evaporation, which also lowers the stomatal opening and enhances stress tolerance. Humic compounds decrease oxidative stress in plants by having a favourable impact on peroxidase activity and proline levels, which lower reactive oxygen species levels within the plant cells.

Apart from enhancing crop growth and productivity, fulvic and humic acids have positive effects on the environment. Their distinctive physicochemical properties (excellent adsorption and ion exchange capacities) enable their use as a successful soil amendments for stabilising potentially toxic elements in soils. Due to their aromatic nature, humic and fulvic acids effectively bind some persistent organic pollutants, such as polycyclic aromatic hydrocarbons. As carbon additives, humic and fulvic acids can also help reduce the issue of carbon dioxide emissions because they have a negative carbon footprint.

CONCLUSION

Humic and fulvic acids are vital constituent and an intimate part of soil organic matter. Several humic and fulvic acid products are being used in crop production in recent years to ensure the sustainability of agriculture production. Humic and fulvic acids ensure sustainable crop production by improving physical, chemical and biological properties of soil. Humic and fulvic acids enhance abiotic stress tolerance, nutrient uptake, foster the

ISSN (E): 2582 – 7022

plant growth and developments and play an important role in maintaining the quality as well as quantity of produce. Humic and fulvic acids have positive effects on plant growth, yield and productivity, paving the way for sustainable agriculture. Beside improving the agricultural production, humic and fulvic acids also play important role in maintaining the environmental quality and hence is a sustainable way of crop production.

REFERENCES

Ampong K, Thilakaranthna MS and Gorim LY. 2022. Understanding the role of humic acids on crop performance and soil health. *Frontiers in Agronomy* DOI: 10.3389/fagro.2022.848621