International Journal of Microbial Science, Volume 2, Issue 1, August 2021, pp.10-12
Available online at https://internationaljournalofmicrobialscience.com/

Synopsis

Sustainable Agronomic Practices: a Hyperaccumulator Plant and its Associated Health Impacts

[1]Mohite P

[1]Department of Biotechnology, Vidya Pratishthan's Arts, Science and Commerce College, Baramati, Maharashtra, India.

Article Info

Article history:
Received: July 30, 2021
Accepted: August 18, 2021
Published: August 21, 2021

Corresponding Author:
Mohite P
Email:pragatimohite22199@gmail.com

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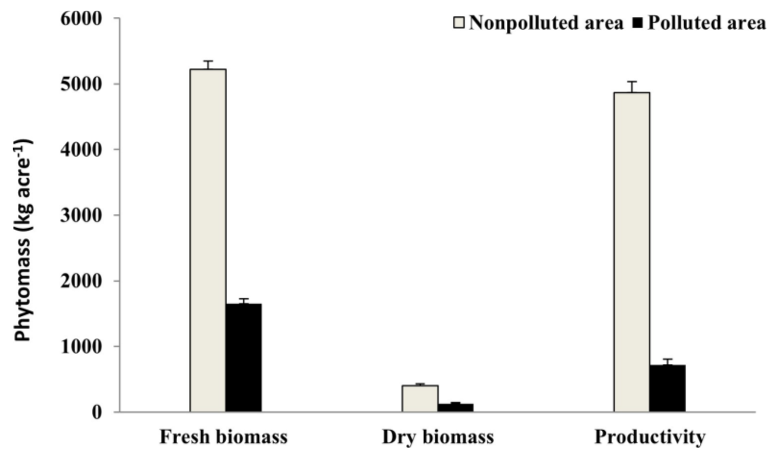

Figure 1: Phytomass and Production (kg/acre) of *Pisum sativum* cultivated in contaminated and non-contaminated regions.

Heavy Metals (HMs) are released through geological and anthropogenic activities and enter the environment through wastewater, soil, and sediment. These inorganic pollutants cannot be degraded and cause damage to vital human organs and ecosystems. Traditional farming practices have also been proposed as an instant approach for expanding the world's food supply. Nevertheless, the inappropriate use of agrochemicals in recent years led to serious biosphere contamination and directly affected the food chain which exhibits a route for bioaccumulation of HMs resulting into the un-sustainability of food crop production. Tarek M. Galal and coworkers thought that in modern farming, the exploitation of polluted soils introduces new obstacles; however, an appropriate agro-technological innovation was required to maintain stability and the long-term viability of the related production system.

The hyper-accumulation of high-density metals by plants depends on factors like the type of metals, soil quality, and temperature. Soil profiling is the main aspect of food security because researchers analyzed that there is a lack of appropriate research knowledge related to the biological integrity of soil. As a result, curiosity of many researchers increased towards the intake of polluted food.

The goal of Tarek M. Galal et al. was to examine the number of heavy metals in different parts of *Pisum sativum L*. (garden pea) cultivated on polluted soil as well as on non-polluted soils in the Egyptian provinces of South Cairo and Giza, and their impact on consumer wellness along with the daily intake of metals and its corresponding health risk index. In an experiment, they maintained all favorable conditions, including relative humidity, temperature and also studied the annual rainfall of the cultivation area.

The authors carried out statistical analysis for determining a bioaccumulation factor and translocation factors, which ultimately helped in evaluation of the Health Risk Index (HRI). The importance of estimation of HRI represents the results of daily intake of HMs concerning a reference oral dose. Further, a significant difference between fresh and dry phytomass and fruit productivity was proposed (Figure 1). This comparative study performed by authors between soil sampling and plant sampling indicates not only the HMs concentration in edible tissues but also the productivity of plants.

In this study, the permissible level and importance of HMs for plants as well as human health was reported by Tarek M. Galal et al. In addition, a minimum concentration of various elements like Co, Fe, Cu, and Zn are essential for plant growth, development, and reproduction. However, at high concentration, metal ions affect photosynthetic pigments, growth performance, soil fertility, and economic yield.

The researchers reported that leaf pigments of *P. sativum* plants decreased under the stress of HMs. These circumstances demand site-specific economic procedures and agro-technological activities to improve crop growth during unfavorable environments and simultaneously preventing hazardous contaminants' translocation to phyto-products. Further, authors showed that both contaminated and non-contaminated lands were within acceptable limits.

This may be due to the continuous elimination of toxic metals through agricultural production in such areas, as well as heavy metal leaching into the soil's deeper layer. As a result, those certain heavy metals are compatible components for phytostabilization and reduce metal mobility and solubilization into underground aquifers, lowering metal bioavailability, or even potential danger with insertion into the food system. In a recent paper, the experts described a further possible technique for limiting the absorption of hazardous contaminants into plant components.

Using this approach, authors systematically discovered nanomaterials to facilitate the breakdown of contaminants (nanoremediation) in polluted areas. This is exciting because of the generation of a new assay for soil remediation, nanoparticles (NPs) such as nZVI, ZnO, TiO_2, carbon nanotubes, fullerenes, and bimetallic nanometals can be possible. Rhizospheric engineering is also another strategy for altering the rhizospheric microenvironment to increase the fertility of polluted fields while reducing pollution in the root zone.

In this concern of Plos Biology, scientists take benefit on these recently described technologies like, relocating biomass and biofuel cultivation to polluted land. Furthermore, growing biofuel crops on contaminated land could serve to minimize CO_2 emissions and pollution which can be a feasible alternative. Recycling polluted areas for biomass and biofuel production may improve not only energy security but also job prospects and community involvement.

Implementation of ‘omic innovations' to develop genetically modified (GM) crops featuring improved yield, nutritive values, and stress resistance is a technique that can be useful. Simultaneously, these practices underlined the value of innovations in environmental biotechnology and have led to understanding of agriculture sustainability.

Authors’ contributions: PM: Developed an idea, wrote manuscript and verified the content.

Competing interest:
Author declares that no competing interest exists.

Ethical statement: Since the presented work is based on only theoretical information without harming ethical aspects, no ethical permission needed in relation with the work in question.

Grant Support Details: Author did not receive funding from any concerned agency to complete write-up this work.

Acknowledgement: The author is thankful to Dr. Rajesh Sharma, Department of Biotechnology, Vidya Pratishthan's Arts, Science and Commerce College, Baramati, Maharashtra, India for his positive motivation to complete this work.

Reference:

Galal TM, Hassan LM, Ahmed DA, Alamri SAM, Alrumman SA, Eid EM. Heavy metals uptake by the global economic crop (*Pisumsativum*L.) grown in contaminated soils and its associated health risks. PLOS ONE. 2021;16(6):e0252229. doi: 10.1371/journal.pone.0252229, PMID 34086714.

Cite this article as:

Mohite P. Sustainable Agronomic Practices: a Hyperaccumulator Plant and its Associated Health Impact. Int. J. Micro. Sci. 2021;2(1): 10-12.