Indian J. Applied & Pure Bio. Vol. 36(2), 541-544 (2021). **ISSN: 0970-2091**
A web of Science Journal

Agriculture and Soil Health

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Abstract

Agriculture is the backbone of our country's economy. Maximum number of people are dependent on it directly or indirectly. Food is a necessity without which survival is impossible. In other words, every human being is dependent on agriculture. The value of agriculture was realised well during the pandemic and its subsequent lockdown. The agricultural commodities and produce were the only sector which did not come to a halt and was continued because of food being necessary for one's survival.

With green, golden and white revolutions, for our ever-increasing population, latest varieties, techniques and research led to increased yield thus sufficient food. Conventional farming utilised all the modern techniques along with the use of chemical fertilisers, herbicides, pesticides insecticides. Indiscriminate industrial waste and its disposal resulted in water and soil pollution. The indiscriminate use of these resulted in soil pollution because of coming in contact with one or the other pollutant. Thus, in a way the health of the soil got affected. Health of the soil is not a single entity. Many micro and macro soil ecosystems got affected as well. Not only this, but also the heavy and toxic metals got accumulated as well and that resulted in bioaccumulation and bio magnification, ultimately a cause of worry or health hazard.

In the present paper some ways and means which can be adapted to improve the soil health vis-à-vis crop and human health being the final dependent, in an eco-friendly manner has been discussed.

Agriculture being the key sector for the production of food needs to produce in a sustainable manner. The demand for agriculture commodities is increasing at a rapid speed. In order to fulfil the need of the hour which is to meet the demand with supply more and more means are being researched for the same. Although green, golden, white and even the yellow revolution helped to make India self-sufficient yet there's always a need for more. In order to keep up with the pace of production one needs to think about or devise more means.

There's no doubt that this production has to be more but not such that it taxes the environment and public health. The food produce should be nutritious and healthy and most importantly sustainable in its origin. As Franklin Roosevelt once said that, "A nation that destroys its soils destroys itself", it not only applies to the country he belonged to but the entire world with its nations being developed, undeveloped and developing. We can thus understand from that as what he wanted to convey was that soil is the soul for the sole existence that one has to sustain on this planet. Healthy soil is key to healthy crop and health of people ultimately. The soil which is contaminated/polluted with its varying pollutants, and that being caused by indiscriminate use of chemical fertilisers, herbicides, pesticides, insecticides and indiscriminate dumping of garbage and industrial affluents, has resulted in water and soil pollution. This in turn can result in bio accumulation and bio magnification which is a threat to the population.

Agricultural produce :

Includes all food items or commodities, right from cereals millets edible oils pulses and other food items. Infact all the essential food is provided by agriculture. So, food this is of mainly the plant origin or plants directly or indirectly contribute to food supply. Animal products also come under agriculture (animal husbandry). It's the plants which are the producers and pass on food to higher trophic levels in food chains and food webs. These plants grow in the soil, that corresponds to the fact that soil sustains life[9]. Plants take up nutrients from soil and because of that, soil health is important and it's the vital component of all ecosystems.

Soil pollution :

Due to use of chemical fertilisers, herbicides, pesticides, insecticides and indiscriminate use of chemicals and dumping of affluents given out by industries results in pollution of soil. Soil organic matter and different micro and macro nutrients which are utilised by the plants are made available by the microorganisms present in the soil. Every soil depending upon topography, geography has its own indigenous flora and fauna. It's the bacteria and mostly fungi which really metabolise or simply decompose these nutrients if they're found in bound form. It is soil that determines the productivity of any ecosystem. Clean soil will definitely hold clean crop. It can provide all micro and macro nutrients to the developing crop. But when it gets polluted by lead or mercury, contaminated waters ground water it becomes life threatening, fatal to all[18]. As plants not only take it up but also deposit more or less of it in their tissues. This accumulation also called bio accumulation leads to toxicity[7]. As at higher concentrations these get passed onto various trophic levels along the food chains and webs. World over problems of soil pollution have been reported by various organic and inorganic pollutants[4]. Consumption of such food from such soils can lead to diseases from simpler to fatal ones. Excess content of arsenic causes infertility which in turn has become a cause of concern[11]. Various other contaminants like poly aromatic hydrocarbons poly chlorinated biphenyls have also been reported from soils and waters[4]. Water, especially contaminated ground water with these pollutants if used for irrigation purposes can pollute the soil and crop and ultimately the consumers up the food chain. There's a need for increasing yield not at the cost of ecology of the habitat of these crops especially the soils. Agricultural produce we need to increase but in a sustainable manner without disturbing the various soil ecosystems.

Remedies :

Remedies which can be considered or thought of are many. One needs to implement ecological principles like instead of monoculture one needs to go for multiple cropping, to reduce competition for nutrients and other things. Indiscriminate use of chemical fertilisers and other pollutants as mentioned before need to be stopped or replaced by something sustainable like bio fertilisers, bio herbicides, bio pesticides and bio insecticides as is done effectively in organic farming. Infact conventional methods can be mingled with organic farming methods and utilised. Proper disposal of waste that is waste to be treated and then disposed off into the water bodies or soils as these pose a great threat and are main cause of water and soil pollution[13].

One needs to go in for bio remediation by using various bacterial and fungal species. Before introduction of these species some field trials need to be carried out. Various bacterial and fungal species isolated from these places have been reported earlier[4].

For removal or bioremediation of atrazine petroleum hydrocarbons etc have been reported by earlier studies[3,16].

Fungi as agents of bioremediation have been reported earlier these studies have revealed that fungi can thrive in soils in different topography these studies have also revealed survival of various fungal species in effluent treatment waters[16-18]. White rot fungi which can be utilised for bio remediation include *Phanerochaete chysosporium, Trimetes versicolor, Bejerkandera adjusta* and *Pleurotus* sps[5,15]. Agaricomycetes from the Amazon forests[6], *Coriolus versicolor, Hirschioporus larincinus* etc. have been reported for decolonisation of dye effluent[8,20]. Many thermophilic fungi have been reported to be good agents of bioremediation. Application of metalophilic microbes have been suggested in earlier study[19]. *Cryptococcus* sps isolated from deep sea has the capability of withstanding presence of high levels of heavy metals up to (100mg per litre) as reported previously[17]. These and many other fungi reported from extreme environments can be used for bioremediation. Filamentous fungi like *Aspergillus, Curvularia, Acremonium* and *Pythium* sps have also been studied and reported for their metal tolerance ability[1,2]. Fungi like *Aspergillus niger* and *Penicillium chrysosporium* have been reported to remove petroleum hydrocarbons from the soil contaminated with the same[12]. Thus, the toxicity of these pollutants can be reduced or completely removed from the agricultural soils thus making the soils, crops and consumers healthy.

For every problem there is a solution. Contaminated soil with contaminants can be removed by virtue of microbes after proper screening and observations. Bacterial species have also been utilised but many fungal species reported along with Arbuscular mycorrhizae can be utilised for bio remediation (Mycoremediation) and also as bio fertilisers. This is cost effective, ecofriendly and sustainable.

References :

1. Akhtar, S., M. Mahmood-ul-Hassan, R. Ahmad, V. Suthor, and M. Yasin (2013)

Soil Environ 32: 55–62.
2. Anastasi, A., V. Tigini, and G.C. Varese (2013) *Soil Biol 32:* 29–49.
3. Badia-Fabregat, M., D. Lucas, M. Gros, S. Rodríguez-Mozaz, D. Barceló, G. Caminal, and T. Vicent (2015) Identification of some factors affecting pharmaceutical active compounds (PhACs) removal in real wastewater. Case study of fungal treatment of reverse osmosis concentrate. *J Hazard Mater 283:* 663–671.
4. Deshmukh, R., A.A. Khardenavis, and H.J. Purohit (2016) *Indian J. Microbiol* 2016: *56:* 247–264.
5. dos Santos, G.C. Bazanella, A.V. Araujo R. Castoldi, G.M. Maciel, F.D. Inacio, C.G.M. de Souza, A Bracht, and R.M. Peralta (2013) Ligninolytic enzymes from white-rot fungi and application in the removal of synthetic dyes. In: Polizeli TM, Rai M, De Lourdes M (eds) Fungal enzymes. CRC Press, Boca Raton, pp 258–279.
6. dos Santos, YVS, D.A. Freire, S.B. Pinheiro, L.F. de Lima, J.V.B. de Souza, and J.R.P. Cavallazzi (2015) *Sci. Res. Essays 10:* 132–136.
7. Gupta, S., S. Satpati, S. Nayek, and D. Garal, (2010) *Environmental monitoring and assessment, 165:* p-177.
8. Jebapriya, G.R. and J.J. Gnanadoss (2013) *Int J. Curr Res Rev 5:* 1–13.
9. Jon Schoonover and F. Crim Jackie (2015). Journal of contemporary water Research and Education. 154(1): pp 21-47.
10. Lien, P.J., H.J. Ho, T.H. Lee, W.L. Lai, and C.M. Kao (2015) *Adv Mater Res 1079:* 584–588.
11. Lokhande, Vaibhav N., Ratnadeep, and R. Deshmukh (2016). Monitoring Arsenic Contamination in Agriculture Soil using Spectroradiometer *International Journal of Innovative Research in Science, Engineering and Technology: 5*(4): 5508-5513.
12. Maruthi, Y.A., K. Hossain, and S. Thakre (2013) *Eur J. Sustain Dev 2:* 57–66.
13. Pande, K., J. P. Shukla, and S.P. Trivedi (2006) fundamental of toxicology, New Central Book Agency Kolkata, 88.
14. Qin, G., D. Gong, and M.Y. Fan (2013) *Int Biodeterior Biodegradation 85:* 150–155.
15. Rodríguez-Rodríguez C.E., V. Castro-Gutiérrez, J.S. Chin-Pampillo and K. Ruiz-Hidalgo (2013) *FEMS Microbiol Lett 345:* 1–12.
16. Sagarkar, S., S. Mukherjee, A. Nousiainen, K. Björklöf, H.J. Purohit, K.S. Jørgensen, and A. Kapley (2013) *Environ Pollut 172:* 108–115.
17. Singh, P., C. Raghukumar, R.R. Parvatkar, and M.B.L. Mascarenhas-Pereira (2013) *Yeast 30:* 93–101.
18. Singare, Pravin U., Lokhande, Ram S. and P. Pathak Pragati (2010) Soil Pollution along Kalwa Bridge at Thane Creek of Maharashtra, India. Journal of Environmental Protection, *1:* 121-128.
19. Sinha A., R Sinha,and S.K. Khare (2014) Heavy metal bioremediation and nanoparticle synthesis by metallophiles. In: Parmar N, Singh A (eds) Geomicrobiology and biogeochemistry, soil biology. Springer, Berlin, pp 101–118.
20. Zhang Y., J. Xie, M. Liu, Z. Tian, Z. He, J.D. Van Nostrand, L. Ren, J. Zhou, and M. Yang (2013) *Water Res. 47:* 6298–6308.