

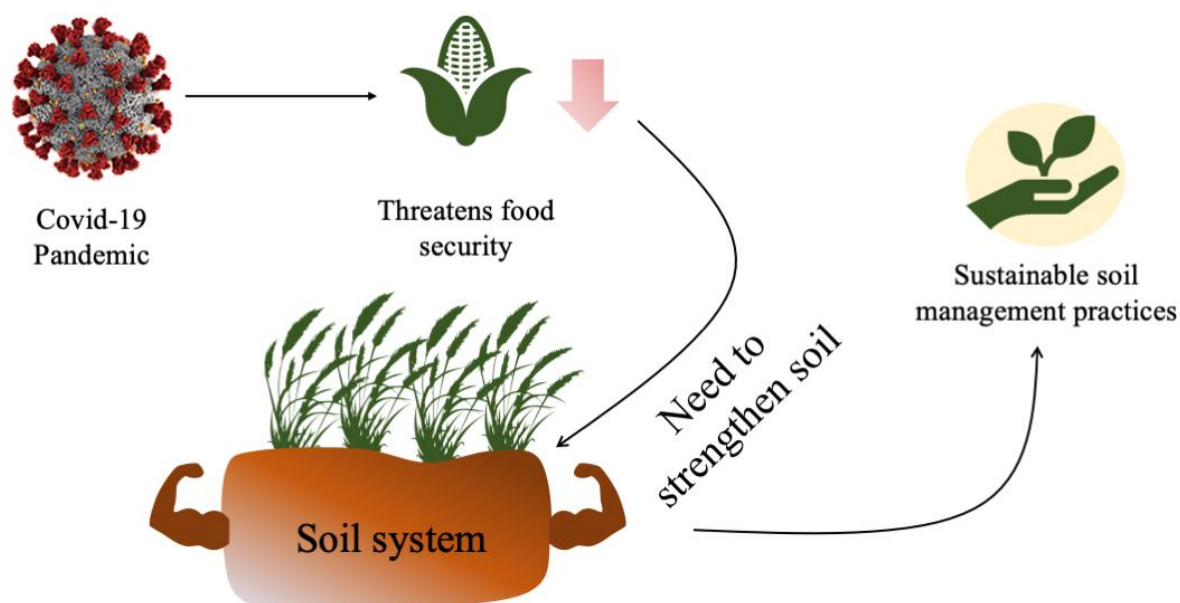
Soil System and COVID-19: Few Thinkable Aspects for Future

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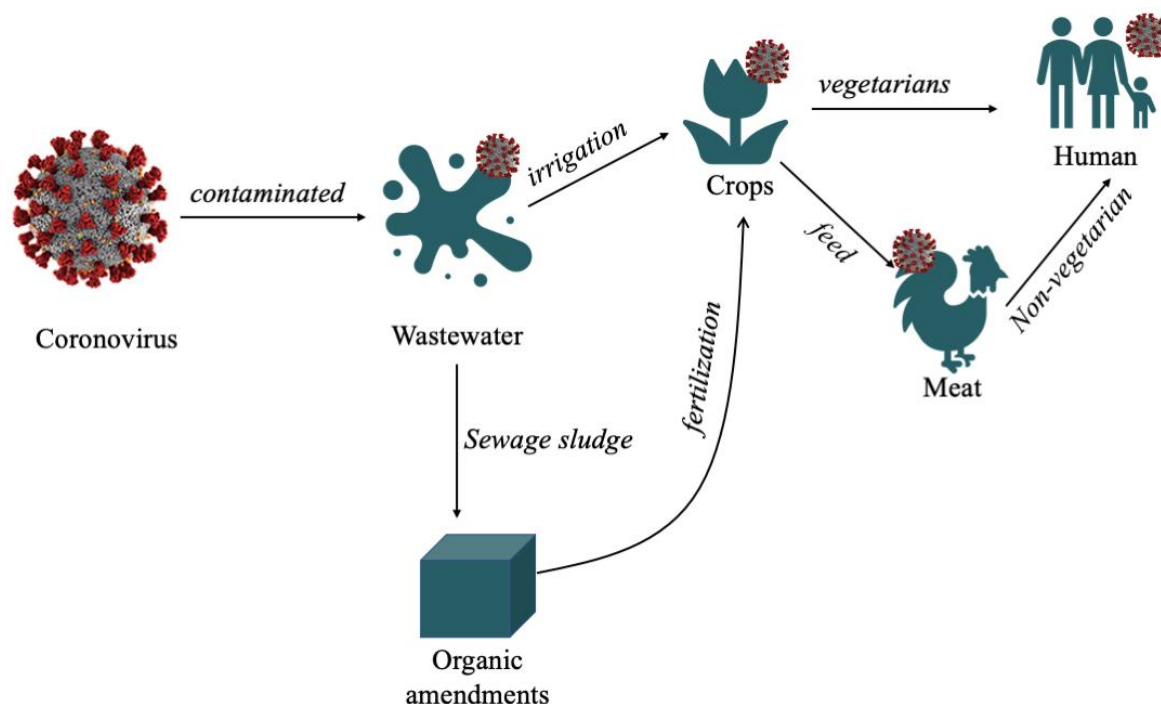
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ARTICLE ID: 131

While the world was facing the threats of climate change, human population explosion, land degradation on food security, the fast-moving corona virus disease, popularly tagged as COVID-19 pandemic has exacerbated the nutritional security in a global scale. Since the pandemic has started engulfing and spanning over several countries, a large body of research is initiated to understand and unravel the virus, with an aim to control and protect from its infection. However, owing to the priorities, investigations on soil quality in relation to COVID-19 are meagre and less exerted. Soil system is teemed with millions of soil microorganisms, including viruses, although the soil virome diversity is well underestimated. FAO's "One health Initiative" addresses the link between human health and soil health. Healthy and fertile soils form the most crucial natural resource to maintain food production and in which human existence has been depending since ages. Moreover, soil resource is easily overlooked in several decision making activities and policies. Therefore, it is the right time to disentangle all the information related to sustainable soil management to solve and anticipate food security.



Researches have detected and quantified SARS-CoV-2 in wastewater. In this regard, several urban farming sites are irrigated with untreated sewage water for a long term, that hampers soil health and quality. Wastewater are generally applied in cultivated soil due to water scarcity and poor quality of irrigation water. In addition, wastewater contains few essential nutrients that could help in plant growth and productivity. Failing to know is the high levels of toxic heavy metals in the wastewater that loads into soil and transfer to human body through food chain. Same case might be applied to COVID-19, depending on the persistence of the virus in the soil system. Moreover, the farmers handling the wastewater or the animals grazing upon the contaminated soils are exposed to this virus. Depending on the temperature and other factors, coronavirus has shown a variable persistence time in wastewater, ranging from few days to various weeks. Another problem that rises is the organic amendments manufactured with sewage sludge as raw materials. Quantification of viruses in such organic amendments needs to be further studied. So, what soil microclimate is favourable or suppressive for such viruses needs to further investigated in-depth. Are the well known plant growth promoting microorganisms effective towards the virus through their multifaceted properties? To answer all these complexities, an exhaustive research must be carried out. But, during this peak of the pandemic, most effort must be directed to fight the pandemic and assist the affected people. However, if this pandemic persists for a longer period of time, thinking on these aspects will open many doors to COVID-19 research. Soil biota has been well explored as a source of several antibiotics and medicines. So why not explored further for coronavirus control from soil biome? Soil biodiversity will help in protecting the human pathogens and will have the potential to control epidemic outbreaks. Therefore, soil biodiversity must be preserved and studied. Burying of dead human bodies infected with coronavirus must have some effects on the soil system. In the current phase where there are less burial grounds available for covid victims, several questions arises on soil pollution.



Due to rapid industrialization, forests are increasingly cleared for cultivation purposes. Soil studies indicated that land use changes severely affects soil quality and thus threatens ecosystem sustainability. Such land use change is closely related to rising of pandemics. Our human bodies and other animals contain different types of microorganisms, both pathogenic as well as beneficial. When a pathogen get transferred from animal to human which is not a familiar host for the pathogen, first of all it tends to exploit the defense system of human and cause several types of diseases. Such type of pathogen that moves from animals to human is generally termed as “zoonosis”. Ebola is such a prominent example in this case. Researchers often hypothesized that COVID-19 may be classified in this group. Among humans, majority of new disease outbreaks are belonged to zoonotic diseases. It seems that humans are the victims of an onslaught of these pathogens from wild animals. But what if this increase of pandemics is due to human intervention? Anthropogenic activities are increasing the probability of such pandemics. Humans has been using land resources for several purposes, from agriculture to industrialization, leading to a shrinkage of undisturbed natural ecosystems. This land use conversion has been accelerating in last 100 years. As the source of COVID-19 is still debatable, the land use shifts can be correlated with Ebola that started in West Africa. During late 1990s civil wars, hundreds of refugees were forced to migrate to a forest where Guinea, Sierra Leone and Liberia meets. With the human settlement, trees were cut down, roads were made and a complete land use shift was prominent. The change in forest cover during this period can be easily verified trough satellite images. This forest was a natural habitat for several wild bats. Researchers believe that humans exposed to fluids of these bats carrying Ebola was the main route of Ebola to human system,

which further spread to families, houses and then villages. The encroachment not only exposes the humans to such pandemic but also lead to extinction of wild animals. Such disappearing of wild animal species forces the pathogen to find a new host (human). Keeping all these views in mind, it is the crucial time to adopt sustainable soil management practices to improve soil health for a better food security. In addition to these, studies mentioned above can be focused in future studies to widen the concept of soil and rising pandemics.

