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Up Keeping Soil Health during Population Explosion

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ARTICLE ID: 001

The world population is increasing at an alarming rate. As projected in the *2021 World Population Data Sheet* by the Population Reference Bureau (PRB), the world population will boom to 9.7 billion by 2050, from the present estimated 7.8 billion. The exponential increase in population exerts huge pressure on natural resources, most importantly on the soil, which is essential to sustain life. Fertile soils are the basis for healthy food production, which in turn helps to ensure food security. The absence of healthy soils will thwart agriculture, without a doubt. As the growing population demands increased food production, fertile soils world over have been under increased pressure over the past decades, threatening its productive capacity to meet the needs of the present and future generations. Maintaining and improving soil fertility is equally important for sustainable agriculture.

Studies have found that even the fertile soils may not give expected higher yields and may fail to maintain the quality of their ancestral stock. This can be attributed to the improper maintenance irrespective of their sufficient nutrient status and balanced physical, chemical, and biological properties. The lack of preservation adversely affects the soil's ability to regenerate. All the present-day practices, from injudicious chemical application to increased gold mining, cause irreparable damage to the soil and agro-ecosystem. Hence, more intense efforts should be spent to maintain the long-term viability of fertile soils. These facts emphasize that agriculture has a very fragile foundation. Therefore, conserving the fertility of different soil types in the era of booming world population, diverse but changing climatic conditions, and soil erosion combined with the loss of cultivable land to urban sprawl, pose as one of the toughest challenges to humanity.

Soil fertility is the ability of soil to provide suitable habitat to agricultural crops and give high-quality yields in a consistent and sustainable way. Healthy soils are living, dynamic ecosystems, which can perform nutrient cycling, improve soil structure for water and nutrient

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holding capacity, and alleviate climate change by managing its carbon content. The organic matter content, which determines the soil fertility, is contributed by organic wastes, cattle manure, different composts, mulching, and nitrogen-fixing leguminous plants. It affects the diversity and activity of soil organisms, plant nutrient availability, and many chemical and physical properties of the soil, thus contributing to its overall health. When the organic matter is lost, the nutrient cycles are broken and soil fertility is declined. In the past, we had adopted practices like 'jhum farming', where the forest vegetation was cut and burnt to convert them into arable land, and 'shifting cultivation' where the land is kept fallow, allowing the soils to regenerate. But, with the increasing population and food demand, these practices are not continued, as they are time-consuming and labour-intensive. Moreover, the fertility and resilient capacity of soils are different all over the world.

With the advent of the "green revolution", the overuse of chemical fertilizers has become a common practice. Over the past decades, easy-to-use synthetic mineral fertilizers have been extravagantly used by the farmers, without expert consultation. Their production requires an enormous amount of energy, which in turn makes soil fertility dependent on oil prices. Even to this day, people apply fertilizers without conducting soil testing. As a result, the humus formation is negatively impacted, accelerating leaching and acidification. This necessitates the application of higher doses of mineral fertilizers. It is imperative that greater emphasis is laid on preserving inherent soil fertility while improving it. In this instance, zero tillage, organic farming, and conservation agriculture deserve much consideration.

Even though soilless farming systems like **hydroponics, aquaponics, and aeroponics** are gaining ground, world food security is still centered on enhancing the productive capacity and quality of food crops using the soils. Therefore, the management systems and practices followed to achieve high soil productivities should also supplement agroecosystem health in an ecologically and economically sustainable way. To attain this, it is crucial to refrain from all forms of agricultural and soil management practices that disregard the fundamental value of fertile soils, like over-fertilization, overexploitation of sensitive soils, exposure to water/wind erosion, and sealing of fertile land adjoining the industrial regions. Fertilization should be carried out only based on the soil analytical results and expert advice. Adopting techniques for soil structure protection, water absorption, and storage, wind protection, prevention of run-off, terracing, etc. are equally important in

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retaining soil fertility. The chemical nutrients are potential pollutants when washed away. So, technologies to recycle them by "capturing, and putting them back into the ground", as claimed by the University of California scientists, should be practiced. Programs to create public awareness on the linkages between soil, ecosystem function and the impact of human interventions are to be promoted. These practices will enable soil preservation and improve soil fertility more effectively for productive agriculture.