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Opinion Article

Perennial Cropping System in Sustainable Agriculture and Food Systems

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DESCRIPTION

Perennial crops can be harvested numerous times over the course of their lives and can survive for more than two years before needing to be replanted. Integrating perennial crops such as grains, oilseeds, and legumes, as well as forages and trees, into our existing agricultural system is critical for sustaining healthy soil ecosystems that will assure long-term food security. The development of vast root systems is one of the most important characteristics of perennial cropping. Annual grain crops have shallow roots, roughly 12 inches deep, but perennial grains have roots that can extend up to 10 feet long. By preventing the soil from breaking up and eroding, long and vigorous root networks support and preserve it. Perennial staple crops are also more tolerant of less-than-ideal circumstances, which is important in the face of climate change extremes like prolonged droughts. Perennial crops have more regular access to precipitation and deep-soil water stores due to their longer lifespans and deeper roots. Furthermore, perennial cropping methods seldom expose the soil, and vegetation is able to absorb water more efficiently, reducing runoff.

Crops that will never go out of vogue are known as perennial staples. Crops are perennial plants that produce staple meals. These protein, carbohydrate, and lipid-rich plant sources may be harvested without harming the plant or preventing future harvests. Grains, pulses (dry beans), nuts, dry pods, starchy fruits, oilseeds, high-protein leaves, and some more exotic items like as starch-filled trunks, sweet palm saps, and aerial tubers all fall under this group of crops. These trees, palms, grasses, and other long-lived crops present a unique choice for crops produced for basic human food that may concurrently trap carbon, stabilize slopes, and build soils as part of no-till perennial agricultural systems.

Perennial plants (crops, forages, and trees) may regrow and generate grains, seeds, fruits, and biomass after a single harvest. Intentional integration of perennialized crops in diverse farming systems, landscapes, and agro-ecosystems to: make farming more financially resilient and diversified; contribute to the overall well-being of farmers, farm workers, and rural communities; increase farm and landscape diversity and productivity; prevent soil erosion and promote efficient water storage; reduce the amount of energy used in agriculture. Converting annual fields to permanent fields has a number of biodiversity-friendly advantages. Reduced soil erosion is one of these advantages. Between growing seasons, annual farming leaves fields fallow, resulting in less root mass throughout the development cycle. Fields become subject to wind and water erosion as a result of this. This erosion depletes topsoil, putting microbial and plant communities under stress. Perennial plants have a significantly larger root system and can protect the soil all year. Perennial farming has been shown to lower erosion rates by up to 50%.

Advantages of perennial cropping

Reduced chemical runoff is another advantage of perennialization. Fertilizers and pesticides are not entirely absorbed by crops, and the surplus migrates into bodies of water. In the United States, agriculture is responsible for 70% of all water contamination. Water contamination has a number of negative effects on biodiversity. The formation of ocean dead zones that encompass hundreds of square kilometers is one of the most significant. Perennials can help minimize agricultural chemical runoff by absorbing chemicals more efficiently thanks to their large root systems. Annual crops, for example, have been shown to lose up to 35 times more nitrogen than perennial crops. Annual plants do not preserve freshwater as well as perennial ones. Annual crops might waste up to five times the amount of water that perennial crops do. As a result, yearly fields will require more irrigation, posing a hazard to fresh water supplies and, as a result, biodiversity in some areas.

For both wealthy and developing nations, replacing annual crops with perennials has several advantages. Perennial crops, on the other hand, are not yet ready to take the place of annual crops. Perennials require genetic improvement in order to compete with the production of annual crops. Perennial strains must be modified to exhibit particular features such as big seed size, palatability, sturdy stems, and high seed output. Because developed countries have greater capability for genetically

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modifying crops, they bear the brunt of research and development.

Environmental benefits

Perennial crops have more extensive root systems than annual crops, making soil particles more difficult to dislodge and thereby decreasing soil erosion. The low quantity of tilling required to sustain the crop reduces erosion even further. Furthermore, perpetual crops take less labor than annual crops since they do not need to be replanted every year, and perennials develop quickly in the spring, allowing them to outcompete annual weeds. They've also evolved to deal with local insects and illnesses over time, so they need less pesticide treatments than annuals. Furthermore, their extensive root systems help them to withstand climatic stresses such as drought and unpredictable rainfall, and they may absorb carbon more effectively than annuals. Perennial grains might also be engineered to mimic some of the essential characteristics of vulnerable grasslands, such as providing wildlife habitat and improving or maintaining soil health while still generating food for humans.