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Zero Tillage: A Practice for Conservation Agriculture

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Increasing population of the world is leading to stress on the planet and its resources. Conventional agriculture is largely characterized by tillage, which leaves soil vulnerable to erosion. In traditional ploughing, the top layer is completely turned over before sowing. Tillage aids in the aeration of the soil, incorporation of manure and nutrients, loosening of the soil for easy emergence of seedling roots, destruction of pests and the eradication of weeds. However, this farming method encourages soil erosion by removing cover, disrupting micro communities, and releasing soil carbon into the atmosphere contributing to the greenhouse effect. Soil erosion, water losses from runoff and soil physical degradation may be minimized by reducing soil disturbance and maintaining soil cover (Serraj and Siddique 2012). With less soil disturbance comes less fuel use, resulting in lower carbon dioxide emissions (Holland 2004).

Conservation Agriculture is a way out which enhances the productivity of farm land already in use and can regenerate land left in poor condition by past misuse. Conservation agriculture (CA) is characterized by minimal soil disturbance, diversified crop rotations and surface crop residue retention to reduce soil and environmental degradation while sustaining crop production (Farooq and Siddique, 2015). Conservation agriculture practices like zero tillage and residue retention are both associated with substantial change in physical and chemical soil characteristics which could influence the growth and yield of crops.

No-till farming methods suggest zero or least soil disturbance. Zero tillage is an extreme form of minimum tillage. Primary tillage is completely avoided and secondary tillage is restricted to seed bed preparation in the row zone only. It is a method of growing crops without disturbing the soil through ploughing or tillage. This method allows the residue of previous crop remain on the soil surface and decompose naturally. Permanent soil cover with straw started to be considered an important component for weed control.

Advantages

1. Reduced soil erosion caused by plowing and tillage
2. Increased soil organic matter
3. Improved soil structure and aeration
4. Increased beneficial soil microbes
5. Retained soil moisture and water conservation
6. Reduced fuel use from not plowing i.e., cost of cultivation.

Mechanized Field Preparation Options in CA

Zero-till seed-cum-fertilizer drill: Zero-till-drill consists of frame, seed box, fertilizer box, seed metering mechanism, fertilizer metering mechanism, seed tubes, furrow opener, seed/fertilizer adjusting mechanism and transport cum power transmitting wheel. The frame

is built of mild steel box section of dimensions 185 x 60 cm. There are 9 to 13 inverted T-type furrow openers on it. When affixed to a tine, these T-type furrow openers open a tiny slit 3-5 cm wide. The tynes are clamped in place to achieve infinite row spacing, as required by various crops. Furrow openers are positioned 17.5 cm apart in a zero-till seed-cum-fertilizer drill. The fundamental difference between a zero-till drill and a standard drill is that instead of reversible shovels, it features inverted T-type furrow openers placed on the tynes. The main benefit of inverted t-type furrow openers is that they do not generate clods, uses less draught, and penetrate the soil more easily.

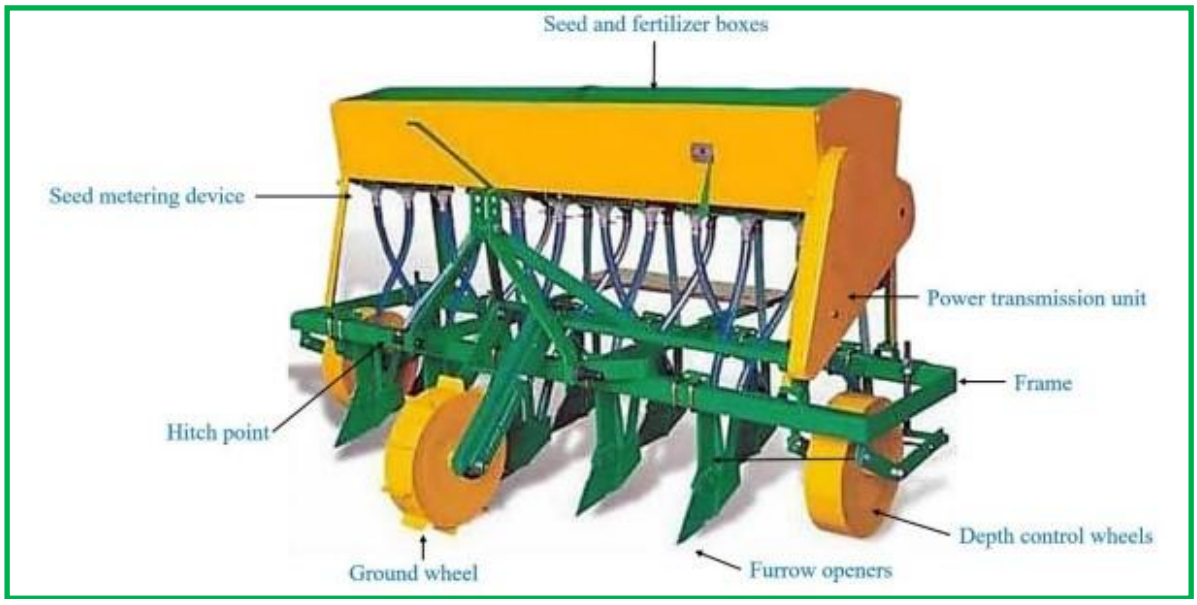

Figure.1. Zero-till seed-cum-fertilizer drill

Happy seeder: Happy seeders popularly used to sow wheat seeds directly in the combine harvested paddy field without any prior seedbed preparation and without getting jammed (Venkat and Mohan, 2022). It combines stubble mulching and seed drilling practices into one operation. It encourages dry direct sowing of rice (DDSR) i.e., direct sowing of paddy seeds in the dry field rather than by transplanting of seedlings from the nursery. It is connected to tractor with a three-point linkage and operated by a pto. It consists of a straw chopper i.e., a rotor and a zero till drill to sow seeds in the residue of the previous crop. Flail type straight blades are mounted on the rotor that chops off the stubbles followed by sowing tines. It deposits the residue of the previous crop over the sown field as mulch.

Figure.2. Happy seeder

Conclusion

Zero tillage farming system standout as best to stabilize the soil temperature, favoring biological processes and soil life. It increases the organic matter in the soil profile, improving the cation exchange capacity and physical structure of the soil. Tillage is reduced to only one pass with zero tillage. It enables earlier sowing, which increase yields while reducing costs by conserving soil, fuel, water, fertilizer, and herbicides. This method is a viable option for conserving scare resources and increasing net farm income. ZT decreases time and energy-intensive traditional tillage procedures, lowering cultivation cost and minimize the emission of CO2.

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