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Eminence of CONSERVATION TILLAGE

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The indiscriminate use of agricultural chemicals over the years to achieve production has depleted the soil of macro, micro nutrients, organic matter and soil microbes affecting the physical, chemical and biological properties of the soil. Continuous clean plowing breaks up soil aggregates, increases aeration and opens the soil for rapid decomposition of organic matter along with compaction of soil with heavy machinery. It also increases soil

moisture loss by evaporation and makes soil more vulnerable to erosion with little heavy rainfall or turbulent air. Water deficit and low fertility levels make the agro-ecosystems of the site susceptible to the climate change adversities. Stagnant crop yields and degrading soil health is necessitating the adoption of an approach which sustainably manage the production as well as soil health. One such approach is conservation tillage which involves no overturning or loosening of the soil with the addition of residues and mulching. Conservation tillage has the potential to mitigate the effects of drought based on improved physico-chemical soil properties, which ultimately leads to improved crop yields. Awareness and adoption of conservation tillage gain a momentum after the farmers have realized that climate change is real and seriously hamper the productivity of crop in a region. Conservation tillage is both mitigation and adaptation strategy in a climate change scenario. Conservation tillage in addition with crop rotation form the basis of conservation agriculture. FAO defines conservation agriculture as an agricultural system that can prevent the loss of arable land while regenerating degraded land. It promotes the maintenance of permanent soil cover, minimal soil disturbance and diversification of plant species. Conservation tillage is based on the principle that at least 30 percent of the soil surface is covered with residue, reducing tillage operations. This applies to all agricultural systems with locally adapted practices. However, the results of conservation tillage vary from place to place depending on local conditions, extent and type of conservation practices adopted. Soil temperature is considered as a vital factor in determining soil sustainability, crop growth and production by regulating heat energy exchange between soil and the atmosphere. Conservation tillage helps in maintaining soil temperature by cutting off the direct intercepted radiation due to presence of residues over the surface. Conservation tillage helps in maintaining soil temperature by cutting off direct blocking radiation due to the presence of residues on the surface. Conservation tillage is a multi-pronged approach that moves farming towards sustainable agriculture. It not only improves soil health and quality, but also protects soil and environment from pollution, maintains biodiversity and ecological balance by providing high quality healthy food.

The major benefits accrued with conservation tillage are:

- Improve water holding capacity and percentage moisture in soil by reducing runoff, evaporation, soil temperature; and increase the number of microscopic pores and the opportunity time for moisture absorption. The soil temperature is not always reduced but is maintained depending on the local weather conditions.
- Conservation tillage improves soil physical properties such as aggregate formation, lower bulk density, better soil structure with more addition of organic matter and higher CEC (cation exchange capacity).
- Conservation tillage makes the soil conducive to the growth of micro-organisms (earthworms, arthropods,

fungi, bacteria and actinomycetes), useful in the decomposition of residues and providing macro and micronutrients for plant growth.

- Conservation tillage reduces greenhouse gas emissions such as CO_2, CH_4 and improves carbon sequestration by reducing the burning of crop residues and increases incorporation or is left as stubble mulch.
- Conservation tillage prevents soil degradation by reducing soil erosion with wind and water due to high organic matter and continuous presence of surface cover.
- Nutrient recycling is promoted and nutrient mining is restricted in conservation tillage. It improves soil fertility and quality by maintaining the balance of C:N and various micro macro nutrients.
- Conservation tillage reduces the need for nutrients (chemical fertilizers), thus reducing wastage and excessive use of agricultural chemicals to maintain soil health and protect water bodies from eutrophication and heavy metal contamination.
- Adoption of conservation tillage with minimal use of heavy machinery for seed bed preparation prevents soil compaction and structural degradation.
- Conservation tillage in the form of reduced energy use and economic cost in crop production reduces tool and equipment interventions for the management of poor agricultural soil conditions.
- Crop production stability and food security along with high quality produce and environmental sustainability.
- High economic benefits and risk mitigation due to adequate soil moisture availability, less labour, agrochemicals and fuel requirements.

Conservation tillage Practices

✓ **Reduced or minimum tillage**: Tillage operations are minimized by combining two or more tillage operations in order to keep soil disturbance minimum. Either land preparation and sowing operations are combined or sowing and fertilizer application in one pass with ploughing eliminated and crop residue retained. It includes row zone tillage (primary tillage operations are omitted with secondary tillage restricted to row zone), plough-plant tillage (special planter is used for planting after soil ploughing), wheel track planting (ploughing is done as usual and row zone is pulverized while sowing operations are performed with tractors).

✓ **No-till**: No till is also know with names such as as zero-till, eco-fallow and slot planting. Zero tillage is the most severe form of reduced tillage where soil is left fully undisturbed and only seeding operations are performed. Seeds and nutrients are injected in narrow slots in seedbed and the drilling and planting operations are completed. Specialized tools such as row chisel, happy seeder and roto-tillers etc. are used in sowing or planting operations. Till planting and stubble mulch tillage are two forms of zero tillage. Till planting is followed in the crops like maize, soybean and cotton which are planted on ridges where tillage is reduced by preparing the seedbed only on shallow ridges formed during the previous season. Fields with poor drainage and little elevation are more suited for this practice. **Stubble mulch tillage is practiced with the goal to keep soil covered with residues all over the year either by sowing in standing crop residues or by leaving a good layer of crop residues as mulch on soil surface.**

Conservation tillage is a must adopt practice for farmers to attain production sustainability and good health of soil, plant, animal and environment. Foundation of healthy ecosystem is based on healthy soils and we must take care of it.