

The “Cut-Soiler” tractor attachment easily constructs shallow subsurface drainage systems using agricultural residues such as rice and wheat straw

Production

Demonstration

Item: Field crop,
Agricultural residueClimate disaster mitigation
Biomass utilization

Outline

Using the "Cut-Soiler" tractor attachment, developed in Japan, is an inexpensive and easy method for constructing shallow subsurface drainage* systems. In this method, drainage systems are constructed using agricultural residue by simply pulling the attachment while driving a tractor. This method contributes to improving drainage, mitigating salinization, and processing agricultural residues.

* Shallow subsurface drainage: a drainage hole constructed at 40–60 cm depth without excavation in the farm field.

Background/effect/note

Conventionally, when constructing material-filled subsurface drainage systems, it is necessary to prepare the hydrophobic material to be buried in the soil and load it into the construction machine. Cut-Soiler (Fig. 1) does not require these tasks; instead, harvested residues such as rice and wheat straw can be scattered in the field and buried simply by running a tractor equipped with Cut-Soiler. Therefore, shallow subsurface drainage systems can be constructed inexpensively and easily (Fig. 2).

Salinization is a serious issue in the Indo-Gangetic Plain owing to tube well irrigation‡. Considering the high-salinity irrigation water and poor drainage in the region, Cut-Soiler to construct shallow subsurface drainage systems has been shown to reduce soil salinity and improve yields.

Cut-Soiler does not have wheels for long-distance transport; therefore, it must be loaded onto a truck for transportation. The estimated useful life of Cut-Soiler is approximately 7 years when covering 30–50 ha per year. If there are no problems with the frame, it can be used continuously by simply replacing the consumables. In paddy fields, the water requirement rate may increase. Construction is difficult when there is a gravel layer**, stone, or wood (more than 5 cm thick).

‡ Tube well irrigation: an iron pipe (10–20 cm in diameter) is driven into the groundwater layer, and groundwater is pumped up for irrigation.

** Gravel layer: a layer formed of sand and pebbles.



Fig. 1. Cut-Soiler

① The shredded residue (straw, stems, and leaves) and compost are scattered on the field after harvesting.

② Driven by a tractor, the Cut-Soiler cuts the soil into an inverted triangular (V) shape and lifts the soil to open a trench. Simultaneously, the surface materials are collected and pushed toward the narrow groove formed during trench opening.

③ The lifted soil is backfilled over the filling material, creating a groove-shaped, shallow subsurface drainage system. As the ground is raised after construction, the field should be leveled using a rotary, leveler, or disc harrow.

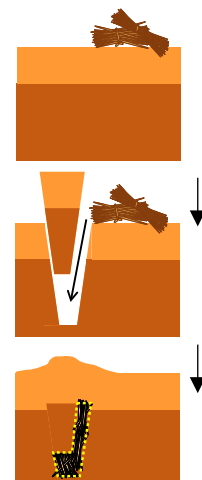


Fig. 2. Method of constructing a shallow subsurface drainage system using Cut-Soiler



Technical details:
JIRCAS Research Highlights(2022)
https://www.jircas.go.jp/en/publication/research_results/2022_a11



Cut-Soiler User's guide
https://www.jircas.go.jp/ja/publication/manual_guideline/jircas-2022-001
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