

Reinforcement technology that can be applied by farmers themselves using ground-cover plants for irrigation facilities in paddy fields

In Ghana, locally produced rice comprises only 34% of consumption, resulting in the importation of the remaining 66%. It is thus necessary to improve paddy rice productivity, and irrigation facilities in paddy fields play an important role in achieving sustainable irrigated rice cultivation. However, irrigation facilities in inland valleys in Ghana have not performed efficiently due to high intensity rainfall and poor maintenance. According to the 1995 FAO Report, 40% soil surface coverage reduced raindrop erosion by 90%. Thus, a reinforcement technology using ground-cover plants to prevent raindrop erosion is being developed in accordance with research policy on preventive maintenance.

Local species are recommended as ground-cover plants as they minimize the impacts on ecosystems and overcome the psychological obstacles for the farmers. Vegetation around paddy field irrigation facilities are relatively resistant to changes in soil hardness and soil moisture, and therefore, has advantages over other plants. The targets of this technology are the levees and irrigation canals at paddy fields and, more specifically, the slopes and crowns of canals except for the wetted perimeter. Ground covers are planted by cuttage (i.e., propagation by plant parts) in a zigzag pattern at 15cm intervals. Local farmers are already familiar with this through rice transplanting, hence they can develop and manage it themselves (Fig. 1). Figure 2 shows that cover plants, especially "*Chrysopogon aciculatus*," strengthen the soil around the irrigation facilities. Employing this technology, therefore, will eventually establish a dense plant community, which in turn will improve the facilities' functionalities and durability (Fig. 3). The planting will be scheduled based on farmers' viewpoint with due consideration to the following: 1) the dry season from Dec. to Feb. must be avoided as root extension growth tends to be difficult under the hardened topsoil, 2) the agricultural off-season is from Nov. to Mar. when the farmers themselves undertake planting work and implement plans to reduce construction costs, 3) the end of the longer rainy season from Jul. to Nov. promises moderate water supply to rice without significant raindrop impact (Fig. 4). The total cost of implementing this technology, including maintenance costs per 100m of irrigation canal in 10 years, is equal to the current cost of an unlined canal or 50% cost of a concrete-lined canal. Moreover, farmers do not need to spend cash if they install the reinforcement technology by themselves.

This technology is expected to be applied in West Africa where high intensity rainfall is common and irrigation facilities are poorly maintained. Prior to implementation, native plant characteristics will be elucidated and plants preferred by farmers would be selected. Control strategies will be identified and established before introducing new plants so they cannot invade the paddy fields. Thorough maintenance during the first year is key to ensuring the durability of the irrigation facilities because planting work will continually improve the cover plants' erosion prevention function against raindrop impact in the succeeding years.

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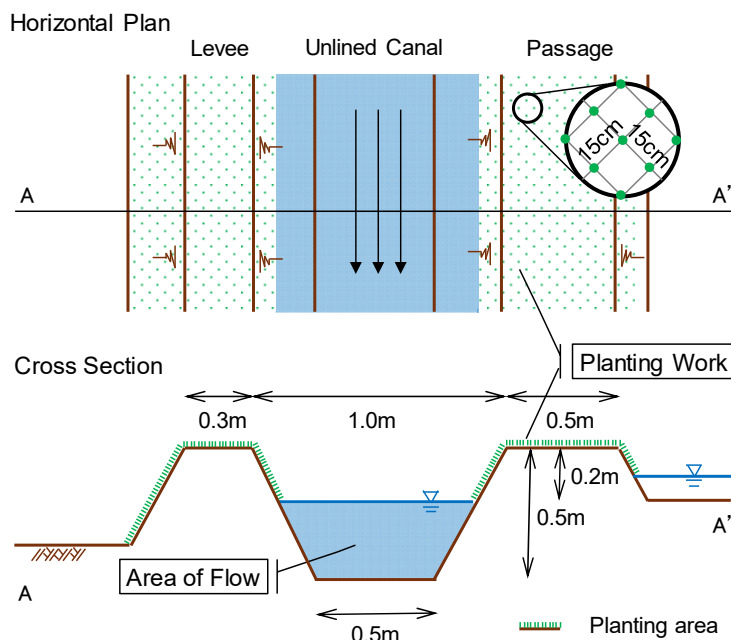


Fig. 1. Standard design of the reinforcement technology

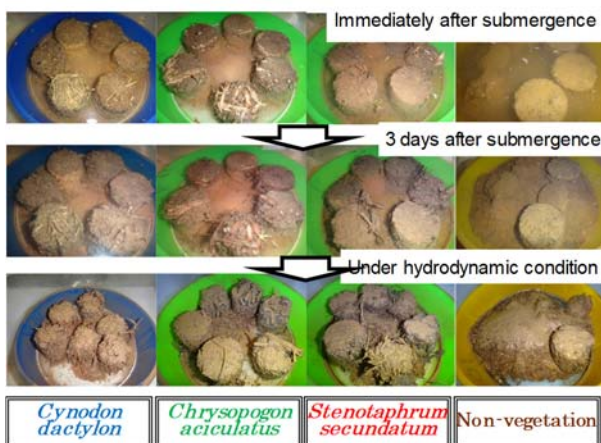


Fig. 2. Grade and process of collapse between three test plants and under non-vegetation condition



Fig. 3. Test canal 6 months after installing
Left: Canal without vegetation
Right: Canal planted with ground covers

Year	20**												20**												20**											
	Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Precipitation	Longer Rainy Season				Shorter R. S.				Dry Season				Longer Rainy Season				Shorter R. S.				Dry Season				Longer Rainy Season				Shorter R. S.							
Paddy Rice Calendar	▲ ● ■												▲ ● ■												▲ ● ■											
Herbicide, Burning	○												○												○											
Vegetable Calendar	▲ ● ■												▲ ● ■												▲ ● ■											
Planting Work	Planting												Establishment												Replanting / Management											
	Criteria I: At good condition 70 % coverage in 3 months												Criteria II: At bad condition 40 % coverage in 4 months																							
Plowing, root cleaning	Unnecessary after reclamation												○																							
Planting, replanting	Replanting is one-fifth of planting												○												○											
Irrigation, fertilizer	Basically unnecessary																																			
Manual weeding	8 times in first year, 3 times from 2nd year												○○○○												○○○○											
Cutlass slashing	3 times from 2nd year												○○○○												○○○○											
	▲ Preparation ● Seeding ■ Harvest																																			

Fig. 4. An example of a construction schedule and maintenance plan for this technology