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Aerobic method of rice cultivation: Water saving and safe environment

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Rice cultivation requires large quantities of water and is labour intensive. There are large water losses by seepage, percolation and evaporation. Rice grown under wetland conditions contributes to the bulk production of rice. In recent years the erratic pattern and irregular rains due to global warming has limited the rice cultivation. Very soon it may be not possible to grow rice in the existing practice as water requirement of irrigation water is huge. In the current scenario of water situation it may not be possible to continue to have the luxury of this kind of cultivation as available water has to be shared for various purposes. Cultivation of rice will be challenging and can affect both production and productivity. Hence, alternate cultivation practices have to be identified with responsive varieties and popularized without having to compromise on yield and sustainability of the rice production. In a pioneering effort Shailaja Hittalmani and Shivashankar G in 1985 conceptualized and tested Aerobic rice cultivation involving upland local rice crosses. This visionary work was initiated by the teacher-student duo in form of a doctoral thesis during 1980-85 to explore growing rice under sub-optimal water and soil conditions with local base genotypes that are responsive under non-submerged aerobic soil conditions. It was essentially to upgrade the existing farmers' practice of direct seeding of rice in rainfed situation with local varieties that fetched very low yields.

Aerobic rice cultivation is a sustainable rice production methodology for immediate future to address water scarcity and environmental safety arising due to global warming. Aerobic rice is a renewed way of growing rice in non-submerged unpuddled condition in aerated soils. It is grown like maize or sorghum on dry soils with surface irrigations once in 5-7 days with intensive agronomic practices.

In a pioneering effort in March, 2007. India officially released its first drought tolerant aerobic rice variety MAS 946-1 followed by MAS 26 (2008) at *University of Agricultural Sciences, Bangalore, India*. Yields were on par with irrigated puddled rice with an average of 5.5-6/ha with 60 percent less water requirement. Savings are also from land preparation, no transplanting costs, seed costs and labor costs. Aerobic rice emits 80-85 percent lesser methane gas and Nitrous oxide into the atmosphere under dryland hydrology thus keeping the environment safe. The incidence of pests and diseases are minimum. Large scale adoption of cultivation and government policies on water regulation could also earn carbon credits to the country.

Water management is crucial in aerobic rice cultivation. There is no need for raising nursery or puddling or transplanting. Dry sowing is carried out with seeds directly sown with higher spacing. Surface irrigations 30-40 mm each is provided at regular intervals of 5-7 days once based on soil type and dry land hydrology is maintained. Appropriate herbicide is used for effective weed control in supplement to manual weeding twice during the crop growth period. Irrigation is provided once in 3 days to avoid chaffiness. Surface Irrigation must be given at the critical stages of germination, tillering, panicle initiation, flowering and grain filling stages. Aerobic rice can be successfully raised with 500 to 600 mm of total water in summer and entirely on rainfall in wet season with a well distributed rain. Aerobic cultivation can reduce the irrigation by about 40 -50 percent when compared to transplanted rice.

Varieties and aerobic cultivation : MAS 946-1 and MAS 26 released by University of Agricultural Sciences, Bangalore became the two first varieties to be released and popularized for Aerobic cultivation in the country in 2007 and 2008. MAS 25, MAS 66, MAS 868 were soon to follow. Varieties specially bred for this situation by farmer participatory selection have higher productivity and yield sustainability that yield 5-6 tons/ha with water savings of 60 percent and cost of production by 30 percent. Package of practices were developed for aerobic rice cultivation.

MAS 946-1 (**Ona Siri) :**The first aerobic rice variety MAS 946-1 is drought tolerant, deep rooted, resistant to blast disease, profuse rooting, high tillering (60 nos) and medium slender grain type. It has medium duration of 125 days with erect plant type. It yields 5.5-6.0 t/ha of grain and 6.00t/ha of fodder yield. This variety was released for Sothern Dry Zone-5 of Karnataka in 2007.

MAS 26 *(Sharada*) : MAS 26 is a early duration, fine grain drought tolerant (with deep root system), resistant to blast disease, profuse root volume, high tillering and medium slender grain type. It has early-medium duration of 115-120 days. It yields 5.0-5.5 t/ha of grain and 5.5 t/ha of fodder yield. It was released for Mid-transition Zone-4 and Zone-5 of Karnataka in 2008.

Aerobic rice and safe environment : Methane is produced in many ways, but one major producer is the paddy fields that is used to grow rice. In flooded rice cultivation methane is produced by the anaerobic (without oxygen) decomposition of organic matter in the soil. It is estimated that paddy cultivation accounts for 20-25 per cent of the methane gases emitted in the atmosphere.

The process of methanogenesis which is emission of methane through decomposition of organic is prevented as soil bacteria decompose organic matter under aerobic conditions. As there is no standing water, fertilizers are less volatile and more efficiently used and hazardous gases are not let into the atmosphere.

Aerobic rice, the rice of the future : By 2025 water scarcity is predicted to be severe and management of the available water for various purposes will be a challenging situation. The water crisis could be managed by good Governance and Policies and water budgeting can effectively address the water scarce situation. Aerobic rice is a possibility for sustainability of rice production and productivity in the future.

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