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Nitrogen Fixation Bacteria Associated with Yams (Dioscorea spp.) Grown in Nigeria

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Abstract

Yams belong to the Dioscoreaceae family, Dioscorea spp.; and are generally cultivated using traditional systems. Intensive yam farming as a cash crop has been increasing in West Africa due demand and limited availability of suitable land. The effect of fertiliser on yam growth varies depending on cultivation method, species and fertilisation management. The most appropriate fertilisation method for yams is not established in tropical areas (Igwilo, 1989; Shiwachi et al., 2015). The results of our previous experiment suggested water yam (D. alata) could grow under low fertility soil conditions without nitrogen fertilisation in Japan (Takada et al., 2017). The water yam plants absorbed nitrogen from air; moreover, nitrogen fixing bacteria (NFB) were isolated from non-fertilised plants (Takada et al., unpublished). From our experiments, the NFB were associated with lesser yam (D. esculenta), and isolated from stem and root tissues (Rezaei et al., 2017). Therefore, there is a possibility that other yam species, not only water yam or lesser yam, are growing with associated NFB. This study aimed to investigate the symbiotic relationship between yam plants and NFB. The tested materials were collected from eight varieties of white yam (D. rotundata) and two varieties of water yam germplasm maintained in IITA, Ibadan, Nigeria. Stems and roots of three plants of each variety were sampled and used for bacterial culture. Acetylene reduction assay (ARA) was conducted after 10 days' incubation. Isolation of bacteria was performed from a sample that was found to be active in ARA. When the colony had grown sufficiently, each bacterium was cultured in semi-solid medium. After 10 days' incubation, isolated colonies were analysed using ARA again. DNA was sampled from the isolated strains and used for phylogenetic analysis of 16S rRNA gene sequences. All the stem and root samples of the 8 white yam varieties showed ARA and after plate dilution culture, colony formation was confirmed in almost all samples. The results suggest that NFB is associated with white yam and water yam grown in Nigeria.

Keywords: ARA, Dioscorea alata, dioscorea rotundata

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