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Strategies for Reversing the Yield Decline of Continuous Cropping of Aerobic Rice

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Yield decline of continuous cropping of dryland rice crop was attributed to soil sickness. The build-up of nematodes and soil pathogens, reduction in soil mineral nutrients, accumulation of toxic substances, and changes in soil physical properties under continuous cropping of dryland crop were speculated to cause the soil sickness. We conducted several pot and field experiments to determine if nutrient deficiency caused yield decline of continuous cropping of aerobic rice. The "sick" soil for the pot experiments was collected from a long-term field experiment where aerobic rice has been grown continuously for 11 seasons. In this continuous cropping of aerobic rice experiment using variety Apo, we observed 40% yield reduction when the 7th-season aerobic rice was grown. Oven treatment of "sick" soil at 120 °C for 12 hours increased chlorophyll content, tillering, plant height, and biomass of Apo grown under aerobic condition at 35 days after sowing compared with untreated soil. Application of K and micronutrients did not improve the plant growth under the "sick" soil. Application of N in the form of $(\text{NH}_4)_2\text{SO}_4$ was effective in promoting plant growth, but not in the form of urea, NH_4NO_3 , NH_4Cl and KNO_3 . The application of Solophos fertilizer increased biomass of Apo by several times. When two newly developed aerobic rice varieties (IR80508-B-57-3-B and IR78877-208-B-1-2) were tested, they produced biomass 319% and 244% more than Apo under "sick" soil. Micro-plots (1 x 1 m) were installed in two field experiments with continuous cropping of aerobic rice to confirm the results of the pot experiments. Application of Solophos in the micro-plots increased crop growth significantly in both experiments, whereas application of S as Gypsum was not effective. These results suggest that (1) soil sickness could be eliminated by improved fertilizer management and (2) it is possible to reverse the yield decline of continuous cropping of aerobic rice by developing new varieties with tolerance to the soil sickness.