

Sustainable and efficient land management practices in the Sahel

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To develop sustainable and efficient land management practices with reference to the reality on which sedentary pastoralists and crop farmers stand in the Sahel, West Africa, we have conducted a series of investigations and field experiments in Niger since 2004.

An investigation revealed livestock management practices based on the relationship between farmers and sedentary pastoralists to promote efficient use of livestock excreta through corralling in the Sahel region. Corralling, parking herds in harvested fields at night, by the sedentary pastoralists was carried out mainly in fields rented from farmers. Another type of corralling was performed on a contract basis in farmers' fields, on the condition that the farmers provide food for the pastoralists staying for corralling. About half of the sedentary pastoralists were not engaged in the practice of contract corralling or contracted livestock, suggesting the existence of a loose relationship between the farmers and sedentary pastoralists in terms of corralling and livestock grazing. In half of the households with contract corralling, the practice changed in two consecutive seasons. This implies that contract corralling is a flexible practice to compensate for the shortage of millet production and forage resources.

A 4-year field experiment on the effect of livestock excreta on millet production clearly showed that the effect was proportional to the amount of livestock excreta and the years after the application. Soil nitrogen loss during 4-year cultivation could be attributed to crop uptake and erosion by water and wind. Considering the actual amount of livestock excreta applied in the field and the residual effect on millet production clarified by the experiment, a few households of sedentary pastoralists had the potential to promote contract corralling for more efficient use of livestock excreta.

Thus, crop farmers with a few livestock should seek for another land management practice to improve crop production. To achieve this goal, we have developed "Fallow Band System" (FBS) (Ikazaki et al. 2011). This practice, considered as a shifting herbaceous windbreak, arranges 5-m-wide herbaceous fallow bands at a right angle to the erosive wind direction in a cultivated field during the rainy season. Crops are cultivated in the remainder of the field. Fallow bands are maintained during the subsequent dry season so that they will trap wind-blown soil materials and control wind erosion in the field. During the next rainy season, new fallow bands are established windward of the former fallow bands, where in turn crops are cultivated as well as in the cultivated bands. As reported elsewhere (Ikazaki et al. 2011), we could enhance crop production and control wind erosion. Nevertheless, we cannot deny the possibility of nutrient mining from the soil since no external input is taken. To improve this practice, we have conducted another field experiment to incorporate the means of external input into FBS. As external input, we considered application of NP fertilizer by micro-dosing and rock phosphate since they are expected to be applicable for resource-poor farmers and tried to extend by several aid agencies. We found that micro-dosing could enhance crop yield with FBS, although rock phosphate did not. Application of rock phosphate could increase available phosphorus in the soil, but since no nitrogen was applied, no yield increase was achieved. On the other hand, micro-dosing with FBS let aboveground biomass of the crop absorb more nitrogen than applied by micro-dosing. This "excessive" enhancement of nutrient uptake by micro-dosing could be explained by observation that stimulated root growth with micro-dosing could reach to soil available nitrogen farther from the plants than without micro-dosing. Thus, micro-dosing could improve nutrient efficiency when combined with FBS. However, considering that the farmers tend to remove not only grains but all the stalks as building materials or animal feeds, it should be noted that micro-dosing might accelerate nutrient mining under such tendency.

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