Improved sugarcane cultivation in the subtropical islands of Japan using controlled-release N-fertilizers

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Objectives

Nitrate pollution in ground water has become a serious problem worldwide; one of its causes is known to be the excessive use of nitrogen fertilizers in agricultural production (Fig. 1). Using water containing nitrate-nitrogen concentrations above the standards of the World Health Organization's (WHO) (10 mg/L) leads to agricultural products becoming unsuitable for human consumption, particularly for infants ("blue baby disease"). Nitrate pollution has become much more serious in the past few years at Miyako Island, Okinawa Prefecture, where people are entirely dependent upon subsurface dam water, which is currently polluted with nitrate.

To solve the nitrate-nitrogen pollution of subsurface dam water in Okinawa Prefecture, we applied controlled-release N-fertilizer (LPS160) to sugarcane.

Results

The trials showed that about 40% of nitrogen fertilizer usage could be cut down without causing reduction in expected sugar yield (Table 1). The weight of sugarcane stalks, Pol percent cane (sucrose content of juice) and expected sugar yield did not decrease in the LPS160 treatment (40% reduced nitrogen) compared to those of plants that underwent conventional fertilizer treatments.

The apparent nitrogen absorption rates were estimated as 57.7% in conventional and 90.9% in LPS160 treatments (Fig. 2), and labeled ^{15}N absorption rates were calculated as 22.4 and 38.8%, respectively. Judging from these results, it seems possible to reduce nitrate-nitrogen leaching to ground water by application of LPS160.

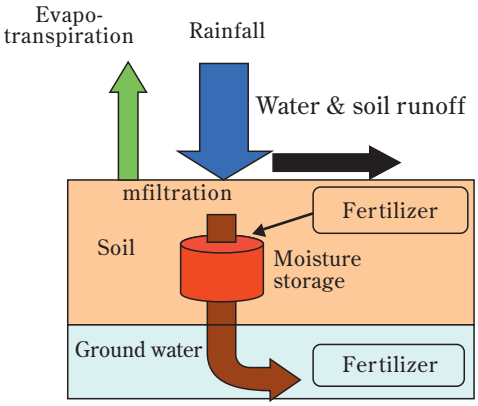

Fig. 1. Water movement in the field.

Table 1. Comparison of sugarcane yields between plants grown with conventional and LPS160 (40%-reduced nitrogen) treatments in spring planting.

Treatment	Nitrogen dose (kgN/ha)	Weight of talks (ton/ha)	Pol percent cane (%)	Expected sugar yield (ton/ha)
Conventional	Basal dressing (60) + Top dressing (60) + Top dressing (80)	94.3	15.05	13.2
LPS160 (40% reduced nitrogen)	Basal dressing (60) + LPS(60)	89.5	14.96	12.5

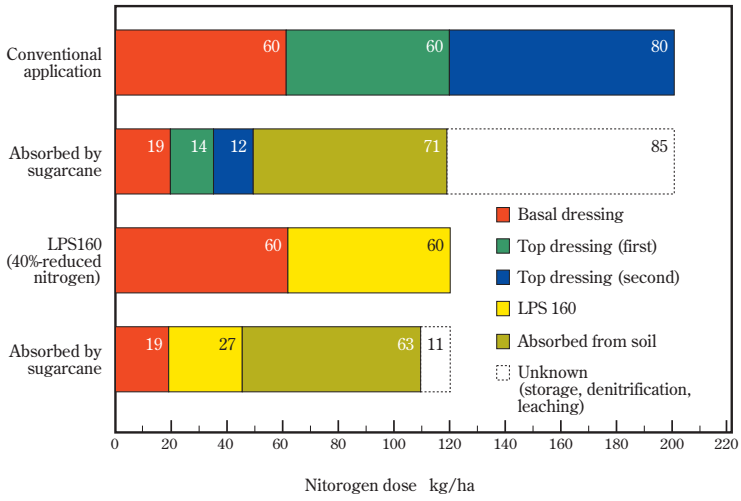

Fig. 2. Sources of nitrogen absorbed by sugarcane.

References

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