STUDY OF COLONY-TYPE GRASS FOR WIND-BLOWN SAND CONTROL: WIDTH AND SPACING CONSIDERATIONS

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Sand transport by wind is a common occurrence in coastal environments. *Carex kobomugi* Ohwi is one of the most common species growing on sand dunes and sandy beaches in Japan. *C. kobomugi* are sometimes transplanted due to their ability to act as dune-stabilizers. These plants usually form a 0.1m-0.2m circular-shaped colony and spacing between two colonies can be very wide because of the severe conditions, high temperature and sand movement. Studies on wind-blown sand phenomena have shown a close relationship between the porosity of the bush type roughness (Musik et al., 1996). Previous studies on the coherent vortex structures on a plate (e.g. Tamai et al., 1988) would play an important role in understanding the relationship between wind-blown sand phenomena and dune-stabilization using *C. kobomugi*. However, the relationship between porous roughness and the flow phenomena still remains ambiguous in sparsely vegetated cases (Tanaka et al., 2004).

The purpose of this study was to elucidate the relationship between the density of *C. kobomugi* and the required width of vegetation for depositing wind-blown sands against the prevailing wind direction. Wind tunnel experiments and numerical analysis was conducted to analyze the effect of spacing between two colonies of *C. kobomugi*. By the presence of colony-type roughness, local scouring around the plants and sand deposition behind it was occurred with dry sand condition (Series-B experiment). In field observation, the scour was not observed, therefore the experiment of fixed bed with blown-sand was conducted (Series-A experiment) and sand deposition amount was measured. Sand deposition amount with fixed bed became larger than that with local scouring. The effect of the spacing of colonies on the amount of sand deposition around them was investigated and represented as a function of the colony spacing. Considering the colony density varied in the prevailing wind direction and the result of wind tunnel experiment, the capacity of sand deposition in the *C. kobomugi* vegetated region at the field was calculated. Fig. 1 shows the calculated sand transport amount ($q_{total} - S_L$,) and amount of sand deposition behind a real plant-colony in relation to the distance from edge of *C. kobomugi* vegetated region. The required width was found about 100 m from the calculation with the colony distribution observed in 2004. The width corresponds to the length from the edge to the point at which no sand deposition was observed behind a *C. kobomugi* colony in prevailing wind direction. With the friction velocity (0.33 m/s) at Ryuyo Beach, the width was ranged about 30-200 m with 0.30-1.0 m spacing. The required width has a wide range with the spacing, so the colony density at the site has a very important meaning.

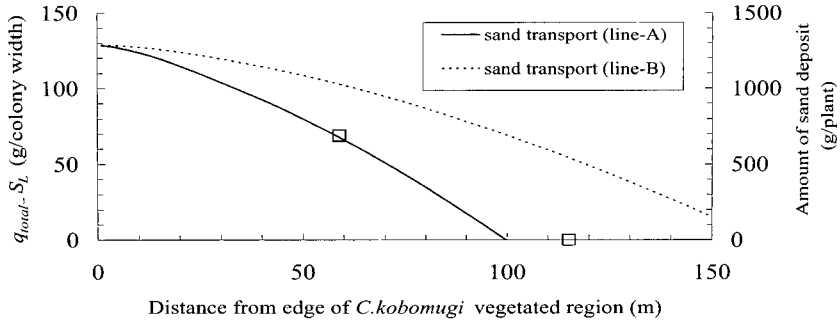

Fig. 1 Calculated sand transport amount ($q_{total} - S_L$) where q_{total} is the total wind-blown sand amount at the site, S_L is the total deposition capacity behind colonies and deposited sand amount behind real plants with the distance from edge of *C. kobomugi* vegetated region: line-A, line-B are correspond to the results in Series-A, Series-B, respectively

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