

# On the Insulating Effect and Air Temperature Moderation by Planting From in Rooftop Gardening

Tetsuro YOKOBORI<sup>1</sup>, Shiro WAKUI<sup>2</sup>, Kentaro IJIMA<sup>2</sup>

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## Abstract

Therefore I investigate a building structure and behavior of the heat in the outskirts in this study and, at the same time, I clarify the mechanism of the heat environment improvement effect by the difference of the tree planting form and am aimed for comparison about effective tree planting technique. I performed a temperature plumb profile measurement to inspect heat environment relaxation effect according to each planting form in this study. For roof Slav division, heat environment relaxation effect for the earth surface of each tree planting division except the *Sedum* mat was accepted. In other words *Buxus microphylla* height of 50cm, *Buxus microphylla* height of 30cm, *Hibiscus syriacus* height of 30cm is an effect by what it is hard to warm the surface of the earth by covering light of the sun and did, and, about the *Sedum* mat, I receive sun emission, and it is thought that the mat material is a result by a high temperature being easy to become it.

**Keywords :** Thermal environment relaxation, Heat insulation, Air temperature moderation, *Buxus microphylla*, *Hibiscus syriacus*, *Sedum* plants.

## 1. Object

In the urban region, aggravation of the heat island effect worsens year by year. As one of the effective technique to reduce such situation, it is hoped that I promote the green cover of the roof and the wall surface, in late years the movement to institutionalize roof tree planting becomes active in each local government. As technical development to

embody such an expectation, a study about the relaxation of the heat environment where I used tree planting materials for, various inspection has been performed. About the heat environment improvement effect by one roof tree planting, it has been inspected with an individual tree planting form till now. However, the plant which is used in these studies, management such as the fertilizer application is necessary, there is the problem

<sup>1</sup>Graduate School of Biomedical Engineering, Toin University of Yokohama

<sup>2</sup>Faculty of Biomedical Engineering, Toin University of Yokohama, 1614 Kurogane-cho, Aoba-ku, Yokohama, 225-8502

that load of the live load to the building grows big. In addition, as for the study method, Experiment time is short, there are few examples which I measured for a long term. In other words, about the improvement of the heat environment, the inspection of the effect of various tree planting types is necessary with behavior of the heat for the night and

day.

Therefore I investigate a building structure and behavior of the heat in the outskirts in this study, at the same time, I clarify the mechanism of the heat environment improvement effect by the difference of the tree planting form, I am aimed for comparison about effective tree planting technique.

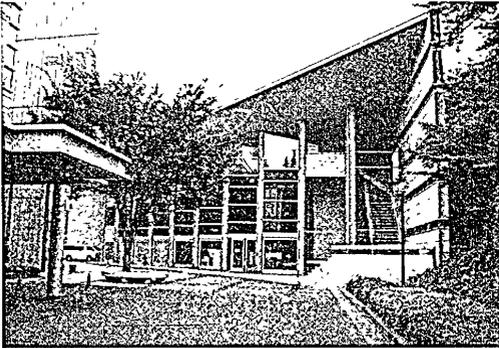


Fig.1 Exchange assembly hall

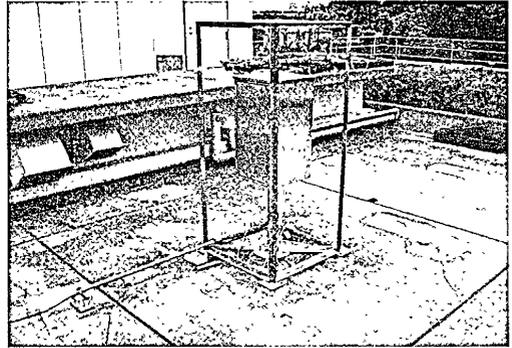


Fig.2 Roof Slab



Fig.3 Sedum mat

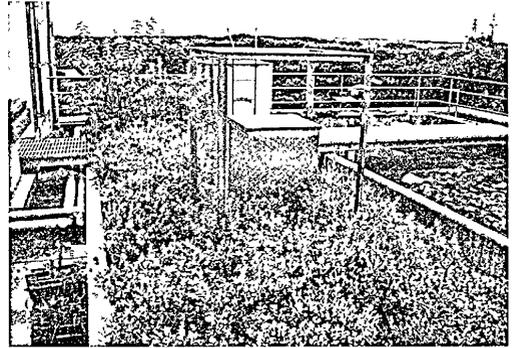


Fig.4 *Buxus microphylla* height of 50cm

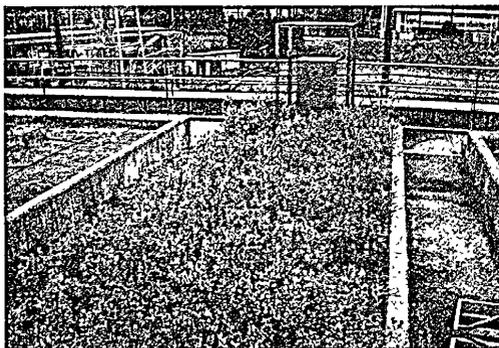


Fig.5 *Buxus microphylla* height of 30cm

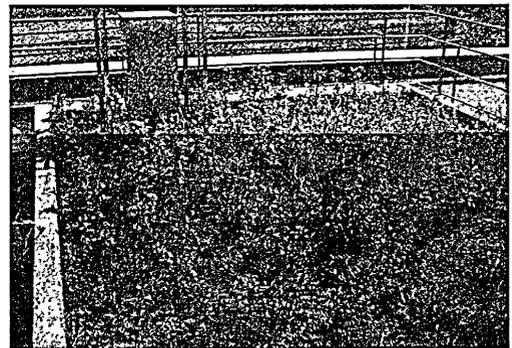


Fig.6 *Hibiscus syriacus* height of 30cm

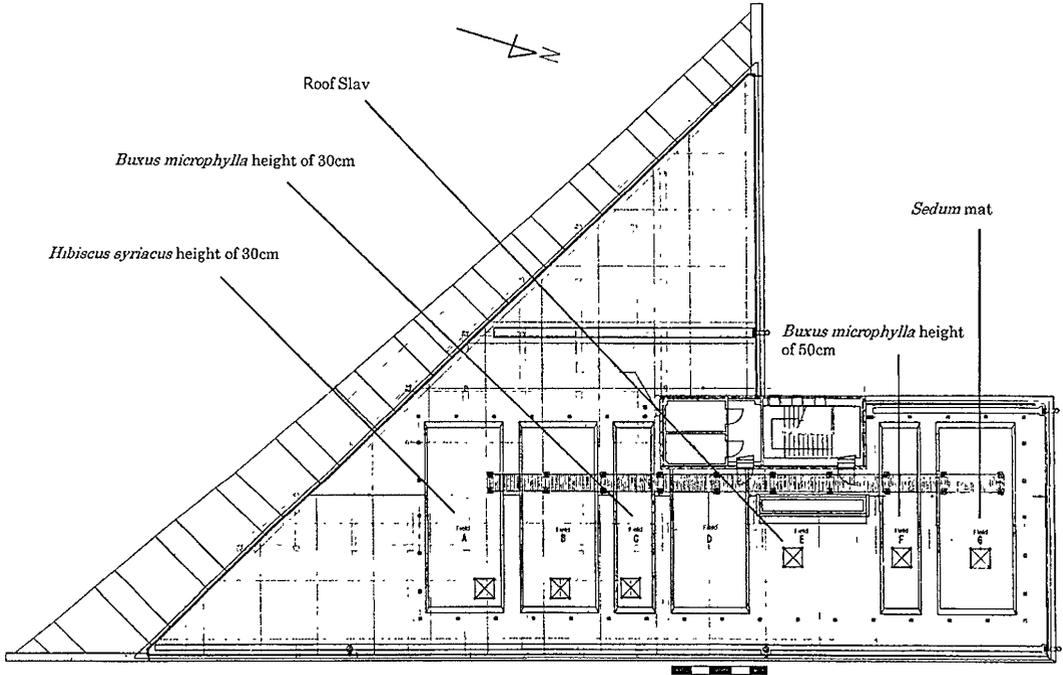


Fig.7 Test conditions for evaluating the function of roof gardening

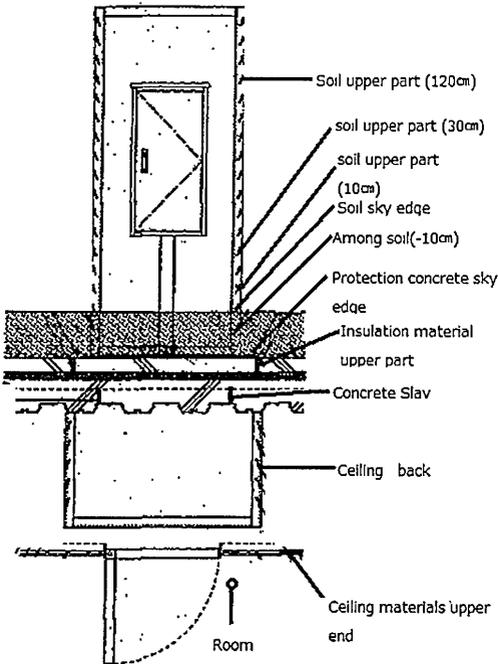


Fig.8 Places of experiment and measurement (Planting division)

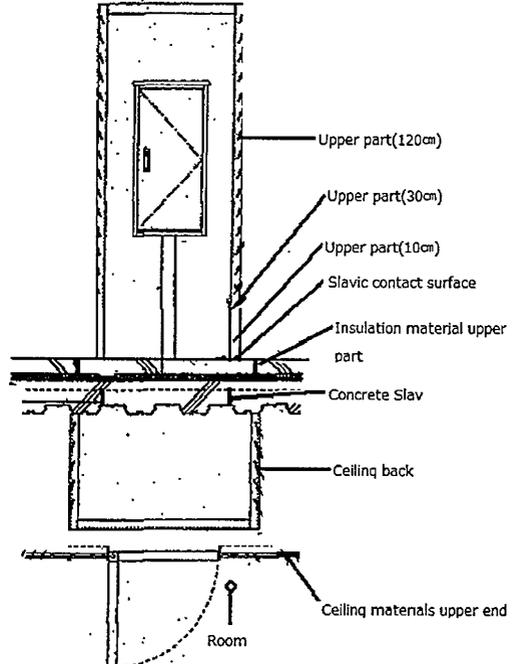


Fig.9 Places of experiment and measurement (Slav division)

## 2. Study design and methodology

In this study, to inspect heat environment relaxation effect according to each planting form, I performed a temperature plumb profile measurement. The experiment, roof Slav of the non-tree planting (Fig.2), *Sedum* mat ward that is four (Fig.3) of tree planting, *Buxus microphylla* height of 50cm (Fig.4), *Buxus microphylla* height of 30cm (Fig.5), I set *Hibiscus syriacus* height of 30cm (Fig.6). In each experiment ward, on a plumb direction the insulation material upper part, protection concrete sky edge, the surface, an altitude of 10cm, an altitude of 30cm, temperature of an altitude of 50cm, measured it for every 20 minutes of the summer (41 days until from August 1, 2008 to September 10). For a measurement, I used Thermo

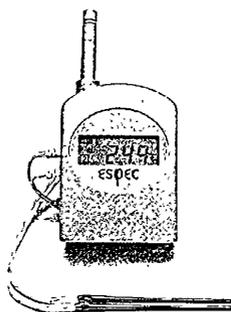


Fig.10 Thermo recorder wireless and a thermocouple sensor

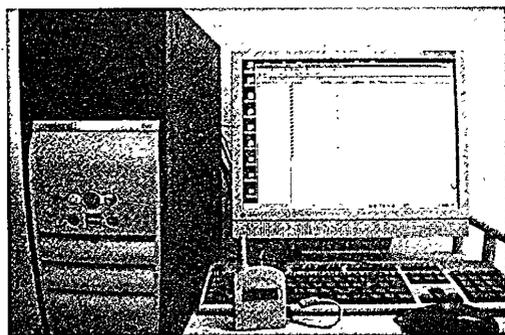


Fig.11 PC and main phone

recorder wireless (RWT -10 ESPEC company) (Fig.10). In addition, it is three wards of tree planting except the *Sedum* mat, for one hour until daily life from 6:00 a.m. to 7:00 a.m., I supplied it with water with drip type.

## 3. Experiment result and consideration

On the other hand, I examined the temperature record days of each experiment ward to be able to put it all over the summer. About the surface temperature of the roof Slav, more than 60 °C on 4 days, more than 50 °C on 7 days, more than 40 °C record it for 28 days, it was a severe condition. In comparison with it and, without reaching it to 50 °C in each tree planting, the records more than 40 °C, in a *Sedum* mat on 19 days, in a *Buxus microphylla* height of 50cm on 4 days, in a *Buxus microphylla* height of 30cm on 0 days, next in a *Hibiscus syriacus* height of 30cm 1days, it is a tree planting except the *Sedum* mat among other things, heat environment relaxation effect was remarkable (Fig.12).

By the summer, I consider it mainly on a measurement result of August 15, 2008 when I recorded the highest temperature. At first it is roof Slav, surface temperature reached 61 °C in the high temperature most by the summer. In contrast in a *Sedum* mat 44 °C, *Buxus microphylla* height of 50cm 42 °C, *Buxus microphylla* height of 30cm 37 °C, Next 38 °C in *Hibiscus syriacus* height of 30cm, a fall effect of 17 °C - 24 °C degrees Celsius was seen in each tree planting (Fig.13). About an altitude of 10cm, *Buxus microphylla* height of 50cm, *Buxus microphylla* height of 30cm, in the *Hibiscus syriacus* height of 30cm, in comparison with roof Slav ward and the *Sedum* mat and it was the situation that lowered temperature

slightly (Fig.14). However, about the temperature of an altitude of 30cm and an altitude of 50cm, there was not a big difference (Fig.15 and Fig.16).

For roof Slav, heat environment relaxation effect for the earth surface of each tree planting ward except the *Sedum* mat ward was accepted. In other words, *Buxus microphylla* height of 50cm, *Buxus*

*microphylla* height of 30cm, in the *Hibiscus syriacus* height of 30cm, by covering light of the sun, it is an effect by what it is hard to warm the surface of the earth, and it did, about the *Sedum* mat, it is thought that it is a result by it takes sun emission, and the mat material being easy to become a high temperature. The effect of environmental summer heat by the tree planting by the

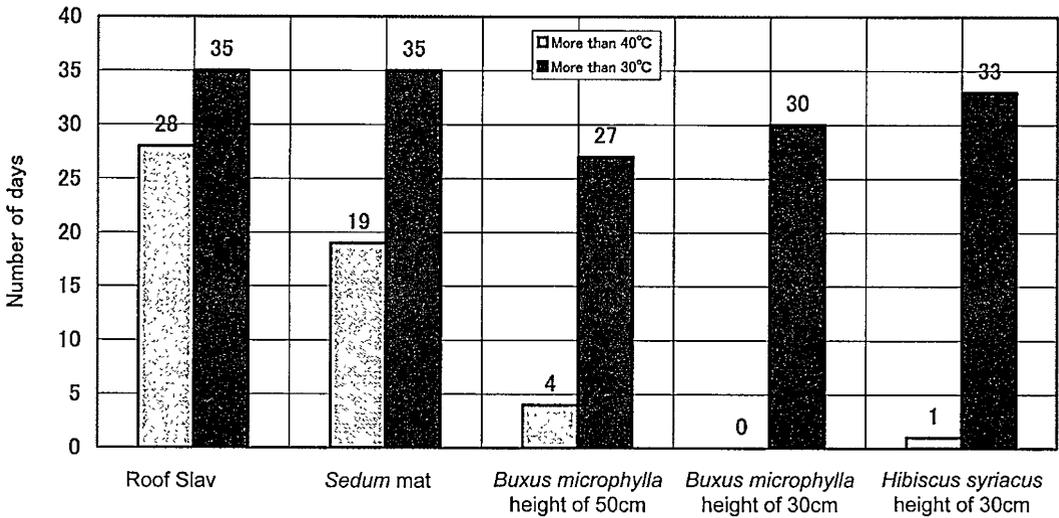


Fig.12 The surface temperature days of the summer

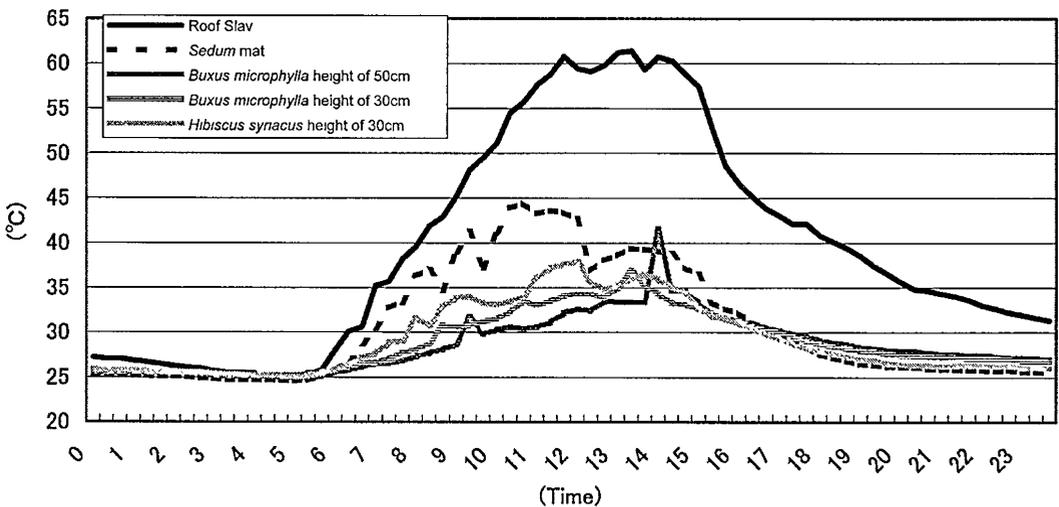


Fig.13 Surface temperature of 8.15

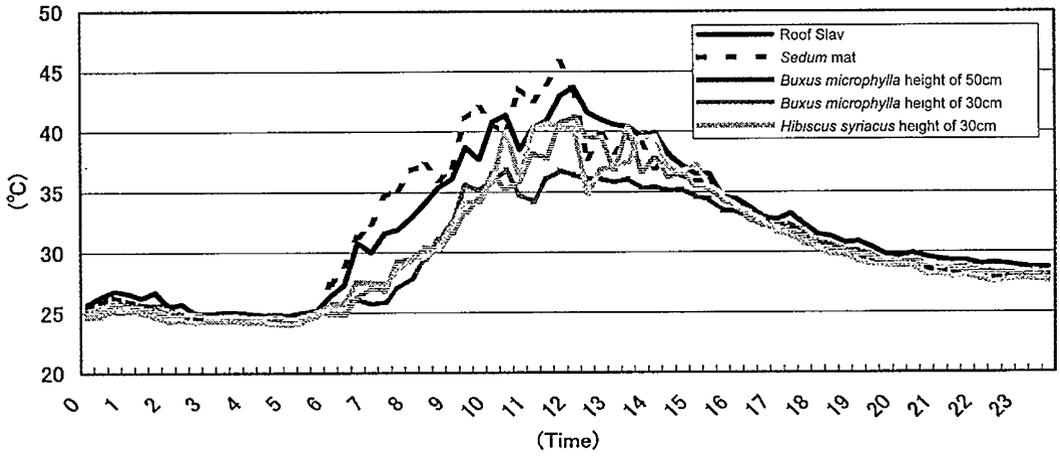


Fig.14 Temperature of an altitude of 10cm of 8.15

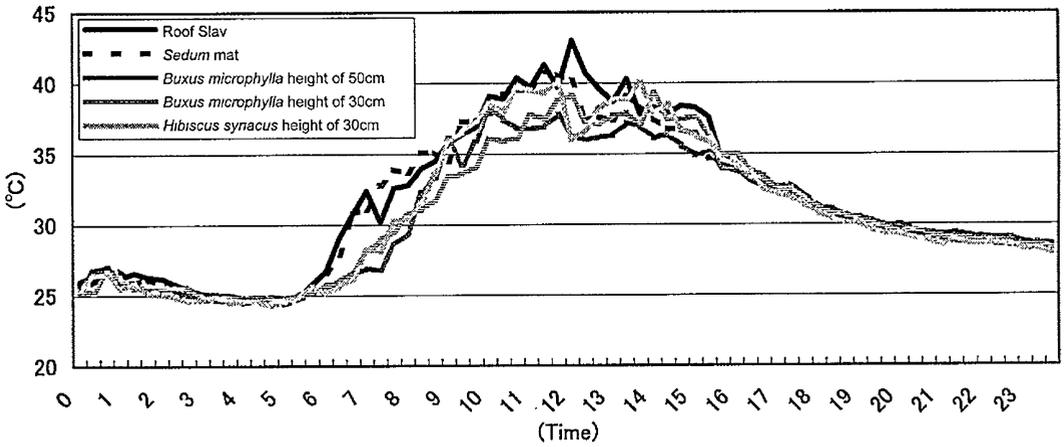


Fig.15 Temperature of an altitude of 30cm of 8.15

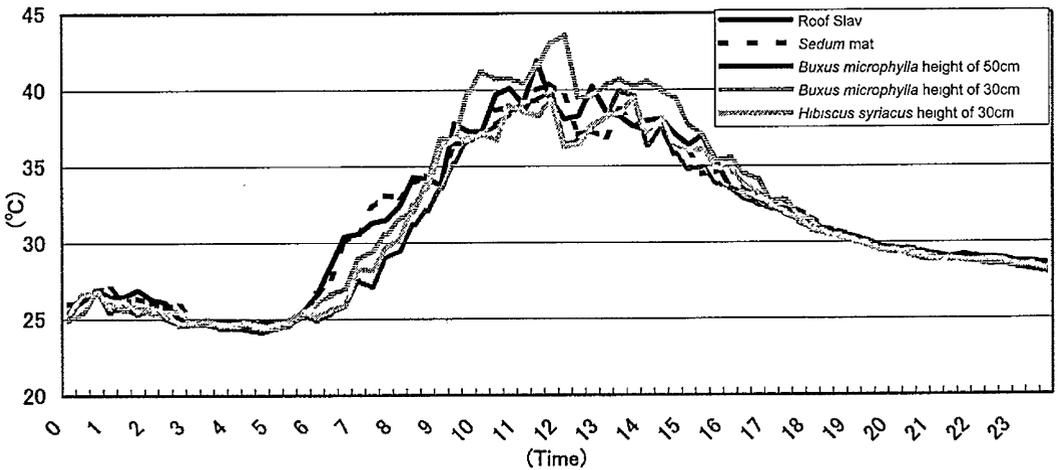


Fig.16 Temperature of an altitude of 50cm of 8.15

above, relaxing it, the form of the plant, it was suggested that I was affected by thickness of the soil.

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