III - A 278 EFFECT OF SOIL MOISTURE CONDITIONS ON THE EVAPOTRANSPIRATION

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INTRODUCTION

On a nation wide basis, approximately 70% of the water that falls on the soil surface is returned to the atmosphere through evapotranspiration. Therefore vegetated areas constitute an important part of the earth hydrologic system [1]. The evapotranspiration from the vegetated areas is affected by many factors temperature, radiation, wind velocity, type of the plant, soil type and soil moisture conditions, ect. Laboratory tests have been carried out to study the effect of the soil moisture conditions that can be considered as one of the most important factors.

1. MEASURING APPARATUS.

Figure (1) schematically shows the measuring equipment. The evaporation measurements are mainly depend on the new evaporation technique that has been proposed by Watanabe and Tsutsui [2]. This technique depends on the fact that if some part of the ground surface is covered by a box made from transparent sheet and air is injected from one side and exhausted from the opposite side the absolute humidity of the exhausted air increases when the vapor is coming out from the ground surface by evaporation or by evapotranspiration.

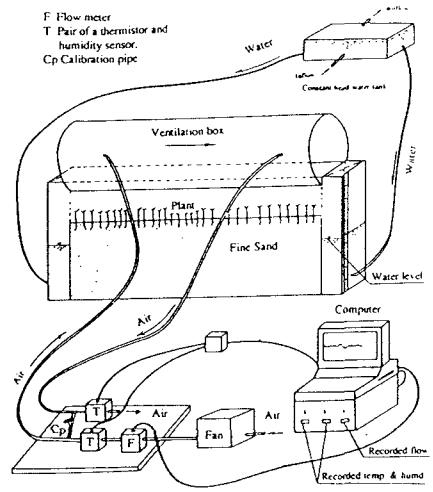


Figure (1)

2. LABORATORY TESTS.

Laboratory tests were carried out on fine sand (Toyoura standard sand). The tests were carried out under constant temperature (25 °C). The vegetated and soil cases were studied. Vegetated case was obtained by cultivating a speedily growing plant (radish) with density of 9000 unit/m^2. The height of the plant at the end of the experiments was 12.0 cm and the root depth was about 5.0 cm. Fertilizers are used for plant feeding at the first stage of plant's age. The area of the ventilation box above the plant was 316 cm^2. The change of the soil moisture condition was obtained by changing the ground water table.

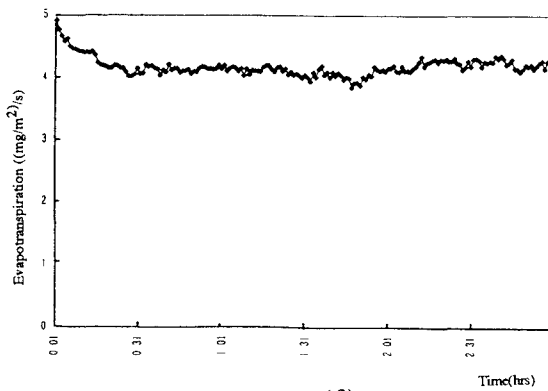


Figure (2)

3. EXPERIMENTAL RESULTS.

The transient changes of the evapotranspiration with time for one run as example are as shown in figure(2).Figure (3) illustrates the saturation distribution of the used sand above the ground water table. Figures 4 and 5 respectively show the variance of evapotranspiration and evaporation rates results from change of saturation of soil at the root zone. From these figures it is obvious that both the evapotranspiration and evaporation rates increase with the increase of soil saturation at the root zone.

The two cases; (a) bared area (b) vegetated area, are compared as shown in Figure (6). The evaporation rate from the bared area was higher than that of the vegetated area. This may be due to, that the effect of the direct contact between the moving air and the sand soil is more than the transpiration from plant. Another reason is that the transpiration from plant was small because of the small radiation . Tests were performed to examine the effect of the average air velocity above the plant on the evapotranspiration. From Figure (7) evapotranspiration rate much increases with the air velocity.

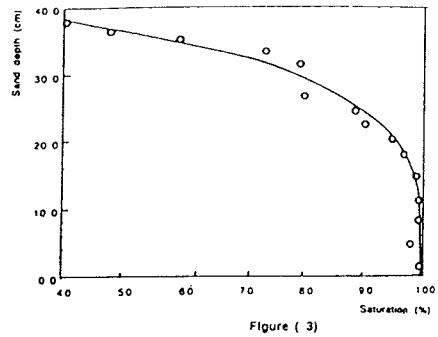
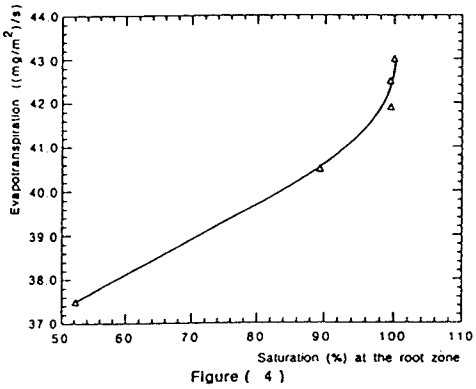


Figure (3)



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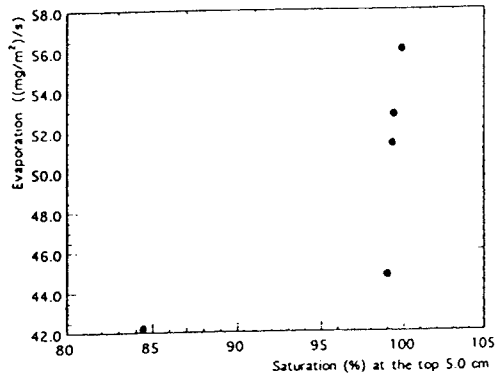

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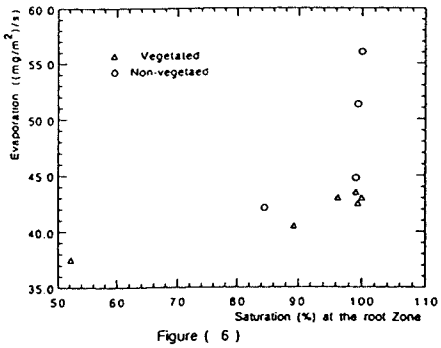

Figure (6)

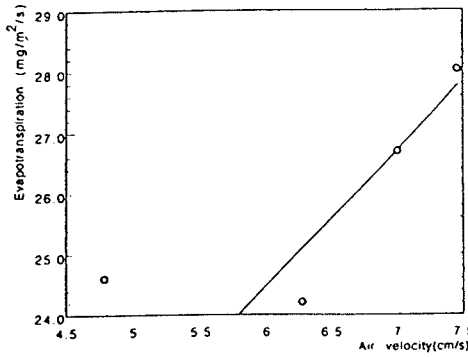

Figure (7)

4. CONCLUSIONS.

The moisture soil condition affects both evaporation and evapotranspiration. In windy areas with shallow ground water, vegetation tends to save the ground water than desertation. The evapotranspiration increases with the increase of the air velocity above the plant. Precisely determination of the plant's transpiration is lagged till a typical artificial plant model will be done.

5. REFERENCES.

1 - Penman, H.L., The water cycle, Sci. Am., 222, 99-108, 1970.

2 - Watanabe, K., Tsutsui, Y., 1994. A new equipment used for measuring evaporation in a field, Proc. 7th Congr. IAEG : 309-313.