# Characteristics of Changes in Soil Moisture and Soil Temperature in the Region of Non-Irrigated Field Crops in Northeast Thailand

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## 1. Introduction:

Cropping systems have been reviewed as a climate change adaptation measures in Northeast Thailand. In this study, we aim to focus on a combination of rice and cassava and to determine the optimum planting date after harvesting rice. Soil moisture and soil temperature were observed continuously for the period up to mid-October from March 2011 non-irrigated field crops in the area of Khon Kaen Province, Thailand. As a result, it was found that the relationship between air temperature and soil temperature differed among the months. This feature seems to dependence on the state of the vegetation cover.

## 2. Materials and tools:

2.1 Field Monitoring System (FMS): The field monitoring system run at the upland cropping area from early March to mid-October 2011. The field monitoring system included an automatic rain gauge, an anemometer, a temperature sensor and a camera. The data can be accessed and downloaded via web server connection to the wifi-internet space. The field monitoring system provided the photo of real field via the camera, daily at 12 am (Thailand standard time).

2.2 5TE sensors: To measure soil moisture, soil temperature and bulk electrical conductivity. The sensors were connected to Em50 data logger and all data were recorded hourly.

## 3. Method:

3.1 Field Experiments:

❖ The study area is located at UTM 1792158 N and 0266434 E. The field landscape includes with 1 to 5 percent slope. The soil series is a Chom Phra, the elevation at 201 m above mean sea level. By using this system, the meteorological data such as; rainfall, solar radiation, wind speed, wind direction, air humidity and air temperature can be continuously collected.

❖ Five sets of 5TE sensor were set into soil at 4, 8, 16, 32 and 64 cm from soil surface. This sensor collected hourly data of soil moisture, soil temperature and bulk EC started from early March to mid-October 2011. At that time, the farmers have just finished harvesting sugarcane and leaf a land for a while before starting to prepare the land for planting rice.

3.2 Soil properties analysis: We performed soil profiling in the field. Soil samples were taken to analysis the physical and chemical properties of soils in laboratory.

## 4. Results and discussion:

Based on recorded data obtaining from field monitoring system could reveal the relations among precipitation, air temperature and continuous changes of soil moisture in various soil levels can be analyzed (fig.1 and fig.2).

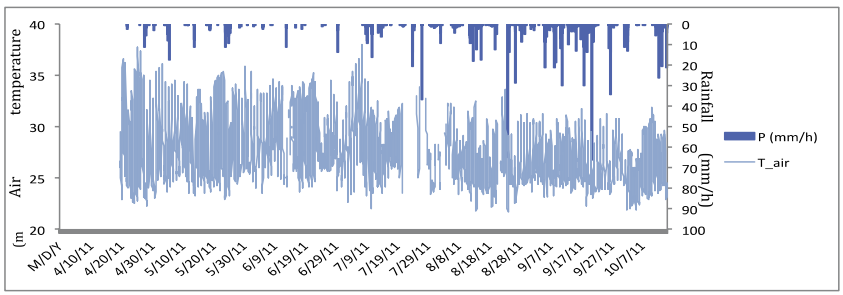


**Fig.1** The amounts of rainfall (mm/h) and air temperature (°C) in period of April to mid-October, 2011.

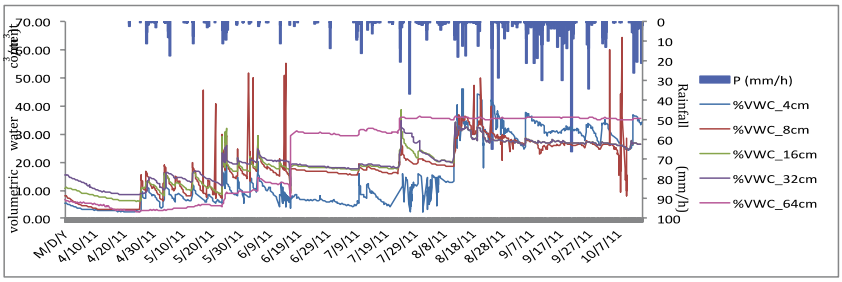


**Fig.2** The amount of rainfall and changes in soil moisture at 4, 8, 16, 32 and 64 cm depths (volumetric water content; $m^3/m^3$).

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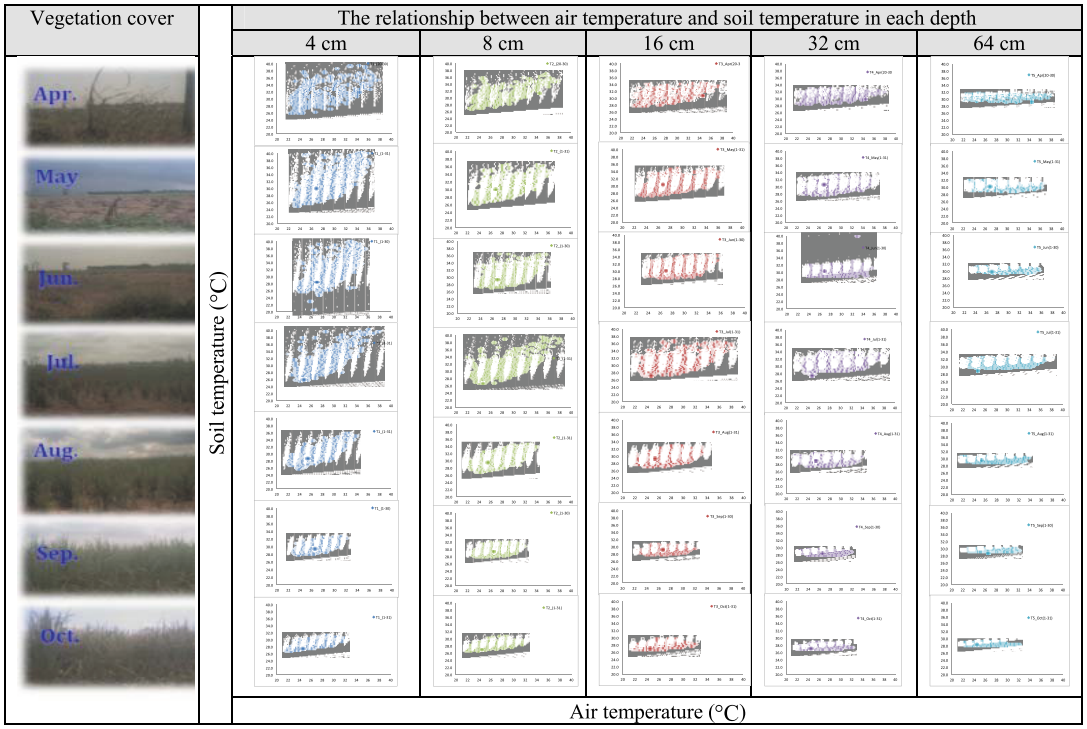
Fig.1 show the distribution of rainfall from April to October during times of the rice season. Meanwhile the air temperature started to decrease from August as affected by rainfall. Fig. 2 show strong influences of the amount of rainfall that changed soil moisture from mid-August to October. Soil moisture levels were increased between 30-50%. Additionally at 64 cm depth, increase of soil moisture content may have been influenced by rising groundwater levels rather than influenced by rainfall. From April to mid-August, changes in soil temperature affected by variations in air temperature (Table1). During April to August, it was shown that the relationship between air temperature and soil temperature at 4 and 8 cm depths were mainly influenced by air temperature. In addition during the months (April to August), the ground cover density was low and there was less rainfall compared with September and October. Accordingly, from September to mid-October it was found that the soil temperatures was not influenced by air temperature as much as in April to August because of the vegetation cover. The above patterns show that the characteristics of rice growth (density of leaf) being able to affect air temperature.

**Table1** Changes of ground cover related to the patterns of hourly air temperature and soil temperature at 4, 8, 16, 32 and 64 cm depths in period of April to October 2011.




Soil samples were analyzed for determination of their chemical properties at 0-15 and 15-30 cm depths. The values for the 0-15 cm depth were pH 5.22-5.49, organic matter 0.28-0.31%, Total N 0.018-0.022%, available P 17-20 ppm, exchangeable K 6-7 ppm and CEC 3.55-4.35 c mol/kg, and those at 15-30 cm depth were pH 5.26-5.49, organic matter 0.31-0.38%, total N 0.018-0.020%, available P 24-27 ppm, exchangeable K 6-7 ppm and CEC 4.15-4.95 c mol/kg (Table 2).

**Table 2** The properties of soils.

| Sample | Depth | pH | Organic Matter (OM; %) | Total N (%) | Avai. P (ppm) | Exc..K (ppm) | CEC (c mol/kg) |
|---|---|---|---|---|---|---|---|
| 1 | 0-15 | 5.22 | 0.28 | 0.022 | 17 | 6 | 3.55 |
| | 15-30 | 5.26 | 0.31 | 0.020 | 24 | 7 | 4.15 |
| 2 | 0-15 | 5.38 | 0.31 | 0.018 | 20 | 7 | 4.35 |
| | 15-30 | 5.49 | 0.38 | 0.018 | 27 | 6 | 4.95 |

Howeler R.H (2002) reported that cassava was well adapted to very acid soils, pH 4.5-7.5, available P>5 ppm, exchangeable K>0.17 me/100g dry soil, and it needs adequate soil moisture mainly during planting. According to soil moisture and the soil properties shortly after rice harvest in October 2011 we found that the values were optimum for cassava growth. Thus, in this area, cassava could be transplanted in November 2011 and grew well.

## 5. Conclusion:

Based on the climatic data, soil moisture, and soil temperature in addition to the soil properties, farmers could transplant cassava in November 2011. This period was thought to be the optimal planting time for cassava in 2011 regarding the environmental condition.


## 6. Acknowledgement:

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