The response of local rice varieties with intermittent irrigation with microclimate factors

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Abstract. Intermittent irrigation is a method carried out for irrigation efficiency in rice farming. This study aims to discover the effect of local rice varieties and types of irrigation and their interaction on rice microclimate factors. The study was conducted with an experimental method of factorial 3x4 strip plot design with a Randomized Completely Block Design (RCBD) with 3 replications. Type of irrigation consisted of 3 levels: conventional irrigation, irrigation ten days inundated five days dry, and irrigation seven days inundated three days dry. Rice varieties comprised four groups: Rojolele, Pandan Wangi, Mentik Wangi, and Cihelang. The results showed that the Pandan Wangi rice variety with seven days of inundation in 3 dry days had higher temperatures above the canopy. During the initial vegetative, irrigation ten days inundated five days dry and seven days inundated three days dry had higher soil temperatures above the surface than conventional irrigation. When flowering, irrigation seven days inundated three days dry has a soil temperature-depth of 15 cm higher than conventional irrigation and irrigation ten days inundated five days dry. The microclimate condition was expected to be useful concerning plant physiology, pests, diseases, and rice weeds and their control.

1. Introduction
The majority of Indonesia's population consumes rice per capita per year, an average of 124 kg. With an estimated population of 273.2 million in 2025, for providing food needs, especially rice, the government must procure around 41.5 million tons of rice or the equivalent of 65 tons of Harvest Dry Grain (HDG) per year. Efforts to increase rice production is performed by improving farming techniques. Variety is one of the technological components essential for increasing rice productivity. Based on its characteristics, varieties are divided into two groups, superior and local rice. The answer to this question on short versus medium duration varieties depends on how many days exist within the year with a favourable climate [1].
On the one hand, superior rice varieties play a higher role in increasing the yield of broad unity for having many tillers and resistance to pests and diseases. Besides, great yielding varieties are generally shorter in age and have smaller plant heights than local varieties. On the other hand, local varieties have a resistance to biotic and abiotic stresses in the local area and suboptimal agroecosystem conditions such as drought, acid soils, inundated land, iron poisoning, thus forming local varieties tolerant of these suboptimal conditions.

Rice is a rice-producing food crop commodity playing an essential role in Indonesia’s economic life. Therefore, rice is a top priority for the community in meeting the needs of carbohydrate intake that can fill and is the primary source of carbohydrates quickly converted into energy. Sustainable Agricultural Intensification (SAI) is particularly important for countries where population growth, food insecurity, reductions in arable land and resources, and on going climate change impacts coincide [2].

Climate shows conditions connected to each region’s atmosphere, closely related to weather, such as temperature, humidity, rainfall, wind direction, and speed. Microclimate effects, such as sunlight intensity, air temperature, and humidity, affect rice productivity. The power of sunlight plays a vital role in photosynthesis, in which plants produce food and energy to grow and develop. Promoting better root growth and enhancing the soil’s fertility with organic materials are being found effective means for raising the yields of many crop plants with less water, less fertilizer, reduced seeds, fewer agrochemicals, and greater climate resilience [3].

Apart from varieties and microclimates, intensive farming techniques should be implemented to increase rice productivity. One of the efforts to increase rice production is to intensify rice plants or the System of Rice Intensification (SRI). SRI is an alternative farming technology with an excellent opportunity to increase the productivity of lowland rice in Indonesia by changing the management of crops, soil, water, and nutrients. Resistance to biotic and abiotic stresses will become more important in the coming decades as farmers around the world have to cope with the effects of climate change and the growing frequency of 'extreme events' [4]. The intermittent irrigation SRI concept only provides irrigation water according to the amount and time needed by plants. The System of Rice Intensification (SRI) is claimed to be a new, more productive and more sustainable method for cultivating rice. These claims have proved controversial [5]. The “System of Rice Intensification” (SRI) developed in Madagascar has been demonstrating substantial productivity gains and other benefits through making changes in crop, soil, nutrient, and water management, rather than from introducing new varieties or increasing external production inputs [6]. SRI reduces water consumption by half, which makes it a promising farming system in the adaptation to climate change in moisture-constrained areas, and it does not require flooding of rice fields, resulting in reduced methane emissions [7]. Some SRI publications claim rice yields that appear to exceed known physiological yield limits [8]. SRI management practices have been reported also to have some countervailing effects that reduce irrigated rice paddies’ contribution to global warming potential (GWP) by their reducing the emission of greenhouse gases (GHGs) [9].

The rice plant growth is influenced by the type and quality of planting material used, superior and local varieties. Farmed local and excellent varieties will control environmental factors. The shape of the rice plant morphology, especially the broader leaves, causes the microenvironment above the canopy to be different from that under the canopy. Climate not only affects plants but is also influenced them. New opportunities are thus emerging for raising agricultural production in ways that can directly reduce food insecurity for several billion people and that do this in environmentally-friendly ways that enable crops to withstand biotic and abiotic stresses which are becoming more severe with climate change [10]. Also, rice varieties will affect the farming factor, namely irrigation. This research was conducted to determine the microclimate factors of plants influenced by varieties and types of irrigation. Therefore, it is necessary to identify the productivity of various varieties and their effect on rice plants' microclimate factors.

This study's objectives were to identify the effect of local and superior varieties of rice varieties on the rice plant microclimate, discover the effect of the irrigation system on the microclimate of rice
plants, and determine the influence of varieties and irrigation interactions on the microclimate of rice plants.

2. Materials and methods
This research was conducted at the Research Area of the Faculty of Agriculture, Universitas Muhammadiyah Yogyakarta in Tamantirto Village, Kasihan District, Bantul Regency, Indonesia, with a height of 113 meters above sea level with regosol soil type. It was conducted from April to August 2019.

The materials used included the seeds of Rojolele, Pandan Wangi, Mentik Wangi, Ciherang, farm manure, Urea, SP-36, and KCL. This study utilized tools consisted of soil thermometer, maximum and minimum thermometer, HTC-1 LCD digital thermometer, Hygrometer, lux meter, pipe, hoe, meter, ruler, scale, stationery, and documentation tools.

This study employed an experimental method on a 3x4 factorial design plotted arranged in a completely randomized block design with three replications. The first factor was the type of irrigation (A), consisting of 3 levels: conventional irrigation (A1), ten days inundation five dry days (A2), and seven days inundation three dry days (A3). The second factor was rice varieties comprising four levels: Rojolele (V1), Pandan Wangi (V2), Mentik Wangi (V3), and Ciherang (V4). This study involved 12 treatment combinations, resulting in 36 experimental units in total.

Primary data were obtained every day, directly from each experimental unit, both above and below the canopy of air and soil temperature, humidity, light intensity, and groundwater level. Data on rainfall obtained from the local Meteorology, Climatology, and Geophysics Agency equipped the primary data.

Data analysis was performed by analyzing variance with levels (α = 5%) to determine whether there was a real difference between treatments. If so, then it continued to test it with the Duncan Multiple Range Test (DMRT), with a level (α = 5%). Several of them were analyzed descriptively with graphs.

3. Results and discussion

3.1. Microclimatic factors

3.1.1. Air temperature. The results of the maximum vegetative phase air temperature variation above and below the canopy revealed a significant interaction between the types of irrigation and rice varieties. The air temperature above the canopy of Pandan Wangi rice with seven days of inundation three days of dry irrigation was significantly higher than that of 7 days of inundation of 3 days of dry Ciherang varieties 28.11 °C and 27.25 °C. The air temperature under Ciherang rice's canopy with conventional irrigation was significantly higher than that of 7 days inundated three days dry, respectively 28.22 °C and 27.39 °C. It signified that with seven days of irrigation being flooded with three dry days, the air temperature above the local Pandan Wangi rice canopy was significantly higher than the superior Ciherang rice. Pandan Wangi rice has leaf length morphology higher and broader than Ciherang rice [8]. Air temperature is related to plant morphology. Rice farming with seven days periodic inundation three days dry was significant for Pandan Wangi rice as it produced a higher air temperature. The average air temperature in the maximum vegetative phase above and below the canopy is presented in Table 1.

The air temperature above the canopy in conventional irrigation and 3 days dry did not significantly differ in various varieties. In 7 days of inundation, three dry days of irrigation, there was a significant difference; namely, the Pandan Wangi variety was significantly greater than the Segara Anak and the Ciherang varieties. In the varieties of Rojolele Gepyok, Pandan Wangi, and Segara Anak, there were no significant differences in various irrigation systems. In the Ciherang variety, there was a significant difference, namely conventional irrigation was significantly higher than that of 7 days inundated three days dry.
For Rojolele, Pandanwangi, and Mentik Wangi rice, the air temperature under the rice canopy with various kinds of irrigation was not significantly different. In Ciherang rice, the air temperature under the rice canopy with conventional irrigation was significantly higher than that of 7 days inundated three days dry, respectively 28.22 °C and 27.39 °C.

Table 1. Air temperature above and below the canopy of 60 days of the rice plant

| Treatments irrigation                  | Rice varieties |
|----------------------------------------|----------------|
|                                        | Rojolele | Pandanwangi | Mentik | Ciherang | Average |
|                                        | Top of the Canopy (°C) |          |         |          |         |         |
| Conventional                           | 27.98<sup>ab</sup> | 28.07<sup>ab</sup> | 28.08<sup>ab</sup> | 28.07<sup>ab</sup> | 28.05  |
| 10 days inundation 5 dry days          | 27.71<sup>abc</sup> | 27.95<sup>ab</sup> | 27.78<sup>abc</sup> | 27.75<sup>abc</sup> | 27.79  |
| 7 days inundation 3 dry days           | 27.63<sup>abc</sup> | 28.11<sup>a</sup> | 27.53<sup>bc</sup> | 27.25<sup>c</sup> | 27.63  |
| Average                                | 27.77    | 28.04       | 27.80   | 27.69    | (+)     |
|                                        | Under of the Canopy (°C) |          |         |          |         |         |
| Conventional                           | 28.06<sup>ab</sup> | 28.08<sup>ab</sup> | 27.99<sup>ab</sup> | 28.22<sup>a</sup> | 28.09  |
| 10 days inundation 5 dry days          | 27.67<sup>ab</sup> | 28.06<sup>ab</sup> | 27.78<sup>ab</sup> | 27.55<sup>ab</sup> | 27.76  |
| 7 days inundation 3 dry days           | 27.74<sup>ab</sup> | 28.06<sup>ab</sup> | 27.55<sup>ab</sup> | 27.39<sup>b</sup> | 27.68  |
| Average                                | 27.83    | 28.07       | 27.77   | 27.72    | (+)     |

Note: The mean followed by the same letter in one column shows not significantly different based on the analysis of variance and DMRT at the α 5% level. (+) There is significant interaction between treatments.

Figure 1 depicts air temperature fluctuation in the maximum vegetative phase in various irrigation systems and varieties above and below the canopy from 55 days to 61 days of age. The observation results revealed a relatively decreasing trend in the graph from 55 days to 58 days of age on various kinds of irrigation and rice varieties to the temperature above and below the canopy. It occurred because the rice plants were getting bigger and bigger each day, thereby reducing the air temperature to the maximum vegetative phase.

Plant canopy density affects the plant's air temperature because the intensity of sunlight radiation is blocked and decreased. The lowest air temperature above and below the canopy occurred at the age of 58 days after planting with seven days of irrigation and three days of dryness in Ciherang rice. The highest air temperature above and below the canopy occurred at the age of 59 days after planting with ten days of irrigation and five dry days of Rojolele rice.

The daily average air temperature resulted from the average air temperature from three observation times (morning, afternoon, and evening). The occurrence of fluctuations in air temperature above and below the canopy was influenced by observation time. Between the ages of 55 and 61, there were differences in the plant canopy condition, causing a difference in temperature above and below the canopy. Air temperature determines the rate of diffusion of the liquid in plants. When the air temperature decreases, the water viscosity increases, thus reducing photosynthetic activity and water evaporation.

Figure 2 illustrates that the daily minimum and maximum air temperature fluctuations showed a fluctuating pattern. The lowest mean temperature was recorded at 26 °C when the rice was eight days old, and the highest average temperature was recorded at 31 °C when the rice was 13 and 33 days old. The lowest minimum temperature during the observation was discovered at 20 °C in the maximum vegetative phase. Rice productivity is more sensitive to the minimum temperature than the maximum temperature [11]. The vegetative stage is one of the defining steps of rice production.
A1 = Conventional Irrigation
A2 = Irrigation after ten days inundation, five dry days
A3 = Irrigation after seven days of inundation, three dry days
A4 = Irrigation after ten days of inundation

V1 = Rojolele Variety
V2 = Pandan Wangi variety
V3 = Mentik Wangi variety
V4 = Ciherang variety

Top C= top of the canopy
Under C.= under of the canopy

**Figure 1.** Air temperature fluctuation at maximum vegetative phase

**Figure 2.** Daily air temperature fluctuation

3.1.2. **Soil temperature.** The results of the soil temperature variation in the early vegetative phase indicated that the type of irrigation system significantly affected the temperature at the soil surface. In contrast, the variety of irrigation systems had no significant effect on soil temperature at a depth of 15 cm. The mean soil temperature in the early vegetative phase, flowering, and seed formation at the surface and 15 cm depth are presented in Table 2.

In the early vegetative phase, the soil surface temperature with intermittent irrigation of 10 days of inundation of 5 dry days was not significantly different. The two treatments had significantly higher temperatures than conventional irrigation. In the flowering phase, conventional irrigation had a significantly higher soil surface temperature than irrigation after seven days of inundation three days dry. Soil temperature with a depth of 15 cm in conventional irrigation and 10-day intermittent irrigation of 5 dry days was significantly higher than that of 7 days of inundation three days of dry irrigation. The variation in surface soil temperature and depth of 15 cm in the seed formation phase was not significantly different between irrigation systems.
Ice canopy during the flowering phase was not significantly different between

Irrigation system was significantly different, namely conventional

is significant interaction between treatments

Note: The mean followed by the same letter in one column shows not significantly different based on

3.1.3. Humidity. The results of the air humidity variation above the rice canopy during the flowering phase revealed no significant interaction between irrigation and rice varieties. The type of irrigation had no significant effect on humidity above the canopy, nor did the variety. Air humidity under the canopy had a significant interaction between irrigation and rice varieties, signifying an interplay between types of irrigation and rice varieties on humidity under the canopy. In Ciherang rice, the highest humidity under the canopy of rice with ten days of wet five dry days was 68.91%. The mean humidity in the flowering phase is presented in Table 3.

Table 2. Average soil temperature in the early vegetative phase, flowering, and seed formation

| Irrigation system | Soil temperature in early vegetative phase (°C) | Soil temperature in flowering phase (°C) | Soil temperature in seed formation (°C) |
|-------------------|-----------------------------------------------|-----------------------------------------|----------------------------------------|
|                   | Surface | Depth 15 cm | Surface | Depth 15 cm | Surface | Depth 15 cm |
| Conventional      | 28.55<sup>a</sup> | 30.55<sup>a</sup> | 28.22<sup>a</sup> | 27.33<sup>a</sup> | 25.89<sup>a</sup> | 23.67<sup>a</sup> |
| 10 days inundation 5 dry days | 27.66<sup>b</sup> | 30.22<sup>a</sup> | 27.66<sup>ab</sup> | 27.00<sup>a</sup> | 25.44<sup>a</sup> | 23.45<sup>a</sup> |
| Seven days of inundation, three dry days | 27.55<sup>b</sup> | 30.55<sup>a</sup> | 27.11<sup>b</sup> | 26.55<sup>b</sup> | 24.11<sup>a</sup> | 23.00<sup>a</sup> |
|                   | (-)     | (-)         | (-)     | (-)          | (-)     | (-)         |

Note: The mean followed by the same letter in one column shows not significantly different based on the analysis of variance and DMRT at the α 5% level. (-) There is not a significant interaction between treatments.

In conventional irrigation and seven days of inundation and three days of dry irrigation, the humidity under the rice canopy during the flowering phase was not significantly different between varieties. In 10 days of irrigation, five days dry, the humidity under the rice canopy during the flowering phase was significantly different, namely the Ciherang variety was substantially greater than the Pandan Wangi and Mentik Wangi varieties. In Rojolele and Ciherang, there was no significant difference in various irrigation systems. In Pandan Wangi and Mentik Wangi varieties, the humidity under the rice canopy during the flowering phase was significantly different, namely conventional irrigation and irrigation, with seven days of inundation three dry days significantly higher than irrigation ten days of inundation and five dry days.

Table 3. The humidity of the air above and under the rice canopy in the flowering phase at 70 days of age

| Treatments | Irrigation | Rice Varieties | Top of the Canopy (°C) | Under of the Canopy (°C) |
|------------|------------|----------------|------------------------|-------------------------|
|            |            | Rojolele       | Pandan Wangi           | Mentik Wangi            | Ciherang | Average |
| Conventional | 67.58     | 65.33          | 68.00                  | 66.83                  | 67.70    | (-)     |
| 10 days inundation 5 dry days | 68.41     | 65.25          | 67.66                  | 69.50                  | 67.70    | (-)     |
| 7 days inundation 3 dry days | 68.16      | 67.00          | 68.33                  | 67.66                  | 67.79    | (-)     |
| Average    | 68.05<sup>a</sup> | 65.86<sup>b</sup> | 68.00<sup>a</sup>      | 68.00<sup>b</sup>      | (-)      | (-)     |
| Conventional | 68.33<sup>ab</sup> | 66.66<sup>bc</sup> | 68.83<sup>ab</sup> | 67.41<sup>abc</sup> | 67.81    |
| 10 days inundation 5 dry days | 67.25<sup>abc</sup> | 64.66<sup>i</sup> | 66.00<sup>cd</sup> | 68.91<sup>abc</sup> | 64.70    |
| 7 days inundation 3 dry days | 68.25<sup>abc</sup> | 67.33<sup>abc</sup> | 68.58<sup>ab</sup> | 67.58<sup>abc</sup> | 67.93    |
| Average    | 67.94      | 66.22          | 67.80                  | 67.97                  | (+)      |

Note: The mean followed by the same letter in one column shows insignificantly different based on the analysis of variance and DMRT at the α 5% level. (-) There is not a significant interaction between treatments. (+) There is significant interaction between treatments.
Figure 3. The humidity of rice flowering phase in various kinds of irrigation and varieties

Figures 3 (a) and (b) show that the rice canopy's humidity during the flowering phase with various irrigation and rice varieties fluctuated. The highest humidity in conventional irrigation under the canopy with a 73.23% humidity was 69 days. It occurred because a higher radiation transmission was used for the evaporation process, hence causing a higher moisture content under the canopy. The lowest humidity in 10 days wet five dry days under the canopy, namely 60.44%, was 72. The air humidity of Ciherang rice above the canopy at 69 days was relatively higher than other varieties. The lowest humidity above the canopy occurred in Pandan Wangi rice, 60.08%, at 72 days.

3.1.4. Light intensity. The results of variance prints on the light intensity above and under the rice canopy during the maximum vegetative phase, flowering, and seed formation implied no interaction between varieties and irrigation, indicating no significant relationship between irrigation and rice varieties above and below the rice canopy. The intensity of sunlight above the canopy had the same relative power between treatments and the light intensity under the rice canopy. The light intensity under the rice canopy was lower than above the rice canopy in various types of irrigation and rice varieties. Some of the light was absorbed and utilized by the rice canopy for photosynthesis.

3.1.5. Rainfall. Rainfall data were obtained from secondary data in the local Meteorology, Climatology, and Geophysics Agency from 9 May to 30 August 2019 from the vegetative phase to the
seeds' ripening stage. There were two rainy days, namely at the age of 23 (1 June 2019) and age 75 (14 August 2019). The rainy day entered into observing the maximum vegetative phase and seed ripening. At the age of 23, the rainfall was 1.8 mm, while at the age of 75, the average rainfall ranged from 1.3 mm. Apart from these two days, there were no rainy days. Rainy days can have an impact on other climatic factors, namely, temperature.

3.2. **Groundwater level**
The results of the various groundwater levels in the early vegetative phase, flowering, and seed formation disclosed significant differences between the types of irrigation and the groundwater level. The average groundwater level in the early vegetative, flowering, and seed filling phases is presented in Table 4.

Conventional irrigation had a higher groundwater level and showed a positive value than irrigation ten days inundated five days dry and seven days inundated three days dry. In conventional irrigation, the water level was above the ground since the land was flooded.

**Table 4.** Average levels of groundwater in the early vegetation phase, flowering, and seed filling

| Irrigation system                  | Levels of Groundwater (cm)                  |
|-----------------------------------|---------------------------------------------|
|                                   | Early Vegetation Phase | Flowering Phase | Seed Filling Phase |
| Conventional                      | 3.73a                                      | 3.40b          | 2.00c             |
| 10 days inundation, 5 dry days    | -2.17b                                     | -4.03b         | -0.50c            |
| Seven days of inundation, three   | -1.23b                                     | 4.50c          | -2.93a            |
| dry days                          |                                            |                |                   |

Note: The mean followed by the same letter in one column shows not significantly different based on the analysis of variance and DMRT at the α 5% level.

The results of the variety of groundwater levels during the flowering phase discovered a significant influence between the types of irrigation systems on the groundwater level. In the seed formation phase, there was no significant influence between irrigation systems on the groundwater level, implying that the type of irrigation had the same effect on the water level during the seed formation phase (Table 4).

3.3. **Sunlight interception coefficient value on the canopy**
The results of the light interception coefficient by the canopy in the maximum vegetative had not significantly interaction between varieties and irrigation, indicating no significant relationship between irrigation and rice varieties on the canopy interception coefficient.

Table 5 depicts that the value of the light interception coefficient by the rice canopy at maximum vegetative showed no significant interaction, implying no interplay between types of irrigation and rice varieties on the value of the light interception coefficient rice canopy when vegetative was maximum. There were no significant differences between types of irrigation and between rice varieties, both in the morning, afternoon, and evening. It showed that the type of irrigation given did not significantly affect the value of the light interception coefficient by the canopy and the various rice varieties. The canopy's light interception coefficient value on several types of irrigation and rice varieties was the smallest during the day, followed by the afternoon, and the highest was in the morning. The smaller the value of the light interception coefficient by the canopy, the more light was absorbed.

Each plant had a different light interception coefficient (k) depending on the leaf area index (LAI). LAI increased with plant growth and reached its maximum when the canopy growth was tight. External factors influence the optimal LAI value, such as spacing (plant density) and cropping system.
Table 5. Mean light interception coefficient value at maximum vegetative

| Treatment              | Sunlight interception coefficient |
|------------------------|-----------------------------------|
|                        | Morning | Afternoon | Evening |
| Rice Variety           |         |           |         |
| Rojolele               | 1.17^p  | 0.91^p    | 0.94^p  |
| Pandanwangi            | 1.17^p  | 0.89^p    | 0.93^p  |
| Mentikwangi            | 1.11^p  | 0.89^p    | 0.87^p  |
| Ciherang               | 1.17^p  | 0.91^p    | 0.85^p  |
| Irrigation system      |         |           |         |
| Conventional           | 1.13^a  | 0.90^a    | 0.86^a  |
| 10 days inundation 5 dry days | 1.14^a | 0.90^a    | 0.91^a  |
| 7 days inundation 3 dry days | 1.20^a | 0.91^a    | 0.93^a  |

Note: The mean followed by the same letter in one column shows not significantly different based on the analysis of variance and DMRT at the α 5% level. (-) There is not a significant interaction between treatments.

3.4. Crop yield

*Yield per hectare.* Grain yield per hectare can determine rice production and is carried out by weighing all grain in one plot. The results of the variance of grain yield per hectare revealed no real interaction between varieties and irrigation, indicating no influence between different types of irrigation systems and various varieties on grain yield per hectare of rice. The types of irrigation systems showed no significant difference, while the various varieties showed significantly different results. The average grain yield per hectare can be seen in table 6.

Table 6 shows that irrigation and rice varieties did not show significant interactions, meaning that there was no relationship between irrigation and crop yields between irrigation and varieties. Between irrigation had no significant effect on grain yield per hectare, while rice varieties had a significant effect. The Pandan Wangi variety gave significantly higher grain yields per hectare than other varieties, namely 6.9 tons per hectare. The research results on rice production factors analysis showed that Rojolele rice productivity reached 7 tons, while Pandan Wangi rice productivity reached 9 tons per hectare.

Table 6. Grain yield per hectare of rice plants (ton per hectare)

| Treatment               | Rice varieties |
|-------------------------|----------------|
|                         | Rojolele | Pandan Wangi | Mentikwangi | Ciherang | Average |
| Irrigation system       |          |             |             |          |         |
| Conventional            | 5.53     | 6.94        | 4.20        | 4.33     | 5.25^a  |
| 10 days inundation 5 dry days | 4.59   | 8.14        | 4.73        | 5.54     | 5.75^a  |
| 7 days inundation 3 dry days | 5.41   | 5.61        | 5.60        | 5.18     | 5.45^a  |
| Average                 | 5.18^a   | 6.90^p      | 4.84^a      | 5.02^a   | (-)     |

Note: The mean followed by the same letter in one column shows not significantly different based on the analysis of variance and DMRT at the α 5% level. (-) There is not a significant interaction between treatments.

4. Conclusion

Rice varieties and types of irrigation interacted in influencing the microclimate, namely the air temperature above and below the canopy at the maximum vegetative phase and humidity below the flowering phase canopy. The air temperature above the highest canopy occurred in the local rice variety Pandan Wangi with seven days of waterlogging three dry days having an air temperature of 28.11°C. The air temperature under the highest canopy on the superior Ciherang rice varieties with conventional irrigation had 28.22°C. The highest air humidity in Ciherang excellent rice varieties with ten days of wet five dry days was 68.91 %. The rice irrigation system affected various microclimates,
such as soil surface temperature and groundwater level during early vegetative and flowering. Rice varieties influenced grain yield per hectare. Pandan Wangi rice provided a significantly higher yield of unhulled rice per hectare than other varieties, 6.9 tons per hectare.

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