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## Amit Biswas

a) Senior Research Fellow,  
Agricultural & Food Engineering  
Department, IIT Kharagpur, West  
Bengal, India

b) Assistant Professor, School of  
Agriculture and Bio-Engineering  
(SoABE), Centurion University of  
Technology and Management  
(CUTM), Paralakhemundi,  
Gajapati, Odisha, India

## Anindita Roy

Assistant Professor, Department of  
Horticulture, M S Swaminathan  
School of Agriculture (MSSSOA),  
Centurion University of  
Technology and Management  
(CUTM), Paralakhemundi,  
Gajapati, Odisha, India

## M Viswanath

Assistant Professor, Department of  
Horticulture, M S Swaminathan  
School of Agriculture (MSSSOA),  
Centurion University of  
Technology and Management  
(CUTM), Paralakhemundi,  
Gajapati, Odisha, India

## Subhrajyoti Chatterjee

Assistant Professor, Department of  
Horticulture, M S Swaminathan  
School of Agriculture (MSSSOA),  
Centurion University of  
Technology and Management  
(CUTM), Paralakhemundi,  
Gajapati, Odisha, India

## Suprajit Roy

a) B Tech, Faculty of  
Agricultural Engineering,  
BCKV, Kalyani, West Bengal,  
India

b) MBA, Narula Institute of  
Technology, West Bengal, India

## Corresponding Author:

### Amit Biswas

a) Senior Research Fellow,  
Agricultural & Food Engineering  
Department, IIT Kharagpur,  
West Bengal, India

b) Assistant Professor, School of  
Agriculture and Bio-Engineering  
(SoABE), Centurion University  
of Technology and Management  
(CUTM), Paralakhemundi,  
Gajapati, Odisha, India

## Canopy temperature of potato crop with different planting dates and irrigation frequencies

Amit Biswas, Anindita Roy, M Viswanath, Subhrajyoti Chatterjee and Suprajit Roy

### Abstract

A farm level experiment was carried out with two (i.e. *Jyoti* and *Ashoka*) different potato cultivars (i.e. *Ashoka* and *Jyoti*) at “C” block farm of the Bidhan Chandra Krishi Viswavidyalaya during November-March (2009-2010) to assess the canopy temperature of potato under three different irrigation levels (I<sub>1</sub>, I<sub>2</sub> and I<sub>3</sub>) with 3 cm irrigation depth. The experiment was conducted under two planting dates (D<sub>1</sub>: 20/11/2009 and D<sub>2</sub>: 29/11/2009) during the above period. The plot size was 4.5 m × 3.7 m. The soil was sandy-loam with medium land situation. In a particular day, readings were taken four times with two hours interval (9:00, 11:00, 13:00 and 15:00 h). Throughout the period, it was observed that the maximum canopy temperature value was at 13:00 h and minimum was at 09:00 h irrespective of the irrigation level, planting date and variety of potato. The maximum canopy temperature was found more for *Jyoti* variety than *Ashoka*.

**Keywords:** Canopy temperature, planting date, potato

### 1. Introduction

The mismanagement of agricultural crop leads to acute shortage of food grain (Islam *et al.*, 1990) [6]. The food production target of India will be 457 million tonnes by the year 2050 to feed 1413 million populations. In contrast, per capita per year surface water availability which was 1902 m<sup>3</sup> in 2001 will be declined to 1492 and 1345 m<sup>3</sup> by the year 2025 and 2050 respectively. At present, the share of supplementary irrigation for fresh water is around 80 percent. Along with this issue, scarcity of fresh water resources put irrigated agriculture in an alarming state during dry period (Sharma and Dixit, 1992) [10]. Thus the challenge for future is to grow more food with less water (Nagaz *et al.*, 2008) [8].

Scientific irrigation in proper time, amount and at a desired depth is essential for the successful production of potato (Kang *et al.*, 2002) [7], but the fertility status of the soil (Zavalin *et al.*, 1993) [11], variety, plant population, clump maturity and plant protection measures are also to be properly considered (Acharya and Kapur, 1993; Abdelghany, 2009) [2, 1]. Measurement of canopy temperature with infrared thermometers has been an efficient tool for irrigation scheduling (Nasare *et al.*, 2009) [9] in arid as well as semi-arid situations (Evet *et al.*, 2000) [4]. Hence, the moisture status of plant as well as soil can also be indicated by canopy temperature of crop. Keeping these in view, the present investigation was on the measurement of canopy temperature of two potato cultivars under three different irrigation levels and two planting dates.

### 2. Materials and Methods

The experiment was carried out at “C” block farm (lat - 22.5° N, long - 89° E and altitude 9.75 m above msl) during November-March, 2009-10. The soil of the study site is sandy-loam with medium land situation.

#### 2.1 Experimental design and treatments

The treatments were distributed in a split plot design, where the date of planting was considered as the main plot treatment, the irrigation levels as sub plot treatment and varieties as sub-sub plot (Biswas *et al.*, 2020) [3].

**The treatment combinations were as follows**

Main plot treatment (Dates of planting; D)

D<sub>1</sub> – 20<sup>th</sup> November  
D<sub>2</sub> – 29<sup>th</sup> November

### Sub plot treatment (Irrigation level; I)

IW/CPE

I<sub>1</sub> = 1.40  
I<sub>2</sub> = 1.20  
I<sub>3</sub> = 1.00

Total plot size was 4.5 m × 3.7 m. In a particular plot, the spacing is 45 cm × 15 cm.

### Sub-sub plot treatment (Potato variety; V)

V<sub>1</sub> – Ashoka  
V<sub>2</sub> – Jyoti

## 2.2 Measurement of Canopy temperature

With the help of an infrared thermometer (Redington model no. 9930-IRT) canopy temperature was recorded. It was taken as average of three values. Unit of the recorded temperature was °C.

## 2.3 Field Observations

Readings were taken in the field with two weeks interval. In a particular day, readings of canopy temperatures were taken from 9:00 h to 15:00 h with 2 h interval.

## 3 Results and Discussion

### 3.1 Canopy temperature of potato crop

The canopy temperature is the measure of the status of water in the crop. Indirectly, it also indicates the moisture status of the soil as well as the leaf water potential (Gandar and Tanner, 1976) [5]. The canopy temperature of potato was measured by Infrared thermometer during the period of 14<sup>th</sup> January to 11<sup>th</sup> February 2010, at two weeks interval. Results revealed that the canopy temperatures at 13:00 h of different treatments are the highest on all observation dates. On an average, throughout the growing period, the magnitude of canopy temperature was lowest at 9:00 h. The canopy temperatures on all observation dates are listed below (Table 1-3):

**Table 1:** Diurnal variation of canopy temperature (°C) on 14/01/2010

Canopy temperature Treatment	Time of observations			
	9:00 h	11:00 h	13:00 h	15:00 h
D <sub>1</sub>	17.1	18.0	19.2	18.9
D <sub>2</sub>	17.2	18.1	20.9	19.8
I <sub>1</sub>	16.3	17.3	20.2	18.5
I <sub>2</sub>	16.7	17.9	19.2	18.8
I <sub>3</sub>	17.4	18.9	20.8	20.8
V <sub>1</sub>	17.0	18.3	19.8	19.5
V <sub>2</sub>	16.6	17.8	20.3	19.2

**Table 2:** Diurnal variation of canopy temperature (°C) on 28/01/2010

Canopy temperature Treatment	Time of observations			
	9:00 h	11:00 h	13:00 h	15:00 h
D <sub>1</sub>	18.3	19.4	23.2	21.4
D <sub>2</sub>	16.3	17.3	19.2	17.4
I <sub>1</sub>	17.5	18.7	21.6	20.1
I <sub>2</sub>	16.4	18.3	21.5	19.7
I <sub>3</sub>	16.6	18.3	20.4	18.4
V <sub>1</sub>	16.5	18.4	21.0	19.2
V <sub>2</sub>	16.5	18.4	21.3	19.6

**Table 3:** Diurnal variation of canopy temperature (°C) on 11/02/2010

Canopy temperature Treatment	Time of observations			
	9:00 h	11:00 h	13:00 h	15:00 h
D <sub>1</sub>	21.6	23.9	26.7	24.6
D <sub>2</sub>	21.3	25.5	27.1	28.0
I <sub>1</sub>	21.5	25.0	28.2	25.4
I <sub>2</sub>	23.4	25.6	28.2	26.3
I <sub>3</sub>	22.7	25.4	28.5	26.9
V <sub>1</sub>	21.4	25.3	27.1	26.3
V <sub>2</sub>	22.6	26.8	28.9	28.6

## 4. Conclusions

The varieties of a crop may require different amount of irrigation water for better productivity and cultivar selection should be such that minimum water can produce maximum, making the slogan 'more crop per drop'. The annual requirement of potato in West Bengal is quite high. Potato is sown in the month of November and harvest to March. In this study, the canopy temperature of two different potato cultivars was investigated under two different planting dates and three different irrigation water regimes.

Based on the study, the following conclusions were drawn:

- The canopy temperature was found to be the highest at 13:00 h in a particular day irrespective of the irrigation level, planting date and variety of potato.
- The canopy temperature was observed to be the lowest at 09:00 h in a particular day irrespective of the irrigation level, planting date and variety of potato.
- The maximum canopy temperature was observed to be more for *Jyoti* variety than *Ashoka*.

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