Variation of relative humidity and air temperature in rice (oryza sativa L.) canopy

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ABSTACT

A field experiment was conducted at Regional Agricultural Research Station, Jagtial (18°50' N, 78°56' E; 248.4 m above MSL) during *kharif*, 2005 and *rabi* 2005-06 to study the micro climate variation, particularly relative humidity and air temperature in rice crop canopy. Higher relative humidity was recorded within crop canopy at flowering stage than at panicle initiation and dough stage in both the seasons. During *kharif* higher relative humidity was recorded compared to *rabi* season. Higher relative humidity and air temperatures were recorded within crop canopy than above crop canopy.

Keywords: Rice, relative humidity and air temperature

In Andhra Pradesh, rice is being cultivated in an area of 4 million ha, of which 95 per cent is under irrigation. To improve production, it is imperative to understand the weather both at macro and micro level as weather directly influences the crop growth and development. For higher productivity, rice requires higher light intensity. Temperature and relative humidity within the crop canopy vary as the crop grows. Atmospheric humidity influences the internal water potential of plants and the rate at which plants transpire water into atmosphere (Hoffman, 1973). Most of the rice is cultivated under irrigated ecosystem. In this system, 2-5 cm depth of water is maintained during the crop period that changes the microclimate of the crop. There is a need to know the microclimate variations particularly relative humidity and temperature in rice crop for optimum crop production. Hence, the present investigation was undertaken to study the relative humidity and air temperature profiles in rice crop during day time.

MATERIALS AND METHODS

A field experiment was carried out during *kharif*, 2005 and *rabi* 2005-06 with rice *Cv*. Jagtiala Sannalu by adopting 15cm X 15cm spacing with a plot size of 12m X 9m at Regional Agricultural Research Station, Jagtial, Andhra Pradesh. The coordinates of the study site are 18°50' N latitude and 78°56' E longitude with an altitude of 248.4 m above MSL. The weekly meteorological data pertaining to *kharif*, 2005 and *Rabi*, 2005-06 were presented in Table 1 & 2. The *kharif* crop was sown on 04.07.2005 and harvested on 14.11.2005. *Rabi* crop was sown on 07.12.2005 and harvested on 04.05.2006. All the recommended cultural operations and protection measures were adopted.

The relative humidity and temperatures were measured within crop canopy (*i.e.*, 10 cm height from ground level) and above crop canopy (*i.e.*, 10 cm height from above crop canopy) using instrument 'Kesrtel Pocket Wcather Tracker' (Mfd. by Nielsen-Kellerman, USA) at fortnightly interval from 9.00 h to 16.00 h IST during both the seasons. The weather tracker gives instantaneous readings and three readings were recorded eacl. time and averaged for interpretation.

RESULTS AND DISCUSSION

Temporal and seasonal variation in RH

The study revealed that, daytime relative humidity decreased gradually from 9.00 hrs to 15.00 hrs within crop canopy with slight increase of 2-4% by 16.00 h. Roy and Tripathi (2006) also observed similar results in wheat crop. Similar trend in relative humidity was also observed above crop canopy. Higher relative humidity (up to 8%) was recorded within crop canopy than above crop canopy during both the seasons. During *kharif* and *rabi*, higher relative humidity was recorded within crop canopy at flowering stage than at PI stage and dough stage (Table 3).

Higher relative humidity was recorded in *kharif* than in *rabi* crop. During *kharif* the relative humidity within crop canopy at 09.00 h ranged from 57-85% (Table 3) and in *rabi* it was 49 - 65% (Table. 4). Whereas, the relative humidity above crop canopy in *kharif* was in the range of 50-82% and in *rabi* it was 46-60%. Higher variations were observed in a day during the *kharif* than in *rabi*.

The rice grain yield was higher during *rabi* season (5.30 t ha⁻¹) compared to *kharif* season (5.14 t ha⁻¹). This was due to the availability of relatively more number of sunshine hours during *rabi* season compared to *kharif* (Table 1 & 2).

Temporal and seasonal variation in air temperature

Sometimes sudden fall in air temperature was observed during the day time due to the passage of cloud while recording observations. Higher air temperature was recorded within crop canopy than above crop canopy and it was in the range of 0.1 to 2.0 °C.

Higher air temperature was recorded within and above crop canopy during early stages of the kharif crop and decreased with advance of the crop growth. Whereas, in *rabi* with the advance of crop growth higher air temperatures were recorded.

CONCLUSIONS

It can be concluded that, higher relative humidity was recorded within crop canopy at flowering stage than at panicle initiation and dough stage in both the seasons. During *kharif* higher relative

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standard week	Pnenopnase		l emperature (U)		Kelative Humidity (%)	shine	Evaporation (mm/day)	(mm)
Number		Maximum	Minimum	Mcan	III I	Hours		
26		32.2	24.0	28.1	83 71	1.1	2.7	127.0
27		33.5	25.7	29.6	78 64	3.2	5.1	0.6
28		29.3	24.6	26.9	TT TT	1.4	2.1	66.4
29		33.5	25.1	29.3	79 61	5.5	3.7	28.8
30		27.8	23.0	25.4	88 82	0.1	1.8	149.0
3]		29.5	23.5	26.5	81 80	0.7	2.7	65.4
32		30.6	22.7	26.6	79 68	4.4	3.2	6.2
33	Transplanting	31.2	22.5	26.9	85 70	2.6	3.3	33.8
34		30.5	23.3	26.9	81 65	4.2	3.0	6.8
35		34.7	25.1	29.9		7.6	4.5	1.8
36		32.4	24.3	28.3	86 71	5.4	3.1	72.4
37	Pamele initiation	30.6	23.9	27.2	80 70	1.7	2.5	12.2
38		29.9	22.9	26.4	82 75	4.1	3.4	253.4
39	Booting	32.5	23.7	28.1	80 57	7.8	3.9	0.0
40		34.9	23.1	29.0	78 49	8.6	4.4	0.0
41	Heading	32.9	22.3	27.6	83 59	5.7	3.6	43.4
42		29.4	22.6	- 26.0		4.5	2.0	89.2
43	Milky stage	31.1	20.9	26.0	77 53	7.0	2.9	2.5
44	Dough stage	30.5	18.3	24.4	77 43	5.9	3.4	2.2
45		30.5	14.5	22.5	81 35	8.2	3 .3	0.0
46		30.7	13.6	22.1	80 31	9.1	33	0.0
Mean/Total		31.3	22.4	26.9	82 62	4.7	3.2	969.6

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Table 1: Weekly meteorological data recorded at RARS, Jagtial during kharif, 2005

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4929.713.6 21.7 505129.310.8 20.0 515229.310.8 20.0 525228.09.618.81128.09.618.82128.09.618.82128.09.618.82128.09.618.82312.120.923.43730.716.023.442931.212.120.95134.715.925.3637.117.827.4937.117.827.4935.719.727.710Panicle initiation30.419.925.21132.219.925.712Booting36.118.327.213Heading40.121.130.615Milky stage40.121.729.61716Dough stage37.521.71716Dough stage37.521.7171721.721.729.61716Dough stage37.521.7171721.721.729.61716Dough stage37.521.7171721.721.729.6171721.721.729.6171721.721.721.717<		Maximum	Minimum	Mean	I II	Hours		
50 $20.$ 29.3 10.8 20.0 51 1 29.9 14.0 22.0 52 28.0 9.6 18.8 1 1 28.9 12.1 20.5 2 30.9 12.1 20.5 23.4 2 1 28.9 12.1 20.5 3 7 16.0 23.4 23.4 4 29.8 30.7 16.0 23.4 5 31.2 12.1 20.9 6 32.1 13.4 21.6 7 34.7 13.4 22.8 8 37.1 17.8 27.4 9 37.1 17.8 27.4 9 37.1 17.8 27.4 10Panicle initiation 30.4 19.9 25.2 11Panicle initiation 30.4 19.9 25.2 12Booting 36.1 18.3 27.4 13Heading 40.1 21.1 30.6 14Hading 40.1 21.1 30.6 15Milky stage 40.1 21.7 29.5 16Dough stage 37.5 21.7 29.6		29.7	13.6	21.7	78 41	6.2	3.3	0.0
51 29.9 14.0 22.0 52 9.6 18.8 1 1 28.0 9.6 18.8 1 1 28.9 12.1 20.5 2 30.9 15.9 23.4 3 7 16.0 23.4 4 7 30.7 16.0 23.4 4 7 30.7 16.0 23.4 4 7 30.7 16.0 23.4 4 7 30.7 15.9 23.4 6 7 37.1 13.4 20.9 7 8 37.1 13.4 27.4 7 8 37.1 13.4 27.4 7 9 37.1 17.8 27.4 9 9 37.1 17.8 27.4 9 11 32.2 19.7 25.2 11 8 37.1 19.9 25.2 11 23.2 19.7 27.4 12 800000 36.1 19.9 25.2 11 21.7 32.2 19.7 27.4 12 800000 36.1 19.9 25.2 13 10.9 25.2 19.7 27.4 11 21.1 32.1 19.2 25.7 12 8000000 36.1 19.2 25.7 13 10 10.1 21.1 30.6 13 10.1 21.1 21.1 30.6 11 15 10.1 <t< td=""><td></td><td>29.3</td><td>10.8</td><td>20.0</td><td>74 38</td><td>7.9</td><td>3.9</td><td>0.0</td></t<>		29.3	10.8	20.0	74 38	7.9	3.9	0.0
52 28.0 9.6 18.8 11 28.9 12.1 20.5 2Transplanting 30.7 16.0 23.4 3Transplanting 30.7 16.0 23.4 4 29.8 12.1 20.9 23.4 5Transplanting 30.7 16.0 23.4 6 $3.1.2$ 12.1 20.9 7 $3.1.2$ 12.1 20.9 7 $3.1.2$ 12.1 21.6 8 $3.7.1$ 17.8 27.4 9 $3.7.1$ 17.8 25.3 10Panicle initiation 30.4 19.9 25.3 11Panicle initiation 30.4 19.9 25.7 12Booting 36.1 18.3 27.4 13Heading 40.1 21.1 30.6 14Heading 40.1 21.1 30.6 15Milky stage 40.1 21.7 29.5 17 17.8 21.7 29.6 17 17.8 21.7 29.6 18 37.5 21.7 29.6 19 21.7 21.7 29.6 17 16 000 stage 37.5 21.7 17 17.8 21.7 21.7 29.6 18 32.2 21.7 21.7 29.6 19 21.7 21.7 21.7 21.7 19 21.7 21.7 21.7 21.7 19 21.7 21.7 21.7		29.9	14.0	22.0	. 81 50	7.2	2.9	1.0
128.912.120.52Transplanting 30.9 15.9 23.4 3Transplanting 30.7 16.0 23.4 4 29.8 12.1 20.9 23.4 5 7 29.8 12.1 20.9 6 $3.1.2$ 12.1 20.9 23.4 7 34.7 13.4 22.8 7 34.7 13.4 22.8 7 34.7 13.4 22.8 7 34.7 13.4 22.8 7 37.1 17.8 27.4 9 8 37.1 17.8 27.7 10Panicle initiation 30.4 19.7 27.7 11 20.4 19.9 25.2 12Booting 36.1 18.3 27.2 13 16 23.2 19.7 27.7 14Heading 40.1 21.1 30.6 15Milky stage 40.1 24.1 32.1 16Dough stage 37.5 21.7 29.5 17 16 Dough stage 37.5 21.7 29.6		28.0	9.6	18.8	77 32	7.5	2.8	0.0
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4 29.8 12.1 20.9 5 8 $3.1.2$ 12.1 20.9 6 $3.2.1$ 13.4 22.8 7 $3.4.7$ 13.4 22.8 7 $3.4.7$ 15.9 25.3 8 37.1 17.8 27.4 9 37.1 17.8 27.4 9 37.1 17.8 27.4 9 37.1 17.8 27.4 10 Panicle initiation 30.4 19.9 25.2 11 30.4 19.9 25.2 27.4 11 Booting 36.1 18.3 27.4 12 Booting 36.1 18.3 27.2 13 Heading 40.1 21.1 30.6 14 Heading 40.1 21.1 32.1 17 Nilky stage 40.1 21.1 32.1 17 Dough stage 37.5 21.7 29.6 17 10 23.2 23.9 33.1	Transplanting	30.7	16.0	23.4	72 27	7.4	3.2	0.0
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17 42.3 23.9 33.1	Dough stage	37.5	21.7	29.6	65 40	8.6	5.1	17.0
		42.3	23.9	33.1	56 27	8.8	6.7	0,0
18 42.0 24.8 33.4		42.0	24.8	33.4	59 31	7.1	7.1	0.0
Mean/Total 34.0 17.1 25.5		34.0	17.1	25.5	70.3 35.5	7.8	4.3	06

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Table 3: Day time variation in air temperature (°C) and relative humidity (%) in rice crop during kharif, 2005

					Within	crop can	opy (10 c	m height	from gr	ound lev	el)					
Date				Air tempe	rature (°C	()					R	elative H	umidity((%		
Time (Hrs)	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
16.08.2005	27.5	28.0	29.7	30.8	30.5	30.9			75	70	64	61	65	61		
06.09.2005	31.1	34.2	38.6	33.1	•	36.4	35.3	36.1	LL	66	53	69		64	69	65
20.09.2005	27.1	30.3	28.8	31.0	*	*	28.1	27.5	85	68	<i>LL</i>	68	•	•	82	81
04.10.2005	30.6	32.6	35.6	32.7	34.2	32.6	34.4	33.9	69	69	54	61	63	70	65	65
18.10.2005	31.0	30.3	31.2	33.0	31.9	30.7	29.6	29.9	78	<i>3L</i>	91	71	76	74	81	<i>6L</i>
01.11.2005	30.2	31.7	32.9	33.1	32.4	31.4	33.7	30.6	57	5 6	49	50	50	ĊĊ	52	44
					Abovc	crop cano	рру (10 с	m height	above c	rop cano	py)					
Date				Air tempe	rature (°C	(1			• •		R	elative H	lumidity((%		
Time (Hrs)	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
16.08.2005	27.6	28	29.4	29.9	30.2	30.8	•	•	74	69	62	60	63	60	•	
06.09.2005	31.0	33.5	38.4	32.9		36.7	35.1	35.7	74	64	50	67		55	62	57
20.09.2005	26.7	29.4	28.4	30.7	•	•	28.0	27.3	82	66	75	67		•	80	80
04.10.2005	30.3	31.7	34.3	32.4	33.7	32.5	33.4	33.9	63	66	48	56	56	65	59	63
18.10.2005	30.3	29.5	30.4	31.2	31.9	30.2	28.8	29.1	75	74	14	65	70	71	78	76
01.11.2005	29.5	30.3	31.7	32.0	32.1	30.6	32.2	31.2	50	42	37	41	37	42	43	43

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Table 4: Day time variation in air temperature (°C) and relative humidity (%) in rice crop during rabi, 2005-06

	.00 15.00 16.00	25 25	32 34 35	*	19 52 58	54 51	58 49 54			15.00 15.00 16.00	24 24 24	43 29 31	* *	42 42 46	44 40 44	44 45 45
midity(%)	13.00 1/	30	52	64	53	63	58		umidity(%)	13.00 1	26	46	59	44	46	50
elative Hu	12.00	35	53	66	53	62	58		elative Hu	12.00	33	44	62	44	51	49
R	11.00	38	50	64	55	63	64	(V0	8	11.00	35	46	62	46	52	55
	10.00	43	53	63	59	65	62	rop canol		10.00	45	46	61	56	59	59
	00.6	49	59	63	61	65	62	abovec		9.00	46	55	60	58	57	59
	16.00	30.7	34.6	*	34.5	35.8	35.9	m height		16.00	30.8	34.6	*	33.8	34.3	34.2
	15.00	30.4	34.7	*	34.6	37.8	35.6	ppv (10 c)		15.00	30.3	34.7	*	33.9	38.6	33.8
()	14 00	30.3	33.6	32.2	36.4	37.1	36.1	crop cano	. ()	14.00	30.0	33.4	31.8	34.3	35.8	34.6
rature (°C	13.00	30.0	33.1	32.5	35.6	35.9	35.7	Above	rature (°C	13.00	29.8	33.1	31.4	33.0	35.4	33.4
vir temper	12.00	28.0	33.2	31.0	35.2	36.1	35.0		Airtempe	12.00	28.0	32.4	30.5	32.9	34.9	32.5
A	11.00	26.6	31.5	31.9	34.6	35.0	33.8		ł	11.00	26.8	30.7	30.2	31.7	34.5	31.8
	10.00	24.1	29.7	30.9	31.6	33.9	33.3			10.00	24.1	29.0	30.1	29.5	31.8	30.5
	0.00	22.2	28.6	30.7	30.6	32.0	33.5			9.00	21.9	26.7	29.4	28.7	29.8	30.9
Date	Time (Hrs)	07.02.2006	21.02.2006	07.03.2006	22.03.2006	04.04.2006	18.04.2006		Date	Time (Hrs)	07.02.2006	21.02.2006	07.03.2006	22.03.2006	04.04.2006	18.04.2006

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humidity was found than in *rabi* season. Higher relative humidity and air temperatures were recorded within crop canopy than above crop canopy. The rice grain yields were higher during *rabi* compared to *kharif* season.

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