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Effect of different treatments on humidity and growth attributes

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Abstract
The field trial was conducted during both the seasons (2009-10 and 2010-11) on PGI Farm without changing randomization and analyzed on pooled basis. The experiment was laid out in *Rabi* season. The various components of growth attributes viz. no. of branches and plant spread were calculated at an interval of 28 days. The stomatal conductance and humidity were significantly more in irrigation level at 1.2 IW/CPE and planting on 44th MW (I3D2). The frequent application of irrigation at 1.2 IW/CPE ratio and early planting favours the development of microclimate including humidity (77 %) in the crop vicinity for better crop growth and development activities mainly at tuber formation stage (56 DAP) obtaining maximum tuber yield on pooled basis. It also recorded significantly higher values of biometric parameters viz., plant height, number of branches, plant spread per plant than rest of the treatments.
The humidity value, growth parameters viz., plant height, number of branches, plant spread were significantly more with sugarcane trash mulching than without mulching. Favours the microclimate in the root vicinity, which affects the better tuber growth and development. Whereas, water stress condition impose due to without mulching at recorded significantly less values of these characters as compared to mulching.

Keywords: Triclosan, TCS, determination, detection, sensor

Introduction
Potato is one of the most important crops of the world, ranking next to rice and wheat. It assumes greater significance for its ability to provide food security to millions of people across the globe, as it provides more dry matter content, proteins and calories from per unit area of land and time. It is a wholesome food which is rich in carbohydrates, phosphorus, calcium, vitamin C and vitamin A, minerals and is high yielding short duration crop with high protein calorie ratio. Potato is one of the unique crop grown in our country having high productivity and supplementing food needs. (Gupta, 2006) [3]. The non-adoption of improved agro-techniques in a climate change scenario as irrigation scheduling, variable planting dates and use of mulch are the limiting factors for low productivity and poor in creation of favorable microclimatic conditions. Globally this climate change should also be addressed in eco-friendly manner. With this back ground in view, the present investigation was undertaken to know the humidity and growth attributes as influenced by sowing windows in potato.

Material and Methods
The field trial of Potato (Variety) Kufri Pukhraj was conducted during both the seasons (2009-10 and 2010-11) on PGI Farm without changing randomization. The experiment was laid out Split Plot Design in *Rabi* season with Recommended dose of fertilizer. 120:60:120 NPK Kg ha-1. There were eighteen treatments comprised of nine main plot treatments and two sub-plot treatments:

Treatment details*:* A. Main plot Treatments (Nine)	
Irrigation levels (I) X Planting dates (D)	
I_1D_1 - (0.8 IW/CPE) X (42 MW)	I_2D_1- (1.0 IW/CPE) X (42 MW)
I_1D_2 - (0.8 IW/CPE) X (44 MW)	I_2D_2- (1.0 IW/CPE) X (44 MW)
I_1D_3 - (0.8 IW/CPE) X (46 MW)	I_2D_3- (1.0 IW/CPE) X (46 MW)
I_3D_1 - (1.2 IW/CPE) X (42 MW)	
I_3D_2 - (1.2 IW/CPE) X (44 MW)	
I_3D_3 - (1.2 IW/CPE) X (46 MW)	
B. Sub-plot Treatments (Two) Mulching (M)	
M1 - With mulch	M2 - Without mulch

Results and Discussion
The important findings of the experiment studies under different irrigation levels, planting

dates and mulching are presented in this under appropriate heads.

The mean relative humidity (RH) during morning hours was quite high (87 percent) in first season, while during second season the corresponding values of them shown almost similar trend (86 percent). Similarly, the mean relative humidity during evening hours was quite high (71 percent) in first season, while it was slightly low (61 percent) in second season, as compared to normal (22 percent). In general, relative humidity increased progressively with the increase in crop life, but later on it decreased at maturity. Unlike RH, the pan evaporation (PE) was progressively increased with the increase in crop life, except that there was a quite drop in PE in the month of November in first season due to considerable increase in atmospheric humidity along with lowering of the temperature, as compared to normal. Moreover, during both seasons, the mean evaporation rate was considerably lower (1.6 and 3.0 mm day^{-1}, respectively) than the normal (6.3 mm day^{-1}) of the corresponding weeks, which clearly indicated that the atmospheric evapotranspirative demand was considerably low.

Effect of different treatments on humidity

The data pertaining to humidity as influenced by various treatments at different growth stages are housed in Table 1. In general, during *Rabi* season, there was a rapid increase in mean humidity from early growth stage to 56 days and thereafter it gradually decreased towards maturity of the crop. The highest mean values of humidity were recorded at 56 days as 78%.

Effect of irrigation levels and planting dates (IxD) on humidity

During the first year at 28 DAP the mean humidity was maximum with I_3D_2 (77 %) followed by I_2D_2 which was at par with I_1D_2 and I_3D_1 followed by remaining treatments in descending order.

The higher tuber yields were obtained when plants were grown under 85% RH. Leaf areas were greater under 50% RH and leaves tended to be larger and darker green under drier than at more humid atmospheric conditions. The elevated humidity appeared to shift the allocation pattern of photosynthates to favour allocation to the tubers over leaves and stems. Response of stomatal conductance to changes in CO_2 concentration varies with humidity and that the humidity effect can be quite localized (Table 1).

When potato is grown under *Rabi* weather conditions, climatic parameters *viz.*, air temperature, relative humidity, aerodynamic factors *etc*. play a predominant role in governing the water needs of crop.

Effect of mulching on humidity

The data presented in Table 1 implies that the mean humidity was significantly influenced due to mulching. The maximum and significantly higher mean humidity was recorded in mulching as compared to without mulching at all the days of observations during both the years of experimentation.

Table 1: Humidity (%) as influenced by various treatments.

Treatments	Pooled											
	28 DAP			56 DAP			84 DAP			AT harvest		
	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean
I_1D_1	54	54	54	62	57	60	48	48	48	44	44	44
I_1D_2	71	67	69	72	71	72	65	61	63	62	58	60
I_1D_3	36	34	35	47	45	46	30	28	29	26	24	25
I_2D_1	65	57	61	65	64	64	59	51	55	56	46	51
I_2D_2	71	67	69	75	74	75	65	61	63	62	58	60
I_2D_3	42	41	42	56	53	54	37	35	36	33	31	32
I_3D_1	67	66	67	68	67	68	62	61	61	58	57	58
I_3D_2	80	74	77	80	75	78	75	68	71	71	64	68
I_3D_3	47	44	46	62	57	60	41	38	40	37	34	36
mean	59	28	44	65	31	48	54	25	39	50	23	36
	S.Em±			CD at 5%		S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±		CD at 5%
Main plot (I X D)	1.20			3.61		1.10	3.30	1.72	5.14	1.66		4.99
Sub plot (M)	0.26			0.78		0.28	0.84	0.40	1.20	0.45		1.34
Interactions												
I X M	0.45			NS		0.49	NS	0.70	NS	0.78		NS
D X M	0.45			NS		0.49	NS	0.70	NS	0.78		NS
(I X D) X M	0.79			2.34		0.85	2.53	1.21	3.61	1.35		4.02

Note- I_1-(0.8 IW/CPE), I_2-(1.0 IW/CPE), I_3-(1.2 IW/CPE), D_1-(42 MW), D_2-(44 MW), D_3-(46 MW), M_1- (with mulch), M_2- (without mulch)

Effect of irrigation level and planting dates on growth attributes

During the tuber development stage till maturity phase, the growth rate in terms of mean plant height, number of branches and functional leaves as well as leaf area plant-1 was slowed down.

The various growth attributes of potato *viz.*, mean plant height (cm), number of branches and functional leaves as well as leaf area (dm^2) plant^{-1} were influenced significantly due to different irrigation levels and planting date during both the years of investigation. The beneficial effect of irrigation on growth and development of potato crop is well established with reference to all the growth attributes.

It is evident from the data presented in Table 2 and 3 that during both the years of experimentation, the irrigation scheduled at 1.2 IW/CPE and planting date on 44th MW (I_3D_2) was comparable with other treatments and exhibited significantly higher and plant spread over rest of the irrigation levels. Whereas, during the same period, 0.8 IW/CPE treatments recorded significantly minimum values of mean number of branches plant^{-1} and plant spread compared to other treatments. The mean number of branches per plant at 28, 56, 84 DAP and at harvest was 4.84, 6.46, 8.42 and 7.38 respectively, whereas plant spread were 30.87, 37.28, 25.98 and 7.08 cm respectively. Thus, these results showed that the number of branches increased with the increasing availability of soil moisture with favourable climatic conditions during the crop growth period in the plots of proper planting date, it was in variance with those reported by.

Table 2: Number of branches as influenced by various treatments.

Treatments	Pooled											
	28 DAP			56 DAP			84 DAP			AT harvest		
	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean
I_1D_1	6.15	4.00	3.38	7.92	6.08	4.67	10.58	9.08	6.56	9.67	7.42	5.69
I_1D_2	8.25	7.00	5.08	11.00	8.50	6.50	14.33	10.17	8.17	13.33	8.08	7.14
I_1D_3	3.83	2.50	2.11	5.08	3.42	2.83	6.83	5.42	4.08	4.33	3.08	2.47
I_2D_1	6.67	6.50	4.39	8.17	6.58	4.92	11.00	9.25	6.75	10.50	7.75	6.08
I_2D_2	9.98	7.17	5.72	15.67	8.75	8.14	18.00	11.25	9.75	16.67	8.42	8.36
I_2D_3	3.33	3.00	2.11	6.67	3.83	3.50	9.00	5.58	4.86	8.67	4.42	4.36
I_3D_1	8.17	6.83	5.00	9.75	6.75	5.50	12.50	9.42	7.31	11.17	8.08	6.42
I_3D_2	11.50	7.50	6.33	15.67	9.08	8.25	19.00	12.08	10.36	17.00	11.08	9.36
I_3D_3	5.33	3.17	2.83	7.33	5.18	4.17	10.08	8.33	6.14	9.33	6.08	5.14
mean	7.02	2.65	4.84	9.69	3.23	6.46	12.37	4.48	8.42	11.19	3.58	7.38
	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CD at 5%
Main plot (I X D)	0.63		1.88	0.61		1.83	0.80		2.41	0.75		2.25
Sub plot (M)	0.20		0.60	0.22		0.66	0.28		0.83	0.26		0.78
Interactions												
I X M	0.35		NS	0.38		NS	0.49		NS	0.46		NS
D X M	0.35		NS	0.38		NS	0.49		NS	0.46		NS
(I X D) X M	0.60		1.79	0.66		1.97	0.84		2.50	0.79		2.34

Note- I_1-(0.8 IW/CPE), I_2-(1.0 IW/CPE), I_3-(1.2 IW/CPE), D_1-(42 MW), D_2-(44 MW), D_3-(46 MW), M_1- (with mulch), M_2- (without mulch)

Table 3: Mean plant spread plant -1(cm) as influenced by various treatments.

Treatments	Pooled											
	28 DAP			56 DAP			84 DAP			AT harvest		
	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean	M_1	M_2	mean
I_1D_1	39.50	37.25	25.58	51.40	45.45	32.28	35.08	34.25	23.11	8.17	6.62	4.93
I_1D_2	44.42	42.50	28.97	54.50	49.83	34.78	37.67	37.00	24.89	10.92	9.45	6.79
I_1D_3	31.84	26.65	19.50	38.00	20.83	19.61	26.32	11.00	12.44	7.42	5.50	4.31
I_2D_1	42.65	40.63	27.76	51.82	45.95	32.59	36.67	34.77	23.81	8.40	8.15	5.52
I_2D_2	49.11	43.42	30.84	55.51	50.33	35.28	40.00	38.25	26.08	11.75	9.54	7.10
I_2D_3	36.26	33.18	23.14	47.51	36.83	28.11	33.50	27.35	20.28	7.76	6.66	4.81
I_3D_1	43.03	42.33	28.46	51.92	49.00	33.64	37.17	34.47	23.88	10.42	8.76	6.39
I_3D_2	62.45	39.34	33.93	70.00	58.33	42.78	41.50	39.50	27.00	18.15	10.83	9.66
I_3D_3	37.50	32.57	23.36	51.00	42.25	31.08	34.76	33.50	22.75	7.83	7.75	5.19
mean	42.97	18.77	30.87	52.40	22.16	37.28	35.85	16.12	25.98	10.09	4.07	7.08
	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CD at 5%
Main plot (I X D)	1.67		5.02	2.18		6.53	1.83		5.48	0.56		1.69
Sub plot (M)	0.93		2.78	1.03		3.06	0.84		2.50	0.29		0.87
Interactions												
I X M	1.62		3.00	1.78		NS	1.45		NS	0.51		NS
D X M	1.62		3.00	1.78		NS	1.45		NS	0.51		NS
(I X D) X M	2.80		8.33	3.09		9.17	2.52		7.49	0.88		2.62

Note- I_1-(0.8 IW/CPE), I_2-(1.0 IW/CPE), I_3-(1.2 IW/CPE), D_1-(42 MW), D_2-(44 MW), D_3-(46 MW), M_1- (with mulch), M_2- (without mulch)

Effect of mulching on growth attributes

The various growths attributes of potato *viz.*, mean plant height, number of branches and functional leaves as well as leaf area plant^{-1} were influenced significantly due to mulching during both the years of investigation. The beneficial effect of mulching on growth and development of potato crop is well established with reference to all the growth attributes. Same trend was reported by Chen Go Ling (1997) [2] It is evident from the data presented in Table 2 that during the experimentation, the mulching was comparable with without mulching and exhibited significantly higher mean number of branches plant^{-1} over without mulching. Whereas, during the same period, without mulching recorded significantly minimum values of mean number of branches plant^{-1} compared to with sugarcane trash mulching. The maximum number of branches were recorded at 84 DAP 8.42 plant^{-1}. Thus, these results showed that the number of branches increased with the availability of soil moisture with favourable climatic conditions during the crop growth period in the plots of with sugarcane trash mulching. Similar consistency in results was reported by Abhijit Sarma and Dutta (1999) [1].

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