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Response of potato to different depths and methods

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ABSTRACT

The investigation entitled, "Response of Potato to Different Depths and Methods" was undertaken during *Rabi* 2002-03 with potato cv. Kufri Jyoti at Water Management Project, Mahatma Phule Krishi Vidyapeeth, and Rahuri. The field experiment was laid out in split plot design with three replications and twenty treatments comprising of four main plot treatments viz., sprinkler, micro-sprinkler, drip, surface and five sub plot treatments viz. depth of 3.53, 3.03, 2.43, 1.98, 1.50 cm. water at 25 mm CPE by sprinkler and micro-sprinkler, wetted area of 1.30, 1.10, 0.90, 0.70, 0.50 for drip, depth of 7.06, 6.05, 4.85, 3.95 and 3.00 cm water at 50 mm CPE by surface and method. The soil was clayey in texture, low in available nitrogen (182.68 kg ha^{-1}), medium in available phosphorus (16.80 kg ha^{-1}) and rich in available potassium (562 kg ha^{-1}) with slightly alkaline in reaction (pH 8.2). The growth and yield contributing characters attained maximum value under sprinkler method than other methods. The highest tuber yield (23.39-t ha^{-1}) and haulms yield (1.68 t ha^{-1}) was recorded due to sprinkler method. There was an increase of 64.55 per cent in tuber yield over surface method. The big size tubers were maximum under sprinkler methods, while the total number of tubers per plant was higher under micro-sprinkler method. The highest tuber yield (20.85-t ha^{-1}) was obtained from regime I_1 which was at par with regime I_2 (20.24 t ha^{-1}). The water requirement of regime I_1 (43.90 cm) was highest, but WUE (474.9-kg ha^{-1} mm) was lowest. The gross and net returns were maximum for sprinkler and micro-sprinkler methods with regime I_1 with B : C ratio of 4.80 and 3.27, respectively, while the drip system was not economical for potato.

Key words : Potato, Irrigation depth, Irrigation methods.

INTRODUCTION

Potato provides vitamins, minerals, proteins and valuable food for those, who suffers from stomach acidity and low blood pressure. In the year 1999-2000 production of potato was 24.2 million tones from area of 1.24 million hectares, with the productivity 19.4 tonnes per hectare. (Anonymous, 2001). About 82 per cent area and 88 per cent production are contributed by it's winter crop alone (Sangwan, 1991).

Maharashtra accounts 15000 hectares are i.e. 1 to 2 per cent of all India acerage with productivity of 4.8 t ha^{-1} (Anonymous, 1999). Irrigation water may be applied to the crops either by surface method or by pressurized irrigation methods such as drip, sprinkler and minor sprinkler. In order to overcome the losses which takes place by surface methods and to use available water efficiently, the modern pressurized methods are adopted. Optimum use of water as per crop requirement is the times need. The water production function is the quantitative expression relating yield output to irrigation input. It is a valuable tool to decide the level of water use. The formation of crop response to quantity of water applied will be of practical use in deciding upon the application of irrigation water to maximize the total production per unit input of irrigation water.

As the potato crop is susceptible to the excess and shortage of irrigation water the optimum levels of irrigation water should be applied at particular time with modern methods of irrigation like drip, sprinkler and micro-sprinkler. A systematic attempt on the basis of IW/CPE ratio for potato has not been studied. For recommending the most appropriate irrigation method and the optimum irrigation depth, so that the present investigation was planned with following objectives.

1. To study the effect of different irrigation methods on growth and yield of potato.
2. To study the growth and yield response of potato to varying water application depth in relation to irrigation methods.

MATERIALS AND METHODS

The investigation entitled, "Response of Potato to Different Depths and Methods" was undertaken during *Rabi* 2002-03 with potato cv. Kufri Jyoti at Water Management Project, Mahatma Phule Krishi Vidyapeeth, and Rahuri. The field experiment was laid out in split plot design with three replications and twenty treatments comprising of four main plot treatments viz., sprinkler, micro-sprinkler, drip, surface and five sub plot treatments viz. depth of 3.53, 3.03, 2.43, 1.98, 1.50 cm. Water at 25 mm CPE by sprinkler and micro-sprinkler, wetted area of 1.30, 1.10, 0.90, 0.70, 0.50 for drip, depth of 7.06, 6.05,

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4.85, 3.95 and 3.00 cm water at 50 mm CPE by surface and method. The soil was clayey in texture, low in available nitrogen (182.68 kg ha^{-1}), medium in available phosphorus (16.80 kg ha^{-1}) and rich in available potassium (562 kg ha^{-1}) with slightly alkaline in reaction (pH 8.2).

Uniformity Coefficient (UC)

$$UC = 100 \left[1 - \frac{SX}{m + n}\right]$$

UC = Uniformity coefficient per cent.
m = Average depth of all observations, mm
n = Total number of observation points.

For micro-sprinkler UC was 82 per cent and for overhead sprinkler 85 per cent.

Water requirement, of the crop

WR = IR + ER + S
WR = Water requirement, mm
IR = Total irrigation water applied mm
ER = Effective rainfall
S = Ground Water Contribution.

Field Water Use Efficiency (kg ha $^{-1}$ mm)

$$WUE = \frac{Y \text{ (kg ha}^{-1})}{WR \text{ (mm)}}$$

WUE = Water use efficiency (kg ha^{-1} mm)
Y = Yield of crop (kg ha^{-1})
WR = Seasonal water requirement of crop (mm)

Table 1 : Potato tuber yield and haulms yield (t ha^{-1}) as influenced by different irrigation methods and irrigation regimes.

Irrigation Methods	Potato tuber yield (t ha^{-1})	Haulms yield (t ha^{-1})
A) Main plot treatments		
Sprinkler	23.39	1.68
Micro sprinkler	18.70	1.25
Drip	15.98	1.08
Surface	14.11	1.16
Sem±	0.49	0.02
C.D. at 5 %	1.71	0.06
B) Sub plot treatments		
I_1	20.85	1.42
I_2	20.24	1.39
I_3	18.35	1.40
I_4	16.76	1.13
I_5	14.05	1.11
Sem±	0.36	0.03
C.D. at 5 %	1.05	0.08
Interaction.	Sig.	Sig.
General Mean.	18.05	1.29

Sig. = Significant.

I_1 Depth of 3.53 cm of 25 mm CPE by sprinkler, micro-sprinkler, depth of 7.06 cm of 50 mm CPE by Surface and 1.30 wetted area for drip.

I_2 Depth of 3.03 cm of 25 mm CPE by sprinkler, micro-sprinkler, depth of 6.05 cm of 50 mm CPE by Surface and 1.10 wetted area for drip.

I_3 Depth of 2.43 cm of 25 mm CPE by sprinkler, micro-sprinkler, depth of 4.85 cm of 50 mm CPE by Surface and 0.90 wetted area for drip.

I_4 Depth of 1.98 cm of 25 mm CPE by sprinkler, micro-sprinkler, depth of 3.94 cm of 50 mm CPE by Surface and 0.70 wetted area for drip.

I_5 Depth of 1.50 cm of 25 mm CPE by sprinkler, micro-sprinkler, depth of 3.00 cm of 50 mm CPE by Surface and 0.50 wetted area for drip.

Treatment Details :

1. Irrigation methods (4)

i) Over head sprinkler
ii) Micro-sprinkler
iii) Drip
iv) Surface

method. There was an increase of 64, 32 and 13 per cent for sprinkler, micro-sprinkler and drip, respectively over surface method of irrigation. Yadava *et al*. (1988), Saggu and Kaushal (1993) and similar results. Obtamed Patel and Patel (2001).

Table 2 : Potato tuber size distribution under irrigation system.

S. No.	Treatment	Small size (< 50 gm)		Medium size (50-100 gm)		Large size (> 100 gm)		Greening potato per cent	
		Per cent No.	Per cent Wt.	Per cent No.	Per cent Wt.	Per cent No.	Per cent Wt.	Per cent No.	Per cent Wt.
A)	Irrigation system								
	Sprinkler	23.05	11.63	33.34	22.47	43.80	63.97	4.48	2.64
	Micro-sprinkler	21.81	12.39	38.20	25.20	43.19	62.66	10.43	5.08
	Drip	33.36	20.72	33.79	39.97	30.49	40.22	4.16	2.34
	Surface	34.52	25.31	30.82	32.58	33.10	42.57	9.40	5.57
	SE m ±	3.02	0.73	2.06	2.72	2.67	3.74	1.03	0.98
	C.D. at %	10.46	2.54	NS	9.44	9.25	12.96	3.57	NS
B)	Irrigation regimes								
	I_1	25.20	11.91	30.70	26.26	43.60	61.49	10.68	5.74
	I_2	30.55	17.46	32.26	27.84	39.19	59.36	7.98	4.17
	I_3	28.44	20.45	33.92	30.38	39.55	51.34	7.52	3.77
	I_4	23.42	17.26	35.89	31.29	34.49	47.28	6.69	3.18
	I_5	33.33	20.50	37.41	34.51	31.40	42.31	2.72	2.68
	SE m ±	2.65	1.13	2.95	2.84	2.14	3.23	1.35	0.86
	C.D. at %	NS	3.24	NS	NS	6.17	9.31	3.89	NS

2. Irrigation Regimes (5)

i) Over head sprinkler : 3.53, 3.03, 2.43, 1.98 and 1.50 cm Depth of water at 25 mm CPE.
ii) Micro-sprinkler : 3.53, 3.03, 2.43, 1.98 and 1.50 cm Depth of water at 25 mm CPE.
iii) Drip method : 1.30, 1.10, 0.90, 0.70, 0.50 wetted area factor.
iv) Surface method : 7.06, 6.05, 4.85, 3.95 and 3.00 cm Depth of water at 50 mm CPE.

RESULTS AND DISCUSSION

Tuber yield (t ha^{-1}) :

Effect of Irrigation Methods :

The sprinkler method recorded the highest yield (23.39-q ha^{-1}) which was significantly superior over other methods, followed by micro-sprinkler and drip method. The lowest yield was (14.11 t ha^{-1}) obtained at surface

Effect of irrigation regimes :

The highest tuber yield was obtained at regime I_1 (20.85 t ha^{-1}) which was at par with regime I_2 (20.24 t ha^{-1}). This was significantly superior over rest of regimes, followed by regime I_3, I_4 regime I_5 recorded the lowest tuber yield (14.05 t ha^{-1}), which was 32.61 per cent less than regime I_1 similar results were reported by Patil (1993), Anonymous (2002).

Dry haulm's yield (t ha^{-1}) :

Effect of irrigation methods:

The dry haulms yield (t ha^{-1}) was significantly influenced due to different irrigation methods. Sprinkler (1.68 t ha^{-1}) recorded significantly superior haulms yield over all other methods, followed by micro-sprinkler and surface method. The lowest haulms yield was recorded (1.08 t ha^{-1}) for drip irrigation. These results are in conformity with those obtained by Anonymous (2001), Anonymous (2002).

Effect of irrigation regimes :

The highest haulms yield (1.42 t ha^{-1}) was recorded by regime 1_1 which was at par with regime I_3 and regime I_2. The lowest haulms yield (1.11 t ha^{-1}) was recorded regime I_5 which was at par with regime I_4. Similar results were reported Anonymous (2001), Anonymous (2002).

REFERENCES

Anonymous (1999). Economic survey of Maharashtra (1998-99).

Anonymous, (2001). A report of research work done on Irrigation Water Management at MPKV, Rahuri. 2000-01.

Anonymous, (2001). Economic survey of India (2000-01).

Anonymous, (2002). A report of Research work done in Irrigation Water Management at MPKV, Rahuri. 2001-02.

Patel, J.C. and Patel, B.K. (2001). Response of potato to nitrogen under drip and furrow methods of irrigation. *J. Indian Potato Assoc*., **28(2-4) :** 293-295.

Patel, J.C. and Patel, L.R. (2001). Effect of irrigation and nitrogen on yield attributes in potato. *J. Indian Potato Assoc.*, **28(2-4) :** 285-287.

Patil, R.B. (1993). Irrigation scheduling and water requirement of potato. M.Tech. Thesis submitted to MPKV, Rahuri.

Saggu, S.S. and Kaushal, M.P. (1993). Drip irrigation is better than furrow irrigation for potato crop. *Indian fmg.*, **43 (9) :** 11-12.

Sangwan, S.S. (1991). Production and marketing of potato in India Ist Edition. Mittal Publication, New Delhi. pp.258.

Yadava, A.C., Pandit, M.L. and Yadav, S.K. (1988). Water management in solanaceass vegetables. A review, Agril. Reviews, karnal, Haryana. Agril. Univ. Hissar, India, **9(3) :** 111-124.

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