

## Effect of Irrigation on the Growth and Yield of Wheat (*Triticum aestivum* L.)

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Application of irrigation at all the critical stages significantly increased the grain yield of wheat over control. Tillering stage showed the highest response in increasing the grain yield of wheat when only one irrigation was given. For two irrigations tillering and jointing stages, for three irrigations crown root initiation, tillering and jointing stages and for application of four irrigations crown root initiation, tillering and jointing and flowering stages were observed to be beneficial in increasing grain yield of wheat variety Kalyansona.

Wheat is an important food grain crop in India. In Maharashtra cultivators sow wheat variety Kalyansona after harvesting the cotton crop in the month of October or November. The irrigation application to wheat crop is not either as per the physiological stages nor according to its water requirements. The basic reasons for low yield seems to be the irrigation given to wheat crop when water is available or the cultivators do not irrigate. Patel *et al* (1971) obtained higher yield with irrigation given at defined physiological stages of crop growth which was presumably coincided with maximum physiological activity. An investigation, therefore, was undertaken at the College of Agriculture, Pune-5 to know the optimum number of irrigations required for wheat crop and the physiological stages at which it should be given. Similarly to study the impact of application of irrigation

on the growth and yield of wheat variety Kalyansona.

### MATERIAL AND METHODS

The field experiment was laid out at the Agricultural College Farm, Pune-5 in the plot No. 695 of 'F' Division during 1972-73 and 1973-74. The soil from the experimental plot was of medium black type with the pH of 7.3 and 7.2 during the year 1972-73 and 1973-74. The total nitrogen (per cent) of the soil was 0.065 and 0.064 during 1972-73 and 1973-74 respectively. The available  $P_2O_5$  (mgm/100 gm) was 5.2 and 5.1 in 1972-73 and 1973-74 respectively. The organic carbon (per cent) was 0.63 and 0.62 in the year 1972-73 and 1973-74 respectively. The maximum water holding capacity (per cent) of the soil was 60.20 and 60.18 in the year 1972-73 and 1973-74 respectively.

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The moisture at 13rd atmospheric pressure (per cent) was 36.20 and in the year 1972-73 and 1973-74 respectively. The moisture at 15 atmospheric pressure (per cent) was 20.14 and 20.13 in the year 1972-73 and 1973-74 respectively. The bulk density of the soil was 1.20 in the year 1972-73 and it was 1.18 in the year 1973-74. All nineteen treatments were replicated for three times with gross plot size of  $6.00 \times 2.76$  m and  $5.08 \times 1.84$  m net. As the presowing irrigation is essential for better seed bed preparation and successful germination of the seed it was given in both the years of the experimentation. After pre-sowing irrigation, the basal dose of 60 kg N/ha in the form of urea, 67 kg.  $P_2O_5$ /ha in the form of single super phosphate and 67 kg.  $K_2O$ /ha in the form of muriate of potash were applied at the time of sowing, however, the topdressing of 60 kg N/ha was given after 21 days from sowing in both the years of experimentation. The wheat variety Kalyansona was drilled on 29th November, 1972 and 27th October, 1973. Sowing was done by four coultered seed drill with 22.50 cm spacing between two rows. Harvesting was done at dead ripe stage on 13th April in 1973 and 10th March in 1974. In all there were nineteen treatments replicated for 3 times. No irrigation (control), only one irrigation was given at crownroot initiation stage (C at 21 days from sowing), tillering stage (C at 41 days from

sowing), jointing stage (J at 62 days from sowing), flowering stage (F at 82 days from sowing) and milk stage (M at 102 days from sowing). Two irrigations at crownroot initiation and tillering (CT), tillering and jointing (TJ), jointing and flowering (JF) and flowering, and milk (FM) were given. Three irrigations were applied at crownroot initiation, tillering and jointing (CTJ), tillering, jointing and flowering (TJF), jointing, flowering and milk stages (JFM) were given. Four irrigations at crownroot initiation, tillering, jointing and milk (CTJM), crownroot initiation, tillering jointing and milk (CTJM) crownroot initiation, tillering, flowering and milk (CTFM), crownroot initiation, jointing flowering and milk (CJFM), and tillering, jointing, flowering and milk stages (CJFM). For application of five irrigations, irrigations were given to all the critical stages i. e. crownroot, tillering, jointing, flowering and milk stages (CTJFM). The temperature data during the crop period are presented in Table I.

## RESULTS AND DISCUSSION

The mean height of plant, length of the ear, weight of the ear, grain weight / plant thousand grain weight, grain and straw yield as affected by frequency of irrigation given at different physiological stages to the wheat crop variety Kalyansona during 1972-73 and 1973-74 are given in Table II. In general the year 1973-



74 was more favourable to growth and yield of wheat crop. The reason being the lowest temperature recorded during the year.

**(1) Effect on growth :**

i) **Height :** The mean height of wheat plant was observed to be 59.24 and 54.73 cm during 1972-73 and 1973-74 respectively. The lowest height was recorded in the treatment of control 47.28 and 44.33 cm during 1972-73 and 1973-74 respectively. The significant increase in height was observed in the treatment of T, CT, TJ, CTJ, TJFM, CTFM, CTJM, CTJ and CTJM over control and the treatments were found to be on par during 1972-73. However, the treatments T, J, F, CT, FM, CTJ, TJF, CTFM and CTJM increased the plant height significantly over control and were on par during 1973-74. The treatments JFM, CJFM, CTJF and CTJFM were found to be on par and increased the plant height significantly over control in the year 1973-74.

ii) **Length of ear (cm) :** The lowest length of ear was recorded in the control in both the years. However, the treatment CTJFM showed significant increase in length of ear over all other remaining treatments in the year 1972-73. The results were observed to be not significant in 1973-74.

**(2) Yield contributory characters :**

i) **Weight of ear (g) :** The lowest weight of ear was recorded in

the treatment of control in both the years of experimentation. The treatment of T, CT, TJ, TF, CTJ, TJF, CTJF and CTJFM have increased the weight of ear significantly over the control and found to be on par during 1972-73. However, the results are observed to be non-significant in respect of weight of ear in 1973-74.

ii) **Grain weight/plant (g) :**

The lowest grain weight/plant was recorded in the treatment of control in both the years of experimentation. The treatments CT, TJ, CTJ, TJF, CTJF, CTJFM were observed to be on par and increased the grain weight/plant significantly over control only during 1972-73.

iii) **1000 grain weight (g) :**

The mean thousand grain weight was found to be 29.94 and 30.08 during 1972-73 and 1973-74 respectively. The treatments T, TJ, TFI TJF, TFM, TJFM CJFM and CTJFM were found to be on par and increased the thousand grain weight significantly over control in 1972-73. But the, treatments CJFM and CTJFM alone increased it significantly over control in the year 1973-74.

**(3) Yield (q/ha) :**

i) **Grain yield (q/ha) :** Maximum grain yield was obtained in the treatment of CTJFM when irrigation was given to all the critical stages i. e. 32.45 and 52.37 q/ha during 1972-73 and 1973-74 respectively and the



yield increase was significantly higher over all the treatments including control. The grain yield of wheat was found to increase with increase in the number of irrigations from one to five and the response to number of irrigations was linear. The results are in conformity to those of Patel *et al* (1971) and Singh (1970) who have reported that the grain yield of wheat increased with application of irrigation to all the critical stages. In the present investigation the growth and yield contributory characters were more favourably influenced with the application of irrigation to all the critical stages and increased of the grain yield of wheat.

Tillering stage showed the highest response in increasing the grain yield of wheat when only one irrigation was given. The grain yield obtained was 19.26 and 23.66 q/ha during 1972-73 and 1973-74 respectively. For two irrigations tillering and jointing stages yielded 19.26 and 32.31 p grain yield/ha during 1972-73 and 1973-74 respectively. For three irrigations crownroot initiation, tillering and jointing stages yielded 26.38 and 35.51 q/ha grain yield of wheat during 1972-73 and 1973-74 respectively.

Four irrigations at crownroot initiation, tillering, jointing and flowering stage the yield obtained was 28.64 and 43.64 q/ha during 1972-73 and 1973-74 respectively. Five irrigations gave

the maximum grain yield of 32.45 and 52.37 q/ha during 1972-73 and 1973-74 respectively.

The mean grain yield for application of one irrigation was 12.33 and 19.30 q/ha, over control during 1972-73 and 1973-74 respectively. The mean grain yield for two irrigations was 15.01 and 24.25 q/ha showing thereby a difference of 2.68 and 4.95 q/ha increase over application of one irrigation during 1972-73 and 1973-74 respectively. The mean grain yield for three irrigations was 19.61 and 31.08 q/ha showing the difference of 4.60 and 6.83 q/ha increase over two irrigations during 1972-73 and 1973-74 respectively. The mean grain yield for four irrigations was 25.21 and 37.32 q/ha showing the increase of 5.6 and 6.24 q/ha grain yield over three irrigations during 1972-73 and 1973-74 respectively. Similarly, five irrigations increased the grain yield by 7.24 and 15.05 q/ha over four irrigations during 1972-73 and 1973-74 respectively.

The grain yield increased by five irrigations over control was 5.05 and 3.53 times during 1972-73 and 1973-74 respectively. The results are similar to those of Bharadwaj *et al* (1970) and Sharma Mahendra Singh (1971). Who have stated that grain yield of wheat increased with given irrigation when given to all the critical stages.



### ii) Yield of straw (q/ha) :

Maximum straw yield 70.73 and 85.77 q/ha was obtained when the irrigation was given to all the critical stages of wheat during 1972-73 and 1973-74 respectively. The increase in growth and yield contributory characters due to application of irrigation to all the critical stages might have favourable enhanced the yield of straw/ha. In the year 1972-73 the treatment CTJFM increased the yield of straw significantly over control, C, T, J, F, M, CT, TJ, TF, TM and JFM while the remaining treatments were found to be on par. Similarly, in the year 1973-74 the treatment CTJFM increased the straw yield significantly over control, C, T, J, F, M, TJ, TF, TJF and CTFM. Summarising that application of five irrigations applied at all the critical stages increased the grain and straw yield significantly over control in both the years of experimentation.

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# IRRIGATION EFFECT ON WHEAT YIELD

TABLE I Temperature during the crop period.

Month	1972-73		1973-74	
	Maximum	Minimum	Maximum	Minimum
October	33.22	19.36	29.92	19.02
November	30.65	11.48	29.13	11.15
December	30.55	13.35	28.92	12.25
January	30.78	10.70	30.48	9.68
February	32.68	14.28	32.15	12.13
March	36.50	12.78	33.98	12.50
April	38.96	21.96	36.72	21.40



TABLE II Mean Values of the Characters Studied

Treatments	1972-73						
	Growth		Yield con. characters			Yield	
	Weight (cm)	Length of ear (cm)	Wt. of ear (g)	Grain Wt./plant (g)	Thousand grain Wt. (g)	Grain yield (q/ha)	Straw yield (q/ha)
Control	47.28	6.40	1.58	0.93	25.00	6.42	27.61
C	54.96	8.20	2.54	1.61	27.66	13.91	43.15
T	63.23	8.16	2.69	1.58	31.33	19.26	46.75
J	52.93	8.10	2.30	1.64	28.33	11.40	35.11
F	51.73	7.90	2.29	1.04	26.33	10.33	32.98
M	51.30	7.85	2.01	0.96	26.00	6.77	29.42
CT	62.73	8.00	3.62	2.00	26.66	14.08	36.38
TJ	66.96	7.80	3.50	2.06	30.66	19.96	48.26
TF	52.26	7.90	2.74	1.52	32.33	14.44	46.88
FM	50.93	8.00	1.64	0.83	27.00	11.58	35.16
CTJ	66.76	8.10	3.15	1.86	30.00	26.38	62.91
TJF	60.36	7.66	3.74	1.96	32.80	21.75	58.63
JFM	59.40	7.96	2.30	1.50	34.33	10.70	46.01
TJFM	62.16	7.93	1.78	1.09	35.66	20.68	58.48
CJFM	58.56	8.96	2.50	1.53	35.88	26.20	63.10
CTFM	61.26	8.73	2.32	1.30	28.33	23.54	59.40
CTJM	70.33	8.20	2.47	1.66	28.33	27.00	64.65
CTJF	67.70	8.23	3.23	1.96	29.33	28.64	66.88
CTJFM	64.70	9.33	2.68	1.89	33.33	32.45	70.73
General mean	59.24	8.07	2.58	1.51	29.94	18.18	49.08
'F' test	Sigt.	Sigt.	Sigt.	Sigt.	Sigt.	Sigt.	Sigt.
S. E. $\pm$	5.00	0.37	0.40	0.38	2.00	1.63	6.21
C. D at 5%	13.46	0.99	1.09	0.74	5.48	3.80	16.15

C—Crowroot initiation, T—Tillering, J—Jointing, F—Flowering, M—Milk, Control—No irrigation, Sigt.—Significant, N. S.—Not-significant.



1973-74						
Growth		Yield con. characters			Yield	
Wt. (cm)	Length of ear (cm)	Wt. of ear (g)	Grain Wt./plant (g)	Thousand grain Wt. (g)	Grain yield (q/ha)	Straw yield (q/ha)
44.33	7.00	5.50	3.63	23.31	14.83	28.53
52.00	8.66	8.05	4.12	23.72	17.09	46.73
62.00	8.33	8.25	4.31	32.01	23.66	55.80
56.33	8.66	7.91	4.84	27.61	22.69	41.04
52.66	8.00	6.54	3.98	24.42	17.18	37.93
45.00	7.33	6.01	4.24	24.25	15.92	32.42
55.33	8.33	7.56	3.93	26.35	26.31	64.41
52.00	8.66	6.65	5.13	31.26	32.31	75.70
48.66	8.33	7.42	4.65	32.56	23.21	59.99
53.00	9.00	7.46	4.10	25.85	15.20	45.44
55.33	9.00	7.54	4.69	30.90	35.51	70.05
56.66	8.00	9.48	5.78	31.34	35.05	65.51
61.00	7.66	8.35	3.97	33.79	22.70	53.78
52.33	8.00	7.64	5.70	34.78	27.37	60.36
60.66	8.00	7.52	4.52	37.91	40.21	70.35
55.00	9.33	8.46	4.60	30.88	32.05	58.05
54.33	8.66	7.92	5.57	31.19	43.37	63.97
60.00	8.33	8.80	6.03	31.83	43.64	69.05
63.33	9.33	11.69	7.17	37.57	52.37	85.77
54.73	8.35	7.83	4.79	30.08	28.45	57.11
Sigt.	N.S.	N.S.	N.S.	Sigt.	Sigt.	Sigt.
3.00	0.59	1.05	0.68	1.75	2.46	8.98
8.00	—	—	—	4.37	6.70	23.66