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Yield, water use efficiency and economics of wheat (*Triticum aestivum* L.) as influenced by different lateral spacing with drip irrigation and nitrogen levels

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Abstract
A field experiment was conducted at the Regional Research Station, Anand Agricultural University, Anand, Gujarat during *rabi* season of 2015-16. The experiment comprised of eight treatment combinations with four lateral spacings (drip at 60, 80 and 120 cm and conventional method) and two levels of nitrogen (100% and 75% RDN). The field experiment was laid out in a split plot design with four replications. Grain and straw yields were significantly higher in lateral spacing of 60 cm over rest of the treatments but, it was at par with 80 cm lateral spacing. Water use efficiency was highest under spacing of 60 cm. Highest BCR was obtained with lateral spacing of 80 cm closely followed by 60 cm lateral spacing. Non-significant influence of nitrogen levels was found on yields. Higher water use efficiency, net realization and BCR were obtained with 100% RDN.

Keywords: wheat, drip irrigation, nitrogen, water use efficiency, profitability

Introduction
Wheat (*Triticum aestivum* L.) is one of the most important staple food grains of human race. It contributes substantially to the national food security by providing more than 50% of the calories to the people who mainly depend on it. The increase in demand of wheat with increasing population can be achieved by adopting high yielding cultivars and appropriate agronomic practices like optimum seed rate, time of sowing, drip irrigation, fertilizer uses, weed management, time of harvesting etc. Out of all the above mentioned factors, irrigation plays a very significant role in enhancing yield. Also, considering the present scenario of water scarcity, emphasis should be given on use of more efficient methods of irrigation like drip irrigation. Deciding optimum spacing between drip laterals is very important for proper water application and cost management. Along with increased irrigation efficiency, it is also important to provide optimum amount of nutrients to the crop. Nitrogen is the key element for plant growth and development, as it is a constituent of chlorophyll and proteins. Keeping this in view, the present investigation was undertaken to study the yield, water use efficiency and economics of wheat (*Triticum aestivum* L.) as influenced by different lateral spacing with drip irrigation and nitrogen levels.

Materials and Methods
A field experiment was carried out during *rabi* season of the year 2015-2016 at the Regional Research Station farm, Anand Agricultural University, Anand (22 ^{0} - 35' N, 72 ^{0} - 55' E and 45.1 m above the mean sea level), Gujarat. The soil was sandy clay with bulk density 1.43Mg m^{-3}, 0.24 dSm^{-1} EC (1:2.5) and 7.7 soil pH (1:2.5) and having good drainage. It was low in available nitrogen (237 kg ha^{-1}), medium in available phosphorus (50. 34 kg ha^{-1}) and potassium (347 kg ha^{-1}). The experiment was laid out in split-plot design with four replications and eight treatment combinations with four lateral spacings (drip at 60, 80 and 120 cm and conventional method) and two levels of nitrogen (100% RDN and 75% RDN). Lateral spacing was relegated as main plot treatments and two nitrogen levels were allotted as sub-plot treatments. Wheat variety GW-496 was sown on 23 November, 2015 with seed rate of 120 kg/ha and 20 cm row spacing was kept. The field plots were of size 4.8 m × 6 m were and crop was raised with recommended package of practices. Irrigations were applied through drip irrigation based on alternate day pan fraction evaporation (ADPEF) approach. Laterals with emitters of 4 lph discharge capacity were installed at a spacing of 60, 80 and 120 cm and the distance between two emitters was 37.5 cm. Total 45 irrigations of 372 mm were applied in drip treatments. Eight irrigations of 430 mm was given in the conventional method through irrigation channels.

Irrigation in the conventional method was given through irrigation channels. The daily pan evaporation values were measured with the help of USWB class 'A' open pan evaporimeter installed in the experimental field. The entire quantity of phosphorus (60 kg ha^{-1}) in the form of SSP along with 40 percent of nitrogen (as per treatment) in the form of urea was applied uniformly in the furrows as basal dose. The remaining 60 percent of nitrogen was applied in two equal splits as top dressing at 30 and 60 DAS. The annual rainfall recorded during the growing season was 539 mm. However, there was no rain during experimental period. The biometric observations were recorded from five randomly selected plants tagged within each plot. Plant population at 20 DAS and periodical plant height at 15, 30, 60, 90 DAS and at harvest were recorded. Yield attributing characters like tiller conversion index, length of spike, number of spikelets $spike^{-1}$, number of grains $spike^{-1}$ were calculated at the time of harvest. The crop was harvested manually with the help of sickle when grains almost matured and straw had turned yellow and data on test weight, grain yield, straw yield and harvest index were recorded. The sun-dried bundles were threshed and winnowed and grains obtained were weighed. The straw yield was obtained by subtracting the grain yield from the biological yield. The economics was calculated based on prevailing prices of inputs and output.

Results and Discussion

Yields

Grain and straw yield were registered maximum under lateral spacing of 60 cm and lateral spacing 80 cm remained at par. Treatment 120 cm lateral spacing recorded the lowest grain and straw yield. Lateral spacing treatments 60 and 80 cm recorded 44.08 and 16.48 % higher grain yield and 13.96 and 9.51 % higher straw yield than conventional method, respectively (Table 1). Higher grain yield was due to the cumulative effect of improvement in growth and yield attributes. It was also found that with sufficient moisture in the soil profile under higher irrigation frequency with drip irrigation, plant nutrient particularly nitrogen, phosphorus and potash were more available and might have translocated to produce more dry matter. Secondly, increase in yield might be due to more irrigations providing constant wetting of root zone which might have favoured greater release of nutrients from soil. Other reason might be due to increase in numbers of irrigation applied at shorter intervals and total consumptive use of water. These results are in conformity with the results of Chouhan *et al.* (2015) [3].

Water use efficiency

Water use efficiency (kg ha^{-1}-mm) was maximum (13.00) under lateral spacing 60 cm, followed by treatments 80 cm lateral spacing (12.25) and conventional method (10.63). The minimum field water use efficiency was registered under lateral spacing of 120 cm (9.00) (Table 1). The reason was mainly due to higher grain yield in proportion to the quantity of water used. Similar results were also reported by Abdelaraouf and Habbasha (2014)[1], Chouhan *et al*. (2015) [2], Chouhan *et al*. (2015) [3] and Ignatius *et al.* (2013) [4].

From Table 1, it is clear that higher water use efficiency was recorded under 100% RDN (11.31) as compared to 75% RDN (11.13). This is due to the fact that yield obtained is higher with 100% RDN as compared to 75% RDN. Similar were the findings of Mallareddy and Padmaja (2014) [5] and Pradhan *et al*. (2014) [6].

Table 1: Yields and water use efficiency of wheat as influenced by levels of lateral spacing and nitrogen

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Water use efficiency (kg ha^{-1}-mm)
Lateral spacing (S)			
S_1 : 60 cm	4869	5583	13.00
S_2 : 80cm	4571	5365	12.25
S_3 : 120 cm	3396	477558	9.00
S_4 : conventional method	3924	4899	10.63
S.Em. ±	185.60	173.90	-
C.D. (P=0.05)	593.74	556.31	-
Nitrogen (N)			
N_1: 100 % RDN	4228	5178	11.31
N_2: 75 % RDN	4152	5124	11.13
S.Em. ±	40.66	94.46	-
C.D. (P=0.05)	NS	NS	-
S×N	Non- significant		

Table 2: Economics as influenced by levels of lateral spacing and nitrogen

Treatments	Gross realization (□ ha^{-1})	Total cost (□ ha^{-1})	Net realization (□ ha^{-1})	BCR
Lateral spacing (S)				
S_1: 60 cm	81245	39229	42016	2.07
S_2: 80 cm	76426	35997	40429	2.12
S_3: 120 cm	57747	33128	24619	1.74
I_4 : conventional method	65974	32224	33750	2.05
Nitrogen (N)				
N_1 : 100 % RDN	70962	29068	41894	2.44
N_2 : 75 % RDN	69734	28657	41077	2.43

Price: Wheat grain – □ 15.25 per kg (MSP)
Wheat straw – □1.25 per kg

Economics

Lateral spacing at 60 cm fetched maximum net realization, closely followed by 80 cm spacing. Higher BCR was found under treatment 80 cm lateral spacing. The lowest net realization with BCR was observed with lateral spacing of 120 cm lateral spacing. Higher net gain per hectare under lateral spacing 60 cm was due to higher yield (Table 2). These results are in conformity with the results of Abdelaraouf and Habbasha (2014) [1] and Chouhan *et al.* (2015) [2].

Highest net realization along with higher BCR were obtained with nitrogen level100% RDN) as compared to 75% RDN. Higher yields were obtained due to the application of higher dose of nitrogen which enhanced net income and BCR.

Conclusion

Based on the results obtained from the study conducted, it can be concluded that drip irrigation was found profitable for getting higher yield and economic returns over conventional method. Irrigating wheat at 80 cm lateral spacing along with 75% RDN is better in terms of water saving along with better yield, net realization and highest water use efficiency as it saves 14% water and gives 16.48% higher yield and 24.49% higher net returns over conventional method of irrigation.

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References

1. Abdelaraouf RE, Habbasha SF. Wheat production in the arid regions by using drip irrigation system. International Journal Advanced Research. 2014; 2(3):84-96.
2. Chouhan SS, Awasthi MK, Nema RK, Koshita LD. Effect of dripper spacing on yield and water productivity of wheat under drip irrigation. Research on Crops, 2015; 16(3):456-464.
3. Chouhan SS, Awasthi MK, Nema RK. Studies on water productivity and yield responses of wheat based on drip irrigation systems in clay loam soil. Indian Journal of Science and Technology, 2015; 8(7):650-654.
4. Ignatius M, Imtiyaz M, Kumar JL. Response of cabbage (*Brassica Oleracea*) under variable irrigation and lateral spacing. Research Journal of Engineering Sciences. 2013; 2(10):1-9.
5. Mallareddy M, Padmaja B. Productivity and water use efficiency of no-till winter (*rabi*) maize (*Zea mays*) as influenced by drip-fertigation. Indian Journal of Agronomy, 2014; 59(1):96-100.
6. Pradhan S, Chopra UK, Bandopadhyay KK, Singh R, Jain AK, Chand I. Effect of deficit irrigation and nitrogen levels on water productivity and nitrogen use efficiency of wheat (*Triticum aestivum*) in a semi-arid environment. Indian Journal of Agricultural Sciences. 2014; 84(7):887–91.