CHAPTER V

SUMMARY AND CONCLUSIONS

Agriculture has been the prominent occupation to provide food and fiber to the growing population of India. Irrigation has been considered essential for the fast growth in agriculture and it will continue to be a major factor in future too. Today water scarcity is alarming and there is every reason to be worried about. In many regions water use has exceeded water availability.

Wheat (*Triticum aestivum* L.) is one of the most important staple food grains of human race. The total area of wheat in the world is around 240 M ha with a production of 700 MT. In India, most of the area under wheat crop is irrigated by flood irrigation with very poor water use efficiency. There is need to improve irrigation efficiency through optimization of irrigation water under conditions of limited water availability. Hence, adoption of micro irrigation technology is needed to reduce the losses of irrigation and also to bring economy in water use.

Drip irrigation is one of the best and latest methods for efficient utilization of irrigation water. It is an efficient method of application of water in which, the water and fertilizer are applied at low rate over long period of time at frequent intervals with low-pressure delivery system, in order to avoid water stress to the plant. Drip irrigation provides high water use efficiency, higher crop yield, less labor requirement and relatively low operating cost, less weed growth, less insect and pest attacks, shorter growing season and earlier harvest of the crop. Use of poor quality of water is also possible through drip up to certain limit, more automation, easy adjustment and control and more irrigated crops cultivation is possible in problem soils are some advantages of drip irrigation as compared to conventional methods.

Fertigation has the potential to supply a right mixture of water and nutrients to the root zone, and thus meeting plants’ water and nutrient requirements in most efficient possible manner. When nutrients are applied as broadcast or band placement, due to various losses the fertilizer use efficiency could not be improved. Fertigation provides the essential nutrients directly to the active root zone, thus minimizing the loss of expensive nutrients which ultimately helps in improving the productivity and quality of farm produce. The drip fertigation has been proved the most efficient tool for judicious
utilization of scared fertilizer and water. However, the higher initial cost, lack of sufficient technical knowledge among the farming community and high maintenance of drip system are the main constrain for its wide scale adoption.

The experiment was carried out in winter season of 2017-18 (November-March) at Instructional Farm, College of Agricultural Engineering and Technology, JAU, Junagadh to study “Response of Wheat (Triticum aestivum L.) under drip fertigation system”. Keep in view the problems discussed above a study has been under taken with following objectives:

1. To study the response of different drip irrigation and N-fertigation levels on growth and yield of wheat crop.
2. To find out the crop water requirement and N-fertigation levels for drip irrigated wheat.
3. To evaluate the cost economics of drip fertigation in wheat.

The experiment was undertaken with four fertigation levels viz; 40% RDF-N (F₁), 60% RDF-N (F₂), 80% RDF-N (F₃) and 100% RDF-N (F₄) and three fertigation level viz; 0.6 ETc (I₁), 0.8 ETc (I₂) and 1.0 ETc (I₃). Large plot technique was adopted with three replications of each treatment. The Impact of fertigation levels and irrigation levels on wheat was evaluated in terms of plant morphological parameters and yield attributes. Fertigation levels and irrigation levels were taken as a main and sub factor respectively. The effect of these factors on plant height, ear length, number of grains per ear, number of tiller per m², number of ear per m² grain yield (kg/ha), biological yield (kg/ha), straw yield (kg/ha), Harvest index, test weight, fertilizer use efficiency and water use efficiency were analyzed. Economics was considered in present study, cost of cultivation, cost of irrigation, gross return, net return and benefit cost ration was calculated.

The result showed that, the effect of fertigation level gave a significant effect on plant height, ear length, number of grains per ear, number of tiller per sq. m., number of ear per sq. m., test weight, grain yield, biological yield and straw yield. Application of fertilizer under fertigation level F₄ (100% RDF-N) recorded significantly higher plant height (78.98 cm) which was higher as compared to fertigation level F₃ (80% RDF-N) (73.79 cm), F₂ (60% RDF-N) (71.93 cm) and F₁ (40% RDF-N) (69.24 cm). Similarly, maximum ear length was observed under fertigation level F₄ (100% RDF-N) (7.83 cm)
which was higher as compared to fertigation level F₃ (80% RDF-N) (7.41 cm), F₂ (60% RDF-N) (7.06 cm) and F₁ (40% RDF-N) (6.83 cm). Application of fertilizer levels under fertigation level F₄ (100% RDF-N) recorded significantly highest number of grains per ear (31.7) followed by fertigation level F₃ (80% RDF-N) (28.1), F₂ (60% RDF-N) (25.6) and F₁ (40% RDF-N) (23.4). Maximum number of tiller per m² was observed under fertigation level F₄ (100% RDF-N) (396.11) which was higher as compared to F₃ (80% RDF-N) (348.67), F₂ (60% RDF-N) (336.67) and F₁ (40% RDF-N) (299.11). Application of fertilizer under fertigation level F₄ (100% RDF-N) recorded significantly highest number of ear per m² (319.50) which was higher as compared to fertigation level F₃ (80% RDF-N) (295.34), F₂ (282.16) and treatment F₁ (256.68). Application of fertilizer under fertigation level F₄ (100% RDF-N) recorded highest 1000 grain weight (51.60 gm.) which was higher as compared to fertigation level F₃ (80% RDF-N) (50.39 gm.), F₂ (60% RDF-N) (49.79 gm.) F₁ (40% RDF-N) (49.28 gm.). Maximum grain yield was observed under fertigation level F₄ (100% RDF-N) (5026.23 kg/ha) which was higher as compared to fertigation level F₃ (80% RDF-N) (4506.19 kg/ha), F₂ (60% RDF-N) (3910.48 kg/ha) and F₁ (40% RDF-N) (3742.30 kg/ha). Maximum biological yield was observed under fertigation level F₄ (100% RDF-N) (13998.49 kg/ha) which was higher as compared to fertigation level F₃ (80% RDF-N) (12152.78 kg/ha), F₂ (60% RDF-N) (11149.69 kg/ha) and F₁ (40% RDF-N) (9674.38 kg/ha). Maximum straw yield was observed under fertigation level F₄ (100% RDF-N) (8972.26 kg/ha) which was higher as compared to fertigation level F₃ (80% RDF-N) (7646.59 kg/ha), F₂ (60% RDF-N) (7239.21) and F₁ (40% RDF-N) (5932.09 kg/ha). Harvest index was not significantly influenced by different fertigation levels. However, the application of fertilizer under fertigation level F₁ (40% RDF-N) recorded highest harvest index (38.73 %) and the lowest harvest index (35.22 %) was observed under fertigation level F₂ (60% RDF-N).

Analysis of experimental result showed that, the effect of irrigation level gave a significant effect on plant height, ear length, number of grains per ear, number of tiller per m², number of ear per m², test weight, grain yield, biological yield and straw yield. Application of irrigation under irrigation level I₃ (1.0 ETc) recorded significantly highest plant height (75.25 cm) than I₁ (0.6 ETc) (71.47 cm), but it was found at par with irrigation level I₂ (0.8 ETc) (73.74). Application of irrigation under irrigation level I₃ (1.0 ETc) recorded significantly highest ear length (7.57 cm) than I₁ (0.6 ETc) (6.89
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cm), but it was found at par with irrigation level I\textsubscript{2} (0.8 ETc) (7.39 cm). Application of irrigation under irrigation level I\textsubscript{1} (1.0 ETc) recorded significantly highest number of grains per ear (28.5) than I\textsubscript{1} (0.6 ETc) (25.5), but it was found at par with irrigation level I\textsubscript{2} (0.8 ETc) (27.8). Maximum number of tiller per m\textsuperscript{2} was observed under irrigation level I\textsubscript{3} (1.0 ETc) (363.50) which was higher as compared to irrigation level I\textsubscript{1} (0.6 ETc) (322.17), but it was found at par with I\textsubscript{2} (0.8 ETc) (349.75). Maximum number of ear per m\textsuperscript{2} was observed under irrigation level I\textsubscript{3} (1.0 ETc) (303.50) which was higher as compared to irrigation level I\textsubscript{1} (0.6 ETc) (274.32), but it was found at par with I\textsubscript{2} (0.8 ETc) (287.43). Maximum test weight was observed under irrigation level I\textsubscript{3} (1.0 ETc) (50.97 gm.) which was higher as compared to irrigation level I\textsubscript{2} (0.8 ETc) (50.52 gm.) and I\textsubscript{1} (0.6 ETc) (49.31 gm.). Maximum grain yield was observed under irrigation level I\textsubscript{3} (1.0 ETc) (4619.22 kg/ha) which was higher as compared to irrigation level I\textsubscript{1} (0.6 ETc) (3953.65 kg/ha), but it was found at par with I\textsubscript{2} (0.8 ETc) (4316.03 kg/ha). Maximum biological yield was observed under irrigation level I\textsubscript{3} (1.0 ETc) (12599.54 kg/ha) which was higher as compared to irrigation level I\textsubscript{2} (0.8 ETc) (11803.24 kg/ha) and I\textsubscript{1} (0.6 ETc) (10828.73 kg/ha). Maximum straw yield was observed under irrigation level I\textsubscript{3} (1.0 ETc) (7980.31 kg/ha) which was higher as compared to irrigation level I\textsubscript{1} (0.6 ETc) (6875.08 kg/ha), but it was found at par with I\textsubscript{2} (0.8 ETc) (7487.21 kg/ha).

Harvest index was not significantly influenced by different irrigation levels. However, highest harvest index was recorded under irrigation level I\textsubscript{3} (1.0 ETc) (36.84 %) and the lowest harvest index was observed under irrigation level I\textsubscript{1} (0.6 ETc) (36.73 %).

Based on the result analysis, the following conclusions could be drawn.

1. The highest plant height, ear length, number of grains per ear, number of tiller per m\textsuperscript{2}, number of ear per m\textsuperscript{2}, test weight, grain yield, biological yield and straw yield were observed under treatment T\textsubscript{12} (100 % RDF-N@1.0 ETc).

2. Higher plant height at harvesting, ear length, number of grains per ear, number of tiller per m\textsuperscript{2}, number of ear per m\textsuperscript{2}, grain yield, biological yield and straw yield were observed at 1.0 ETc for all fertigation levels but, it was found that 0.8 ETc statistically at par with 1.0 ETc. So, optimum irrigation level for wheat under drip irrigation found 0.8 ETc.

3. Higher fertilizer use efficiency of 84.58 kg/kg was observed at fertigation level 40% RDF-N (F\textsubscript{1}) combination with irrigation level 1.0 ETc (I\textsubscript{3}).
4. Higher water use efficiency 17.12 kg/ha-mm was observed at irrigation level 0.6 ETc (I₁) combination with fertilizer level 100% RDF-N (F₄).

5. The highest net return under drip irrigation system was found as ₹65650.49/ha with treatment 100% RDF-N @ 1.0 ETc.

6. Highest benefit cost ratio (2.52) was found with treatment 100% RDF-N with 1.0 ETc.

7. Considering above facts, wheat crop should be irrigated at 1.0 ETc and fertilized at 100% RDF-N to attain higher grain yield, straw yield, yield attributes and benefit cost ratio.

8. Nitrogen concentration was in all the treatments reduces as distance from dripper increases. The expansion of fertilizer distribution bulb is more in case of 1.0 ETc as compare to 0.8 ETc and 0.6 ETc.