SUMMARY

The importance of the problem "Physiomorphological Response of Triticale to Sewage Wastewater" has been briefly considered. In view of the lacunae in the understanding of this problem, justification has been put forward for undertaking the present work (Chapter 1).

The literature pertaining to sewage wastewater effect on plants and soils, sludge and history and progress of triticale as a crop has been reviewed with special reference to the work done abroad and in India (Chapter 2).

The details of the materials and methods employed for the five field experiments have been given with the relevant meteorological and edaphic data (Chapter 3).

The data which were found significant on statistical analysis at 5% level according to the design of each experiment, have been considered in detail (Chapter 4).

The main results have been discussed in the light of earlier researches undertaken at Aligarh and elsewhere (Chapter 5) and are summarised below:

Experiment 1 was conducted during the 'rabi' season of 1991-92 to test the comparative utility of sewage wastewater and groundwater used as irrigant on the basis of growth,
yield and quality of five triticales, including Mexican varieties, Delfin (established at Aligarh as the best yielder), Juppa 'S', Mula 'S', Tigre 'S' and the Indian variety TL-419 (bred at PAU, Ludhiana employing Mexican parents) and one of the locally popular dwarf wheat (HD-2204) as check. A uniform basal dose \( \left( N_{120} P_{60} K_{60} \right) \) was applied at sowing. Growth characteristics were noted at three stages namely, tillering (70 d), heading (100 d) and milky grain stage (120 d) included tiller number, leaf number, plant height, fresh weight and dry weight per plant, leaf NPK, net assimilation rate. Yield characteristics, recorded at harvest included ear number per plant, length per ear, ear weight per plant, spikelet number per ear, grain number per plant, 1,000 grain weight, grain yield and straw yield. Grain quality was assessed after harvest on the basis of grain protein content and yield and carbohydrate content and yield. Sewage wastewater proved superior to ground water in increasing most of the parameters mentioned above. Among the varieties, Delfin performed best followed by TL-419 and wheat. On the other hand Juppa 'S' and Mula 'S' gave the poorest response, TL-419 surpassed the wheat check for grain quality, except protein content.

Experiment 2 was conducted simultaneously with Experiment 1. The aim of this experiment was to compare the effect of sewage wastewater and groundwater at six doses of
growth, yield and quality of triticale variety TL-419 (because of its adaptation to Indian conditions) at three growth stages. A uniform basal dose of P$\_60$K$\_60$ was applied at sowing.

In comparison to groundwater, application of sewage wastewater resulted in better growth, yield and quality. The nitrogen doses applied at sowing responded differently. N$\_120$ proved optimum with doses higher than N$\_120$ exhibiting luxury consumption.

Experiment 3 was conducted in the following ‘rabi’ season (1992-93). The aim of this experiment was to study the effect of sewage wastewater applied with four nitrogen doses (N$\_0$, N$\_60$, N$\_90$ and N$\_120$) on the basis of the comparative performance of the two contrasting varieties of triticale and on one wheat check, namely TL-419, Juppa‘S’ and HD-2204. A uniform basal dose of P$\_60$K$\_60$ was applied at sowing. The same growth, yield and quality parameters as in Experiments 1 and 2 formed the basis of comparison. N$\_120$ proved optimum for most of the parameters studied, including the grain yield and quality. Among the varieties, TL-419 proved superior to wheat and Juppa‘S’ in terms of growth and yield parameters. Regarding grain quality, wheat performed best, followed by TL-419 and Juppa‘S’ for total soluble and insoluble protein content. However, for protein yield, TL-419 proved best, followed by wheat and Juppa‘S’ in that order.
In conclusion, it may be added that the following observations are new additions to the literature:

1. Sewage wastewater proved beneficial to plant growth and yield.

2. Sewage wastewater does not affect the protein and carbohydrate content significantly.

3. However, sewage wastewater enhances total protein and carbohydrate yield.

4. Fertilizer treatments $N_{90}$ and $N_{120}$ and $P_{40}$ proved optimum in presence of sewage wastewater irrigation for triticale.

5. Treatment $N_{120}P_{40}$ proved optimum for TL-419 and Juppa'S' when irrigated with sewage wastewater.

6. Out of the five triticale cultivars, Delfin and TL-419 proved superior to wheat (HD-2204) under local agro-climatic conditions.

7. Among various varieties tested Juppa'S' proved inferior in all respect.

8. TL-419 remained superior in grain yield, protein and carbohydrate yield, and thus can be safely be recommended for commercial cultivation under sewage wastewater irrigation.
Experiment 4 was carried out together with Experiment 3. The aim of this experiment was also to study the effect of sewage wastewater on the performance of the same three varieties as taken in Experiment 3, applying four phosphorus doses of $P_0$, $P_2$, $P_4$ and $P_6$ with a uniform basal dose of $N_{120}K_{60}$ at sowing. Parameters recorded were the same as in earlier experiments. $P_4$ proved optimum for growth, yield and quality parameters while $P_6$ proved wasteful. TL-419 gave the best results regarding growth, yield and quality, except grain protein content.

Experiment 5 was performed together with Experiment 3 and 4. The aim of the study was to find out the effect of sewage wastewater taking ten combinations of nitrogen and phosphorus. The varieties tested were TL-419 and Juppa'S'. The N and P doses were $N_0P_0$, $N_6P_2$, $N_9P_2$, $N_{12}P_2$, $N_6P_4$, $N_9P_4$, $N_{12}P_4$, $N_6P_6$, $N_9P_6$ and $N_{12}P_6$. A uniform basal dose of $K_{60}$ was also applied at sowing. Parameters recorded were again the same as selected in earlier experiments. $N_{12}P_4$ gave optimum results, TL-419 out-yielded Juppa'S' in all respects.

The present chapter is followed by references cited in the test and an appendix giving details of the procedures adopted for the preparation of various reagents used in the course of five experiments.