Summarize the main findings and conclusions of Chapter 6.
SUMMARY AND CONCLUSIONS

Slow controlled release fertilizers (SRFs), which restrict the rapid availability and thus losses of the nutrients through leaching, runoff and volatilization in the agricultural fields are considered as a sustainable alternative for the enhanced plant productivity with the lower nutrient input. It has many advantages over the conventional chemical fertilizers, organic manures and biofertilizers. The only major concern which limit their popularity amongst the farmers is an increase in the cost of the formulations. One of the major challenges in plant nutrient management is minimizing the cost of SRFs to make them cost effective and acceptable even in low input agriculture.

Many combinations of low cost, non-toxic, organic waste based matrix e.g. clay soil, cowdung, neem leaf powder and rice bran with low cost binders e.g. Arabic gum and saresh were prepared and half recommended doses of conventional chemical fertilizers of nitrogen (urea) and sulfur (gypsum) were immobilized. In another type of SRFs which is completely organic a biofertilizer (Azotobacter) was immobilized with the same matrices and the binder.

The best performing SRFs, SRG-O (for chemical based formulation) and SRG-B (for biofertilizer based formulations) were selected for further
studies on the basis of longer retention time for N and S nutrients and better growth, productivity and yield of Indian mustard (*Brassica juncea*) in the small experimental fields.

The results presented in this thesis clearly indicate that our SRFs increase the growth, productivity and yield of two oilseed crops Indian mustard (*Brassica juncea* L) and sesame (*Sesamum indicum* L) and one essential oil producing commercial crop mentha (*Mentha piperata*) in non-saline and saline environment.

The cost of these SRFs, though calculated high over the conventional chemical fertilizers, it is very evident from the tables presenting the input/income ratio that due to a very significant increase in yield of these oilseeds the farmers are at very high net gain, if they opt for these organic matrix based SRFs or organic SRFs developed in this study. One of the most significant finding of this study is the performance of these SRFs to the productivity and yield of the oil crops in saline soil. Though the total yield was lower than the same obtained in non-saline soil conditions, the yield of these crops was significantly higher in SRF applied fields as compared with no fertilizer, or chemical fertilizer applied fields. These results clearly indicate that these newly developed SRFs are well promising nutritional alternatives for oil crop production in saline soil especially for Indian mustard, sesame and mentha which were tested in this study.
Another significant finding is development of SRFs based on immobilized biofertilizers which are totally organic and indicate that SRF technology based organic farming is also promising as it can provide an enhanced yield over the conventional methods of the organic farming. The following specific conclusions have emerged under the study presented in this thesis.

- The study presented indicate that Indian mustard and sesame required nitrogen, sulphur and boron as fertilizer in optimum quantity for higher productivity. The combination (sulphur 5 mM + nitrogen 5 mM + boron 10 μM) has been found better among all other combinations attempted in this study in laboratory based experiments.

- The best performing supergranules, SRG-O and SRG-B made the consistent availability of ammonium and sulphate to the plant upto 50 days, resulting more synchronization with the growth rate of plant.

- Slow release supergranules SRG-O and SRG-B proved to be best out of various newly developed slow release supergranules.

- The best performing supergranules, SRG-O contain cow-dung, clay soil, rice bran and neem leaf powder as matrix with 10% saresh and half of the recommended dose of chemical fertilizer (chemical fertilizer recommended for the respective crop) showed significant
increase in growth, total biomass, plant productivity, seed yield and oil content in all the three crops under the study.

- SRG-B contained *Azotobacter* in bound form in the same matrix and the binder also showed increase in yield and oil content by 30% and 38% in mustard, 29% and 32% in sesame and oil contents in mentha increased by 7% over the *Azotobacter* applied in free form.

- The newly developed SRFs (SRG-O and SRG-B) increased the total soluble protein, glutamine synthetase activity and ammonium and sulphur contents, significantly in all the three crops under the study.

- Supply of slow release fertilizer ameliorated the negative effect of salinity on the three crops by significant recovery in growth and yield parameters over the conventional chemical fertilizers. This indicate that these SRFs can be very useful to grow oil crops in field suffering from low level salinity.

- The newly developed SRFs (SRG-O and SRG-B) resulted appreciable increase in net return.