CHAPTER

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Today India has become the tenth largest industrial nation of the world. But at the same time, it is one of the most polluted countries of the world as far as industrial pollution hazardous wastes are concerned. Majority of industrial units are producing effluents which are toxic and hazardous (Srivastava et al., 2000). Sugar industry is one of them. The water polluted by sugar industry effluent affects the aquatic ecosystem. It also affects the vegetation of that area which is irrigated by that water.

India is one of the largest producers of sugar in the world and per capita consumption of sugar in the country is 134 kilograms per annum. Sugar industry offers employment potential and contributes substantially to economic development. There are about 579 sugar mills in India. Uttar Pradesh with about 78 sugar factories, which are in operation, contributes the major part of the total production of the sugar. Sugar industry effluent contains a huge amount of water and macro and micro elements along with some toxic substances. Macro and micro elements include nitrogen, phosphorus, boron, zinc, magnesium, iron, chromium etc. Toxic substances present in the sugar industry effluent are sulphates, sulphite, borax, lead, mercury, reducing sugar, oil and greases etc.

Pulses are important source of protein supply in Indian vegetarian diet. Proteins have significant role in nutrition. Among the pulses, pea is the most important crop. Pulses make a much more important contribution
to the diet of all classes of society. In our country especially people who are mostly vegetarian depends largely on cereals and pulses as their staple food, which serve as the main source of dietary protein and energy. Pulses are also a good source of B group of vitamins. Germination increases the vitamin C content of pulses. It also plays an important role in the Indian economy. Uttar Pradesh is the second largest producer of pulses in our country.

Sugar industry is an agriculture based industry that's why it is a common industry of Purvanchal, U.P. Therefore, it was proposed to study the effect of sugar industry effluent on growth and nutritional status of pea. The effluent used was obtained from The Kisan Sahkari Chini Mill Ltd., Sathiaon, Azamgarh and the effluent analysis was obtained from the chemical cell of the same. The two high yielding varieties of pea i.e. *Pisum sativum* L. var. Aparna and *Pisum sativum* L. var. Rachna were obtained from Azamgarh Agriculture office, Sidhari, Azamgarh. The effluent contains some important nutrient elements along with several toxic substances. The nutrient elements generally present in the effluent of sugar industry are phosphorus, zinc, magnesium, iron, chromium etc. It also contains sulphur in the form of sulphate and sulphite, which may be harmful to some crops.

Two high yielding varieties of pea i.e. *Pisum sativum* L. var. Aparna and *Pisum sativum* L. var. Rachna were sown in Randomized Block method and five replicates were taken from each variety. Five treatments with sugar industry effluent were given to the crop i.e. $T_1$ (irrigation with 20 per
cent concentration of sugar industry effluent), \( T_2 \) (irrigation with 40 per cent concentration of sugar industry effluent), \( T_3 \) (irrigation with 60 per cent concentration of sugar industry effluent), \( T_4 \) (irrigation with 80 per cent concentration of sugar industry effluent) and \( T_5 \) (irrigation with 100 per cent concentration of sugar industry effluent). A control was also grown side by side named as \( T_0 \). Several vegetative characters like length of plant, length of stipule, breadth of stipule, length of leaf, breadth of leaf, length of stomatal apperture, breadth of stomatal appature and number of stomata per unit area etc. were recorded, compared with control (\( T_0 \)) and statistically analyzed. It was found that almost all the vegetative characters increased with the application of sugar industry effluent except length of stomatal apperture in \( Pisum sativum \) L. var. Aparna. It was noted that the maximum increase was observed in \( T_4 \) treatment where crop was irrigated with 80 per cent concentration of sugar industry effluent. Same type of observation was recorded in both the varieties. The pH of sugar industry effluent ranges from 5 to 7 which is the best growth range observed in the species including \( Pisum sativum \) L. var. Aparna and var. Rachna that may be the reason why the vegetative growth of \( Pisum sativum \) L. var. Aparna and var. Rachna increased with the application of sugar industry effluent in suitable concentration.

Yield characters like diameter of flower, pollen fertility, number of pods per plant, length of pod, number of seeds per pod, 1000 seeds-weight and grain productivity were also studied and data were statistically
analysed. All the yield characters considered were found to increase with the increase of sugar industry effluent except number of seeds per pod in variety Aparna. In *Pisum sativum* L. var. Aparna number of seeds per pod decreased with the application of sugar industry effluent but the decrease was not significant. Maximum increase was recorded in T₄ treatment where plants received 80 per cent concentration of the effluent. In *Pisum sativum* L. var. Aparna increase in grain productivity per hectare was 82.88 per cent in treatment T₄ as compared to control. In *Pisum sativum* L. var. Rachna grain productivity was found to increase by 96.90 per cent over control in the same treatment i.e. T₄.

Chemical contents of leaf and grains i.e. nitrogen, phosphorus and potassium content in leaf and carbohydrate and protein content in grains were also studied and it was found that almost all the chemical contents of leaf and grains increased with the increase of sugar industry effluent and maximum increase was observed in treatment T₄ in both the varieties. In *Pisum sativum* L. var. Aparna increase in protein content (per cent by mass) was 7.10 per cent in T₄ treatment as compared to control. While 2.08 per cent increase in protein content was recorded in *Pisum sativum* L. var. Rachna.

With the help of these observations we can conclude that vigorous vegetative growth of the crop was mainly due to favourable pH and the composition of sugar industry effluent. Presence of nitrogen, magnesium, zinc, sulphur, calcium, cadmium etc. favoured the vegetative and
reproductive growth of the plants. These chemicals when present in excessive concentration damage the vegetative and reproductive growth of the plant. But its suitable concentration enhanced the yield and growth of the crop.

The experiment repeated next year showed almost same results. In this way we can conclude that the sugar industry effluent may be used as liquid fertilizer for irrigation of crop field and particularly pea crop.

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