DISCUSSION

Multiple cropping is a system of growing crops one after the other in quick succession with an object of utilizing the land and available input resources to the maximum. As many as three or even four crops can be grown on the same land in one year. However, an ideal system of multiple cropping should include such crops which should produce minimum problems of soil exhaustion and pest build up, while ensuring maximum production or maximum return per unit input to the farmers. It should also ensure maximum efficiency per unit input, such as fertilizer, water, pesticide, labour, land and capital.

Therefore, the present study was undertaken at Meerut, on Toria-Wheat rotation. Toria is a short duration crop and fits admirably well in the multiple cropping scheme. If it is sown and harvested in time, other rabi crops like wheat and barley can follow Toria. Toria oil is also of good quality. It is not very pungent and as such is valued. Wheat is also an important item of human food and it is one of the most important rabi cereals of Northern India.

In this chapter an attempt has been made to discuss the performance of two Toria varieties under varying
levels of nitrogen and row-spacings and their residual effect on succeeding wheat crop. Since rainfall, temperature and relative humidity during the crop growth period are major factors responsible for the yield stability of a crop, it is desirable to discuss first the march of crop under the environmental conditions of both years of experimentation. The total rainfall during first crop season was only 368.63 mm, while 12.5 mm in 1976-77. The greater rainfall in first year also kept relative humidity high. These conditions proved conducive to poor growth of the Toria crop due to severe aphide attack and ultimately poor yield as compared to over all performance of crop during the second year. During 1976-77 the yield of wheat grain was better than 1975-76 due to rainfall in the month of April. Overall the weather conditions were better for both the crops in the second year than in the first year.

Among the varieties tested in the present experiment, the plants of variety IMA (V<sub>1</sub>) accumulated more dry matter due to its increased capacity for photosynthesis (LAI) and greater relative growth rate (RGR) as compared to plants of variety V<sub>2</sub> (Sangham). The plants of variety V<sub>1</sub> were also able to take up greater amount of
total nitrogen as compared to \(V_2\) variety. The overall better performance of \(V_1\) variety of Toria equipped its each plant with favourable, yield contributing characters like number of pods per plants, weight of grain per plant, mean length of pod, number of grains per pod and 1000-seed weight. This resulted in significantly higher seed yield in Q/ha from variety \(V_1\) as compared to \(V_2\) variety. As evident from the interactions, it was also noted that variety \(V_1\) is more responsive to nitrogen application and closer row-spacings as compared to variety \(V_2\). This is why variety \(V_1\) responded significantly with highest plant population, while \(V_2\) gave better yield at medium plant population. However, variety \(V_2\) was found to be early in maturity as compared to \(V_1\) variety. It is further noted that the plants of variety \(V_1\) were more prolific in nature as compared to the plants of variety \(V_2\) as is evident from its growth characters such as number of branches per plant and dry matter production quintal per hectare.

Toria is an important source of vegetable oil in India after groundnut and Sardan. It is, therefore, essential to evaluate the performance of various treatments on oil production too. Among the varieties tested in the present studies, variety \(V_2\) was high in oil percentage
and oil production C/ha as compared to Variety $V_1$. However, in terms of protein percentage and total protein production per hectare, variety $V_1$ was better than $V_2$.

In the present investigation a remarkable influence of nitrogen on the yield potential of *Toria* crop was observed. Increase in the rates of nitrogen increased the yield of *Toria* seed yield per hectare, linearly. A same trend was noted in terms of oil production and protein production per hectare. The reason for such an increase can be traced out to the increased values of almost all the growth and yield attributes as affected by nitrogen levels. It was found that with the increase in nitrogen levels the oil percentage decreased and protein percentage increased. These results are in conformity with the findings of Gupta (1972), Kulkarni (1965), Singh (1971) and Dalal (1962). As expected increasing levels of nitrogen increased total uptake of nitrogen and nitrogen percentage in plant and seeds. However, the oil percentage in seeds was adversely affected by the application of nitrogen. But, if we take into account the total yield of seeds per hectare, total yield of protein per hectare and total yield of oil per hectare, it increased with increasing levels of nitrogen.
It is interesting to note that yield of seeds increased significantly with every increase in levels of nitrogen during both the years. However, a linear curve was obtained. Therefore, more nitrogen is required to *Toria* crop for more yield. The response curve is depicted in Fig. 7.

The yield differences with various plant populations were significant in second year and also in pooled data for both the years. The yield of seeds per hectare increased progressively with increase in plant population through row-spacing. A similar trend was observed in oil percentage, oil yield Q/ha and protein yield Q/ha. However, the reverse was true for the yield contributing characters, like number of pods per plant, weight of grains per plant and number of grains per pod. However, this adverse effect was nullified by more number of plants per unit area with increase in plant population. These findings are in agreement with those of Maini et al., (1964) Singh et al., (1972), Dhindsa et al., (1973) and Wankheda et al., (1970).

**Residual Effect of Nitrogen on Wheat:**

Residual content of nitrogen with soil after *Toria* was noted in terms of available nitrogen percentage
and organic carbon percentage. More available nitrogen percentage and organic carbon percentage were found in the soil under $V_2N_3S_1$ treatment combination. This is due to the fact that $V_2$ variety of Toria is a short duration crop and it might have taken up less nitrogen than $V_1$ variety. Under medium and wider row spacings the nitrogen in the soil might have been shared by more weed growth.

**Residual Effect of Nitrogen applied to Toria crop on succeeding Crop of Wheat:**

No residual effect of nitrogen applied to Toria crop was observed on the agronomic characters and yield of succeeding wheat crop. This was expected due to high nitrogen requirement of wheat crop and the rather small residual amounts that might be expected from the lower levels of nitrogen added to Toria. Further, wheat received relatively large amount of nitrogen directly. However, out of the many characters studied, the effect of residual nitrogen was noticed only on the dry weight per plant (gm), number of spikelets per ear, ear length, number of grains per ear and pooled yield of grains. The residual nitrogen from all the four levels of applied nitrogen (0, 20, 40 and 60 Kg N/ha) gave yield of seed as 22.30, 24.18, 24.20 and 25.75
Q/ha respectively. These yield data are statistically significant.

Economics of Fertilizer Application with Two Varieties of Triticum sowing at different row spacings:

The economics of fertilizer (Nitrogen) treatments was worked out on the basis of average grain yield (Triticum-sheat) for two years (table 43). The other field operations done were also taken into account.

Though, all the fertilizer treatments gave economic returns over control yet treatment $V_{1N3S1}$ gave Rs.1042.37 more than fertilizer treatment ($V_{1N0S1}$) and $V_{2N3S1}$ only Rs.354.29 over $V_{2N0S1}$ treatment. Hence, it is clear, that for higher yield and economic return, a treatment combination of $V_{1N3S1}$ is best for Triticum-sheat rotation under the soil and climatic conditions of Hecmat.