CHAPTER 1
INTRODUCTION
INTRODUCTION

Vegetable oils and fats are esters of the trihydric alcohol glycerol and fatty acids. They may be fluid or solid at ordinary temperature, leave a permanent oily mark on paper and dissolve in boiling alcohol or in cold or warm ether. They are universally of lower specific gravity than water. They are found in large quantities in many fruits and seeds. Smaller quantity occurs in almost all tissues of leaves, starchy seeds, starch bearing fruits etc. In the cell, they are stored in oil bodies, known as oleosomes.

There are mainly nine oilseed crops. These include: groundnut, rapeseed - mustard, soybean, sunflower, sesame, castorseed, nigerseed, linseed and safflower. In addition to oilseeds, palm is also a source of oil.

Vegetable oils and fats are used both for edible and industrial purposes. On equimolar basis, edible oils provide more than double the calories than carbohydrates. In the human body, fats and oils act as a transport medium for vitamin A, D, E and K (Anonymous, 1993). Some fats, especially vegetable oils, provide what are called essential fatty acids (linoleic and arachidonic acids) to the human body. Groundnut oil, sesame oil and sunflower oil, which contain a high proportion of poly-unsaturated fatty acids do
not increase blood cholesterol levels to the same extent as coconut oil, butter, ghee (margarine) and hydrogenated vegetable oils, which contain high proportions of saturated fatty acids. In industry, oil and fats are used in the manufacture of cosmetics, hair oils, lubricants, paints and varnishes. The oilcake, a by-product left after the extraction of oil, is used as manure, nematicide and cattle and poultry feed.

India has about 19.85 m ha (equal to 13 per cent of the net arable land) under oilseeds cultivation and ranks first in the world as far as area under groundnut, linseed, sesame and niger is concerned. It is third in the world in respect to acreage (3.73 m ha) under rapeseed-mustard, Canada being first, followed by China. Ironically, productivity of oilseeds in India is much lower than that in several other countries. It is a meagre 736 kg/ha in comparison with the average yield of Nigeria-1,615.38, United States-1,474.58, Argentina-1,153.49 and China-1,148.55 kg/ha (Anonymous, 1983). Considering our productivity of rapeseed-mustard (707 kg/ha), it is nowhere near that of France-2,991, Canada-1,235 and China-1,243 kg/ha, the world average being 1,262 kg/ha (Saini et al., 1989). Inspite of being one of the major oilseed growing countries of the world, India is therefore, not able to feed its population with regard to oils and has to import edible oils worth
1,000 crore rupees every year (Saini et al., 1989; Tripathi, 1993).

The main reason for the low average productivity of oilseeds in our country is that 75 per cent of the farmers producing oilseeds have small or marginal holdings of less than two hectares. Moreover, only 15 per cent of the area under oilseeds is irrigated in contrast to 72 per cent under wheat and 44 per cent under rice. In addition, oilseeds are more prone to pests and diseases compared with rice and wheat (Tripathi, 1993). Slow progress in developing high yielding varieties and post-harvest technology as also lack of proper storage and processing facilities, are other causes of low productivity.

To improve the productivity of oilseeds, the Government of India has launched some new schemes recently, like the Technology Mission on Oilseeds and the "Yellow Revolution". The main thrust is to increase yield by introducing better seeds, ensuring supply of fertilisers at subsidised prices and stepping up irrigation facilities (Chengappa, 1989; Tripathi, 1993).

However, it is noteworthy that, for their optimum performance, improved varieties of oilseeds, like the high yielding varieties of other crop plants, require large amount of fertilisers, which the majority of Indian farmers can ill afford. Even when the full dose of fertilisers is
applied basally, much of it is known to be rendered unavailable to plants due to many factors. For example, upto 50 per cent nitrogen may be lost through leaching, decomposition, volatilisation etc. (Anonymous, 1971) and upto 70 per cent phosphorus, by fixation (Russell, 1950). To guard against such losses, judicious supplemental application of the nutrients through top-dressing or foliar spray may be necessary (De, 1971, Afridi and Wasiuddin, 1979; Khannan, 1986, Mohammad et al., 1987).

With this in view, a project was started at Aligarh about two decades ago to optimise the productivity of crops, including improved varieties of rapeseed-mustard, as and when they were released by the Government. The research work presented in this thesis is an extension of this programme and consists of five field experiments.

The first of these was an exploratory trial to test the relative efficacy of two combinations of basal nitrogen and phosphorus (given with a uniform dose of 30 kg K/ha) and to compare their effect with split application (top dressing/foliar spray). For this, two doses of supplemental nitrogen were applied to three newly evolved high yielding varieties of mustard, namely Rohini, Vaibhav and Varuna at 50 and 70 days after sowing.

The results of this experiment revealed the superiority of application of 60 kg N and 30 kg P/ha with 30
kg supplemental nitrogen applied by foliar spray. Among the varieties, the performance of Rohini was noted to be superior to the other two.

The second field trial was also conducted on the same three varieties of mustard with the aim to find out if economy of nitrogen could be attained by reducing its quantity in the spray from 30 kg N/ha to 20 or even 10 kg N/ha. The basal (starter) dose was kept 60 kg N and 30 kg P/ha that proved the best in Experiment 1. The data established 20 kg N/ha as the optimum spray dose and Rohini again as the best responding variety.

The main aim of the third experiment, performed on Rohini (simultaneously with Experiment 2) was to test if its performance on application of the best combination of basal and foliar nitrogen of Experiment 1, could be improved by including small quantities of phosphorus and/or sulphur in the spray, so as to improve its productivity. With further economy of fertiliser in view, an inexpensive source of phosphorus as well as sulphur (monocalcium superphosphate), that is easily available to the farmers, was also included in the spray treatments, to elicit its comparative efficacy.

The data showed that Rohini grown with 60 kg N and 28 kg P/ha and sprayed with 20 kg N and 2 kg P + 2 kg S/ha
(as sodium dihydrogen orthophosphate and sodium sulphate) proved better than all other combinations. However, the combination containing monocalcium superphosphate in the spray that followed it proved economically superior.

The fourth experiment was conducted to test if this fertiliser economy could be maintained/improved without sacrificing productivity of Rohini, by replacing the spray dose of 30 kg N/ha (Experiment 3) with 20 kg N/ha (Experiment 2), while retaining the remaining treatments of Experiment 3.

The results (confirmed in Experiment 5) established that this was possible - 20 kg N, 2 kg P and 3.4 kg S/ha (applied as urea + monocalcium superphosphate spray) providing the best combination for Rohini, grown with a starter dose of 60 kg N, 28 kg P (and 30 kg K/ha) for exploiting its maximum genetic potential.

The present chapter is followed by a brief review of relevant available literature on recently released high yielding mustard varieties (Chapter II). It is followed by the details of the methodology adopted and a description of the agroclimatic condition of Aligarh, where the study was undertaken (Chapter III). The details of the data, analysed statistically according to the design of each
experiment, are presented in Chapter IV and discussed in Chapter V in the light of the results of other workers. Chapter VI includes the summary of the thesis and is followed by an up-to-date list of references.