CHAPTER 1

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Alliums, with their characteristic odour and taste, belong to a small group of herbs that usually regenerate through bulbs. The group belongs to family Alliaceae (Hanelt, 1990) and includes about 500 species, including twenty seven from India. Of these, Allium cepa L. (onion), Allium sativum L. (garlic) and Allium porrum L. (leek) are well known for their culinary uses and medicinal properties (Anonymous, 1948; Jones and Mann, 1963; Kirtikar and Basu, 1987; Brewster, 1994; Chevallier, 1996). Their medicinal uses are briefly described below crop-wise.

Onion is long known to be analgesic, antibiotic, anti-inflammatory, antirheumatic, diuretic, and expectorant. Garlic is considered to be antibiotic, anticancerous, antidiabetic, antimalarial and antirheumatic. Leek hastens suppuration of boils. It is also regarded as stimulating expectorant, dissolving agent for calculus formations in bladder, diuretic and emollient (Dastur, 1962; Jones and Mann, 1963; Chiej, 1984; Kiritkar and Basu, 1987; Brewster, 1994).

Interestingly, Block (1985) and Chevallier (1996) mention a spectacular use of onion, and more notably garlic, against blood clotting that could lead to arterial blockage. They claim its efficacy to match that of aspirin in preventing coronary heart disease.

A perusal of recent data reveals that China, with its 421 thousand hectares under onion and 580 thousand, under garlic - total about one million hectares - tops the list of allium-growing countries. Next comes India, with about 500 thousand hectares under onion and garlic (FAO, 1998) which is 0.35% of the net arable land (Anonymous, 1999). Of the total acreage, about 400 thousand hectares are under onion and 100 thousand,
under garlic. The productivity of alliums in India is, however, much lower than that in several other countries. For example, onion yield is a meagre 10.60 t/ha in comparison with the yields reported from South Korea - 60.75, Japan - 46.69, United States - 44.42 and China - 22.06 t/ha, the world average being 16.54 t/ha. Garlic, with its 4.30 t/ha yield, also stands nowhere near the productivity figures reported from Egypt - 22.65, Lebanon - 19.13, Armenia - 19.33, Sudan - 17.93, Israel - 14.72 and China - 14.22 t/ha, the world average being 10.81 t/ha (FAO, 1998). Commercial cultivation of leek in India is not worth mentioning.

There are several reasons for the low average productivity of these crops in India. A majority of farmers has small holdings of less than two hectares. Poor irrigational facilities and frequent unfavourable weather conditions (excessive rains/drought) bring down average productivity considerably. Compared with other crops, huge fluctuations in price from season to season also dampen the enthusiasm of the farmer with regard to their regular cultivation. Other contributing factors are: high susceptibility to pests and diseases and poor knowledge of post-harvest technology as well as lack of proper storage and processing facilities. Unfortunately, the plant breeders have been more committed for decades to the breeding of improved cereals (and lately of oilseeds) because of the demands of the "Green (and Yellow) Revolution". As such, little attention has been paid to the improvement of several other important crops, including onion and garlic. This neglect has contributed to the stagnation in production which is often insufficient for the consumption of the ever-growing population. At times, crop failure results in such a shortage that the Government of India is compelled to allow imports. For example, 13,000 t onion was imported as recently as October, 1998 (Anonymous, 1998).
Like other vegetable crops, alliums also require large amount of fertilisers, which the majority of Indian farmers can ill afford. Further, much of the basally applied dose of fertilisers is known to be rendered unavailable to plants during the later part of their life span due to many factors, including decomposition, fixation, leaching and volatilisation. For example, about 50% of the soil-applied nitrogen (Anonymous, 1971) and up to 70% of phosphorus (Russell, 1950) is lost due to one or the other of these factors. To economise on nutrient input and to ensure their efficient utilisation, split application, partly at the time of sowing/transplantation and partly as supplemental top-dressing or foliar spray, is recommended. Several studies conducted at Aligarh and elsewhere have also proved the technique to be cost-effective for various crops (Wittwer and Bukovac, 1969; De, 1971; Afridi and Wasiuddin, 1979; Mohammad et al., 1987; Kannan, 1990; Patnaik, 1992).

The present author selected the common alliums for research in view of their age-old multipurpose usefulness in general and the newly discovered efficacy in coronary disorders in particular. To start with, he framed the following hypotheses and planned 13 field trials to test them.

(i) It was hypothesised that the productivity of alliums will be increased by the use of the technique of supplemental foliar spray of nitrogen and phosphorus as has been repeatedly experienced at Aligarh and elsewhere for other crops.

(ii) It was also expected that the yield of alliums will be augmented further by adding sulphur to the nitrogen- and phosphorus-containing spray as established earlier by the present author for mustard - another sulphur-rich crop.
Further, if hypotheses Nos. (i) and (ii) above were confirmed through the planned field trials, it was expected that the less expensive commercial grade fertilisers could replace the traditionally used costly laboratory grade chemicals in the supplemental foliar spray particularly of phosphorus and sulphur, making the technique more cost-effective and, therefore, readily acceptable to the farmer.

To test these hypotheses, the following objectives were kept in mind while planning the extended field trials:

(i) To select one (or more) variety of onion suited best to the conditions obtaining locally.

(ii) To establish the optimum dose of soil-applied nitrogen, phosphorus and potassium for onion, garlic and leek.

(iii) To confirm the data of (i) and (ii) above in subsequent experiments, narrowing the range of the selected nutrient combinations to pin-point the optimum dose for each crop.

(iv) To test simultaneously with (iii) above if supplemental foliar spray of nitrogen and/or phosphorus could augment growth and yield of the selected alliums.

(v) To test if inclusion of sulphur in the foliar spray containing nitrogen and/or phosphorus could maximise yields of these alliums.

(vi) Lastly, to test the cost-effectiveness of the "foliar-feeding" technique by comparing the efficacy of the conventional sources of the sprayed nutrients with commercial grade fertilisers.

The details of the 13 field trials planned with these objectives in mind are given in Chapter 3 (pp. 51-57).