Chapter -1

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Plants have been, and still are, a rich source of many natural products most of which have been used extensively for human welfare especially in toning up loss of vitality or general debility and also to alleviate human pain and suffering due to illness or disease. The variety and diversity of plant products that possessed medicinal value were recognized several centuries ago in the indigenous systems of medicine. Though the treasures of Indian pharmacopoeia and the therapeutic details of medicinal plants of ancient times are not available to us in full, yet due to the utilization of plant products in the allopathic system of medicine, much attention has now come to be focussed on medicinal plants in India.

The history of Indian medicine dates back to the Rigveda written between 4,500 and 1,600 B.C., which includes the use of medicinal plants for the first time. But, it is the Ayurveda (2,500 – 600 B.C.) that lays the foundation of the medicinal science in India. During the times of Lord Budha (563 - 483 B.C.), the traditional indigenous medicine made rapid progress and during the course of time, hundreds of valuable drugs were collected and investigated systematically. Also during the Mughal period, Muslim physicians contributed a lot to popularize the Unani system of medicine in India. The well known monograph “Taleef-e-Shari”, pertaining to the Unani system of medicine is a monumental publication of the period (Khan, 1864, Kirtikar and Basu, 1975). The Mughal rulers also patronized the flourishing perfumery industry of the country. With the advent of the British rulers, the western allopathic system was introduced in the country (Chopra et al., 1958, Kirtikar and Basu, 1975).

Natural products are an integral part of our food, feed and healthcare. However, after the preference for synthetic medicines in the past century, the recent shift to natural health care products has been mainly because there is now popular concern over toxicity and side effects of allopathic drugs. Even practitioners of modern medicine worldwide acknowledge the values of herbal medicines as these are generally less expensive and safer than allopathic drugs. Due to these facts, there has been a considerable revival of interest in the use of herbal medicines in the world over
the past many years (Deshmukh, 1998) The World Health Organisation (WHO) has appreciated the fact that most of the world’s population depends on traditional medicines for primary health care and that medicinal plants are important for health and community. WHO, therefore, has recommended to member-states in their effort to formulate policies to adopt traditional medicines and to study their potential usefulness, including evaluation, safety, and efficacy (Deshmukh, 1998).

According to the United Nations Development Project (UNDP) report, the annual value of medicinal plant derived products from developing countries is about US $32 billion (over Rs 100,000 crore). According to the EXIM Bank’s paper “Indian medicinal plants – A sector study” the value of annual global trade in medicinal plant has been put at over US $60 billion and is growing. In this changing equation, India has a great role to play as supplier of herbal products and trade advantage of the treatments market potentials (Deshmukh, 1998).

India is one of the twelve biodiversity centres with the presence of over 45,000 different plant species. India’s diversity is unmatched due to the presence of 16 different agro-climatic zones, 10 vegetable zones, 15 biotic provinces and 426 biomes (habitats of specific species). India has 15,000-18,000 flowering plants, 23,000 fungi, 2,500 algae, 16,000 lichens, 18,000 bryophytes and 30 million micro-organisms. Nature has, thus provided us a rich diversity of plants. From this flora, 15,000 to 20,000 have been found to possess good medicinal value. However, only about 7,000 plants are at present used in Ayurveda, 600 in Sidha, 700 in Unani and 30 in modern medicine (Deshmukh, 1998). Besides, our country is blessed with most varied diverse soil and climatic conditions, i.e. great range of temperature (about 4.9 °C to 43 °C), rainfall (from 100 mm to over 10,000 mm) and altitude (sea level to over 6000 m), which are suitable for growth of almost all plant varieties (Singh, 1998).

Moreover, investigations in the field of pharmacognosy and pharmacology have supplied valuable information on medicinal plants regarding their availability, botanical characters, methods of cultivation, collection, storage, commerce and therapeutic uses. All these have contributed towards the acceptance of several plants in modern medicine and their inclusion in pharmacopoeias of advanced nations. The production, processing and use of medicinal and aromatic plants have a great
potential. It is noteworthy that 95% of medicinal plants are obtained from the wild resources and they are not cultivated. The time has come to adopt well managed cultivation of medicinal plants on a large scale with the aim to ensure constant supply of raw material to cope with the ever-increasing demand by industries.

In view of these facts, it was felt that although considerable work has been carried out on the nutritional requirements (especially of nitrogen) of various medicinal crops, information regarding the scientific cultivation of *Nigella sativa* L in India is meager. This herb is an important valuable object of the Greco-Arab/Eastern system of Medicine's Pharmacopoeia with interesting ethnobotanical and ethnopharmacological data. In fact, *Habat al-Sauda* and *Shumz* are common names under which black cumin has been described as an esteemed herb of *Islamic Materia Medica*. In this system, the herb has been regarded as a valuable remedy in hepatic and digestive disorder and has been described as a stimulant in a variety of conditions which are ascribed to cold humours. In their external use the seeds give relief when applied on pityriasis, leucoderma, ringworm, eczema, alopecia, freckles and pimples. Besides, it alleviates asthma, chronic headache, migraine and chest congestion. Moreover, the seed oil has been reported to increase the flow of bile experimentally and is of great use in paralysis particularly facial paralysis, back pain and rheumatism (Saeed et al., 1996). Because of these properties, the black seed herb and oil have been used for centuries by millions of people in Asia, Africa and Middle East to promote health and fight diseases. It, thus, occupies a prominent position in all systems of medicine both ancient and modern (Nadkarni, 1982, Riaz et al., 1996, Saeed et al., 1996).

Keeping these important medicinal properties in view, the present author felt that the need of the hour is to investigate the ways which can augment the yield of this medicinal crop with better utilization of fertilizers, especially N as the use of nitrogen as fertilizer to control crop growth and productivity has been one of the key contributing factors for the incremental improvement not only in agricultural but also medicinal crop production. Nitrogen is the prime constituents of all living matter chiefly macromolecules, including RNA and DNA. It is, thus, an important element in various metabolic processes. Moreover, nitrogen functions as a necessary component
of biologically important molecules such as amino acids, purines, pyrimidines, enzymes, coenzymes, structural and catalytic proteins and chlorophyll (Salisbury and Ross, 1992, Marschner, 1995)

Evidently, mineral nutrient deficiencies substantially impair production of dry matter and its partitioning between different plant organs (Marschner et al, 1996, McDonald et al, 1996), reduce sink strength (Farrar and Williams, 1991, Paul and Stitt, 1993), and adversely affect the photosynthesis potential of source (Farrar and Williams, 1991, Stitt, 1991, Pollock and Farrar, 1996) Hence, the application of nitrogen as fertilizer has been an established practice for enhancing the inherent capacity of crops for growth and productivity. To obtain the maximum possible yield permitted by climatic conditions and to be sure of avoiding crop nitrogen deficiency, increasingly large amounts of nitrogen fertilizers are being applied indiscriminately, particular by illiterate farmers However, the success of application of inorganic N fertilizers is invariably associated with the hazards of degradation of the soil and the pollution of the environment

Therefore, an approach which may minimize the application of nutrients, particularly N, without lowering the performance of the crop and sacrificing its productivity, may be explored To achieve this goal the medicinal crop may be manipulated in order to utilize the maximum possible available resources In this context, use of growth regulators (particularly kinetin and GA$_3$), are thought to be trendsetters They are known to be actively involved in various physiological activities such as growth, flowering and ion-transport (Wareing and Phillips, 1981, Angrish et al, 2001, Elanchezian, 2001, Pandey et al, 2001, Takei et al, 2002, Khan and Samiullah, 2003) Moreover, phytohormones act as mediators for acclimation of plants to leaf canopy (Pons et al, 2001), stimulate leaf area expansion (Leopold and Kawase, 1964, Brock, 1993) and induce elongation and osmoregulation in internodes (Azuma, 1997), in addition to increasing dry matter and biomass production (Bhaskei et al, 1997, Kewalanand et al, 1998, Gupta and Datta, 2001) With this dual advantage in mind, graded concentrations of kinetin and GA$_3$ were sprayed on *Nigella sativa* L grown with various levels of soil-applied nitrogen, so as to achieve the goal envisaged therein
Five experiments were conducted on black cumin (*Nigella sativa* L.) in pots with the following objectives:

A. To establish the optimum dose of basal nitrogen for desired maximum growth, physiological activity and yield of the crop.

B. To establish the best concentration and suitable growth stage for foliar application of kinetin or GA₃ for maximum growth, physiological activity and yield of the crop.

C. To compare the efficacy of the treatments, foliar spray of kinetin or GA₃ in association with basal applied level of nitrogen, on maximum growth, physiological activity and yield of the crop.