1. INTRODUCTION

In Himachal Pradesh, sprouting broccoli (*Brassica oleracea* L.var.*italica* Plenck.) and brinjal (*Solanum melongena*.L.) are important cash crops, which bring lucrative returns to the growers. Sprouting broccoli is an important cole vegetable and belongs to family Brassicaceae. It is a new crop in India which is nutritious among cole crops being rich in vitamins and minerals and also a rich source of sulphoraphane, a compound associated with reducing the risk of cancer (Kalia, 1995). This crop is native of Southern Europe and Eastern Mediterranean region. Of late, it is gaining popularity in different pockets of the state due to its nutritional as well as medicinal value, and at present, occupies an area of about 50 hectares (Anonymous, 2008-09). It is used in a variety of ways as salad, in curry, soup, pickles and for freezing.

Brinjal - a member of family Solanaceae, is one of the common, popular and principal vegetable crops of our country. In India, it is grown in an area of 0.6 million hectares with production 10.37 million tonnes and productivity of 17.2 tonnes per hectare (FAO, 2009). It occupies the third position among vegetable crops. It is an important cash crop of Himachal Pradesh especially in low and mid-hills and covers an area of about 903 hectares with a production of 17564 tonnes and productivity of 19.45 t/ha (Anonymous, 2008). West Bengal is the largest producer of brinjal followed by Maharashtra and Bihar. While globally, it is grown in area of 1.97 million hectares with a production of 35.32 million tonnes and productivity of 17.8 t/ha (FAO, 2009). It is mostly consumed as a cooked vegetable. Contrary to the common belief that brinjal is ‘Begun’ (no nutritional qualities), its nutritional value can well be compared with that of tomato and chilli. It is rich source of carbohydrates (4.0g), sulphur (44.0mg), and chlorine (52.0mg) and contains appreciable amount of iron (0.9mg). The productivity of both these crops is still low and can be enhanced by ensuring balanced supply of nutrients and scientific management practices. These vegetables are highly exhaustive and remove considerable amount of macro and micro-nutrients from the soil.
Imbalanced use and ever-increasing cost of chemical fertilizers are two deterrents for enhancing productivity of these crops. Losses by leaching and shortage in supply necessitate exploitation of biological nitrogen-fixation through biofertilizers and organic sources for ensuring high level of crop productivity and also to protect soil from deterioration, thereby ensuring sustainable vegetable production (Singh, 2006). The increasing cost of chemical fertilizers stresses the need to substitute a part of the nutrient requirement through organic sources to make cultivation of sprouting broccoli and brinjal an economically viable proposition.

The use of microbial inoculants *viz.*, *Azotobacter*, *Azospirillum* and Phosphate Solubilizing Bacteria in vegetable crops to supplement nitrogenous and phosphatic fertilizers has assumed immense importance owing to high energy and cost intensive requirements for production of chemical fertilizers. Moreover, the imbalanced and excessive use of chemical fertilizers in these crops has affected the population of beneficial micro-organisms in the soil. These micro-organisms are of significance due to their nitrogen fixing ability, nutrient cycling, mobilizing and increasing the uptake of phosphorous, thereby cutting down the requirement of nitrogenous and phosphorus fertilizers to be used for raising good crops (Kamlakannan and Manivannan, 2003). These micro-organisms also produce certain bioactive compounds such as vitamins, enzymes, hormones alongwith antifungal and antibacterial substances that stimulate the plant growth (Tien et al. 1979; Narula et al. 1980; Sharma et al. 1986; Pandey and Kumar 1989; Sharma et al. 2008). Besides, biofertilizers are non bulky and cheap sources of nutrients and may prove cost effective and eco-friendly supplements in hill farming resulting in 2 to 45% increase in yield of different vegetables (Wani, 1994).

On the other hand, there is sufficient evidence that the intensive agriculture systems have also caused decline in vitamins and minerals contents of fresh fruits and vegetables. Since vegetables are mostly consumed as fresh or partially cooked, excessive use of nitrogen fertilizer and imbalanced use of other
fertilizers have resulted in yield stagnation and deterioration of soil health and poor quality of the vegetable produce. Proper and regular incorporation of farm organic wastes and bio-inoculants are of utmost importance in maintaining the fertility and productivity of agricultural soils.

Nutrient requirement is basically a genetic characteristic of the crop plants and this requirement may vary with the cultivars of the particular crop (Hazra and Som, 1999). Nitrogen, phosphorus and potassium are three major plant nutrients, which are required by the plants in more quantities. Growth and yield gets restricted if any of the three elements is in short supply. So, balanced nutrition demands supply of all the essential nutrients. Sprouting broccoli and brinjal, being heavy and moderate feeder, resp. remove large amount of macro-nutrients especially nitrogen. Nitrogen, the major nutrient which is removed in large amount from the soil is required for proper crop nutrition. Its deficiency results in stunted and slow growth with yellowing of leaves. Phosphorous considered as ‘King Pin’ in agricultural production, plays a vital role in root development, cell division and energy transfer process, besides being as essential constituent of nucleic acid. It plays a significant role in seed and fruit development. Once it is removed from soil, it cannot be replenished except from external sources. There are substantial deposits of low grade rock phosphate in soil which are not available as such for plant growth as most of the phosphorus is fixed by some soil components and converted into form which are not readily available to plants. The incorporation of efficient phosphate solubilizers in the rhizosphere of vegetables and soil increases the efficiency of applied phosphorous.

The concept of integrated nutrient management (INM) consists of improvement and maintenance of soil fertility for sustainable crop productivity through optimization of all available organic, inorganic and biotic resources in an integrated manner, appropriate to each cropping system and farming situations with its ecological, social and economic ramifications. Recent energy crisis and
consequent price hike of chemical fertilizers due to withdrawal of relevant subsidies coupled with low purchasing power of farming community have generated renewed interest in organic recycling throughout the world for sustainable crop production (Agarwal, 2000).

Keeping in view the above facts, the present investigation entitled “Integrated management of nitrogen and phosphorous through bio-inoculants and organic manures in sprouting broccoli – brinjal cropping sequence under mid-hill conditions of Himachal Pradesh” has been undertaken with the following objectives:

1. To study the effect of organic manures, bio-inoculants and chemical fertilizers on yield and quality parameters,

2. To study the response of various sources of organic and inorganic fertilizers on uptake of nutrients, and

3. To work out economics of different treatments.