INTRODUCTION

Declining trends in area, production and yield of Pulses is recorded in the Indo-Gangetic Plains, popularly known as pulse basket of India. Rice-wheat and rice-based cropping systems have replaced to a large extent the traditional pulse crop area, driving them out towards marginal/sub-marginal lands. Pulses are the basic ingredients in the diet of vast majority of the Indian population as they provide a perfect mix of vegetarian protein component of high biological value when supplemented with cereals. The availability of pulses has come down from 60g/day/person in 1951 to 33g/day/person at present. It resulted in doubling of its import (1.27 Million Tonnes to 2.35 Million Tonnes) and sky-rocketing of prices. The agro-ecosystems of this region are becoming fragile and the climate change is posing a potential threat for crop production, especially to Mungbean and Urdbean (Swaminathan and Kesavan 2012; Ali and Gupta 2012; Mark New et al., 2012).

Globally, India is leading country in the production of Mungbean [Vigna radiata (L.) Wilczek] with around 55 percent of the world hectarage and 45 percent of the world production. It is grown in three seasons: (a) Monsoon or rainy season (July-October) (b) Cool dry season (December to February) (c) Summer season (March-June). However, it ranks third among the Pulse crops grown in the country, after chickpea and Pigeonpea. Urdbean [Vigna mungo (L.) Hepper] cultivation is restricted to Indian Sub-continent. India is the largest producer of Urdbean contributing 1.33 million tonnes annually from an area of 3.17 million hectares. It occupies about 14 percent of the total area under pulse crops in the country and ranks fourth in area and production after chickpea, Pigeonpea and Mungbean (Handbook of Agriculture 2009).

As a result of Green Revolution, the Rice-Wheat Cropping System (RWCP) now dominated the food production areas of the Indo-Gangetic Plains and Peninsular regions of the India and this phenomenon relegated the mungbean/urdbean to marginal and sub marginal lands having poor fertility and a rapidly declining organic matter content of the soil (Ali and Kumar 2006).

The farmers also entertain the mistaken impression that these crops do not require fertilizer. Fertilizer management needs of these crops drew attention only after setting up the AICPIP (All India Coordinated Pulses Improvement Project) in 1967 which later evolved into
Indian Institute of Pulses Research (ICAR). The series of experiments carried out throughout the country brought to light the need for Integrated Nutrient Management (INM) for sustaining soil health and crop yields. Widespread deficiency of micronutrients in pulse growing areas was also recorded. The organic manures, green manures, crop residues, Biofertilizers (Rhizobium, PSB and VAM), besides mineral fertilizers are the major components of the INM. Studies on the INM aspects in Mungbean and Urdbean assume greater importance not only for increasing yield but also for improving the soil health, especially when they are being grown on marginal and sub-marginal lands in different agro-ecological sub-regions (AESR) of the country (IIPR 2011).

Agra has semi-arid climate and therefore is more vulnerable to the smallest changes in the climate. Since Mungbean and Urdbean are mainly grown under rain-fed conditions, both the area sown and yield realized depend mainly on the available rainfall and any shortage in rains has direct adverse effect on production. There is an urgent need to increase the resilience of the production systems and improve drought management strategies via technical, institutional and policy options. Research on the impact of climate change and vulnerability of agriculture is of high priority in India. In order to develop appropriate strategies, The National Action Plan on Climate Change (NAPCC) prepared by the Prime Minister’s council on climate change, Government of India, has identified eight missions that included National Mission on Strategic Knowledge of Climate Change as well as National Mission for Sustainable Agriculture (Ninan and Bedamatta 2012).

The Indian Council of Agriculture Research has divided the country into 13 major and 127 micro level agro-climatic zones. Each agro-climatic zone requires location specific studies with regard to changing climate and the status of crops and their performance in the changing scenario. India is predominantly an agricultural country. Disasters cause not only crop losses but compound the problems of resource poor farmers. The losses of agricultural income can be minimized if studies are undertaken about the resilience of crops to climate change. A great and detailed understanding of crop response to various weather parameters, alone and in combination, under different management and soil conditions is required. Efforts should be initiated to develop the database required for detailed and integrated impact assessments. There are a few Indian studies on this theme and they generally confirm a similar trend of agricultural decline with climate change. Our present knowledge is very little, at least in quantitative terms,
to understand the role of climate change on pulse crop production. In a country, such as India, multiple stresses like economic, political and social conditions in addition to climate factors influence pulse crop production. In spite of this, there has been no systematic study in this area (Mall *et al.*, 2006; Kavi Kumar 2007; Ali and Gupta 2012)

Taking into consideration the issues that emerged out from the above review, the objectives of the present investigation [(1)To analyze the nature of decadal and prevalent weather variability from the available meteorological data from local weather center of Agra; (2) To study the reproductive performance and yield patterns of Mung and Urd in response to prevalent weather changes at Agra under different management practices; (3) To survey and collect information on cropping history and the Nutrient management options available and the causes for the fluctuation in yields due to extreme weather events; (4) To evolve and recommended on appropriate adaptation strategy for the cultivation of Mung and Urd in Agra region in responses to change in weather] were classified under the following categories

1. To study the cropping history, vegetative growth and reproductive performance of summer Mungbean, kharif Mungbean and kharif Urdbean for three successive years.

2. To analyze the soil samples of some sites for selected physical, chemical and biological properties and also find out the impact of integrated plant nutrient management of summer Mungbean, kharif Mungbean and Urdbean at Agra.

3. To analyze nearly 112 years of historical weather data and observe trends in weather changes during cropping period, separately for summer season and kharif season at Agra, and also attempt probable estimates of yield losses in summer Mungbean and kharif Mungbean/Urdbean in relation to changing weather trends.