CHAPTER I
INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the most important annual unpredictable legumes, both in subsistence and commercial agriculture in arid and semi-arid regions of the world. It is one of the principal economic crops of the world. The botanical name of groundnut (*Arachis hypogaea* L.) is derived from two Greek words, *Arachis* means a legume and *hypogaea* means below ground, referring to the formation of pods in the soil. It is a member of the order Fabales and family *Fabaceae* also known as *Leguminosae*. It is widely grown annual crop with self-pollinated and dicotyledonous behavior. It is an allotetraploid having chromosome number 2n=4x=40.

Species of the genus *Arachis* are native of South America. Krapovickas (1969) postulated that the cultivated groundnut, (*Arachis hypogaea* L.) is believed to have originated in Northern Argentina and South Bolivia. Bolivia has the second largest number of species followed by Paraguay, Argentina and Uruguay. The gene pool of groundnut has been divided into two subspecies and each subspecies is divided into two botanical varieties. The sub specific classification of *Arachis hypogaea* L. is described elsewhere (Krapovickas, 1973, Gregory et al., 1980 and Weiss, 2000) and have been given in short as under:

- *Arachis hypogaea* L. subspecies *hypogaea*: Semi-spreading or spreading in habit, which have alternative branching pattern, inflorescence simple and absent on main axis, smaller and pointed leaflet with dark green foliage. Generally seed dormancy is present in this type and pod is medium to bold with large and heavier seed size. It includes two varieties, i) var. *hypogaea*: Virginia bunch and Virginia runner and ii) var. *hirsute*: Peruvian runner

- *Arachis hypogaea* L. subspecies *fastigiata*: Erect and bunch in habit, which have sequential branching pattern, inflorescence usually present on the main axis and first branching on the cotyledonary laterals are reproductive, large and oblong leaflet with light green foliage. Generally seed dormancy is absent in this type and pod is small to medium with smaller seed size. It includes two varieties, i) var. *fastigiata*: Velencia and ii) var. *vulgaris*: Spanish
Groundnut is cultivated in tropical, sub-tropical and warm temperate regions between 40ºN and 40ºS latitudes. The production is largely confined to Asian and African countries. Asia accounts for about 50% of area and 60% of world production of groundnut with largest share of India (>20%) in the groundnut coverage followed by China (>18%). However, China accounts for highest share (37%) in the total production of groundnut in the world. The major groundnut producing countries in the world are India, China, Nigeria, Senegal, Sudan, Burma and the United States of America. In India, six states namely Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan and Tamil Nadu account for about 90% of the total groundnut area of the country. Andhra Pradesh and Gujarat contribute >55% of the total area and production of groundnut. The total groundnut production in India during the year 2015-16 is about 6.60 million tones with 4.70 million ha area and with 1400 kg/ha productivity. Groundnut is the major oilseed crop of Gujarat with 16.60 lakh ha area and 27 lakh tones of production with 1663 kg/ha productivity (Anon., 2016).

Groundnut has a distinct position among the oilseeds as it can be consumed and utilized in diverse ways. It is a rich source of edible oil (44-55%), high quality protein (22-32%) and carbohydrates (8-14%) and hence, it is valued both for edible oil and confectionery purposes. Groundnut kernels are consumed as raw, boiled, roasted or fried products and also used in a variety of culinary preparations like peanut candies, peanut butter, peanut milk and chocolates (Desai et al., 1999). Cake left after extraction of the oil is an excellent feed for livestock. Vegetative parts of groundnut like leaves and stems are good source of nutritionally high quality fodder for farm animals. Dry roasted, salted peanuts are also marketed in significant quantities. Boiled peanuts are a preparation of raw, unshelled green peanuts boiled in brine and typically eaten as a snack. Groundnut is also used in cosmetics, nitroglycerin, plastics, dyes and paints.

Presence of genetic variability is a pre-requisite for the success of plant breeding programme. Greater the diversity in the material, better are the chances for evolving promising genotypes. A clear understanding of the genetic variability and heritability of quantitative characters in the genotypes offers the breeders the scope for improvement of characters. Before initiating any breeding program, it is essential to obtain information regarding the interrelationship between various yield attributing characters with pod yield. Knowledge of association between yield and yield components will serve to make simultaneous selection for more characters. Different
components of yield very often exhibited varying degree of association with pod yield and among themselves. Correlation analysis provides the mutual relationship between various plant characters and determines the component character on which selection can be based for genetic improvement in yield. Path analysis splits the correlation coefficient into direct and indirect effects. Path analysis showing direct and indirect effects is effective to get high selection response simultaneously for several characters from the diverse populations. Therefore, path coefficient analysis could provide a more realistic picture of the interrelationship.

Drought is the major abiotic constraint affecting groundnut productivity and quality worldwide. Two thirds of the global production occurs in rain-fed regions of the semi-arid tropics where rainfall is generally erratic and insufficient, causing unpredictable drought stress. Groundnut is cultivated predominantly in the tropics and subtropics, where the availability of water is a major constraint on yield (Viramani and Singh, 1986). From a breeding point of view, knowing whether different stress intensities would affect groundnut yield differently is also critical to set the screening conditions according to those in the targeted environment and it is of major interest for this present work. During the entire season, the crop is subjected to water deficit stress at one stage or another leading to drastic reduction in productivity. This necessitates development of cultivars which can withstand water stress and still can be productive. Reduction in groundnut yield resulting from drought has been well documented (Nageswara Rao et al., 1989 and Reddy et al., 2003). Information on the response of different genotypes to various pattern of drought and exploitation of this variability is an important requirement for crop improvement in drought prone areas. To differentiate drought tolerant genotypes, several selection indices have been suggested on the basis of a mathematical relationship between favorable and stressed conditions. Thus, drought indices which provide a measure of drought based on yield loss under drought conditions in comparison to normal conditions have been used for screening drought tolerant genotypes (Mitra, 2001). Drought Tolerance Index (DTI) was defined as a useful tool for determining high yield and stress tolerance potential of genotypes (Fernandez, 1992). The relative yield performance of genotypes in drought stressed and more favorable environments seems to be a common starting point in the identification of traits related to drought tolerance and the selection of genotypes for use in breeding for dry environments (Clarke et al., 1984).
Therefore, the present study was planned to evaluate genetic variability, correlation and path coefficients and drought tolerance under well watered and imposed drought conditions in advanced breeding lines of groundnut with the following objectives.

1. To estimate the genetic variability, heritability and genetic advance for physiological parameters, yield and yield components under normal and drought conditions
2. To find-out the association of pod yield with its components and physiological parameters under normal and drought conditions
3. To determine the direct and indirect effect of different characters on pod yield using path coefficient analysis
4. To evaluate advanced breeding lines of groundnut for drought tolerance