CHAPTER I
INTRODUCTION

India is a paradise for oilseed crops. Sesame (*Sesamum indicum* L.) is an oilseed plant belonging to the family Pedaliaceae. Sesame is an erect, annual plant known as sesamum or benniseed which originated in India. Sesame seed is considered to be the oldest oilseed crop known to humanity. The historic origin of sesame was favoured by its ability to grow in areas that do not support the growth of other crops. It is also a robust crop that needs little farming support; sesame has been called a survivor crop. It’s mainly cultivated for seeds; which are used as food and as a source of high oil since it contains a good amount of nutrients.

Sesame is usually grown in tropical zones as well as in temperate zones amongst the latitudes 40°N and 40°S. It has been cultivated for centuries, especially in Asia and Africa. In last decade, the world production of sesame seed was 3.97 metric tons and the major production was from Asia (2.48 metric tons) and Africa (1.31 metric tons), constituting about 62.6% and 33.10% of the total world production respectively.

India ranks first in area (29%), production (26%) and export (40%) of sesame in the world. Nearly 78% of seeds produced in India are used for oil extraction, 20% for domestic use and 2.0% for sowing purpose. In India, it occupies an area of about 17.50 lakh hectares with production of 6.13 lakh tons having the productivity of 350 kg ha\(^{-1}\) (Anon., 2014\(^a\)). It is cultivated on large scale in the states of Maharashtra, Uttar Pradesh, Rajasthan, Orissa, Andra Pradesh, Madhya Pradesh, Tamil Nadu, West Bengal, Gujarat and Karnataka. In Gujarat, it occupies an area of about 73,608 hectares with an annual production of 27,511 tones with the productivity of 373 kg ha\(^{-1}\) (Anon., 2014\(^b\)).

Sesame presents ample adaptability to various conditions of climate and soil. Resistance to drought and ease of cultivation characteristics that make it an excellent option for agricultural diversification and of great economic potential in domestic and international markets (Barros, 2001). The main product of the sesame plants are its seeds which are rich in mineral components such as calcium, phosphorus, potassium, iron, magnesium, selenium and zinc (Agropecuária, 2012\(^a\) ). Besides being the major source of edible oil with a high content of unsaturated fatty acids, especially oleic and
linoleic acids (Agropecuária, 2012\textsuperscript{b}), its industrial applications include preparation of sweets, confectionary and bakery products (Ekasit, 2012).

Seed and its quality among others are vital input in crop production. Crop response to other inputs largely depends on the quality of seed. It is estimated that good quality seeds of improved varieties alone can contribute about 18 to 20 per cent increase in crop yield, keeping all the other inputs constant. Seed germination (%) and vigour are important indicators of quality which are substantially reduced during storage. Seed ageing is recognized by some parameters like delay in germination and emergence, slow growth and increasing of susceptibility to environmental stresses in various duration of storage. Seed quality (viability and vigour) decreases under long storage conditions due to aging. It is the reason for declining in germination characteristics. Ageing is manifested as reduction in germination percentage and those seeds that do germinate produce weak seedlings.

Storage is a basic practice in the control of the physiological quality of the seed and is a method through which the viability of the seeds can be preserved and their vigour kept at a reasonable level during the time between planting and harvesting (Azevedo, 2003). Seeds deteriorate and lose their germinability during periods of prolonged storage (Ghahfarokhi \textit{et al.} 2014). Seed deterioration starts immediately after a crop has attained the physiological maturity stage. Thus, in order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted such as seed treatment with suitable chemicals or plant products, as well as seed storage in safe containers. (Oyekale \textit{et al.} 2014) reported that seed deterioration during storage was due to the damage in cell membrane and other concoction changes in the seed system, for example, the protein and nucleic acid accumulation. Such degenerative changes result in complete disorganization of membranes and cell organelles and ultimately causing death of the seed and loss of viability. The most widely recognized and predictable ultra-structural changes in all the cell organelles were the loss in integrity of membranes, which constantly leads to increased seed deterioration particularly during storage.

Sesame plays an important role in human nutrition. Most of the sesame seeds are used for oil extraction and the rest are used for edible purposes (El Khier \textit{et al.}, 2008). Sesame oil is an edible vegetable oil derived from sesame seeds used in various countries.
Introduction

Sesame is grown primarily for its oil-rich seeds. Before seeds were appreciated for their ability to add nutty flavour or garnish foods, they were primarily used for oil and wine (Gandhi, 2009). The chemical composition of sesame shows that the seed is an important source of oil (44-58%), protein (18-25%), carbohydrate (13.5%) and ash (5%) (Borchani et al., 2010).

Sesame seeds are not only used for culinary purposes but also in traditional medicines for their nutritive, preventive and curative properties. The seeds are sources for some phytonutrients such as omega-6 fatty acids, flavonoid phenolic anti-oxidants, vitamins and dietary fiber with potent anti-cancer as well as health promoting properties. On an average, seeds contain about 50% of oil has better quality than other oil seed crop, is mostly utilized for making ghee (Yermonas et al., 1972). The flour that remains after oil extraction from sesame seeds is 35-50% protein and contains carbohydrates. This flour, also called sesame meal, is a high-protein feed for poultry and livestock.

Although sesame has good drought tolerance as compared with many other crops, it is still susceptible to drought during both the germination and seedling stages due to its extensive root system. (Orruno and Morgan, 2007).

Sesame varieties have adapted to many soil types. The high-yielding crops thrive best on well-drained, fertile soils of medium texture and neutral pH. However, these have low tolerance for soils with high salt and water-logged conditions. Commercial sesame crops require 90 to 120 frost free days. Warm conditions above 23°C (73 °F) favour growth and yields. Sesame crops can grow in poor soils, the best yields come from properly fertilized farms.

Many seeds fail to germinate after processing and placing in favourable growing conditions, such seeds are said to be dormant. In some dormant seeds morphological changes must take place before germination. For others, parts of the seed must undergo physiological changes before germination. Under natural conditions necessary changes take place gradually under varying combinations of aeration, moisture, temperature and light.

Seed deterioration starts immediately after a crop has attained the physiological maturity stage. Thus, in order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, Hormone actions and their interactions play an important role in controlling and modulating transition from seed dormancy to seed germination. This review focuses mainly on the actions of Indole acetic acid,
Gibberelins, KNO₃, water soak treatment, storage period, their interactions and their responses to environment in regulating the interconnected process that controls dormancy release and germination.

Some or all seeds of several crop species are dormant at harvest. A major problem faced by seed technologists when tested stored seed for germination is how to overcome dormancy. Dormancy of freshly harvested seeds may be found in practically all groups or classes of plants, whether crops or native plants, including grasses, cereals, clovers and other small-seeded legumes, large-seeded legumes including peanut, cucurbits, vegetables, flowers, trees and weeds. In some seeds, dormancy is caused by (1) seed structures, as seed coats, bracts, glumes, pericarp, and membranes, which limit the exchange of water and gases, (2) physiology of the embryo, (3) germination inhibitors or other blocks and (4) a combination of these factors.

Storage can affect dormancy in many instances. In most crop species, dormancy is dissipated within a few to several months when the seed is stored at ambient temperatures and relative humidity or under controlled atmosphere provided the temperature is held above freezing.

“After-ripening” time is required for seeds in dry storage to lose dormancy. It is the general type of primary dormancy found in many freshly harvested seeds of herbaceous plants (Atwater, 1980; Anon., 1993a, Baskin and Baskin, 1998). This type of dormancy is often transitory and disappears during dry storage, so it generally not a problem by the time the grower sowed the seeds. It is however, a problem with seed testing laboratories requiring immediate germination. In seed testing laboratories, such seeds respond to various short-term treatments, including short periods of chilling, alternating temperatures and treatment with potassium nitrate and gibberellic acid (Anon., 1993b).

Seed physiologists know that the best method of release dormancy in seeds is to treat them with certain growth regulators or chemicals which help in breaking of dormancy. This experiment was done to identifying the best treatments to break fresh seed dormancy in sesame.

Keeping all these factors in sesame in reference to germination, the systemic study was carried out in sesame to know the effect of storage period and seed treatment for release of dormancy with following objectives.
1. To study the effect of genotypes on dormancy and seed parameters of fresh sesame seeds.
2. To study the effect of different seed treatments on dormancy and seed parameters of fresh sesame seeds.
3. To study the effect of storage period on dormancy and seed parameters of fresh sesame seeds.
4. To study the interaction effect of the genotypes, storage period and seed treatments on seed dormancy and seed parameters of fresh sesame seeds.