CHAPTER I

INTRODUCTION
Seeds are the foundation stones of human survival on this planet. The glorious history of ancient human civilization spotted in several corners of the modern world bear testimony to the wonderful relationship shared by seed and man. Since those prehistoric times man has made relentless attempts to perfect the seed-man bond by contribution of novel thoughts and techniques to already specialized skills which he had acquired from his forefathers. Today agriculture is completely refined and it has identified the key points leading to better production and efficient usage of available resources. Seed quality is one of the main key points.

Good quality is an important characteristic feature of seed as it is a key input in agriculture and only seeds with assured quality should be expected to respond to fertilizers and exhibit quality in the expected manner. Experiences with seed have shown that germinability, purity and health are strengthening pillars of seed quality. These three properties of seed quality depend on various physical, physiological, pathological, biochemical and genetical factors within and outside the seed environment.

A "good" seed must possess morphologically uniform population, free from microbial contaminations. Each seed must contain a viable embryo having working enzyme machinery, and integral membrane system and entire system should be regulated by dynamic genome system.

It has taken years of intensive research to improve knowledge of seed-technological and seed-biological processes and principles. However, all these conclusions are of little value unless they reach their real users, i.e. farmers.

'True to type' in terms of genetic constitution is a fundamental property of good quality seeds. It indicates percentage mixture of other than 'type' in the seed lots and offers a guarantee for pure seeds quality. It is an important feature of seed quality because the entire success of crop production depends on the type of seeds sown in the field.

The genetic purity of seed lot or cultivar visibly influences the crop production. Efficient crop production can not be achieved with seeds having
distorted genetic purity.

Occasionally, sometimes even intentionally, cheap quality seeds are mixed with high quality seeds to achieve more profit, other times seeds recommended for some specific area get mixed with seeds adapted to some other topographical situations. Under such conditions, seeds ‘unsuitable’ to particular environmental conditions become susceptible to various diseases and pathogens etc. and therefore fail to survive resulting in huge losses to farmers. Besides, unclean seed harvest procedures and practices also lead to impure seed output. Therefore, seed certification system was launched to protect farmers against seed horrors and test of seed genetic purity was made indispensable.

Kadam (1942) listed different factors responsible for the variety deterioration.

(1) Developmental variations - whenever the crops are grown in different agroclimatic areas, other than recommended, the developmental variations come up.

(2) Mechanical mixtures - Mechanical mixtures may take place at the time of sowing, if more than one variety are sown with the same drill, if volunteer plants of the same crop are present in the seed field or different varieties are grown in the adjacent fields. Two varieties growing side-by-side often get mixed during harvesting and threshing. Besides, produce of all the varieties of same crop is often kept on same threshing-floor resulting in considerable varietal mixture. Secondly, combing or threshing equipments are often used without cleaning off the previously threshed seeds. Cleaning of elevators, gunny-bags, seedbins is also neglected at times.

(3) Mutations - Mutation is a minor factor responsible for deterioration and is often difficult to detect mutants. The mutation could be spontaneous or due to genetical causes.

(4) Natural crossing - Natural crossing is an important source of varietal
deterioration in sexually-propagated crops. The extent of varietal contamination, however, depends upon the amount of natural cross-fertilization. The deterioration of genetic purity also occurs in varieties, due to natural crossing with undesirable types; with diseased plants and with off type plants.

Apparently natural crossing is not problematic in self-fertilized crops unless the variety is not a male-sterile line and is grown in close proximity of other varieties. On the other hand, natural crossing is the major source of genetic contamination and variety deterioration in cross-pollinating and often cross-pollinating crop species. Besides several causes discussed above, practices related to plant breeding techniques also induce culprits if not cared properly. Therefore efficient techniques are required to identify cultivars. Morphological (seed coat texture), physiological (vigour) and biochemical studies (biochemical markers in terms of enzymes, metabolites and electrophoretic patterns of proteins and enzymes) as well as standard Grow-out-test (GOT) are required to be investigated in order to differentiate parents and hybrids.

Traditional grow-out-test (GOT) or field-plot-test is based on the genetically induced morphological and biochemical features expressed at suitable stages of development. The features are studied in detail and all the ‘other’ plants, i.e. off-types, pollen shedders, objectionable and diseased plants etc. are rouged out. Often, the very small genetic differences may be the basis of a new variety, at other times qualitative differences are often difficult to be detected even at maturity. Therefore, the GOT should be framed thorough and precise.

GOT has got certain limitations. It is an expensive procedure and tests should be carried out in suitable seasons for particular crops as certain off-season traits may not express varietal characteristics normally. Hence, authentic samples should be grown along-with test-sample. GOT's take up a full growing season which often results in late entry of seeds in market. Therefore, quicker and easier methods, like biochemical tests, chromosome-counts, electrophoresis, scanning of seed coats, should be
encouraged for varietal testing rather than solely depending on single
grow-out test.

Cotton and castor are the two important cash crops of our country. Practical utilization of the concept of heterosis in cotton has yielded good results in increasing the production of superior quality and has helped our country in increasing the mean production quite substantially, accounting for over 45% of the total lint production in the country.

Similarly, development of high-yielding hybrids in the case of castor in the last two decades has led to increase in production. Gujarat is a leading seed-producer state of castor hybrids. Data on demand and supply of quality hybrid seeds of last few years show crisis in the availability of certified seeds which is a difficult task. Advent of hybrids in castor has enhanced the oil production and could further improve oil variety. But such economically useful crops suffer from serious problems associated with the genetical purity of their hybrids. Hence, the present work was undertaken to find out suitable method for predicting the accurate genetic purity in hybrids and parents of castor and cotton through the formulation of reliable, reproducible, simple, inexpensive and routinely usable technique which could also be applicable at commercial scale testing.

In order to achieve the goal, the following approaches have been employed.

1. Morphological identification of parents and hybrids under laboratory and field conditions.
2. Biochemical studies on seed and seedling for cultivar identification.
4. Use of PGRs in identifying cultivar differences.
5. Studies on seed coat texture.
6. Tissue culture studies on parents and hybrids.

Results are presented in this thesis.