Chapter I

INTRODUCTION

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With a menacing growth in population, a grim forecast of world food shortage in general and of India in particular is looming large in the foreseable future. To meet the situation in the country, all possible resources are being tapped and the relevant machineries geared. Simultaneously, efforts are being made to evolve substitute foodstuffs and to bring them in the regular diet. Want of protein is a single major imbalancing factor in the Indian diet and the choice of Soybean, the gold nugget of the orient, as one of the substitute food-stuffs has been a timely one in this regard - not only because of its yield but also because of its food value with high protein and fat contents. Soybean protein contains most of the amino acids essential for human nutrition and is the cheapest among animal and vegetable proteins. This is of considerable significance, because the majority of the people of India are vegetarians. Also, India imports more than a lakh tonne of Soybean oil for edible purpose. Soybean, therefore, has a relevance to Indian agriculture today.

The crop is a relatively new entrant to the Indian scene and is yet to make a dent as an important crop. At present it is grown in limited areas of Himachal Pradesh, Madhya Pradesh and Uttar Pradesh in about 0.16 million hectares with an average yield of only 750 kg/ha (Nangju 1980). Our production of Soybean and other legumes and pulses represents

only a fraction of what it should be possible even to-day with the progress made in science. Maximization of production along with improvement in seed quality and its preservation is the point of far reaching importance and offers an area with excellent scope for research.

The yield potential of Soybean has been found varying from place to place and very little is known about fluctuation in field emergence at different places in the country(Saxena 1976). There is need for better understanding of the principles underlying these fluctuations. The kind of knowledge that can be put to practical use in crop husbandry consists essentially of establishing the relationship between crop yield and the variation in environment, especially the variation that can be used to advantage by changing cultural procedure, such as date of planting.

Environment affects the rate and duration of growth of the seed, which have direct influence on yield(Egli and Wardlaw 1980). Environmental conditions have very complex interrelationships. Investigating the influence of any one particular condition or a particular part of the environment, as long as this condition is a part of the complex environment, leaves very little room to uncover the cause and effect relationship. A high grain yield can be achieved only when a proper combination of variety and environment is attained and agronomic factors are optimum.

In India, the performance of different varieties of Soybean has been noted to differ from place to place (Lal 1968). Most of the varieties at present grown in the country are introductions from U.S.A. where environmental conditions are different. Some of these introduced varieties have ~~been~~ shown promise; however, their full production potential is yet to be realised, largely because of the gap in our understanding of the problems associated with growing of this crop. Certain inherent difficulties or constraints that have threatened progress of research on this crop in the country are the poor performance of some varieties and the unsuitable climatic condition during some part of the year. Ensuring adequate plant stand is one major problem which is encountered not only in India, but also in many other parts of the world. This is because of non availability of good quality seed at the time of planting (Rathore 1975, Singh 1975), which is essential for successful Soybean production. Surveys conducted in India reveal that about 50 per cent of the farmers are compelled to sow seeds having only about 60 per cent germination (Rathore 1975). Hinson (1974) has gone to the extent of suggesting that seed quality and germination may be the most important factors that determine wheather Soybean will become established in a given area. There is, therefore, a definite need for better understanding of the factors that determine Soybean seed quality and agronomic practices to be used for obtaining high quality seed.

The qualitative properties of the seed are mainly influenced by environmental conditions acting upon the plant and upon the seed from flowering to full maturity. Only a few studies have related seed formation and maturation in Soybean to its germination capacity (Obendor f 1980). Climatic conditions, perhaps the dry season during the post maturation and preharvest period, have great influence on the quality of seed harvested. Deterioration of seed during maturation is also a serious problem (Delouche 1980) - the seed may deteriorate even while on the plant. High humidity, temperature and sunlight can adversely affect the seed before harvest (Harrington 1973, Ndimande et al. 1981).

The choice of planting date should be so adjusted as to enable the crop to mature under cool dry period and produce high quality seed with good germination and vigour. There is lack of information on the performance of Soybean seed harvested from various dates of planting, particularly in different seasons in tropical countries (Nangju 1980).

The general concept of Soybean harvest is that the crop is ready for harvesting when most of the leaves have dropped off and 95 per cent pods are ripe. This may not be precise, because in some cultivars many of the leaves are still retained, or more than 10 per cent pods are still green, even though most of the pods have matured. This is always true when Soybean matures during wet weather in the tropics (Nangju 1980). The

time of harvest can also reduce the quality of Soybean seed. There is, however, little information available on the effect of delayed harvesting on seed germination and vigour (Tekrony 1981).

Metabolism in developing seed probably determines the seed quality through its chemical composition (Ogren and Rinne 1973). There is no information available in the country on protein content of seed when it is harvested from different planting date and from different varieties planted in different seasons. Cultivar differences in the rate of deterioration of Soybean seed during storage have been reported by Minor and Paschal (1977). Usefulness of seeds for planting and their subsequent field performance depend on a number of factors, but largely on the conditions to which they have been subjected during storage and on the degree of degeneration they have undergone prior to planting. Seeds that are in the advanced stages of progressive deterioration are more vulnerable to any adverse change during their emergence (Rajanna and Andrew,1970).

The major factors to be considered for storage of seed include the seed factors, such as history of the seed lot and temperature, relative humidity (seed moisture content) and period of storage (Roberts 1972, Justice and Bass 1978). Some researchers consider Soybean to be the most difficult grain crop to store without deterioration (Alexander et al. 1978) and this is particularly true in the humid tropics (Ndimande et al. 1981). In India Soybean is mostly stored in gunny bags

and cloth bags. Cold storage has been suggested (Agrawal 1975), but it is costly and farmers cannot afford it. Packaging of Soybean seed at low moisture content in polythene bags may be one of the means for storing and for maintaining a satisfactory level of quality for the next planting season. There is lack of information as to what extent it can give protection to Soybean seed under hot humid climate.

It is believed that the seeds of high initial viability and vigour can be stored for longer periods of time. Our seed lots contain a considerable percentage of shrivelled and wrinkled grains and grains with cracked seed coat. These are considered of poor quality. However there is little information on the pattern of changes in viability and vigour of seeds of different quality which are harvested in different seasons.

The present series of investigations are aimed at generating information to bridge the gap in our understanding of two very important problems of the crop, namely (i) performance of the crop and quality of seed in relation to environmental factors under different dates of sowing and harvesting, and (ii) influence of storage conditions on seed quality. The objectives of the work are (1) to examine the influence of different Soybean varieties and planting dates on seed yield and quality in different seasons; (2) to obtain information relating to harvesting time and to study the impact of early, timely and delayed harvest on seed quality;

(3) to study the effect of seed quality on germination and vigour of Soybean seed and its impact on storage; (4) to determine the pattern of losses of viability and vigour in different Soybean varieties during storage; and (5) to investigate the effect of storage conditions on seed viability and vigour.