INTRODUCTION
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Vegetables play an important role in human nutrition. More so in India because a vast majority of the population is traditionally vegetarian in food habit. During recent years, the interest in vegetable production has increased rapidly as a result of greater appreciation of the food value of vegetables and the place of vegetables in the food requirements of the nation. The findings of scientific studies and their wide application in the field have enhanced this interest to a great extent among growers and consumers alike.

Vegetables provide proteins, carbohydrates, minerals and vitamins which constitute the essentials of a balanced human diet. In India, vegetable crops occupy only about 1.2 per cent of the total cultivated area and the total production is about 16 million tonnes per year which is extremely low. Cereal crops have the maximum share of the cultivated area and have received the major attention in our agriculture; next in importance come the pulses, oilseeds and fibre crops. The minimum requirement of vegetables is 284 g per head per day, which is about 20 per cent of the daily requirement of the total food of an adult (ICAR, 1980).

In view of the great importance of vegetables, attention should therefore be given to maximize production of vegetables. As there is little prospect of increasing the cultivated area
for vegetable crops, efforts should be given to increase productivity per unit area.

A major constraint in the successful cultivation of vegetables is the limited availability of good quality seeds. For most vegetables, West Bengal depends on seed supplies from sources outside the State. Vegetable seed production is virtually in its infancy in West Bengal. Further, the climatic condition in many parts of the State is unfavourable for seed storage. Untimely and inadequate supply of seed and loss of viability in transit and storage are some of the factors limiting vegetable production in West Bengal. Even when viability is retained, significant loss of seedling vigour is experienced and field performance and productivity of the resultant crop are adversely affected.

The rate of seed ageing depends on three main factors namely (i) high temperature, (ii) high relative humidity and (iii) oxygen pressure. Within limits, the storage life of seeds of vegetables, flowers and field crops decreases as the seed moisture and storage temperature increase. Harrington (1963) proposed the two 'rules of thumb', which related seed moisture and temperature to the life span of seeds. The rules state that the life of seed is halved (i) for each 5°C increase in seed storage temperature and (ii) for each one per cent increase in seed moisture content. Estimation of storage life of a large number of agricultural seed may be made by viability nomographs constructed by Roberts (1972) based on the viability equations with temperature.
and seed moisture as the extrinsic factors. More recently, Ellis and Roberts (1981) have presented a new improved viability equation to predict seed longevity and storage environment of a number of agricultural crops.

The longevity of seeds of several crop species has been shown to decrease with increase in oxygen pressure (Roberts et al., 1967; Roberts and Abdulla, 1968). Harrison (1966) reported that 3-year-old lettuce seeds stored under nitrogen, air and oxygen had germination percentages of 78, 57 and 8, respectively. Onion, tomato and turnip seeds showed similar results (Harrington, 1973). Justice and Bass (1978) reviewed results of approximately 35 studies on seed longevity under various storage conditions; in these studies, oxygen or air was reported to enhance seed deterioration in at least 20 cases. Ohlrogge and Kernan (1982) also showed that, soybean seeds stored under 7.7 atmospheric oxygen pressure at 25°C and 17% moisture lost all viability within 22 days, whereas the seeds under 7.7 atmosphere of nitrogen pressure showed almost no loss in viability.

It needs to be mentioned here that the relation between moisture and seed longevity as discussed above, holds good only for the "orthodox" seeds (Roberts, 1981) of plants. Fortunately, majority of the crop plants produce such orthodox seeds which can be dried to low moisture contents, 5% or less, without damage and can be stored for long periods. On the other hand, the 'recalcitrant' seeds of high moisture content as in several plantation crops, would suffer irreversible ultrastructural damage on drying
and can be stored only for relatively short periods (Roberts, 1981).

In India, there are many areas with high relative humidity and temperature. Such conditions would cause rapid decline of seed viability. The loss of germinability of stored seeds could be minimized if the seeds are properly dried to a safe limit of moisture content and stored in sealed moisture-impervious containers. However, only a few seed merchants and producers of our country have facilities of seed storage under controlled humidity and temperature conditions. The seed producers depend on sun-drying and usually store seeds under ambient conditions in unsealed moisture-pervious containers with consequent loss of vigour and viability.

In eastern India, the problem of loss of seed germinability is more serious in case of Rabi (winter) crops, the seeds of which pass through the hot summer and humid pre-monsoon and monsoon months. On the other hand, the seeds of Kharif (summer-rains) crops pass through the relatively less hot and dry climate of the greater part of the year and suffer less than seeds of the Rabi crops. Two of our important vegetables, lettuce and carrot, the materials for this study, are typical examples in which poor field performance due to physiological deterioration is very frequent. The seeds of these crops are not produced in West Bengal. The cultivators obtain seeds from seedsmen who bring them from Himachal Pradesh or Kashmir valley. While seeds of lettuce give satisfactory germination by the time they reach our farmers, carrot seeds very often show poor germinability.
The question becomes more serious in carry-over stocks. After the sowing season is over, the surplus seeds pass through a prolonged period of hot and humid climate. The carry-over seeds, unless especially cared for, invariably show a significant loss of germinability. The situation has become more important now because our seedsmen would like to maintain a buffer stock of seeds in view of the possibility of not getting adequate supply in the forthcoming season. Moreover, with the rising prices of seeds, it is often more profitable to store seeds than purchasing fresh stocks from producers every year. An effective method of storage of such seeds is therefore imperative.

Attempts have been made in the present laboratory to develop an easy and cheap method of seed treatment for maintenance of vigour and viability. Investigations carried out since 1973 have led to the development of an easily practicable and inexpensive hydration-dehydration method of seed treatment for the maintenance of vigour and viability of seeds and also to improve the productivity of the crop raised from such treated seeds (Basu et al., 1974, 1975). The method has been successfully followed for the preservation of seeds of a range of crops such as rice, wheat, jute, sunflower and a number of vegetables (Basu and Rudrapal, 1982).

In the present thesis, the efficacy of hydration-dehydration method of seed treatment has been critically investigated in lettuce and carrot. However, a few other methods of seed treatment...
Scope of the present study
such as dry-dressing with chemicals, organic solvent infusion of chemicals and use of certain chemicals in the vapour form have also been evaluated. The dry treatment of seed was taken up with a view to eliminating the problem of drying of hydrated seed as in case of the wet seed treatments. In addition to the morphological investigations on seed treatments, studies on the physiological and biochemical changes in the seeds have also been undertaken.

The experiments described and discussed in this thesis have been presented in the following order:

I. Studies on lettuce and carrot seed deterioration under different storage conditions
II. Standardization of hydration-dehydration methods of seed treatment to control deterioration
III. Standardization of 'dry' seed treatments
IV. Effect of seed treatment on field performance and productivity
V. Physiological and biochemical changes in relation to maintenance of vigour and viability

The experiments were conducted during the period, November 1976 to June 1982, in the University College of Agriculture, Calcutta and in the University Experimental Farm at Barulpur about 20 km south of Calcutta.