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Effects of Storage Period and Temperature on Seed Viability of Wheat

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Abstract

The study was conducted to investigate the effects of storage temperature and storage period on seed viability of a wheat variety, Rawal-87. The seed moisture content and seed viability were determined in control which were 8.0 percent and 90 percent respectively. The interaction among storage period and storage temperature was statistically significant. In wheat, the maximum seed viability was observed at -20 and 5°C after 12 months storage. A decline in germination percentage was observed at 50°C after 4 months. Germination percentage was higher when petri dishes were used for germination tests. During germplasm storage of wheat, storage temperature and storage period play an important role.

Introduction

Plant genetic resources are the most valuable and essential basic raw materials to meet the current and future needs of crop improvement programmes. A wider genetic base, thus, assumes priority in plant breeding research aimed at developing new varieties for increased crop production. The collection and conservation of this diversity in a systematic manner requires suitable conditions for their storage. The storage life of seeds is controlled by two factors which are seed moisture content and storage temperature. According to Harrington rule of thumb, for each rise of 01 percent on seed moisture content and for each rise of 5°C in storage temperature, the storage life of seeds is halved (Harrington, 1973). Moisture content, through its effect on humidity influence the growth of fungi. High temperature promotes both fungal growth and insect development (Roberts, 1972a). Germination of seeds declines rapidly during storage if temperature is not monitored properly (Terkony *et al*., 1993).

The seed deterioration under storage conditions is the natural phenomenon. Although the germplasm is stored under preferred optimal storage conditions in gene bank at low temperatures and with low moisture contents, even then the seed viability/germinability is affected during storage. The rate of deterioration varies greatly from one species to another. It is therefore, imperative to test the viability of crop germplasm before storage and during storage.

The purpose of this study is to optimize/standardize storage conditions to maintain maximum viability during storage.

Materials and Methods

The study was conducted to investigate the effects of different storage temperatures and storage period on seed viability. The seeds of wheat variety, Rawal-87 was used in experiment. After cleaning, the moisture content of seeds was measured by "high constant temperature oven' method (International rules for seed testing; ISTA, 1985) which was 8.049 percent. Initially, seed viability was determined in control, which was 96 percent. Seeds were treated with 2.0 percent benlate solution for two minutes and then washed with sterile water to avoid fungal contamination.

Packets of 200 seeds were prepared, packed and stored in plastic bags at five different temperatures (-20, 5, 25, 37 and 50°C) for 12 months. Samples were drawn from each storage temperature at regular intervals and subjected to standard germination test using four replicates of 50 seeds/replication, grown under dark conditions at 25°C in incubator as per ISTA Rules. The seed germination test is generally conducted in compliance to the rules of the International Seed Testing Association (ISTA), the Association of Official Seed Analysts (Woodstock, 1976) or the National Organization (Official Seed Testing Laboratory). Seeds were tested for germination by two methods viz; TP (Petri dish) and BP (Paper towels). The germination data was recorded on 7th day after start of the test. The experiment continued for 12 months.

Results and Discussion

Significant differences were observed among different storage temperatures for seed germination (Fig.1). Storage temperatures, -20 and 5°C showed same tendency upto 12th month with high germination percent age (90%). A sharp decrease in germination (from 90 to 52%) was observed on second month which again raised upto 90 percent on third month. The reason being is that in this treatment the seeds were treated with 2 percent benlate solution for 2 minutes and then washed with sterile water to avoid fungal contamination. Such treatment, although controlled the fungus but the germination was also significantly affected. Storage temperature, 25°C showed the same value until 11th month, but germination slightly decreased on 12th month, At 37°C, the germination was decreased by 10 percent from 9th month. At 50°C minimum germination of about 70 percent was observed at initial stage whereas more than 80 percent initial germination was recorded with other four temperatures. The germination dropped further with each month passed, finally it was about 5 percent as against the 90 percent germination after 12 months at -20 and 5°C.

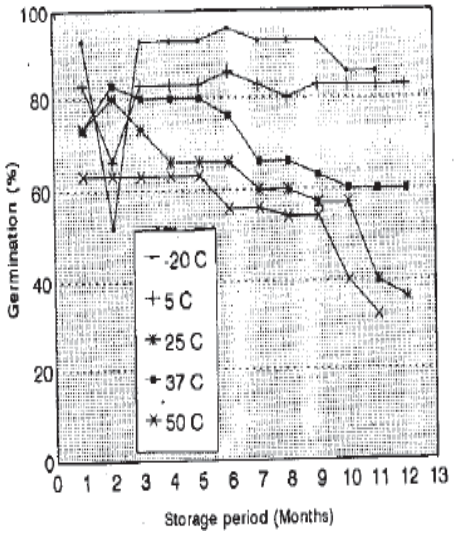

Fig. 1: Effect of storage temperature and storage period on seed viability of wheat

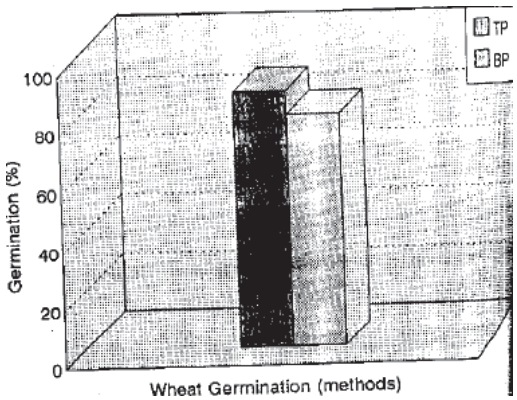

Fig. 2: Influence of germination methods (TP and BP) on seed viability of wheat.

This result is in accordance with the International Board for Plant Genetic Resources which recommends that orthodox seeds be stored at about -20°C and 5 percent moisture content. Storage in adverse conditions results in the production of aged seeds with symptoms of deterioration. These symptoms include reduce viability, or germinability (sometimes to 0 percent germination), as well as more or less complete germination, but with abnormal development of the seedling. Elevated temperature during drying can reduce viability (Rampton and Lee, 1969). Deterioration of some seeds only becomes evident when sub-optimal conditions (e.g.; heat stress) are applied during germination or seedling growth. Otherwise, such seeds appear to develop normally. The longevity of seeds is mainly controlled by their moisture content and the storage temperature (Roberts, 1972b). Seeds can be stored for several months only under optimum conditions of temperature and moisture content. The best suitable temperature for storage of wheat germplasm is 5 and -20°C. From these results, it can be inferred that seed viability is influenced significantly when the seeds are stored at high temperature. Storage period also plays a significant role in seed viability. Two germination methods viz: TP (Petri dish) and BP (paper towel) were also compared (Fig. 2). Interaction between species and germination method was statistically significant. The seeds show higher germination percentage when grown in petri dishes.

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