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Time-course Study of Seed Viability and Vigor in Sunflower Inbred Lines Under Ambient Storage Condition

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Abstract: The study was conducted to investigate the effects of ambient store conditions on seed viability and vigor in sunflower inbred lines. Three inbred of sunflower Inbred lines, Three inbred sunflower (*Halianthus annuus*) viz. RHP-46, HA-89 and HA-55-2-2 grown at national agriculture research center, Islamabad during spring 1999 were dried and stored in paper bags for 12 months under ambient condition. The germination result of the three inbred lines were compared. RHP-46 maintained germination above the maximum certication standard (70%) without much loss in viability for 12 month in the laboratory while others maintained it for comparatively short period. The germination of RH'p-46 remained constant trough out the period, In HA-89 and HA-55-2-2 lines the viability decreased after 9 month and reaced the critical point on 48 th week. Germination of HA-55-2-2 increased up to 85% at 24th week and remained high till 36th week of storage.

Key words: Sunflower, inbred lines, ambient temperature, germination, storage

Introduction

Sunflower is an important oilseed crop having a wide range of adaptability. It contain a high percentage of oil (40-50%) in seed and 17-20% protein contents (Bakhsh *et al.*,1999). After seed yield, the most important aspect in sunflower is oil content and its quality. It also contains fatty acids like Palmitic acid (4.32-9.16), Stearic acid (0.20-6.64%), Oleic acid (10.47-71.41%), Linoleic acid (20.18-81.10%) and Linolenic acid (0.09-2.96%). At present, Pakistan is faced with a chronic deficit in edible oil production which is met through the import at the cost of billion of rupees annually. The development of high yielding hybrids and hybrids resistant to various environment stresses can increase the productivity per unit area and its adaptability to diverse climatic conditions countrywide.

In many plants, a period of rest or inactivity must pass before the fully matured seed can germinate even if the external conditions are favorable. There is something that acts as a block to the process leading to germination. The inability of the viable seed to germinate even under favorable conditions is referred to as dormancy or rest. The basic cause of dormancy is the inability of the embryonic axis to overcome the constraints against growth which reside with in the embryo itself (embryo dormancy) or belong to the enclosing structure (coat-imposed). As many events occurs during germination, it seems possible that a block on any one could account for the failure of the embryonic axis to grow. Certain inhibitors are found to be responsible for the imposition and maintenance of seed dormancy. According to the " Hormonal Theory", dormancy depends on the interaction between inhibitory and primitive 'hormones' such as abscisic acid and gibberellin (Amen, 1968). In sunflower, Absisic acid (ABA) has a key role in the induction of embryo dormancy (Fambrini-M,1998) The ABA level rises in the first 20 days of embryo development and declines during late maturation. The most quick and reliable method to take seed dormancy is Tetrazolium test (International seed testing Association, 1985).

A developing seed passes through a dormancy period which is due to immature embryo in sunflower (Thomas *et al.*, 1973). The period of dormancy ends and ripening takes place in seeds when the seed moisture content becomes low. The germination percentage of seed depends upon The moisture content of seed and storage temperature. The principal factors determining the storage life of seeds are storage temperature and seed moisture content. The oilseeds lose their germination and viability potential quickly if not stored under optimum conditions. The present course of study is to investigate the pattern of seed dormancy, germination, vigor in sunflower inbred lines under ambient storage condition.

Materials and Methods

The study was conducted in National Agriculture Research center, (NARC) Islamabad in 1999-2000 to investigate the effects of ambient storage conditions on seed viability in three sunflower inbred lines, RHP-46, HA-89 and HA-55-2-2, which were obtained from oilseed programme, National Agricultural Research Center, Islamabad. The seeds were cleaned and dried after harvest. The seeds were kept under ambient conditions in laboratory in paper bags. After 15 days of storage, the samples were draw from each inbred lines and subjected to standard germination test using three replicates of 50 seeds/ replication, grown under dark conditions at 25°C in incubator as per ISTA rules. The germination data was recorded on 7th day. The standard germination test was repeated every week. The experiment continued for 48 weeks.

Results and Discussion

The type and depth of dormancy can change with time. A developing seed passes through a period of embryo dormancy (Thomas *et al.*, 1973) Later, there is a gradual reduction in dormancy even until it is completely lost. This process called after-ripening, takes place only in seeds which have a low water content. It is common in seeds in storage but it also occurs in nature when seeds experience long periods under dry conditions. We find that the seeds which for some time after harvest or dispersal, need light, chilling or alternating temperature to break their dormancy slowly become partially or completely independent of such requirements and gain the ability to germinate under conditions which were previously considered unfavorable (Naylor *et al.*, 1961). Dry after-ripening does not have all-or-nothing action but rather has a graded effect. (Nikolaeva, 1969). Many of the best known effects of after-ripening are in cereals like barley, rice, wheat and other grasses (e.g. *Avena fatua*) which lose their dormancy during storage. (Roberts, 1977).

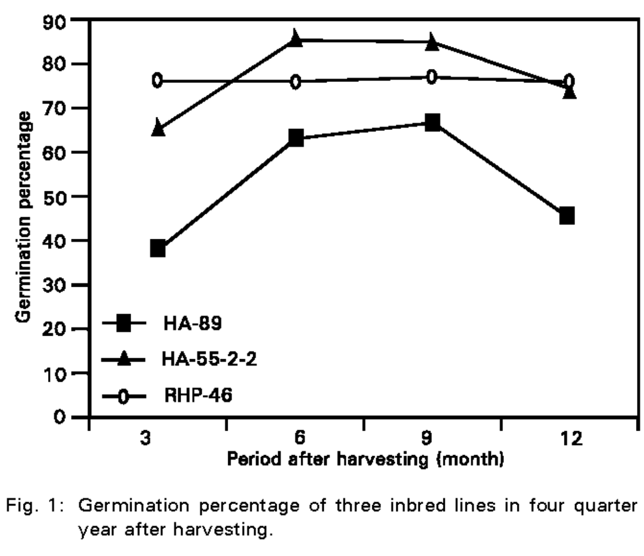

Fig. 1: Germination percentage of three inbred lines in four quarter of the year after harvesting.

Factors important in after-ripening are (a) seed moisture content (b) temperature © oxygen. The time for after-ripening is influenced especially by seed moisture content and temperature. Low moisture content favors after-reopening. Dry seed water contents generally fall in the range of 5-15 % according to the species and external condition. If the moisture content becomes much higher, then secondary dormancy develops (Simpson, 1978). The process of after-reopening is temperature dependent in cereals. Low temperature retards it (Atterberg, 1907). After-ripening is accelerated by oxygen enriched atmospheres and delayed by oxygen depleted ones, e.g., in rice and wild oats (Roberts, 1962). In our experiment, among the three hybrid lines, termination of dormancy started after four weeks of harvest and under ambient store conditions. The germination percentage of RHP-46 became high (77%) at sixth month after harvest and it was maximum (78%) after nine months of harvest (Fig. 1) Germination percentage of RHP-46 remained more or less constant till the end of the experiment. High temperature and moisture had little effect on germination of RHP-46. The pattern of germination in Inbred lines HA-89 and HA-55-2-2 was more or less the same. In these lines, the deterioration started after 09 months of storage and on 12th month, germination percentage reached up to 46 and 74 respectively. The germination percentage of HA-55-2-2 was better than that of HA-89 line (Fig. 1). These variations may be due to differences in genotype and storage potential of the three inbred lines. The critical period started after 9th months when the germination percentage dropped in lines HA-55-2-2. As the seeds were stored under ambient conditions in paper bags, the deterioration seems to be due to insects, disease and low vigor/storage potential. The two principal factors influencing seed deterioration are seed moisture content and storage temperature (Harrington, 1973) however, other factors such as disease organisms, insects, atmospheric gases, pre-storage history and genotype can all have an impact on the rate of deterioration (Butler). Temperature and relative humidity of the storage environment have a key role in maintaining longevity of seeds stored under ambient conditions (Butler). Relative humidity affects the seed longevity through seed moisture content. It should be between 30 and 40 % for oilseed storage. High relative humidity decreases longevity of seed and leads to seed deterioration. Therefore, the longevity and germination percentage of three inbred lines increased when the temperature and relative humidity were low. The results also indicated that sunflower seeds stored in paper bags under ambient conditions can maintain germination above the minimum certification standard (70%) without much loss in viability for nine months in the laboratory.

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